ATTENTION AND EMOTION

A CLINICAL PERSPECTIVE

Psychology Press Classic Editions

Adrian Wells and Gerald Matthews

ATTENTION AND EMOTION

This is a Classic Edition of Adrian Wells and Gerald Matthews' award-winning textbook on attention and emotion, which now includes a new introduction. The book won the British Psychological Society book award in 1998, and is now widely seen as a classic in the field of emotional disorders.

Attention and Emotion: a clinical perspective critically reviews the literature on attention and emotion, and offers an integrative cognitive attentional model of the development and maintenance of emotional disorders. The authors also discuss the implications for clinical practice of attentional theories of emotional dysfunction. In the new introduction, the authors reflect on the influence of their ground-breaking model and the subsequent developments in the field, 20 years since the book was first published. The book will continue to be essential reading for students, researchers and professionals with an interest in disorders of attention and emotion.

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ATTENTION AND EMOTION

A clinical perspective

Classic Edition

Adrian Wells and Gerald Matthews

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INTRODUCTION TO THE CLASSIC EDITION

A brief history of developments

We decided to write Attention and Emotion because we felt that little work up to the early 1990s had addressed fundamental questions concerning the role of attention in the self-regulation of emotion: What role does attention play? How should attention be modelled? Could attention research be used as a rigorous means of linking psychological disorder to underlying causal information processing mechanisms? How might discoveries in cognitive psychology inform our understanding and treatment of psychological disorders? These important questions should be of interest to clinicians, but existing models and treatments often used cognitive terminology without any real understanding of cognitive psychology. Take, for instance, the Schema concept and the idea of cognitive biases as a basis for cognitive-behaviour therapy; most clinicians did not question the nature of these constructs or the mechanisms by which they cause disorder. In fact the very idea that negative thoughts cause psychological disorder is questionable – most people have them but most people do not experience difficulties. Furthermore, whilst there had been an emphasis on the content of cognition (thoughts/memories) as a driving force in pathology, we were not convinced that this was the most relevant dimension of thinking for psychopathology. It seemed that there were some very important unanswered questions and that answering them might set the way to significant insights and to developing more effective, psychologically based treatments.

In our book, we offered new interpretations of the results of studies on attention and emotion, and a new integrative model: the Self-Regulatory Executive Function (S-REF) model. Of course, any model can turn out to be right or wrong, but in any case we felt that it was critical to highlight the importance of basing therapy on an explicit cognitive-psychological model. Unlike prevailing theories of the time, we assigned a central role to conscious strategic processes and to metacognitive beliefs in explaining psychological disorder. We argued for a shift away from a monolithic view of thoughts towards an integrated view in which thoughts are multifaceted inner events and the nature of the person's reaction to them is more important than their specific content. How has this approach and how have the conclusions we reached fared over the last 20 years? In this addendum to the classic issue we will summarise the highlights of the volume and provide an overview of recent developments.

Part 1: Emotion, attention and information processing

In the first section of the book we presented the main psychological theories of attention of the time. Attention can be usefully viewed in two ways: 1) as a process of selection of which stimuli are important and should influence responses; 2) a process of intensive or sustained 'concentration' which increases the efficiency of processing. We evaluated the success of existing theory in accounting for the selection of material for conscious processing, accommodating the limited capacity of attention, and differentiating the role of voluntary and involuntary processes in controlling cognition.

The selective and intensive aspects need to be distinguished in clinical contexts and when building models of psychological disorder. There may be abnormality in one or both of these. For example, in selecting certain stimuli for further processing the obsessional patient with contamination fears may readily detect dirt in the environment. In the domain of 'concentration' the depressed patient may show an inability to intensively focus attention and/or show a preoccupation with feelings of fatigue that sustains attention to symptoms. We contended that abnormality in selection and concentration has significant clinical implications because it shapes the way the (inner and outer) world is experienced. It is precisely biases in such experience that are a foundation for psychological disorder. However, we concluded that subjective and laboratory demonstrations of attention disturbance had not been very informative for the clinician. This is largely because the process of selection and of concentration are dependent on both automatic (habit) and controlled processes and clinical advances require an explanation of which set of mechanisms are involved, so as to causally link attention to emotion disorder.

In Part 1 our review provided abundant evidence of selective attention bias for emotion-related material, as well as deficits in concentration. But less compelling was the evidence that such effects were automatic. In fact, there were clear indications that bias in attention was linked to more strategic processes. Furthermore, one of the problems with laboratory studies of attention, such as those using the emotional Stroop or dot-probe tests, is that they did not represent the types of complex social or ecologically valid internal information that are the focus of the patient's concerns and so the effects were difficult to interpret. There were also questions about whether the effects represent the impact of worrying or the content of underlying structures? We described how the concept of schema has been influential in cognitive-behavioural therapy and used to account for biases in attention. But this concept was also found to have significant weaknesses, not least the proliferation of different schemas required to 'fit the data.' Moreover, schema and automaticity (habit) models fail to account for an important feature of cognition; the individual's influence over whether or not to continue with current processing.

One of our conclusions, and one that had profound implications for the model that we eventually went on to propose, is that we should not underestimate the role of voluntary (strategic) attention. By implication we needed a model placing strategic control centre-stage in emotion disorder. We argued that psychological disorder might be identified with the person's voluntary strategy for controlling attention and as such we must understand what causes the differences between patients and non-patients. We became even more aware that schema theory, the basis of cognitive-behaviour therapy, did not explain how self-knowledge (e.g. believing "I am worthless") could control or bias attention functioning and it ignored significant domains of processing involved in self-control.

When we turned our analysis to the possibility that deficit in attention might be associated with emotion disorder we found ample demonstrations of the negative effect of state anxiety and depression on attention efficiency. These effects, it seemed, were likely to be caused by intrusive thoughts and worries. We questioned the deficit interpretation of poor memory performance in obsessive-checkers as potentially showing an effect of rumination that interferes with encoding or a metacognitive effect of doubting memory. Our view was that true deficits in attention were unlikely to be a main contributor to emotion disorder and instead apparent deficits were more likely to be a consequence of thinking styles (worry/rumination) and of metacognitive factors which were the more important causes of disorder.

Update:

Some contemporary issues remain similar to those we highlighted in 1994. The most basic of these is the pervasiveness of attentional bias across different traits and clinical disorders that might be associated with threat sensitivity. For example, the pioneering theory of Williams et al. (1988) held that selective attention bias was characteristic of anxiety, but not depression. There are now significant research literatures demonstrating bias associated with all the major emotional disorders, as well as relevant personality traits, confirming that bias is not specific to any particular disorder (Cisler & Koster, 2010). Bar-Haim et al.'s (2007) meta-analysis found no differences in the magnitudes of bias across different anxiety disorders, and a meta-analysis of emotional Stroop effects in depression confirmed the reliability of the effect (Epp, Dobson, Dozois, & Frewen, 2012). Broadly, such findings vindicate our transdiagnostic approach of seeking abnormalities in attentional function that may be common to multiple disorders.

The more challenging issue is to identify the underlying processing mechanisms that generate bias, mechanisms which may vary across disorders (Teachman et al., 2012). In 1994, the debate concerned principally whether bias was automatic or strategic in nature. The S-REF model incorporated both but was unique in giving an emphasis to strategic sources. Today, most theorists would probably agree on a role for both types of bias. The evidence for automatic bias is strengthened by numerous demonstrations of bias with subliminal (masked) stimuli. Bar-Haim et al. (2007) showed that effect sizes for subliminal bias in both Stroop and dot-probe paradigms were similar to those for tasks using unmasked stimuli. One could quibble with automaticity on several grounds. Contemporary researchers sometimes neglect the methodological difficulties of demonstrating that encoding stimulus meaning is truly unconscious (Holender, 1986), and wrongly assume that subliminal processing is necessarily automatic and independent of attention (Dehaene et al., 2006). Strategic processes may prime unconscious processing of threat stimuli (Matthews & Wells, 2000; Wells & Matthews, 1996). For example, Luecken, Tartaro and Appelhans (2004) found subliminal bias only when subliminal trials were preceded by supraliminal trials. Similarly, subliminal attitude activation is demonstrated only in experiments in which participants previously assign attention to the relevant affective stimulus dimension (Spruyt, De Houwer, Everaert & Hermans, 2012). Nonetheless, the evidence for bias in processing subliminal stimuli is persuasive, even if the evidence for automaticity is not conclusive.

There is additional evidence for strategic influence on bias, including demonstrations of bias at relatively long stimulus durations (Cisler & Koster, 2010), delayed cross-trial bias (McKenna & Sharma, 2004), and modulatory effects of attentional control and emotion regulation strategies (Cisler & Koster, 2010). Indeed, Phaf and Kan's review (2007, pp. 184) concluded that "the emotional Stroop effect seems to rely more on a slow disengagement process than on a fast, automatic, bias". This conclusion fits neatly with our idea that clinical disorder is linked with sustained or extended processing. Wells (2000) proposed that therapeutic strategies should be developed to enhance flexible metacognitive control aimed to improve disengagement of perseverative processes.

Further evidence indicates that choice of coping strategy appears to affect attentional and interpretive bias (Avero et al., 2003), as well as overall efficiency of attention in stressful task environments (Matthews & Campbell, 2009). Thus, the challenge for theory is to model the interaction of automatic and strategic processes. A first step is to acknowledge that strategic processes may be engaged to inhibit automatically generated bias (e.g., Mathews, 2004). Such a position is reasonable in cases, as in the emotional Stroop, in which threat stimuli have no direct task relevance and processing must be inhibited to prevent distraction. The S-REF model that we proposed goes beyond this position, however, in supposing that bias may be directly generated by strategic search for self-relevant information.

The S-REF model postulated multiple influences on bias including erroneous metacognitive beliefs that thinking is uncontrollable or positive beliefs that focusing on threat is helpful (Wells, 2000). In other respects, the terms of the debate have moved on. In particular, a simple dichotomy of automatic and controlled processing is simplistic. Teachman et al. (2012) point out that there are dissociable criteria for automaticity including inaccessibility to consciousness, efficiency, lack of intention, and uncontrollability. Their review concluded that lack of control of biased processing is commonly found across disorders, but lack of conscious awareness and intention are characteristic of clinical anxiety but not major depression. Also, in activation-based models such as those prevalent in connectionist modeling (Matthews & Harley, 1996), there is no difference between 'automatic' and 'strategic' activation, only in the modules of the network architecture that serve to generate activation. For example, we can model the influence of strategy in relation to executive processing modules that regulate activation of lower-level networks (Matthews, Gruszka & Szymura, 2010).

Recent work has also emphasized that multiple processes may generate bias. Early anxiety studies focused on pre-attentive bias in attention (Williams et al., 1988), but there may be distinct biases in semantic processing. These include interpretative biases such as evaluating neutral stimuli as threatening, and judgment biases such as underestimation of personal control of threats (Cannon & Weems, 2010; Hertel, Brozovich, Joormann, & Gotlib, 2008). Selective attention too may be decomposed into distinct component processes including initial focusing and later disengaging from threat. Typically, disengagement is found to be more sensitive to anxiety (Leleu, Douilliez, & Rusinek, 2014), though not invariably so (Clarke, Hart, & MacLeod, 2013). Such findings support a key premise of the S-REF model, the need to understand the interaction of emotion and cognition within an explicit architecture (Matthews & Wells, 1999). Current theory is actively attempting to accommodate multiple biases and processes; for example, Cisler and Koster (2010) attribute facilitated attention to an automatic threat detection process, difficulty in disengagement to a deficit in attentional control, and attentional avoidance to emotion-regulation.

A similar perspective emerges from work on attentional impairment on tasks using affectively neutral stimuli. Whereas classic test anxiety research implicated a general interference effect, modern theories differentiate multiple processes. Notably, Attentional Control Theory (ACT: Eysenck & Derakshan, 2011) seeks to relate anxiety deficits to executive processes. Effects appear more reliable for inhibition of task-irrelevant processing than for set shifting or memory updating. Differentiation of state dimensions has also contributed to understanding attentional impairments (Matthews et al., 2002). Loss of task engagement reduces attentional resource availability and sustained concentration, whereas distress states especially impair working memory, multi-tasking and executive functioning (Matthews & Campbell, 2010; Matthews & Zeidner, 2012).

We thus have a finer-grained picture of how negative affect may interfere with a range of core cognitive processes than was possible in 1994. Nevertheless, key constructs such as working memory and attentional resources remain somewhat imprecise, and a need for the future is the development of quantitative models, in which anxiety effects can be linked to parameters of an explicit architecture. Matthews and Harley (1996) explored alternative models for attentional bias in the emotional Stroop using a back-propagation network capable of learning across repeated trials. Consistent with the S-REF model, a strategic implementation of bias was more successful in reproducing actual performance outcomes than were either innate or learned automatic biases.

The differentiation of multiple processes in attention is supported from a neuroscience perspective. The neurobiology of bias was beyond the scope of the S-REF model, and we will refer to it only briefly here. Broadly, findings from both humans and other mammals suggest a two-process model similar to those suggested by attentional performance data. One network of brain structures, focused on the amygdala, supports early attention to threat, whereas higher-level regulation and control is effected by cortical structures such as lateral prefrontal cortex (Cisler & Koster, 2010; Hofmann, Ellard, & Siegle, 2012). Individual differences in the serotonin transporter gene (5-HTTLPR) may be implicated in the functioning of these structures (Pergamin-Hight, Bakermans-Kranenburg, van Ijzendoorn, & Bar-Haim, 2012). The integration of cognitive-psychological models of bias, including connectionist models, with the fast-developing understanding in relevant neuroscience is an important challenge for both researchers and clinicians (e.g., Clark & Beck, 2010).

The final issue to highlight here is the functional significance of attentional bias. In 1994, one of our concerns with theory of the time was that it suggested a 'drip-feed' view of anxiety. That is, the person is a passive recipient of infusions of threat stimuli, whose 'dosage' depends on anxiety. This stimulus-driven (bottom-up) perspective conflicts with the view of the person as an active agent who samples the environment selectively and strategically in pursuit of personal goals. In affluent, modern societies the threats we face are often not external agents beyond our control, such as predatory animals. Instead, we choose to accept socially-defined risks in pursuit of personal goals, such as failure in taking an exam, or rejection in seeking interpersonal relationships. The motivational and self-relevant context for processing threat thus becomes important. Consistent with a contextual perspective, a review (Staugaard, 2010) concluded that social anxiety reliably biases processing of threatening facial stimuli only over short stimulus durations, and higher level processes such as interpretation and judgment do not show reliable bias. These findings suggest a low-level automatic bias, but Staugaard's (2010) point is that the photographic images used are rapidly recognized as not posing any real threat. Similarly, biased processing of Stroop and dot-probe stimuli may have limited relevance outside the laboratory.

An emphasis on context is consistent with recent trends in emotion research. Clore and Huntsinger (2009) question the extent to which positive and negative affect drive specific cognitive or attentional styles, as opposed to providing feedback on current perceptions, goals and responses (affect-as-information). For example, Wells (2000) proposed that internal feeling states and affect provide 'metacognitive data' used by patients to infer the 'validity' of beliefs or used as a guide of when to terminate coping efforts. The most radical version of this trend – Martin's (2001) mood-as-input theory – states that affective states have no intrinsic biasing effects at all. Instead, their influences on cognition and behavior derive from how the state is interpreted in context. This theory may be useful for understanding bias effects on relatively complex decision-making tasks that may be more representative of real-life attentional processing than simple laboratory tasks such as Stroop. Matthews, Panganiban, and Hudlicka (2011) developed a decision-making task that required respondents to search through icons representing possible threats and benefits. Trait anxiety related to bias in sampling threat icons as expected, but contrary to a simple automatic bias hypothesis, a state anxiety induction actually eliminated the trait bias. It was suggested that induction allowed trait anxious subjects to attribute their anxiety to the induction materials, including music, rather than to performance concerns. Kustubayeva, Matthews and Panganiban (2012) found relationships between information search and positive and negative affect varied according to whether the person was generally failing or succeeding. For example, negative affect may signal task difficulty in the failure context (leading to loss of motivation) but the need to remain vigilant in the success context (leading to increased motivation). Such context-dependent effects seem rather different to classic attentional bias, but they may be as or more important in real life settings. Correspondingly, it may be important for clinical psychologists to explore how the client understands and uses their feelings of anxiety in a given setting, rather than understand the anxiety solely as an index of threat.

In sum, there are various respects in which basic research on anxiety and attention has advanced since 1994, most notably in the differentiation of multiple processes underpinning bias and impairment, and in the corresponding neurology. The precise specification and modeling of cognitive and neural architectures is a priority for future theory in the area. Consistent with the S-REF model, it is increasingly apparent that such modeling must accommodate strategic processes serving personal goals, in addition to automatic biases. Furthermore, the ecological validity – and hence clinical relevance – of simple laboratory paradigms for examining bias requires further examination. The influence of negative emotion on decision-making may be at least as relevant to bias in real-life settings.

Part 2: Cognitive content and process in emotional disorder

In Part 2 of the volume we turned our emphasis to the content of attention; an area of major importance in clinical theories and in treatment, especially cognitive-behaviour therapy. For some time we harboured concerns about the rather simplistic view of thoughts in clinical theory. In 1994 there was little distinction between worry, automatic thoughts and rumination, for example. Furthermore, processes such as worry were largely viewed as autonomous or merely symptomatic of anxiety. We considered three types of thoughts that had received empirical and conceptual scrutiny: automatic thoughts, worry and intrusive thoughts and explored how they may be similar and different. Whilst acknowledging the content of thoughts and content specificity we opened out the discussion to consider how other specific factors – namely the individual's strategy for controlling thoughts and metacognitive beliefs about thoughts – could play an important role in causing emotional disorder. We contended that metacognitive beliefs and control strategies should be examined as factors maintaining worry and obsessional problems. The distinction we made between intrusive thoughts/automatic thoughts and worry, and the idea that sustained conceptual activity in the form of worry should be seen as a coping strategy was novel and significant in later developments of the S-REF model and in metacognitive therapy (Wells, 1997; 2000; 2009). In particular, it marked a move away from focusing therapy on content to focusing on the control of worry and similar processes of rumination. In subsequent chapters we described how psychological disorder appeared to be caused by perseveration in thinking (e.g. worry/rumination) whilst viewing automatic thoughts as 'triggers' for this more important (and unhelpful) form of sustained processing.

The content of attention that did appear highly significant in emotion disorder and stress responses was self-focused attention. This was a generic factor elevated across all types of psychological disorder examined. Interpreting this finding was problematic because most studies had not attempted to link self-focus with information processing models of attention. Self-focus was viewed in content terms rather than seen in a wider cognitive processing context. We postulated that heightened self-focus was a marker for a certain thinking style involving the prioritizing of worry/rumination, concentrating on threat, and internally directed coping behaviours such as thought control. In Part 3 of the book when describing the S-REF model we termed this thinking style the *Cognitive Attentional Syndrome* (CAS).

We also considered what cognitive models of subclinical stress can tell us about vulnerability to emotional disorder. Such models, notably of Lazarus and Folkman (1984), emphasize the dynamic nature of the stress process. However, in research on personality and vulnerability the subtleties of process models are often lost, so that vulnerability is equated with some stable bias in appraisal and/or coping preference (Matthews, Deary & Whiteman, 2009). Our reading of the stress literature suggested a multi-level perspective on vulnerability to excessive negative affect and emotional disorder. First, vulnerability might derive from low-level biases in threat processing, including selective attention bias. Genetic and biological factors might be antecedent to such biases. Second, vulnerability might be a consequence of social knowledge, and maladaptive beliefs about others. Third, vulnerability might reflect the self-regulatory strategies that the person deployed as intrusions from low-level processing activated dysfunctional social knowledge. Such strategies included conventional coping strategies as well as efforts at thought and emotion control driven by metacognitive beliefs. Personality traits associated with vulnerability, such as trait anxiety, might then be associated with a range of processing characteristics.

Our perspective was dynamic in two respects. First, the various specific processes engaged by a threatening event tended to interact with and feed off one another, so that dysfunction is characterized by the CAS syndrome already described, rather than any single key process. The role of executive processing in accessing metacognitive beliefs is critical in chaining together multiple processes. For instance, Wells (2000) gives the example of a Generalized Anxiety Disorder (GAD) patient worried that their partner would be in a car accident. The metacognition that worry is necessary to counter this threat may drive processes such as monitoring the partner's driving (selective attention bias), reflection on previous near-misses on the road (memory bias), imagining the partner in hospital (intrusion), efforts at discouraging the person from driving (coping), and attempts to think positively (emotion-regulation). Second, as in contemporary personality theory (Matthews et al., 2009), behavior is also regulated by dynamic interaction between the person and the external environment. Dysfunctional cycles of interaction may promote disorder. For example, a socially anxious person may believe others are criticizing them, an appraisal supported by the CAS and its attendant cognitive biases. If the person avoids further social contact as a coping strategy, dysfunctional negative self-beliefs will be elaborated and the person is deprived of the opportunity to experience positive social interaction. Hence, it is essential that therapy is not directed only to specific beliefs but towards modifying the pattern of attention and interpretation that leads to harmful interactions with the outside world.

When we wrote Att*ention and Emotion* a restricted range of research existed on attention-focused treatment techniques. Most published studies investigated simple distraction effects on pain, anxiety or depression or the effects of task-focusing instructions on performance under evaluative stress. Moreover, it was difficult to isolate effects specific to attention manipulations because attention procedures were often embedded in multi-component treatment packages. We briefly discussed a novel attention training technique that was based on modifying self-focused processing (Wells, 1990); however, there was little data on this technique in 1994.

We concluded Part 2 of the volume by considering the direction of the relationship between attention and emotional disorder, concluding that it was bidirectional. There was evidence for an etiological role of attention in the following areas: the initiation of emotional problems, intensification of existing problems and their maintenance.

Update:

Since 1994 research on different types of thoughts and their relation with psychological disorder has expanded rapidly. Experimental and correlational studies reliably demonstrate deleterious effects of worry and rumination on emotional, cognitive and behavioural reactions to stressors (Holeva, Tarrier, & Wells, 2001; Nolen-Hoeksema, 2000; Spasojevic, Alloy, Abramson, Maccoon, & Robinson, 2004; Wells & Papageorgiou, 1995). Such findings demonstrate the impact of thinking styles on emotional outcomes and support the importance of differentiating and modelling the effects of multiple thought types. We suggested that it may be useful to distinguish adaptive worry from maladaptive forms as exemplified by 'ruminative appraisal' but conceded that this was likely to be over simplistic, instead seeing the more problematic forms of worry/rumination as persistent and difficult to control; factors linked to metacognition.

There has been considerable recent work on cognitive vulnerability factors in anxiety and mood disorders. A substantial part of this research focuses on specific factors such as lack of perceived control, anxiety sensitivity and various maladaptive cognitive styles (see Alloy & Riskind, 2006). However, consistent with our perspectives, reviews increasingly acknowledge that multiple risk factors play a role in the etiology and maintenance of disorder (e.g., Behar et al., 2009), as well as the importance of dynamic factors (e.g., Liu & Alloy, 2010). Ferreri, Lapp and Peretti (2011) identified four domains of cognitive dysfunction of primary interest, each of which is represented in the S-REF model: executive control of attention, deficits in memory, maladaptive cognitions and maladaptive metacognitions. The challenge that remains is how to develop an integrated view of the various vulnerability factors. There are various proposals for such an integration, but as we advocated there appears to be growing recognition of the need for an explicit cognitive architecture to guide therapy (e.g., Clark & Beck, 2010; Ouimet, Gawronski, & Dozois, 2009), including neurological substrates for processing in some models (De Raedt & Koster, 2010). The use of the S-REF model as a framework for understanding vulnerability is reviewed by Wells and Matthews (2006).

Research on normal personality traits that confer vulnerability to emotional distress, such as neuroticism and trait anxiety, has arrived at similar conclusions. High neuroticism appears to be associated with multiple maladaptive, interacting biases in appraisal, coping and self-knowledge that increase stress vulnerability (Matthews et al., 2009). For example, relationships between metacognitive beliefs and trait-anxiety have been substantiated (Cartwright-Hatton & Wells, 1997; Wells & Cartwright-Hatton, 2004). Suls and Martin (2005) aptly pointed to the 'neurotic cascade' of dysfunctional processing generated by high neuroticism, including dysfunctional patterns of interaction with the social environment. To some extent, emotionally unstable individuals may elicit negative life events, for example, through becoming engaged in disputes with others. The role of metacognitions in the neurotic cascade has also been demonstrated, for example in excessive test anxiety (Matthews, Hillyard, & Campbell, 1999). However, 'normal' levels of neuroticism and negative affectivity are not necessarily harmful, beyond heightened experience of negative emotions. Matthews (2004, 2008) proposed that many of the cognitive attributes of neuroticism can be understood as an adaptation to threat characterized by attempts at anticipating and avoiding stressful encounters, a strategy the success or failure of which may depend both on external circumstances and the additional coping skills the person possesses.

Evidence has also grown of reliable connections between metacognition, problematic thinking styles and emotion disorder symptoms. Much of this research was enabled by new measures of individual differences in metacognition (Cartwright-Hatton & Wells, 1997; Wells & Davies, 1994; Wells & Cartwright-Hatton, 2004). Metacognitive beliefs are positively related to psychological vulnerability, emotional disorder, and styles of perseverative thinking (worry and rumination) in adults (Spada, Mohiyeddini, & Wells, 2008; Wells & Cartwright-Hatton, 2004, Wells & Papageorgiou, 1998), and in children (Cartwright-Hatton, Mather, Illingworth, Brocki, Harrington, & Wells, 2004; Esbjorn, Lonfeldt, Nielsen, Reinholdt-Dunne, Somhovd, & Cartwright-Hatton, 2014). As our model predicted, such relationships are transdiagnostic and demonstrable in obsessive compulsive disorder (Hermans, Martens, De Cort, & Eelen, 2003), problem drinking (Spada & Wells, 2005; Spada, Moneta, & Wells, 2007), depression (Papageorgiou & Wells, 2001; 2003), generalized anxiety (Ruscio & Borkovec, 2004; Wells & Carter 2001), psychosis (Morrison & Wells, 2003; Stirling, Barkus, & Lewis, 2007), test anxiety (Matthews, et al., 1999) and trauma symptoms (Bennett & Wells, 2010).

The second key area covered in this part of the book was research on self-attention in psychological disorder. By 1994 it was recognized that elevation in self-focused attention measured as a trait or state variable (self-awareness) was associated with heightened vulnerability and symptoms of disorder (e.g. Ingram, 1990). There were theories linking self-focus to individual disorders such as test anxiety (Carver & Scheier, 1988) and depression (Pyszczynski & Greenberg, 1987), but none provided a transdiagnostic model of the mechanisms linking self-focus with pathology or located it within a control architecture. Our thesis was that the similarities between disorders were likely to be the greater influences and self-attention was indicative of a general configuration of the processing system involving self-evaluative, difficult to control processing. We followed this by turning the analysis onto attention treatments that might alleviate such attention effects.

The literature has progressed predominantly around two different attention techniques: Attention Training (ATT: Wells, 1990) and Attention Bias modification (ABM: MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002). Attention Training is grounded in the strategic account of processing offered by the S-REF, whilst ABM is based on early (automatic) detection or the so-called vigilance-avoidance pattern of bias (Mogg & Bradley, 1998). These areas have advanced at a different pace and used different methodologies, with ATT tested in small-sample clinical studies and ABM in laboratory-based manipulations. Whilst ATT aims to decrease self-focused attention and enable greater flexibility to disengage perseverative processing configurations, ABM aims to reduce biased attention towards threat-related stimuli.

ATT is associated with positive clinical outcomes that appear to be sustained over follow-up intervals. Significant symptom improvements have been observed in the treatment of anxiety disorders (Wells, White, and Carter, 1997), hypochondriasis (Papageorgiou & Wells, 1998; Weck, Neng, & Stangier, 2013), and depression (Papageorgiou & Wells, 2000; Siegle, Ghinassi, & Thase, 2007). Siegle et al. (2007) demonstrated that ATT plus treatment as usual was more effective than usual treatment on depressive symptoms and rumination. Improvement after 2 weeks of ATT was greater than the average change in depression associated with the usual 6-week treatment programme. Preliminary fMRI data from a subsample of the patients receiving ATT demonstrated that pre to post treatment right Amygdala responses increased in response to positive word stimuli and decreased in response to negative and neutral words. In laboratory settings, the ATT has been found to lead to large reductions in the frequency of intrusive thoughts associated with stress-exposure (Nassif & Wells, 2014). The technique also appears to increase pain-related threshold in the cold-pressor task (Sharpe, Perry, Rogers, Dear, Nicholas, & Refshauge, 2010). These studies suggest that ATT may provide a basis for new and effective approaches but research in this area remains limited by the small number of published studies and limited number of controlled evaluations.

Studies of Attention Bias Modification (ABM) procedures typically use a modified version of the dot-probe task. Repeated trials are used to override the proposed automatic bias towards disorder congruent stimuli. Results of ABM studies are mixed with some showing a reduction in attention bias and an improvement in anxiety and depression symptoms whilst others show no or little improvement. Several meta-analyses have confirmed the effect, overall. In the most recent meta-analysis of 43 controlled trials including a total of 2,268 participants a small overall effect size on symptoms was found ($g = 0.16$) which was accounted for by studies of anxiety and studies on healthy participants (Mogoase, David, & Koster, 2014). The authors conclude that the therapeutic benefit of ABM is small for anxiety and the effect for other symptoms is limited. It is not confirmed that ABM affects automatic rather than strategic processes. Consistent with ABM effects on later stages of processing, Koster, Baert, Bockstaele and De Raedt (2010) examined the attentional changes resulting from ABM on early and late stages of threat processing. No significant differences were observed between those who received ABM and the control group for the early condition. However, a significant difference emerged at late stages of processing. Taken together these results imply that factors other than automatic vigilance for threat contribute to bias. The development of attention-based treatment techniques might consider the volitional and metacognitive components of processing such as those specified in the S-REF model.

Overall, the chief areas of advancement have been in the exploration of different thinking styles and their negative impact on self-regulation and emotion. In particular, a clear and consistent role of metacognitions in pathology at the level of metacognitive beliefs and strategies has been demonstrated.

Part 3: New theoretical model and clinical implications

In the final part of the book we presented a theoretical model of attention and self-regulation. Our aim was to account for the attentional data reviewed and interpreted in earlier chapters. We aimed at a model that would explain the development and maintenance of clinical problems and also account for laboratory data on attention bias and performance. This model, the S-REF model, was the basis for proposing a move toward a new treatment approach; metacognitive therapy.

Central to the S-REF model was the novel idea that all psychological disorders are caused and maintained by a common or 'transdiagnostic' thinking style we termed the *cognitive attentional syndrome* (CAS). A marker for this is the presence of elevated self-focus. The syndrome consists of perseverative processing typically in the form of worry and/or rumination, maintaining attention on threat, and ironic cognitive control strategies (e.g. thought suppression, self-criticism). We introduced the idea that the knowledge driving the CAS is metacognitive in nature and involves a system of plans and goals for regulating cognition.

We began to elucidate the implications for developing a new therapy, which had as a central goal developing techniques to directly impact on cognitive processes rather than the content of thought. We advocated helping patients to develop metacognitive awareness coupled with control over the CAS. In this context attention control procedures might be developed that promoted a state of 'detached mindfulness' a concept subsequently developed and elaborated within the S-REF architecture (Wells, 2005b). We introduced the idea of a clinical assessment strategy of *metacognitive profiling* for mapping the CAS and associated metacognitions in problematic situations and we suggested that the locus of disorder might be considered metacognitive such that knowledge at this level should be formulated,. We also stated that excessive verbal processing could impair 'natural decay' of emotion and should be prevented following exposure to stress and following the use of exposure-based treatment strategies.

Update:

S-REF was the first model to explicitly introduce the idea of a common or transdiagnostic set of cognitive-attentional processes in psychological disorder. The S-REF model was also pioneering in drawing attention to the multiplicity of process and content factors that may play a role in emotional pathology, and the need to address their interaction within an explicit cognitive model. Contemporary models differ in relation to the factors they identify as critical, but we are encouraged to see greater acceptance of the need for multi-process models, as opposed to a theoretical reliance on a single defective process.

The 1994 book also addressed the issue of the commonalities and differences between subclinical negative affect and clinical disorder, an issue that has become topical with the redesign of diagnostic criteria in DSM-V (Krueger & Markon, 2014). We pointed out the similarities between subclinical and clinical negative emotion in terms of dysfunctional process and content, consistent with the view that pathology in personality represents the extremes of normal trait dimensions (Widiger, 2013). Where our perspective differs from standard dimensional models is in its emphasis on internal and external processing dynamics that may tip a vulnerable personality into actual behavioral dysfunction, within a given social environment. We suspect that those with an interest in abnormal personality factors, including emotional instability, will need to return to questions of person–situation interaction to fully realize the potential of trait models.

The emphasis on metacognition as a key factor in pathology in the S-REF model stimulated the development of measures of dysfunctional metacognitive beliefs used in the clinical research literature. The Metacognitions Questionnaire (Cartwright-Hatton & Wells, 1997; Wells & Cartwright-Hatton, 2004) is widely used, with measures specific to depression (Papageorgiou & Wells, 2001), generalized anxiety (Wells, 2005a), alcohol use (Spada & Wells, 2008) and traumatic stress (Bennet & Wells, 2010) also in use. In accord with the S-REF model metacognitive beliefs are reliable predictors of negative emotion (Wells & Cartwright-Hatton, 2004; Yilmaz, Gencoz & Wells, 2011), show elevation in emotional disorders and psychosis and predict distress in medical patients (Allott, Wells, Morrison, & Walker, 2005; Cook, Salmon, Dunn, Holcombe, Cornford, & Fisher, 2014; Myers, Fisher, & Wells, 2009; Papageorgiou & Wells, 2009; Wells, 2009). Furthermore, metacognition emerges as an independent and stronger correlate of symptoms and disorder than specific cognitive constructs of memory structure/content (Bennet & Wells, 2010), the content of worry (Nuevo, Montorio, & Borkovec, 2004; Wells & Carter, 1999; 2001) and beliefs or dysfunctional attitudes (Gwilliam, Wells, & Cartwright-Hatton, 2004; Myers & Wells, 2005; Yilmaz, Gencoz, & Wells, 2008). In other areas, namely metacognitive control, the analysis stimulated by the S-REF has led to the development of measures to assess individual differences in thought-control strategies (Wells & Davies, 1994) and the related negative effects of using worry and self-punishment as forms of self-regulation (Amir, Cashman, & Foa, 1997; Morrison, Wells, & Nothard, 2000; Warda & Bryant, 1998).

A significant body of evidence now supports a causal role of metacognition (Myers & Wells, 2013; Myers, Fisher, & Wells, 2009; Roussis & Wells, 2008; Yilmaz, Gencoz, & Wells, 2011) and worry and rumination (as referenced above). Furthermore, studies have assessed and investigated the *cognitive attentional syndrome* and demonstrated its uniqueness and generic association with pathology (Fergus, Valentiner, Mcgrath, Gier-Lonsway, & Jencks, 2013). In addition, CAS-focused research supports a central implication of the S-REF that attentional control is a moderator of CAS effects on symptoms of psychopathology (Fergus, Bardeen, & Orcutt, 2012). The contribution of metacognition to treatment outcomes has also been demonstrated, with pre-treatment metacognition scores (Spada, Caselli, & Wells, 2009) or change in specific metacognitions related to positive treatment outcomes (Solem, Haland, Vogel, Hansen, & Wells, 2009).

A major contribution of our synthesis and theory is the impact it has had on the development of new treatments for psychological disorders. It has been a basis for innovations in cognitive-behaviour therapy (Clark & Wells, 1995; Wells, 1997) and for the development of an alternative form of psychotherapy; *Metacognitive Therapy* (Wells, 2000; 2009). The Clark and Wells (1995) model and treatment of social phobia incorporates self-processing, worry/rumination and modification of thinking styles and attention that we emphasized. This approach is recommended by the National Institute of Clinical Excellence (NICE) as the leading treatment of social anxiety disorder (NCCMH, 2013). Metacognitive therapy for generalized anxiety and obsessive-compulsive disorder (Wells, 1999; 2000) has also been recognized (NCCMH, 2011a, b; NICE, 2012) and recent independent controlled trials should strengthen that position (e.g. Van der Heiden, Muris, & Van der Molen, 2010).

Metacognitive therapy is supported by treatment manuals (Wells, 2009) and data are consistent with efficacy in generalized anxiety (Wells, Welford, King, Papageorgiou, Wisely, & Mendel, 2010; Van der Heiden, Muris, & Van der molen, 2010), post-traumatic stress (Wells, Welford, Fraser, King, Mendel, Wisely, & Rees, 2008; Wells, & Colbear 2012), treatment resistant depression (Wells, Fisher, Myers, Wheatley, Patel, & Brewin, 2009; 2012), obsessive-compulsive disorder (Rees & van Koesveld, 2008) and mixed patient samples (Nordahl, 2009). The metacognitive approach also modifies the delivery of exposure techniques, leading to briefer exposures aimed at explicitly changing processing style and metacognition in fearful situations, to good effect (Fisher & Wells, 2005; Wells & Papageorgiou, 1998). Normann, Emmerik and Morina (2014) report an independent meta-analysis of the effectiveness of MCT, concluding that on aggregate the treatment was associated with large effect sizes. Across controlled trials it was significantly more effective than waitlist control groups ($g = 1.81$) and more effective than cognitive behavior therapy ($g = 0.97$).

In sum, the S-REF model has endured the test of time and a significant empirical evidence base supports central tenets and constructs of the model. It continues to provide a framework for research in cognitive processes and it has been a significant grounding for the development of advanced formulations and effective treatments for psychological disorders.

Conclusion

What has changed since the publication of our volume in 1994? Quite a lot has changed; we have more data supporting the role of thinking styles and metacognition in disorder. We also have the assessment tools that facilitate testing of the model. Quite a lot also remains the same. The debate over the loci of bias effects in psychological disorder continues, but our position that strategic effects are the dominant factor is resolute. In fact, the role of automaticity in social behavior remains controversial, given recent doubts about the replicability of high-level unconscious priming effects (Harris, Coburn, Rohrer, & Pashler, 2013). In 1994 (after much discussion) we attached a question mark to a pathway towards unconscious, automatic priming of self-knowledge in our schematic representation of the SREF model (see Fig. 12.1). We believe that question mark remains, and clinicians should remain cautious about attributing pathology expressed in real-life settings to automatic processes without substantial corroborating evidence.

A high volume of studies support the central suppositions of our analysis of attention and emotion. Moreover, the constructs we proposed that are central to the S-REF model have undergone and continue to undergo rigorous evaluation. This volume contains a unique synthesis and interpretation of the literature on attention and emotion that has led to major developments in theory and treatment. It was the foundation for examining generic cognitive processes and metacognitions in psychopathology. Many of the concepts we proposed were novel. Over the last 20 years they have progressed and are now commonplace in the literature. Since publication there has been a substantial growth in interest in thinking styles and their control in emotion disorder and treatment. We are privileged to have initiated this paradigm shift and to have advanced a framework that has led to significant theoretical and therapeutic innovations. Twenty years on from the first publication of *Attention and Emotion* there remain ideas in this volume that we have yet to develop.

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1

INTRODUCTION

Cognitive theory of emotional disorders

Clinical psychology has been revolutionised by an influx of ideas and techniques derived from cognitive psychology and by the central metaphor that the mind functions as a processor of information. The basic assumption of the clinical application of cognitive theory has been expressed most economically by Ellis (1962). He suggests that emotional disorder is associated with *irrational beliefs*, particularly about the self. Irrational beliefs lead to both unpleasant emotions and ineffective, maladaptive behaviour. This theory expresses several hypotheses which have become widely accepted by clinicians working within the cognitive approach. First, beliefs have a causal effect on emotion and well-being. This hypothesis differentiates the cognitive approach from behaviourism. Second, beliefs, as causal agents, are expressed in verbal, propositional form, and can be accessed consciously during therapy. This hypothesis distinguishes the cognitive approach from most psychodynamic approaches, in which "latent" beliefs are unconscious. Third, therapy should be directed towards changing beliefs through restructuring cognitions, as in Ellis' (1962) rational emotive therapy, in which the patient is taught to recognise and modify irrational, harmful self-beliefs.

The core assumptions of the cognitive approach just described are not in themselves sufficient to provide a workable model of emotional disorder. The most obvious difficulty is the resistance to change in irrational beliefs often encountered clinically. The person's self-knowledge is not simply an internal "file" of disconnected beliefs which the therapist can erase and replace with more realistic propositions. People seem to construct and revise self-beliefs actively on the basis of some internal set of ground rules for interpreting the world. Emotionally disturbed patients may be characterised not so much by their specific beliefs as by the general frameworks they use to understand their environment and their place in it. In other words, clinicians must address the cognitive processes by which patients arrive at their maladaptive interpretation of the world. Another factor is the possibility of unconscious cognitive processing. Studies comparing introspective reports of processing with objective data have shown that people lack awareness of even some quite complex mental operations (Nisbett & Wilson, 1977). A patient's self-reports will provide only an incomplete and possibly distorted picture of their actual cognitive functioning. Psychopathology may be influenced by "automatic" processes, which may be more difficult to influence than conscious beliefs. In addition, people may fill the gap in conscious awareness by making *attributions*. The mind seems to abhor an informational vacuum, so, if we experience an emotion, we tend to search for an explanation, which may be incorrect. For example, Abramson, Seligman and Teasdale (1978) suggest that depressives are characterised by faulty attributions for negative events, tending to blame themselves rather than other agencies. Typically, the person is aware of the attributional belief, but not the unconscious and possibly automatic information processing which generates it. In practice, we may need quite a complex cognitive model, incorporating a variety of structures and processes (the "architecture" of the model), to provide a satisfactory basis for therapy.

Next, we consider Beck's (1967; 1976; Beck, Rush, Shaw, & Emery, 1979; Beck, Emery, & Greenberg, 1985) theory of emotional disorders, which offers perhaps the most influential and comprehensive account of cognitive processing in emotional disorders. This approach is based on constructs derived from experimental psychology, and is supported by evidence from both clinical observation and rigorous experiment. Our account will illustrate the need for differentiation of cognitive structures and processes, the role of the person's active construction of a world-view, and the contribution of automatic processes, as just described.

Beck's cognitive theory

Beck's approach to emotional disorders is essentially a schema theory. It proposes that emotional disorders result from and are maintained by the activation of certain memory structures or schemas. Schemas consist of stored representations of past experience and represent generalisations which guide and organise experience. While individuals possess many different schemas, each one of which represents a different array of stimulus-response configurations, one of the most important schemas involved in psychopathology is the self-schema (e.g. Markus, 1977). This particular schema is used specifically to process information about the self.

The basic tenet of Beck's theory is that vulnerability to emotional disorders and the maintenance of such disorders is associated with the activation of underlying dysfunctional schemas. The activation of such schemas is accompanied by specific changes in information processing, which play a role in the development and maintenance of the affective, physiological and behavioural components of emotional disorders. These changes in processing are apparent as an increase in negative automatic thoughts in the stream of consciousness and as cognitive distortions or "thinking errors" in processing. These distortions take the form of biases or incorrect inferences in thinking, which we discuss in more detail later in this chapter. Beck's approach is a tripartite conceptualisation which differentiates between three levels of cognition underlying emotional problems: the level of cognitive memory structures or schemas, cognitive processes termed thinking errors (Beck et al., 1979), and cognitive products, namely negative automatic thoughts. The basic cognitive model is depicted in Fig. 1.1.

Negative automatic thoughts

Each emotional disorder is characterised by a stream of involuntary and parallel negative "automatic thoughts" (Beck, 1967). In anxiety these thoughts concern

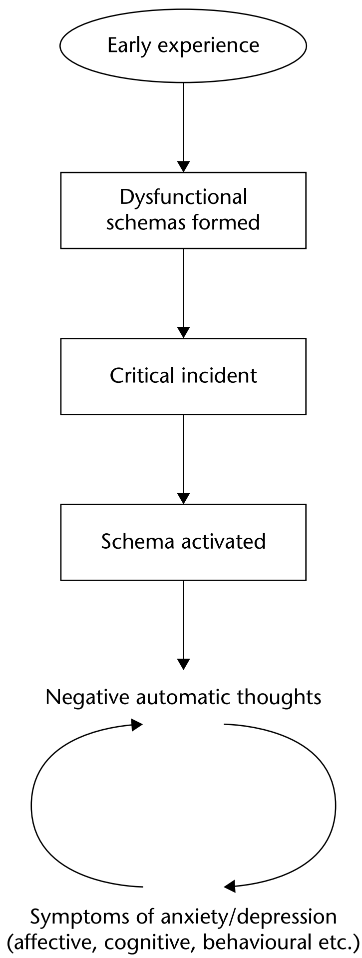

FIGURE 1.1 Beck's cognitive model of emotional disorders.

themes of danger (Beck, 1976; Beck et al., 1985; Beck & Clark, 1988), whereas in depression thoughts about loss and failure predominate. The content of thought in depression has been referred to as the negative cognitive triad, which is dominated by a negative view of the self, the world and the future (Beck et al., 1979; Beck & Clark, 1988). In stress syndromes dominated by hostility, the content of automatic thoughts concern themes of restraint or assault (Beck, 1984). The "chaining" (Kovacs & Beck, 1978) of specific cognitive content to a disorder is the basis of the content specificity hypothesis in schema theory, which asserts that emotional disorders can be differentiated on the basis of cognitive content (e.g. Beck et al., 1987). Normal emotional reactions of anxiety and sadness are also associated with negative thoughts of danger and loss, etc., but in the emotional disorders there is a strong fixation on these themes.

The term automatic thoughts was used by Beck (1967) to describe cognitive products in emotional disorders because they occur rapidly, are often in shorthand form, are plausible at the time of occurrence and the individual has limited control over them. The content of these thoughts mirrors the content of underlying schemas from which they are purported to arise.

Dysfunctional schemas

The underlying schemas of vulnerable individuals are hypothesised as more rigid, inflexible and concrete than the schemas of normal individuals. Dysfunctional schemas are considered to remain latent until activated in circumstances which resemble the circumstances under which they were formed. Their range of activation may generalise and this may lead to an increased loss of control over thinking (Kovacs & Beck, 1978).

Dysfunctional schemas have an idiosyncratic content derived from past learning experiences of the individual. There are at least two levels of knowledge represented in the dysfunctional schema which play a role in emotional distress (Beck, 1987): propositional information or assumptions, which are characterised by if–then statements (e.g. "If someone doesn't like me I'm worthless"), and at the deepest level absolute concepts or "core beliefs", which are not conditional (e.g. "I'm worthless").

In anxiety disorders, the schemas contain assumptions and beliefs about danger to one's personal domain (Beck et al., 1985) and of one's reduced ability to cope. In generalised anxiety, for example, a variety of situations are appraised as dangerous and individuals have assumptions about their general inability to cope. In contrast, panic disorder patients tend to misinterpret bodily sensations as a sign of immediate catastrophe (Clark, 1986) and thus have assumptions about the dangerous nature of bodily responses. In the phobias, patients associate a situation or an object with danger and assume that certain calamities will occur when exposed to the phobic stimulus. Unfortunately, the paucity of research on the content of dysfunctional schemas in different anxiety disorders prevents firm conclusions about schema content in these disorders.

According to Beck et al. (1979), the depressed individual has a negative self-view, and the self is perceived as inadequate, defective or deprived and as a consequence the depressed patient believes that he or she is undesirable and worthless. The Dysfunctional Attitudes Scale (Weissman & Beck, 1978) was developed to assess dysfunctional schemas in depression. The scale consists of a range of attitude clusters (e.g. "I can find happiness without being loved by another person"; "If others dislike you, you cannot be happy"; "My life is wasted unless I am a complete success"), and responses are made on a seven-point scale ranging from "disagree totally" to "agree totally". The higher the overall score on the scale, the greater the level of dysfunctionality and proneness to depression.

Cognitive distortions

Once activated, dysfunctional schemas are thought to override the activity of more functional schemas. Although schema-based processing is economical, because individuals do not have to rely on all of the information present in stimulus configurations in order to interpret events, this type of processing sacrifices accuracy for economy of processing. A consequence of dysfunctional schema processing is the introduction of bias and distortion in cognition. These processes have been termed "thinking errors" by Beck et al. (1979) and are conceptualised as playing an important role in the maintenance of negative appraisals and distress. Specific errors have been identified:

- *Arbitrary inference*: Drawing a conclusion in the absence of sufficient evidence.
- *Selective abstraction:* Focusing on one aspect of a situation while ignoring more important features.
- *Overgeneralisation:* Applying a conclusion to a wide range of events when it is based on isolated incidents.
- *Magnification and minimisation:* Enlarging or reducing the importance of events.
- *Personalisation:* Relating external events to the self when there is no basis to do so.
- *Dichotomous thinking:* Evaluating experiences in all or nothing (black and white) terms.

Other cognitive distortions particularly prominent in anxiety are *attention binding* and *catastrophising* (Beck, 1976). The former is a preoccupation with danger and an involuntary focus on concepts related to danger and threat. Catastrophising involves dwelling on the worst possible outcome of a situation and overestimating the probability of its occurrence.

The role of behaviour in cognitive theory

Behavioural responses in emotional disorders can play a role in the maintenance of dysfunctional states. Phobic disorders are often accompanied by varying degrees of overt avoidance of feared situations. Aside from such gross avoidance, more subtle forms of avoidance also occur in anxiety disorders such as panic, agoraphobia and obsessive-compulsive disorder. The perception of danger in these disorders leads to attempts to avoid the threat. In panic disorder there is a misinterpretation of physical sensations or mental events as a sign of immediate catastrophe such as collapsing or going crazy. Following such cognitions, panickers may employ subtle avoidance or "safety behaviours" aimed at preventing the calamity (Salkovskis, 1991). For example, patients who believe that they are suffocating may attempt to take deep breaths and consciously control their breathing. Patients who believe that collapse is imminent may sit down, hold onto objects or stiffen their legs. Since the catastrophe does not actually occur, patients may then attribute its non-occurrence to having managed to save themselves. In this scenario, safety behaviours can have two effects which contribute to the maintenance of anxiety. First, particular safety behaviours may exacerbate bodily sensations. Deep breathing, for example, can lead to respiratory alkalosis and the range of symptoms associated with hyperventilation (dizziness, dissociation, numbness, etc.), and these sensations may then be misinterpreted as further evidence of an immediate calamity. Second, if panickers judge that they have managed to save themselves from disaster, their safety behaviours prevent disconfirmation of catastrophic beliefs concerning bodily sensations. It follows from this that manipulations which include a systematic analysis of safety behaviours and prevention of these behaviours during exposure tasks may increase treatment effects. Initial data from social phobics is consistent with this proposal (Wells et al., in press).

Behaviours aimed at controlling cognition can have a similar effect in preventing disconfirmation of beliefs concerning the dangerous nature of experiencing certain cognitive events. In addition, attempts to control or avoid unwanted thoughts may lead to a rebound of unwanted thoughts (e.g. Clark, Ball, & Pape, 1991; Wegner, Schneider, Carter, & White, 1987). This may be particularly relevant in the development of obsessional problems and problems marked by subjectively uncontrollable worry (Wells, 1994b), as discussed in Chapter 7. The application of safety behaviours relies on self-monitoring of bodily and cognitive reactions which are appraised as dangerous. This type of self-directed attention could have deleterious effects of intensifying internal reactions (see Chapter 9).

In depression, self-defeating and withdrawal behaviours can serve to maintain or strengthen dysfunctional beliefs. Depressive symptoms may be appraised as evidence of being ineffectual, which then leads to further passivity and hopelessness (Beck et al., 1979). Negative self-beliefs can give rise to self-defeating behaviours which reinforce these beliefs. For example, individuals who believe that they are unloveable may stay in abusive relationships because they negatively appraise their ability to form better relationships. Young (1990) terms such responses "schema processes", which prevent disconfirmation of beliefs and maintain and exacerbate stressful life circumstances.

Cognitive model of panic

Clark (1986) developed a cognitive model of panic which has many overlapping features with Beck's model of anxiety. In the model, panic attacks are considered to result from the misappraisal of internal events such as bodily sensations. Sensations are misinterpreted as a sign of an immediate impending disaster such as having a heart attack, suffocating or collapsing. The sensations most often misinterpreted are those associated with anxiety, although other sensations—for example, those associated with normal bodily deviations or low blood sugar—may also be misinterpreted. Similar misinterpretations are considered central in health anxiety (e.g. Warwick & Salkovskis, 1990), but in this latter disorder the appraised catastrophe is more protracted.

Clark's (1986) model of panic proposes a specific sequence of events which culminate in a panic attack. To begin with, any internal or external stimulus which is perceived as threatening produces a state of apprehension and associated bodily sensations. If these sensations are misinterpreted in a catastrophic way, a further elevation in anxiety results and the individual becomes trapped in a vicious circle which culminates in a panic attack (Clark, 1986; 1988). Once panic attacks are established, two particular processes are involved in maintaining the problem: *selective attention* to bodily cues, and *safety behaviours* of the type discussed previously. Beck (1988) also refers to "attention fixation" on internal sensations in panic and claims that panic patients are "hypervigilant" for bodily sensations. In addition, there also appears to be an inability of the individual during panic to "apply reasoning and logic or to draw on past experience or previous knowledge to re-evaluate the symptoms or to examine the frightening concept objectively" (Beck, 1988, p. 92). Beck (1988) suggests that the predisposition to experience panic under certain circumstances may take the form of chronically increased physiological arousal, an increased tendency to exaggerate or misinterpret the meaning of some symptoms, and in particular an inability to reappraise these misinterpretations realistically. Hypervigilance and loss of reappraisal ability during panic can be construed as a form of cognitive distortion which contributes to the vicious circle of panic.

Clinical models and scientific theory

Beck's cognitive model represents a crucial and most influential development for the treatment and conceptualisation of emotional problems. We owe much of the work in this book to the impetus and basic framework provided by this model. However, as with most models, we see a number of limitations with the present model. First, it is based on concepts such as schemata which are difficult to falsify experimentally. Second, the model as it presently stands only considers limited dimensions of cognition and neglects broader aspects such as attention, regulation of cognition, levels of control of processing, and the interaction between varieties of processing. Third, the use of cognitive psychological concepts such as schemas is not rigorous and the model has not advanced along with recent theoretical and empirical innovations in cognitive psychology. Finally, practical aspects of cognitive therapy are only loosely tied to the theory, in that what therapists do is determined by what their experience informs them will work. A principal aim of this book is to overcome these limitations by the theoretical integration of experimental work on emotion and attention with clinical observation and studies of cognitive therapy.

A key assumption of Beck's (1967) approach, and other related models of affective disorder, is that the primary cause of emotional disorder is the specific content and structure of the internal knowledge-base, particularly as it concerns the self. However, models of emotion based primarily on experiments on normal subjects offer a rather different perspective.

Bower (1981), for example, conceptualises emotions as nodes in a semantic network, related to associated concepts by excitatory links, as discussed in more detail in Chapter 5. Although the theory is primarily directed towards explaining effects of normal moods on information processing, it suggests a rather different cognitive metaphor for clinical models. In the simplest case, the depressed patient, for example, might have an overactive depression node, so that associated negative concepts are prone to activation (see Ingram, 1984). In other words, pathology might relate not to specific beliefs or propositions but to the operating characteristics of fundamental processing units. The emotional processing of the patient may be inaccurately tuned to significant external events. This hypothesis is not tied to the network model. Crudely, we might imagine the person as possessing an internal "well-being thermometer" which influences emotional happiness. If the thermometer is poorly calibrated, the person may be chronically depressed (or unrealistically cheerful). To the extent that emotion influences other processing and behaviour, the individual may well function maladaptively, which in turn influences the knowledge-base, generating negative self-beliefs and so on. However, the primary influence on emotion might, in principle, be a simple malfunction of simple processing system components, rather than complex self-knowledge. (Such an approach would be compatible with psychobiological models of emotional disorder: see Gray, 1982.) If maladaptive beliefs are in fact only a symptom of a more fundamental processing abnormality, the implications for therapy are profound. We might suspect that the emotional thermometer might be recalibrated only by an intensive retraining programme, somewhat akin to the conditioning methods used in behaviour therapy. In the worst case, if calibration is biologically hardwired, the therapist is put in the awkward position of teaching patients to mistrust their emotions and behave as though they were happier than they actually feel.

Experimental psychology of attention and emotion

Attentional research

Experimental research on attention and emotion is of particular value in developing scientifically rigorous theories of emotional disorder. Studies of attention typically investigate tasks requiring selective attention, in which one of several sources of stimuli must be chosen for further processing; focal attention, where processing effort must be directed towards a single source of stimuli; and divided attention, where two or more sources must be scanned simultaneously. In each case, the person endeavours to process only a subset of the many stimuli arriving at the senses. However, like so many everyday terms, "attention" is a decidedly fuzzy concept, with a variety of connotations. A precise definition can be supplied only within the context of a specific information-processing theory. As we shall see, theorists disagree on the nature of the processes influencing the tasks just described, so only provisional definitions are possible. In general, we loosely define *attention* as the selection or prioritisation for processing of certain categories of information, but use of attention as an explanatory construct depends on the theory of selection adopted.

A useful distinction is between attention as an *observed phenomenon*, where selection of information is inferred from the subject's behaviour or self-report, and *attentional mechanisms* which underlie processes generating observable selection. Possible attentional mechanisms are highly disparate. Selective attention theory has tended to conceptualise information as flowing through a series of processing stages, eventually entering consciousness and influencing response. The traditional problem has been to identify the stage at which selection takes place. However, as we shall see in Chapters 2 and 3, radically different conceptualisations are possible. Selection may be a function of active search for information, guided by strategies and abstract knowledge, or it may be an emergent property of networks of interconnected processing units. Another important observation is that the efficiency of processing non-emotional stimuli is often impaired in emotional disorders. Again, changes in efficiency have a variety of theoretical interpretations. They may be attributed to changes in the overall availability of some general attentional capacity, or to the diversion of capacity from the task at hand to processing of internal, emotionally laden stimuli, or to inefficiency in strategic deployment of available capacity.

In the clinical context, attention, broadly defined, is of special interest because many of the symptoms of emotional disorder appear to be associated with abnormalities in selection of thought content. In conditions such as generalised anxiety, obsessive-compulsive disorder, health-anxiety and depression, patients are troubled by the frequency and meaning of disturbing thoughts. Indeed, abnormality may be more apparent in the content of thought than in overt behaviour. Disturbances of consciousness may be experienced or appraised as entirely beyond the patient's voluntary control. For example, the hysterical anaesthesias described by Freud were attributed to medical illness by the victims. The stimuli towards which attention is directed may be external, as when a spider phobic becomes preoccupied with watching cobwebs for spiders, or internal, as when a panic patient's awareness is dominated by physical symptoms, or when a depressive is preoccupied with beliefs of self-worthlessness. In each case, we may infer that conscious awareness reflects some selection of negatively toned information by the underlying processing machinery. However, the nature of these selection mechanisms cannot be inferred directly from the attentional phenomena observed. What is required from experimental studies of attention is an account of the mechanisms which may contribute to observable abnormalities of selection, and techniques for investigating which mechanisms are specifically associated with clinical disorder.

Thus, one important line of research is to investigate attentional phenomena at a purely behavioural level. An idea familiar from clinical practice is that abnormality may be inferred from the patient's behaviour, independent of direct reports of subjective awareness. For example, the clinician may notice that a patient is very quick to detect criticism or evaluation, although the person concerned may deny any sensitivity of this kind. In recent years, researchers have shown considerable ingenuity in adapting experimental techniques to show that patients are abnormal in their speed and accuracy of selection of information. For example, Burgess et al. (1981) conducted a study in which subjects listened to two simultaneous messages presented through headphones, one to each ear. Task instructions to repeat back one of the messages forced subjects to attend to one ear in preference to the other. Under these circumstances, agoraphobics showed better detection of threatening words, implying a bias in selective attention in these patients. A major focus of this book concerns the theoretical inferences which may be made from work of this kind.

In the limiting case, we might discard self-reports altogether, and construct theory only from tightly controlled experimental data. In our view, this would be a mistake. Although self-reports must be treated with caution, they provide important clues to the consciously accessible components of information processing such as choice of strategy. Furthermore, the experimental approach tends to be laboratory-bound, and neglects the role of the patient's natural physical and social environment in influencing symptoms. A second line of research, therefore, is to collect correlational data on the relationships between self-reports of attentional and processing phenomena, and emotional reactions in everyday life. Such research is perhaps more difficult to do rigorously than experiments. Self-report measures must be psychometrically adequate, theoretically based, and validated in controlled experiments. A good example of research of this kind is work on *self-focused attention* by Carver, Scheier and colleagues, reviewed in Chapter 9. This work demonstrates that self-reports of directing attention towards self-relevant information and self-regulatory processing are systematically influenced by experimental manipulation. Self-focus is predictably related to emotional experience, and is an important feature of affective disorders (Ingram, 1990). It is difficult to explain the behavioural consequences of self-focus without making inferences about processing from the patient's self-reports; a purely behavioural approach to the phenomenon is unlikely to suffice. We see both experimental work and rigorous studies of self-report measures as contributing to an understanding of the underlying mechanisms controlling attentional phenomena.

Emotion research

The other important area of experimental research concerns the origins and consequences of emotional states. Emotions are generally seen as complex syndromes with a variety of possible expressions, including activation of the autonomic nervous system, subjective experience, facial expression, and disposition to engage in certain actions or social roles (e.g. Averill, 1980). Emotion research is considerably more diverse than experimental research on attention, and we have not, therefore, provided any general overview of its many facets (see Strongman, 1987). We are also particularly concerned with unpleasant emotion, rather than emotion in general. However, it is worth highlighting several strands of cognitively oriented emotional theory, based in part upon experimental research. First, emotion and information processing interact dynamically. The assumption that emotions are influenced by, or even wholly arise from, cognitive appraisal of external and internal events is now commonplace (e.g. Lazarus & Folkman, 1984). Emotion theory is also concerned with what happens next, as a consequence or concomitant of the emotional state. Mandler (1979) sees emotion as the outcome of cognitive evaluation of the current state of the world. Emotion, and its concomitant autonomic arousal, has an interrupt function which redirects attention to important events in the environment. Direction of attention to autonomic activity is likely to reduce the attentional capacity available for other activities. As the transactional theory of stress (Lazarus & Folkman, 1984) emphasises, there is often a protracted dynamic interplay between emotion and cognition during stressful encounters as the person evaluates and re-evaluates the progression of events over time. Second, emotion may correspond to an abstract, high-level description of the relationship between the person and his or her environment. Thus, Lazarus and Smith (1988) see emotions as dependent on the main relational meanings of encounters between person and environment. Anxiety stems from facing uncertain, existential threat, sadness from having experienced an irrevocable loss. The third strand is that emotions may have an adaptive, functional significance, in that moods and emotions are associated with inclinations to act in certain ways (Thayer, 1989). For example, when angry, we wish to strike out at someone, and so forth. Oatley and Johnson-Laird (1987) propose that the emotions are part of a primitive, non-propositional internal communication system, which assist in rapid switching between plans in response to external events. Fourth, emotions have a pronounced social character. Just as emotions may regulate transitions between plans in the individual, so too they may assist the co-ordination of mutual action by groups of individuals. Emotional signals, especially facial expression (Tomkins, 1984), afford rapid communication of individuals' willingness and ability to proceed with joint plans.

Causal links between attention and emotion

Emotion theories typically make a general assumption of reciprocal causal links between emotion and cognitive processes such as those governing attention, but clinical progress requires more detailed causal hypotheses. As we have seen, cognitively oriented clinicians have supposed that abnormality of information processing is a primary cause of emotional disorder. If we find, for example, that anxiety patients tend to prioritise processing of threatening stimuli, we might reason that clinical anxiety may be caused directly by an excessive bias towards processing threatening stimuli. Anxious persons are systematically mislead by their processing circuitry. In fact, this kind of link from cognition to abnormality is only one of a variety of causal possibilities, which are difficult to distinguish. Cognitive disorder may be only the most proximal cause, and may itself be driven by other factors, such as psychobiological processes. Attentional bias to threat may be caused by over-sensitivity of the cell assemblies activated by threat (see Gray, 1982). Attentional disorder and other symptoms may have a common cause, but no direct causal linkage, as in the case of conditions caused by organic damage to the brain. Alternatively, attentional disorder may be a secondary adaptational process. A soldier traumatised by warfare may be sensitive to imaginary threats as a result of a hypervigilant attentional strategy which was originally beneficial. Even if attentional malfunction is the principal causal agent, abnormalities in the prioritisation of processing may reflect basic structural characteristics of the system or the use of particular voluntary processing strategies derived from the subject's knowledge base. It is frequently unclear whether attention is a symptom, a primary cause, or an intervening process between cause and symptom, and theorists in this area must exercise due caution.

There is no royal road to demonstrating causality in this research area, because the researcher never has more than partial control over the subject's internal processing. The effects of an experimental manipulation may be driven by the person's evaluation of its significance, rather than by its objective attributes. For example, in principle, heightened threat sensitivity in anxious patients might be no more than a demand characteristic, based on the patient's perceptions of the experimenter's wishes. As we see in Chapter 5, even unconscious stimulus processing may be influenced by the person's voluntary strategy. Experiments are important for testing predictions for theory, but they must be supplemented with data from other sources, such as self-report. Treatment of such data must be as rigorous as possible; analysis of longitudinal data and structural modelling of non-experimental designs allow predictions from causal theories to be tested. In general, theory should be supported by converging evidence from different paradigms.

In conclusion, self-report and observational data are unified by the *information-processing* paradigm. Behaviour, subjective awareness of cognitive function and emotion are all expressions of an underlying cognitive system, whose functions include biasing information intake and action to meet some internal representation of the system's goals, selecting the contents of consciousness, and generating subjective emotion from high-level evaluation of the person's adaptive status.

Plan of the book

The structure of this book reflects the two broad lines of investigation applied to studies of attention and emotion: (1) laboratory studies of information processing, and (2) research based on complementary laboratory, clinical and field studies using self-report measures. In Part 1 of the book (Chapters 2–6), we discuss experimental studies. Chapter 2 reviews theories of attentional selection and efficiency, and draws an important distinction between levels of control of attention. Selective processing may be either stimulus-driven, and somewhat "automatic", or driven by voluntary plans and strategies. In Chapter 3, we look at the selection of complex, personally significant and emotional stimuli, and conclude that the person's generic knowledge of attended stimuli may be an important influence. Chapter 4 provides an empirical review of the effects of unpleasant emotion on selective attention to emotionally charged stimuli, and Chapter 5 relates key findings to attentional theory. Emotional disorder is associated not just with attentional bias, but also with the overall decrement in the quality of attention and performance, as discussed in Chapter 6. Much of the research reviewed in Part 1 is concerned with information-processing theory and is necessarily somewhat technical. For the benefit of the reader who wishes to move rapidly to the more clinically oriented parts of the book, we have provided a summary of the main conclusions reached at the end of each chapter. The general argument of this section of the book may be followed by reading each concluding section.

For an adequate understanding of attentional processes in emotional disorder, experimental research must be related to systematic clinical observation, to self-reports of emotion and attention in states of distress in everyday life, and to therapeutic practice. Part 2 (Chapters 7–11) reviews research of this kind, which uses experiments as only one of the investigative tools available. The importance in clinical theory (e.g. Beck, 1967) of subjective symptoms of attentional abnormality, and of knowledge about the self, provides the basis for reviewing attentional content in emotional disorder (Chapter 7). There are parallels between reports of attentional dysfunction in clinical disorders and in non-pathological stress states, so in Chapter 8 we outline cognitive models of stress and how it influences attention in non-clinical samples. We shall argue that a key aspect of affective disorder and stress states is self-focus of attention; distressed individuals are frequently absorbed in their own problems, and are particularly attentive to self-relevant information and social evaluation of themselves. Chapter 9 reviews clinical and experimental studies of self-focus of attention. Two further issues of specific clinical interest are the roles of attention manipulation in cognitive therapy (Chapter 10), and whether self-report measures of cognitive functioning are actually predictive of subsequent pathology (Chapter 11). In several of these chapters, we also review material on the important social aspects of emotion and attention, and the role of personality traits.

Part 3 (Chapters 12–14) aims to provide a theoretical integration of the various lines of evidence on the relationship between emotion and attention. In

Chapter 12, we develop an integrative cognitive-attentional model of emotional dysfunction and stress. The model is intended both to explain experimental data on attention and to specify the cognitive processes which contribute to the aetiology and maintenance of clinical disorders. Our basic premise is that emotional problems are reciprocally linked to a cognitive-attentional syndrome associated with excessive self-focus of attention. This approach has various implications for conceptualising and treating emotional problems in a cognitive-behaviour therapy framework, and for future theory-driven research, which we consider in Chapters 13 and 14, respectively.

PART I

Emotion, attention and information processing

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2

ATTENTION

Basic conceptual and theoretical issues

In the previous chapter, we provided a loose definition of attention as the selection or prioritisation for processing of certain categories of information. We can subdivide attentional processes into the two broad functions attributed to attention: *selection* and *intensive processing*. The information-processing system must select which stimuli are to be processed most extensively, and which are permitted to control response and action. Also, when a mental activity is particularly demanding or important, the system must configure itself to maximise efficiency of processing, possibly at the expense of more peripheral activities. Selective and intensive aspects of attention may have to function in concert, as when listening to a telephone call on a noisy line. These two attentional functions correspond to one of the great axes of theoretical debate among attentional psychologists. On the one hand, theories of selective attention tend to emphasise the importance of detailed knowledge about the structure or architecture of the information-processing system. Armed with a circuit diagram of the mind, we can attempt to diagnose the points at which information is selected for entry into consciousness or for control of action. On the other hand, theories of demanding task performance, such as simultaneous performance of two or more tasks, emphasise the overall capacity or resources of the mind, which may be supported by a variety of specific processing structures.

In the next part of this chapter, we review four broad approaches to attention, each providing a different perspective on the relative importance of the system architecture, and of general processing capacity. First, we consider the search for an attentional bottleneck: at which points is the system forced to discard information? Second, we consider capacity models in detail. Third, we look at dual-level models of attention, which distinguish qualitatively different domains of processing, subject to different processing constraints. Fourth, we consider recent connectionist approaches to attention. In the next chapter, we consider how complex self-knowledge such as Beck's (1967) schemata may influence selective attention, and we review studies of the selection of emotional information.

The search for a bottleneck

Early and late selection

Much research on selective attention assumes that the external environment may be divided into *channels* from which information may be received. The textbook example (e.g. Wickens, 1992) is the many instruments and displays to which an aircraft pilot must attend. Each one is a distinct channel, and the pilot must develop a *sampling strategy* which controls how frequently each one is monitored. In everyday life, channels may be defined not just by different locations in space, but by other distinctions important to the individual. For example, each person participating in a conversation may be seen as a distinct channel supplying visual and auditory input. The basic problem for selective attention theory is to discover how people are able to process incoming stimulus characteristics so as to select some channels for full processing of information, and to ignore or process superficially other channels.

The traditional theoretical dichotomy in selective attention distinguishes early from late selection. Early selection (Broadbent, 1958) proposed a selective filter located after initial perceptual analysis, which could be set so that only stimuli possessing a particular attribute or feature were selected for further analysis. Features are simple physical properties such as colour, spatial location or pitch. In contrast, late selection theories (Deutsch & Deutsch, 1963) proposed that all stimuli were fully analysed, with selection taking place only when a response was selected. Studies of the famous "shadowing" task soon disposed of the original filter theory. This task requires the subject to repeat out loud a spoken message played through headphones. In studies of selection, different messages are played to the two ears, and the subject must shadow one. Since "ear" constitutes a feature, filter theory predicts that shadowing one ear precludes detailed analysis of the message presented at the unattended ear. In fact, several studies of shadowing (e.g. Treisman, 1960) showed that subjects often follow a meaningful message which switches from ear to ear, implying that the supposedly unattended message is in fact analysed for semantic content, contrary to filter theory. Another difficulty for traditional filter theory is the role of perceptual grouping: it is harder to select an item for processing if it forms a Gestalt configuration together with distracting items, than if the stimulus and distractors form separate Gestalts (Prinzmetal, 1981). It has been argued that the selection is not geared towards individual stimulus features, but towards objects, which are naturally perceptually grouped (Duncan, 1984).

Contemporary early selection theories

Early selection theories have evolved to accommodate such findings, exemplified best by a series of models proposed by Treisman. Her first departure from the original filter theory was to propose that the perceptual filter has only an attenuating effect (Treisman, 1964). Most of the encodings of the elementary features associated with an unattended input are discarded but a few features may pass through the filter. In the case of a strongly expected stimulus, these features may be sufficient to trigger conscious recognition, as when a person's name "breaks through" into awareness from the unattended ear in a shadowing experiment. Further developments of the theory primarily concern visual selection. Treisman and Souther (1985) and Treisman and Gormican (1988) proposed two stages or domains of processing. The first stage is passively driven by stimulus input, whereas the second stage is associated with "top-down" processing, stimulus analysis dependent on the person's knowledge and expectations (which may or may not be accessible to consciousness). Early stimulus-driven processing, operating in parallel, generates a series of "maps" of the visual field, each coding the spatial position of features such as colours, lines of specified orientation and so on. Hence, search for a single feature is particularly fast, and unaffected by the presence of other, distracting features. Treisman (1988) also discusses feature inhibition processes which may serve to focus attention on perceptually grouped stimulus elements. Search for *conjunctions* of features requires serial search through maps combined to produce percepts of whole, conjoined objects, and so is slower, and subject to distractor effects. Conjunction search requires allocation of attention to the corresponding locations of the various feature maps, to identify which features are associated with the same percept. The end-product of first-stage processing is the construction of an episodic "object file" encoding the spatial configuration of features associated with each perceptual object, which can be further analysed by the second, serial stage of processing. Unattended stimuli simply fail to generate an object file. Top-down processes serve to control the focus of spatial attention, and to eliminate feature conjunctions incompatible with expectation, though Treisman (1988) suggests that the process of feature conjunction itself is insensitive to top-down control. Cave and Wolfe (1990) have developed a modification of Treisman's (1988) feature integration theory which offers a different view of top-down control. According to their guided search model, top-down processing generates a map coding the similarities between the features actually present and the "target" feature expected on the basis of prior knowledge. A combination of information from bottom-up and top-down processing directs the later, serial processing stage to the most promising spatial locations for finding the desired target.

Contemporary late selection theories

Late selection theories (e.g. Duncan, 1980) make a similar distinction between early, parallel pre-attentive processing, and a limited-capacity system operating later in processing. The essential difference is that, according to late selection theory, stimulus attributes are extensively analysed and assigned to objects pre-attentively. Hence, the system is not selecting which inputs are fully analysed, but which inputs control response. The simplest evidence for this view is provided by studies of dual-task performance, showing that the level of interference between the tasks depends mainly on the similarity of response (McLeod, 1977). Late selection theorists also claim that, contrary to early selection theory, representations of "unattended" stimuli are not simply lost, but may continue to influence processing. Studies of "negative priming" show that target processing is slowed if the target is related to the supposedly ignored distractor of the previous trial (Tipper & Driver, 1988). Duncan and Humphreys (1989) have proposed perhaps the most detailed contemporary late selection model. In contrast to the Treisman (e.g. 1988) theory, object files, or structural units, are compiled by pre-attentive processing. Structural units compete for access to a limited-capacity visual short-term memory, depending on their relative attentional strengths or weights, which are frequently influenced by an advance specification or "template" of expected or important information. The 3–4 most strongly weighted units enter a limited-capacity, visual short-term memory store, at which point they reach conscious awareness and may control the subsequent response.

Comparison of models for selection

At present, no decisive resolution of the early–late selection controversy is possible. The literature on attention is replete with technical arguments on the validity of the various pieces of evidence. Difficulties for the Treisman and Souther (1985) early selection model include a variety of studies suggesting that feature and conjunction search may not be controlled by qualitatively different processes (Duncan & Humphreys, 1989), and that selection by single physical features is not always particularly easy (Allport, 1980). Conversely, it is claimed that dual-task interference is only partially explained by interference between similar responses (Pashler, 1989), and that negative priming may be an artifact of distractor processing taking place after the target has been successfully selected (Yantis & Johnston, 1990). Johnston and Dark (1985) and Allport (1989) provide reviews broadly supportive of early and late selection, respectively. Perhaps more important is the agreement across theories of several general principles, which tends to blur the early–late distinction in some respects. These principles include the distinction between the early parallel processing stage and later capacity-limited processing, which correspond to distinct domains of "pre-attentive" and "post-attentive" processing. There is also a consensus that selective attention is primarily oriented towards the selection of objects, rather than isolated stimulus attributes. It is widely believed, too, that processing is guided by detailed specification of the object to be selected which operates through biasing the bottom-up functioning of the early processing stage, so that non-targets may be rejected prior to entry into the later, limited-capacity domain (Cave & Wolfe, 1990; Duncan & Humphreys, 1989). The nature of the representation of rejected non-targets becomes more an important detail than a fundamental point of principle. As Duncan (1985) has pointed out, it may be more useful to investigate how information is used at different stages of processing, than to ask where stimuli are "identified" in some all-or-none fashion. If so, there appears to be some degree of convergence between early and late selection theory.

In addition, the stage of processing at which selection takes place may vary. As an example, consider the spotlight metaphor for visual attention. Within the area illuminated by the spotlight, late selection operates, as shown by evidence that conflicting, spatially contiguous letter stimuli generate interference at the motor response level (Coles et al., 1985). Late selection may be confined to elements common to a single perceptual object: it is currently somewhat unclear whether processing of unattended objects within the attentional spotlight can generate interference (Johnston & Dark, 1985). However, stimulus processing outside the spotlight is largely restricted to simple physical features (Johnston & Dark, 1985), and early selection by location operates very efficiently when conditions are favourable for establishing a fixed spatial focus (Yantis & Johnston, 1990). The most detailed model of this kind is that of Eriksen and Yeh (1985). They propose that spatial attention operates like a zoom-lens, so that the person can expand the area of space fully attended to, at the cost of a loss of "resolving power" or efficiency of processing. Stimuli associated with conflicting responses will generate interference only within the area of focal attention (Eriksen & Schulz, 1979). Yantis and Johnston (1990) propose that people are flexible in their attentional strategies, selecting early or late depending on task demands and strategy. People may adopt a late selection strategy either because of difficulties in making use of featural information (Johnston & Heinz, 1978), or because task requirements favour late selection, as in the case of dividing attention across two tasks. There may also be multiple selection points within the same task. Pashler (1989) discriminates two quite separate bottlenecks in divided attention, one associated with visual perceptual processing, and one with queuing of responses for selection.

Capacity models of attention

The capacity metaphor

The idea of limited information-processing capacity is one of the most appealing but problematic unifying concepts in attentional theory. It is also one of the most misunderstood. There is no doubt that the neural basis of attention dictates capacity limitations. What is at issue is whether we can identify limitations of the processing system as a whole, as opposed to limitations of its individual constituent parts, whether these are characterised as cell assemblies, or as elementary processes. Several rather different definitions of capacity, in this non-local sense, have been proposed. Early attempts (e.g. Broadbent, 1958) were inspired by the digital computer to see capacity residing in a central, general-purpose processor, with an upper limit to the rate at which serial-processing operations could be performed. A more subtle variant on this theme (Moray, 1967; Navon & Gopher, 1979) was to see capacity as a set of specific processing resources, such as processing networks, memory space, communications channels and so on, which could be allocated flexibly according to processing demands, under the control of an executive resource manager. This model is compatible with a wide variety of processing architectures. A further definition (Wickens, 1980) is to equate capacity with a metaphorical supply of energy or fuel for processing. As with an electrical circuit, loss of power leads to a gradual degradation in output from the powered components. The critical feature of this definition is that capacity is something additional to the information-processing machinery; energisation is *non-local*, in that it is not simply a matter of the response to processing load variation of each individual processing unit. A rather different approach has been provided by Townsend and Ashby (1980), who suggest an operational definition: capacity refers to the effect on performance of changes in processing load. At a micro level, capacity limitations may be a direct result of system architecture (and so of limited theoretical interest). The capacity of a serial processor will simply reflect the time taken to process a single input. However, the definition is equally applicable at the macro level, when the underlying system architecture is unknown. Capacity is a convenient way of describing the load-response characteristics of the system, which may or may not be associated with non-local energisation of resource allocation processes.

Resource theories

The most influential formalisation of capacity theory is Norman and Bobrow's (1975) resource theory. They describe a hypothetical Performance–Resource Function (PRF), a graph relating resources to performance. The key point is that the gradient of the curve may vary, such that performance may vary more or less with changes in resource availability. Processes may be either resource-limited, or data-limited, in which case performance depends on the quality of signal or memory data, and is unaffected by changes in the supply of resources. A process may be resource-limited along some parts of the PRF but data-limited along others. The PRF is not directly observable, because we cannot measure resources and performance independently. Resource theory can only be tested by making indirect inferences about the shape of the PRF in single- and dual-task performance. Dual-task methods have been most widely used. The basic logic is that resource-limited performance on one task should be sensitive to the quantity of resources diverted to a second task. The simple demonstration of dual-task interference is inadequate, since it may reflect changes in data limitations generated by difficulties in combining the tasks, termed the *cost of concurrence* (Wickens, 1984). For example, visual monitoring of two widely separated locations is difficult because we cannot fixate both simultaneously. Dual-task interference must show *difficulty-sensitivity*, so that the amount of interference increases with the difficulty of the interfering task (Wickens, 1980). The most thorough way of investigating resource usage in dual-task performance is by constructing a Performance Operating Characteristic (POC: Wickens, 1984). Subjects perform a pair of tasks, under a variety of instructional priority conditions. If the tasks share a common resource, prioritisation of one task can only be achieved by diverting resources from the other. There will then be a smooth trade-off curve relating performance levels of the two tasks as their relative priorities change. In contrast, if performance is data-limited, performance changes on the tasks will be independent. The POC can also be used to investigate subjects' strategies for *allocating* resources to the two tasks under different circumstances or instructional sets, and to quantify the cost of concurrence. Dual-task performance often provides POCs suggestive of resource limitation (e.g. Matthews & Margetts, 1991), although, because of scaling difficulties, the POC cannot usually indicate the exact shape of the underlying PRF.

Dual-task studies frequently show that interference suggestive of resource-limitations tends to increase with task similarity (Wickens, 1980). To explain such findings, multiple resource models have been proposed: there are separate resource supplies for qualitatively different types of processing. Although it is widely accepted that the original, unitary resource model cannot explain the full pattern of observed dual-task interference, there is no consensus over the number and nature of multiple resources. One of the simpler models (Humphreys & Revelle, 1984) distinguishes resources for speeded throughput of information from short-term memory resources. The most sophisticated (Wickens, 1984; 1989) suggests three dimensions of resource: stage of processing, processing code and processing modality.

Criticisms of resource theory

Several general criticisms of formal resource theory have been advanced. The first argument is architectural—that resource theory is incompatible with the structure of the mind and of the brain. Allport (1980) contrasts the idea of what he terms a general-purpose limited-capacity central processor (GPLCCP) with the distributed nature of brain functions. Neurological studies show that anatomically distinct populations of neurons perform highly specific computations on highly specific inputs. A parallel is drawn with connectionist models of cognition, in which processing is controlled by many distributed, modular units. This argument is misconceived with regard to both the neurological and the cognitive evidence. Cell assemblies may perform specific functions, but the cells of the neocortex are also extensively innervated by pathways ascending from subcortical pathways. At least two of these pathways, the dorsal noradrenergic bundle (Gray, 1982), and cholinergic pathways from the tegmental region (Warburton, 1979), appear to affect information-processing efficiency. Independence of function at the cortical level does not preclude common influences on function from other brain systems. There is also no particular reason to identify resource theory with the GPLCCP architecture of the late 1950s. Indeed, there is no reason why a massively parallel system of the kind favoured by Allport (1980) should not also be subject to non-local performance constraints which cause the system to exhibit resource-limitations at the macro level. For example, Duncan and Humphreys (1989) suggest that the total quantity of activation of distributed processing units may be fixed, through mutual inhibition. Hence, to criticise resource theory on architectural grounds is a category error: resource theories describe general or emergent properties of the system rather than specific architectural properties.

A more serious source of difficulty is methodological. As Navon (1984) has shown, interpretation of all or most of the experimental paradigms used to test resource theory is open to question. Even the POC method is not water-tight. Navon suggests that trade-offs may be generated by mechanisms other than resource reallocation, such as demand characteristics. In addition, if we posit multiple resources, we cannot distinguish the case where one or both of two time-shared tasks is data-limited from the case where the two tasks are limited by different multiple resources (Allport, 1980). There are also scaling difficulties associated with constructing POCs for qualitatively different tasks (Kantowitz & Weldon, 1985). More generally, Duncan (1984) provides several examples of "emergent properties" of dual-task situations, where interference is not predictable from single-task characteristics, such as their capacity requirements, as in trying to simultaneously pat your head and rub your stomach.

The proposal of *ad hoc* alternative explanations for dual-task interference phenomena is a relatively weak argument against resource theory. Methodological criticisms gain force from detailed alternative explanations, such as Navon and Miller's (1987) notion of outcome conflict, where internal processes activated by performance of one task interfere with the processing of the second task. For example, processing two messages in parallel is more difficult if they are semantically similar (Hirst, 1986). Hirst (1986) suggests that divided attention requires a skill of segregating the two streams of processing associated with the two tasks. There is at least one study, though (Fracker & Wickens, 1988), which explicitly measured outcome conflict, and showed dissociations between conflict effects, and task demand effects on performance suggestive of resource competition. Hence, it is far from clear that outcome conflict is the main source of interference in dual-task performance.

In conclusion, neither resource theorists nor their critics have yet to make a conclusive case. The strongest argument against resource theory is that there may be nothing left to explain when we allow for dual-task interference due to the overload of specific structures, outcome conflict, emergent properties of specific task combinations, and maintenance of conflicting goals (Allport, 1980; Navon, 1984). Although the assessment of the prevalence of interference due to resource competition is thus difficult, there is at least some evidence to support the predictive utility of resource theories (Wickens, 1989). Wickens (1989) also indicates that resource theory serves to integrate studies of performance with physiological and subjective workload data. In contrast, theories of the operation of other sources of dual-task interference are poorly developed. Ultimately, the issue may be one of matching the level of theoretical description to the phenomena of interest. In looking at the fine structure of performance of a specific task, it may often be the case that resource theory provides only an approximation to a more detailed architectural theory (e.g. Pashler, 1989). However, resource deficits provide a plausible explanation for a general performance deficit across dissimilar tasks, as found in depressive patients (Ellis & Ashbrook, 1987), although, of course, the theory must still be tested rigorously.

Levels of control of attention

Automatic and controlled processes

One of the empirical difficulties for resource theory is the ability of skilled performers to combine performance of difficult tasks with little interference. Typists can successfully combine copy-typing with shadowing (Shaffer, 1975), for example. Spelke, Hirst and Neisser (1976) have shown that this facility can be developed with practice. Results of this kind suggest that highly overlearned performance sometimes requires little attentional capacity, even for quite complex tasks. It has been suggested that skill learning often involves *automatisation* of performance. The slow, serial, verbally mediated performance observed early in skill learning is gradually superseded by fast, parallel performance requiring little voluntary control or effort (Anderson, 1987). Observations of this kind suggest two different levels of control of attention. Schneider, Dumais and Shiffrin (1984) propose that *controlled processing* is driven by a deliberate plan or strategy, whereas *automatic processing* is reflexively triggered by fixed inputs, and is difficult to stop or regulate. Controlled processing is used for difficult, unfamiliar and unpredictable tasks, whereas automatic processing is used for familiar tasks with a consistent stimulus–response (S–R) mapping. Controlled processing requires large quantities of resources, but automatic processing does not. Controlled processing is more accessible to consciousness than automatic processing, although the fine detail of controlled processing may not be accessible. The key criteria for automaticity are thus *independence from resources*, and its *insensitivity to voluntary control*. In everyday life, the locus of attentional control shifts between these levels frequently. Impinging stimuli will continually trigger off streams or circuits of automatic processing, but controlled processing will be called when feedback signals indicate a breakdown of performance or a situation of special importance.

There is a whole family of theories which have developed the basic idea of levels of control. The distinction has been demonstrated empirically most clearly in two experimental paradigms: search and priming. Schneider and Shiffrin (1977) contrasted varied mapping (VM) and consistent mapping (CM) visual and memory search tasks, requiring controlled and automatic processing, respectively. In VM search, targets and distractors are interchanged from trial to trial so that no distinctions between items can be learnt. Under these conditions, performance is highly sensitive to processing load, whether imposed by the demands of the search task itself, or by other concurrent tasks (e.g. Fisk & Schneider, 1983). In CM search, targets and distractors constitute distinct sets of items. Sets may correspond to already over-learnt categories such as digits and consonants, or the subject may have to learn the distinction through extended practice. It is possible to learn automatic responses to words defined by semantic properties or meaning (Fisk & Schneider, 1983). Once performance has automatised, processing load has little effect. Figure 2.1 shows typical search data, taken from Shiffrin and Schneider's (1977) original studies. The VM task required the subject to search for an instance of 1, 2 or 4 possible letter targets in a display comprising 1, 2 or 4 letters, with targets and distractors drawn from the same pool of items. Reaction time (RT) increases sharply as processing load increases, irrespective of whether load is associated with increased number of distractors displayed, or with increasing number of possible targets to be held in short-term memory. Data of this kind may be fitted to serial search models, which propose that controlled processing performs a series of single comparisons between items in memory and displayed items, in order to detect match or mismatch. There is an approximately linear relationship between the number of serial comparisons to be made and RT. In the CM task (searching for digits among letters), the slope of the load–RT plots is close to zero, which may indicate automatic, parallel search.

Schneider and Shiffrin (1977) describe automatic detection as the "pop-out effect": the target stimulus, if present, pops out of the display without volitional attention, like a familiar face in a crowd, as a result of pre-attentive stimulus identification. Schneider and Shiffrin's (1977) theory has been applied to areas as

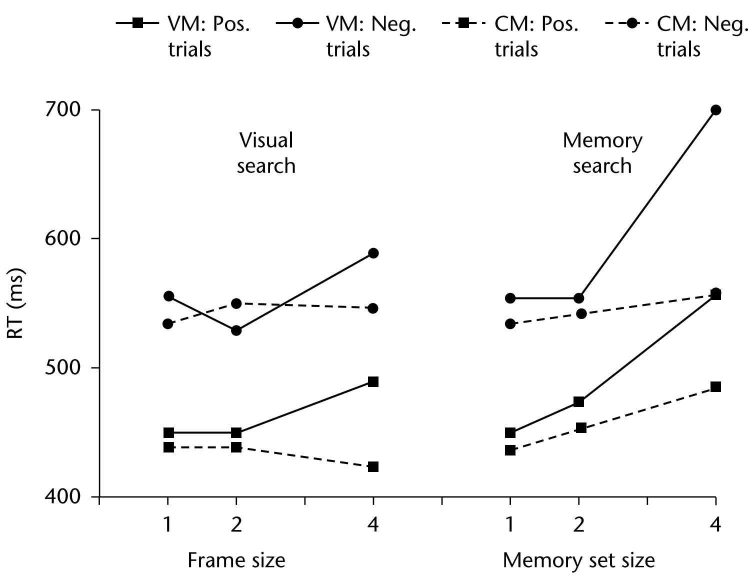


FIGURE 2.1 Relationships between response time (RT) and processing load factors of frame and memory set size, in varied mapped (VM) and consistent mapped (CM) search. Data from Schneider and Shiffrin (1977).

diverse as sustained attention (Fisk & Scerbo, 1987), stress and arousal effects on performance (Fisk & Scerbo, 1987; Matthews, Davies, & Lees, 1990b), and skill acquisition (Ackerman, 1987; 1988).

A second type of task used to distinguish levels of control is the *priming* task. In target detection or discrimination tasks, subsequent response is often speeded by prior presentation of a stimulus related to the target (the priming stimulus). The benefit to performance conferred by the prime (the priming effect) may result either from automatic enhancement of subsequent processing, or from voluntary generation of a conscious expectancy. Posner and Snyder (1975) distinguished the two types of process empirically using a letter-matching task. In their experiments, subjects had to decide whether or not two letters were the same or different. A single letter was used as the prime, which, when the two letters were the same, might or might not match the target letter pair. Posner and Snyder (1975) showed that the nature of priming effects depended on the time-lag between prime and the subsequent target. At short time intervals (< 300 msec), a matching prime speeded letter matching, regardless of the probability of the prime matching the target, but at long time intervals the prime speeded response only when a match between prime and letter pair was expected. An unexpected prime slowed performance only at the longer time intervals. Posner and Snyder (1975) argued that at short time intervals, the subject cannot form a conscious expectancy, and priming depends on automatic activation. However, at long time intervals, priming depends on the subject's expectations, and an incorrect expectation will actually inhibit response.

Posner and Snyder's results generalise to semantic priming of word recognition (see Neely, 1991). In these studies, the subject must decide whether or not a string of letters is a valid English word. Decision is normally speeded by prior presentation of a semantically related prime, so that DOCTOR primes recognition of NURSE, for example. In this task paradigm, the time interval between prime and target letter string is referred to as the *stimulus onset asynchrony* or SOA. Studies reviewed by Neely (1991) show that subjects' expectancies, manipulated by instruction, only affect priming at relatively long time delays, whereas short SOA priming is sensitive to whether or not the prime and target are semantically associated. Priming effects present at short SOAs (< 500 msec or so) but not at longer SOAs are likely to be controlled by automatic activation processes which operate over this time-scale (Neely, 1977; 1991; Posner & Snyder, 1975). Activation spreads between prime and target processing units on the basis of common semantic attributes.

Levels of control and skilled performance

The transition from controlled to automatic processing provides an outline explanation for skill acquisition (Schneider, Dumais, & Shiffrin, 1984), but it fails to specify in detail how complex tasks are performed. Voluntary strategic control may be important even for quite simple attentional tasks, so we may require a detailed specification of the skills used in attentional control (Hirst, 1986), which the theory of automatic and controlled processing does not directly supply. The most successful theory of skill is that of Anderson (1982; 1987), which assumes that skill is supported by systems of procedures or productions: processing units which are triggered by a fixed set of inputs, which include stimuli, outputs of other productions, and representations of the person's goals. Once triggered, the production produces an output on the basis of a fixed algorithm, which may generate a response, or feed into other productions. Anderson (1982) builds on the idea that there are three stages of skill acquisition: cognitive, associative and autonomous (Fitts & Posner, 1967). At the initial, cognitive stage, performance is guided by strategies which can be stated in explicit, verbal form (declarative knowledge). The person uses "weak-method" productions, general-purpose problem-solving procedures such as means-ends analysis, to select and run a set of more specific productions which control performance. That is, the weak-method productions tailor the person's existing knowledge to the new skill. With practice, a stable set of productions becomes integrated into a new production system, which becomes progressively more autonomous from other processing. Knowledge becomes procedural, in that the person acquires internal "programs" which perform the computations needed for skill in a somewhat automatic fashion. At the transitional associative stage, the person has developed a stable strategy, but some voluntary control is still required to regulate the running of productions: procedural and declarative knowledge co-exist. At the autonomous stage, processing is fully procedural and is gradually strengthened and tuned to specific environmental contingencies with further practice.

Anderson's (1982) skill theory has been explicitly linked to the theory of automatic and controlled processing by Ackerman (1988). The transition from controlled to automatic processing is equivalent to that from declarative to procedural knowledge in skill learning. With a consistent mapping and extended practice, task stimuli become capable of eliciting complex sequences of processes requiring little conscious effort. Hence demands for attentional resources are highest in the early, cognitive stage of skill learning and diminish with proceduralisation. Ackerman (1988) points out that tasks will only be proceduralised to the extent that elements of the task are consistently mapped. Hence, high-level skills such as chess-playing and social interaction with others will always require high-level executive processing, although elements of the skill will be proceduralised, freeing capacity for the more complex, inconsistent aspects of performance. The role of computational algorithms in implementing strategies for control of attention has been recognised (P. Dixon, 1981), but under-researched. As we shall discuss later, it is plausible that when experimental subjects are presented with stimuli of personal significance, the selection of algorithms or production sequences is influenced not just by explicit instructions but also by the subject's partially proceduralised routines for controlling attention, built up through prior exposure to the meaningful stimuli of everyday life.

Problems with levels

The main difficulties with levels of control theories concern the conceptual and empirical discrimination of the levels. In general, a close correlation is required between voluntary control, resource-dependence of performance, and (to a lesser degree) conscious awareness at each level. But these criteria may dissociate: Paap and Ogden (1981) showed that perception of single letters was resource-limited (as indexed by a secondary probe RT measure) but involuntary. The notion of controlled processing itself has been attacked, as requiring an homunculus to do the controlling (Allport, 1980). There are difficulties also with the specific task paradigms used to demonstrate the distinctions between levels, such as the visual and memory search paradigms used by Shiffrin and Schneider (1977). Their assertion that controlled search is serial whereas automatic search is parallel has been widely criticised, notably by Townsend and Ashby (1983). Criteria for automaticity developed for search tasks may not generalise to other tasks. Logan (1979) showed that a consistently mapped choice reaction time task automatised according to one empirical criterion (insensitivity to secondary task load), but not according to another (insensitivity to primary task load).

The hypothesis that automatic attention responses are generated by pre-attentive analysis of the trigger stimulus has also been challenged. Treisman, Viera and Hayes (1992) identify several qualitative differences between the "pop-out" of pre-attentively detected single features, and the "pop-out" of learned targets defined by a conjunction of features, which appears to be more sensitive to extraneous aspects of the task such as presence of irrelevant features. The speed-up of processing found with practised CM targets appears to be associated with a later stage than feature integration. In similar vein, Logan (1992) presents evidence that increasing automaticity of detection is not necessarily accompanied by increased pre-attentive processing. He argues that automatic access to the information that a stimulus is a target follows attention-dependent stimulus identification. There are difficulties with theoretical assumptions concerning resource usage, too. Hoffman, Nelson and Houck (1983) demonstrated that two CM search tasks showed dual-task interference within a POC paradigm characteristic of resource-limitations: Schneider (1985) attributes this finding to the degradation of the task stimuli blocking automatic detection. Similarly, Kleiss and Lane (1986) found capacity limitations on letter perception on practised CM tasks attributed to feature integration and filtering.

A more recent account of automaticity in visual search provided by Czerwinski, Lightfoot and Shiffrin (1992) deals with some of these difficulties by a partial retreat from the more contentious claims of the original Shiffrin and Schneider (1977) theory. In particular, automatisation of CM search is due to perceptual unitisation of stimuli defined by feature conjunctions, but the strength of encoding is weaker than that for simple features and unitisation does not by itself lead to unlimited parallel processing. Consistent mapping does not necessarily lead to automatisation, particularly if stimulus sets are large and confusable, so that automatic and controlled processes both tend to contribute to CM search. VM search efficiency may also improve dramatically with practice, as a result of strategy learning, and through learning to integrate parallel search for key features into the visual search process, as originally suggested by Fisher (1986). Hence, CM and VM search are less distinct in their consequences for performance than originally proposed, and controlled search is often as efficient as automatic search. Automatic processing is used mainly to supplement controlled search, when demands for resources are high, for example. It remains to be seen whether this reformulation of theory can cope with the full range of problems identified.

As described previously, automatic and controlled processing can also be distinguished within priming paradigms. The problems of priming tasks are less marked than those of search tasks, but Posner and Snyder's (1975) distinction between automatic activation and conscious attention is over-simplified. Priming of spatial location, for example, depends on several distinct neural sub-systems (Posner, Inhoff, Friedrich, & Cohen, 1987). Semantic priming is affected by post-lexical processes such as checking in addition to automatic and controlled, expectancy-driven lexical activation, although the distinction holds up well when tasks are suitably designed (Harley & Matthews, 1992; Neely, 1991). Non-lexical processing of the prime, such as searching it for a letter, can reduce or eliminate short SOA priming, apparently because semantic activation is too weak to influence subsequent response (Friedrich, Henik, & Tzelgov, 1991). This sensitivity of short SOA priming to encoding strategy is incompatible with a strong automaticity hypothesis, though the spread of activation given a semantic encoding of the prime appears to be genuinely automatic.

Hence, it is difficult to separate the validity of the general idea of levels of control from the validity of specific instantiations of the idea. Conceptually, the most satisfactory criterion appears to be whether or not the initiation of a particular process is under voluntary control (Matthews, 1989). There is accumulating evidence that involuntary processing may require resources (though conceivably a different multiple resource to controlled processing), and that controlled processing has some ability to modify or terminate sequences of automatic processing. The "homunculus" objection can be nullified by specifying the executive functions which affect control in detail (e.g. Logan, 1985), and by specifying the precise mechanisms of control (e.g. Schneider, 1985), although attentional theory has tended to neglect precise specification of control skills. Norman and Shallice's (1985) model is particularly clear in indicating how executive control is exerted: controlled processing biases the activation of a lower-level network of schemas, which can function autonomously, under network-local constraints. The upper level system is controlled by programs resembling Schank's (1982) "memory organisation packets", which specify in general terms sets of actions to be taken in a particular situation, together with likely goals and specific contextual information. The model illustrates an important principle, that voluntary control is not complete, but overlays the spontaneous activity of the lower level, so that the two systems are in perpetual competition for control. If an individual's control appears maladaptive, we must look both for strong maladaptive automatic reactions, and weak or misdirected upper-level control. Norman and Shallice (1985) also propose that dual-task interference is more likely to be associated with the upper-level initiation of actions, rather than with their execution.

Regulation of control

Since we are emphasising the role of control functions, it is worth considering how control shifts between upper and lower levels in more detail. There is general consensus that well-learned lower-level processing sequences can run themselves off in response to external or internal triggers with little or no upper-level intervention (Norman & Shallice, 1985). Hence, lower-level processing affords a set of default options, which may or may not activate a response. We must then specify the conditions which determine whether or not output from lower-level processing calls the upper level into activity. Direct experimental evidence on this issue is rather sparse, possibly because of the unlikeliness of the executive system being disengaged in the unfamiliar, potentially threatening environment of the typical laboratory experiment. However, Norman and Shallice (1980, pp. 21–22) propose some reasonable guidelines for tasks requiring upper-level intervention:

(a) they involve planning or decision-making,
(b) they involve components of trouble shooting,
(c) they are ill-learned or contain novel sequences of actions,
(d) they are judged to be dangerous or technically difficult,
(e) they require overcoming a strong habitual response or resisting temptation.

The general principle is that lower-level control is apt to lead to error in these circumstances. Because these task properties are relatively subtle, the implication is that the executive system normally monitors the inputs it receives from the lower level, and tests for whether any of these criteria are met. (These monitoring functions are not necessarily accessible to consciousness.) When one or more criteria are met, the executive seeks to bias the functioning of the lower-level system according to a plan or strategy, until it is judged safe to return control of processing to the lower level solely. This mode of control is often expressed in cybernetic terms, as in Miller, Galanter and Pribram's (1960) TOTE units. The system TESTS whether some desired end-point has been reached. If not, it OPERATES to change the system state, and TESTS again. If the desired and actual state match, the system EXITS and relinquishes control; otherwise, it continues to cycle through the control loop for as long as necessary.

Hence, an important aspect of executive functioning is *metacognition*, the executive's knowledge of the properties of the whole cognitive system, and its repertoire of routines for regulating cognition in response to feedback (Brown, 1975; Nelson & Narens, 1990). A plausible illustration of these shifts in control is provided by studies of continuous reaction time. Rabbitt (1979a) has shown that on this task, which affords very limited time for conscious reflection between trials, the subject's speed-accuracy trade-off tends to drift towards excessive riskiness, presumably under lower-level control. When an error is made, meeting the trouble-shooting criterion above, executive operations are initiated to adjust the trade-off, so that the responses following the error show a pattern of immediate slowing, followed by realignment with the preferred level of trade-off. Executive function may also initiate post-attentive lower-level processing without planned intent. Logan (1992) suggests that directing voluntary attention to a stimulus causes automatic retrieval of relevant information from long-term memory.

Competition between levels and failures of regulation

If we have two levels of control, there is the possibility of conflict between them, or of control passing to the "wrong" level. The clinical literature is replete with examples of patients whose symptoms appear to be associated with objective symptoms or subjective appraisals of maladaptive control. Many patients are disturbed by intrusive thoughts, which they cannot voluntarily suppress, including fears of losing voluntary control in the case of many social phobics, panickers and obsessive-compulsives. Paradoxically, these patients often appear "over-controlled" in their speech and action, perhaps as a compensatory mechanism. As we have seen, the course of automatic processing is at least partially modifiable by top-down processing (e.g. Friedrich et al., 1991). Schneider and Fisk (1983) point out that some subjects only achieve automaticity after being instructed to stop trying to use controlled strategies. Loosely speaking, the power of controlled processes to override automatic ones depends on the strength of the two types of process, an idea developed more rigorously by connectionist models of attention (Cohen, Dunbar, & McClelland, 1990). A strong, highly over-learnt automatic response, such as that developed in Schneider and Shiffrin's (1977) visual search study after thousands of trials of learning, can only be suppressed by great effort, or not at all. More weakly automatised responses are easier to modify. Hence, failure to exert appropriate control by clinical patients may be a function of either abnormally strong automatic reactions, or of weakness of executive control. Both types of phenomenon have some clinical plausibility. Soldiers are trained in rapid defensive or aggressive responses to threat which, in sufferers of post-traumatic stress disorder, may be elicited by innocuous everyday events, perhaps because of the strength of automatisation. Conversely, depressed patients seem particularly poor at effortful control of memory and attention (Johnson & Magaro, 1987).

There is considerable evidence that certain stimuli automatically generate internal "interrupts", which may interfere with both lower- and upper-level processing in progress. A simple example is the effect of rapid visual onsets and offsets, like a light flash. Such onsets tend to guide the allocation of attentional resources to the corresponding region of space (Yantis & Jonides, 1990). Stimuli with this interrupting property are given priority for processing. Yantis and Jones

(1991) suggest that every element generating an attentional interrupt may be "tagged" as high priority, and processed prior to untagged elements. They suggest that tag strengths are similar to the attentional weights assigned to object representations in the Duncan and Humphreys (1989) model. It is unclear whether other stimulus attributes have similar attention-engaging properties, though it is not simply the presence of a unique stimulus feature which captures attention (Jonides & Yantis, 1988). Interrupts may sometimes be overridden by the current strategy for attention allocation: abrupt onsets do not capture attention if attention is focused in advance (Yantis & Jonides, 1990). Presumably, the outcome depends on the respective strengths of the interrupt and of voluntary control, a conflict which can be readily modelled within activation models of upper- and lower-level control (e.g. Norman & Shallice, 1985).

As we have seen already, stimuli can also acquire a capacity to attract conscious attention and capacity automatically through extended consistent-mapping training, partially overriding voluntary intent (Shiffrin & Schneider, 1977), but in this case the effect appears to be post-attentional in nature (Treisman et al., 1992). Although automatic processing frequently calls controlled processing (Schneider et al., 1984), it does not always do so. Studies of human error suggest that action slips, like peeling an orange and throwing away the fruit, are caused by inappropriate reflexive triggering of well-learnt action sequences (Reason, 1988). The problem is not lack of capacity, because the actions are undemanding. Rather, it appears that the executive system fails to detect the initiation of automatic processing until forced to, after the event, by exteroceptive feedback, such as tasting the orange peel. Reason (1990) attributes such errors to an essentially strategic (or metacognitive) failure of the executive level to check that the lower level is functioning adaptively.

Connectionism and attention

Assumptions of connectionism

A radically different approach to attention is provided by parallel-distributed processing (PDP) models. The core assumption here is that many interconnected modular processing units operate in parallel. Each unit has a level of activation associated with it. Information processing is supported by the spread of activation between units, and its decay or inhibition. For example, word recognition may depend on the activation of a word unit, or cluster of units, reaching a certain threshold level. Changes in activation are governed by mathematical algorithms, which fall into several classes (Rumelhart, Hinton, & McClelland, 1986a). Specification of the algorithms means that the behaviour of connectionist models can always be simulated by computer programs. All algorithms refer to the strengths of connections between units, or *weights*, which determine whether activation is likely to spread from one unit to others. For example, if we have units for words, the connection between units for strongly associated words like

BREAD and BUTTER will be highly weighted, so that activation of one word will tend to activate the other. Learning in PDP models is effected by changes in weights. Frequently, for distributed networks of units to simulate human information processing, they must have some internal structure, so-called "hidden" units intervening between input and output units. The simpler models posit several hierarchical layers of units: word recognition may depend on units tuned to simple perceptual features, to individual letters and to words themselves. Contemporary connectionist models often have a modular structure, with each module comprising a set of units of a particular type, but with a more complex organisation of the modules than allowed by a simple hierarchy (e.g. Plaut & Shallice, 1993; Seidenberg & McClelland, 1989).

Connectionism and attention

Regarding attention, the typical assumption is that there is no separate attentional selector or mechanism. Instead, observed phenomena attributed to attention are spontaneously generated by the properties of the network, without the need for executive control. For example, if we present an obsessional patient with words related to dirt and disease, he or she may show signs of behavioural distraction and diversion of selective attention to these stimuli. Conventional cognitive psychology would attribute this reaction to a selection mechanism highly sensitive to obsession-related stimuli. The connectionist approach, in contrast, supposes that the processing units activated by the verbal stimuli are connected up to other processing units in some abnormal way. For example, the units associated with obsession-related words may have strongly weighted excitatory connections with units associated with unpleasant emotion, or with compulsive responses, which in turn influence the direction of observable behaviours. In other words, attentional bias arises out of the reaction to stimuli of the network as a whole. A corollary of this assumption is that there may be many forms of attention, related to different aspects of network functioning.

The simplest mechanism is to suppose that attention is associated with prior activation of relevant units. For example, Kienker, Sejnowski, Hinton and Schumacher (1986) simulated the spatial "spotlight" of attention by adding activation to perceptual units within the focus of attention. A more sophisticated model of this kind has been proposed by Phaf, Van der Heijden and Hudson (1990), using a simulation of visual selective attention called SLAM. Phaf et al. (1990) propose different selection mechanisms for the early selection of objects, and the late selection of "attributes": stimulus properties of colour, form and position. It is difficult to convey adequately the functioning of a simulation such as SLAM without a detailed technical exposition. In brief, SLAM is made up of three levels of interconnected modules. The first, lowest level comprises modules activated by conjunctions of elementary stimulus properties (e.g. a stimulus of red colour and square shape), and the second, intermediate level is made up of modules related to single attribute types such as colour or form. The third level is the motor programme module which initiates overt response. Object selection may be effected either by activating the first-level modules directly, by a physical cue, or indirectly, through verbal instructions activating higher-level modules. Attribute selection operates through instructions activating intermediate-level modules. For example, Phaf et al. show that if activation is supplied to the colour model, corresponding to instructions to report the colour of an object, SLAM's speed of response is enhanced, even though the required colour is not selectively pre-activated. (Mutual inhibition of the colour units within the module serves to prevent activation to threshold of alternative colours.)

A second possibility is that attention modulates the strength of connection between units, giving attended stimulus properties preferential access to response units. Cohen et al. (1990) report a simulation model somewhat similar to that of Phaf et al. (1990), in that task instructions activate task demand units, which in turn activate intermediate-level processing units. However, in this model, the primary function of this instructional activation is to modify the responsiveness to input of the intermediate units: without "attention" the activation of the unit by lower-level input is sluggish. A similar architecture supports a simulation which models interference effects between character stimuli associated with conflicting responses (Cohen, Servan-Schreiber, & McClelland, 1992), an effect demonstrated experimentally by Eriksen (e.g. Eriksen & Schulz, 1979), as described above. Cohen et al. (1990) provide an explanation for "capacity" limitations in terms of low-level mechanisms. Processing modules often cannot support the processing of two input signals generating disparate patterns of activation. Hence, task interference tends to take place when stimuli are processed concurrently within the same pathway, consistent with multiple resource theory (Wickens, 1984).

Connectionist approaches to attention are highly promising. Even the relatively simple simulations just described account for surprising amounts of data in their respective fields, and generate novel, testable predictions. Our understanding of attention can only benefit from the expression of theories in computational form. Connectionism also allows for interaction between high-level knowledge analogous to schemas and low-level processes. Loosely, within PDP models, schemas are not explicitly represented, but correspond to strongly interconnected sets of units, so that activating one tends to activate the others (see Rumelhart et al., 1986a, for a full account). Cohen et al. (1992) discuss the relationship to connectionist theory of the cognitively controlled production systems expressing procedural rules posited by Anderson (1982) to explain performance on novel, complex tasks. They suggest that it may be useful to see production systems as distinct from the PDP network, although, ultimately, productions should be representable in connectionist terms. However, the connectionist approach has disadvantages also. First, simulations may be less powerful in resolving theoretical argument than is sometimes supposed. It may be possible to construct simulations on different principles which attain an equally good fit to the observed data. For example, it is difficult to choose between the accounts of selective attention of Phaf et al. (1990) and Cohen et al. (1990) on the evidence available. Cave and Wolfe (1990) suggest similar difficulties in distinguishing early and late selection. Second, connectionism has yet to deal adequately with the role of voluntary, strategic control of attention. The models discussed indicate how voluntary control may interact with the lower level of processing, but they do not explain how the activational processes associated with control are generated in the first place. Reference to "activation from higher-level units" and "task demand units" simply regresses the problem back a further stage. Indeed, without an explanation for the activation generated by voluntary control, one might suspect that homunculi continue to lurk in these models. In principle, it can be argued that there are separate modules which implement control processes according to the same broad PDP principles (see Shallice, 1988), but substantive progress on this issue is slight. Hence, although connectionism provides valuable insights into lower-level attentional processes, we must still rely on more traditional models of executive control of processing.

Conclusions

In summary, "attention" is a difficult concept to define precisely. Broadly, we can distinguish two alternative meanings of the term. First, attention refers to the selection of information; the choice of which stimuli are important and which stimuli should influence subsequent response. Second, attention refers to intensive concentration on a task, so as to maximise the efficiency of processing. In clinical contexts, we must distinguish which sense of the word is meant. Patients may be abnormal in either (1) their sensitivity to particular types of stimulus, such as disease-related stimuli in the case of a hypochondriacal patient, or in (2) their efficiency to concentrate on important, high-priority activities. Hence, impairment of selective and intensive aspects of attention should be distinguished as symptoms, although, as we shall see, they frequently occur together in affective disorder.

Experimental work suggests a wide variety of possible mechanisms for abnormality in the selective and intensive aspects of attention. If we wish to use attentional abnormality for diagnosis, or modify attention as part of therapy, we require a rigorous and detailed model of the information processing which explains observable phenomena such as inefficient selection or performance. As yet, there is still considerable debate over models between attention theorists, but some broad principles may be identified.

In the 1950s and 1960s, it was believed that there was a distinct attentional selector controlling entry of perceptual information into a system of limited capacity. Conscious recognition of stimuli took place at this later processing stage. The selector allowed some sources of input, or channels, to be ignored, and others to control response and action. Capacity limitations on later processing were the main influence on the efficiency of intensive processing. Theoretical debate was primarily concerned with whether stimuli could be filtered out early in processing, prior to entry into the limited-capacity system (early selection), or whether it was the limited-capacity system itself which performed the selection, by choosing which stimuli would influence response (late selection). The idea that there are two broad domains of processing remains useful and influential (e.g. Johnston & Dark, 1985). Early processing appears to operate in parallel and requires little or no conscious effort, whereas later processing takes place serially, one step at a time, and may require effort and allocation of some limited attentional capacity. However, other issues have tended to supersede the unresolved question of whether selection is early or late. One important principle is that the system as a whole appears to be designed to select objects in the natural world, rather than abstract stimulus properties such as colour. Hence, all the stimulus attributes of a given object tend to be selected or rejected together.

The traditional view of selection is that it operates rather like an industrial quality control mechanism. In any given context, stimuli must possess fixed properties to advance to the next stage of processing, or they are discarded. Current attentional research challenges this view from two rather different directions. One line of research emphasises the flexibility of attentional selection. People may use a variety of different strategies to select stimuli, depending on their intentions. With practice, individuals may learn to make highly complex discriminations as they develop specific skills for dealing with particular contexts. A second line of research, connectionism, challenges the basic idea of the existence of a separate attentional selector. Processing is supported by a network of elementary processing units of various types, operating in parallel. Attention is then an emergent property of the processing system as a whole, and there are no discrete attentional filters or gates.

We have argued that these various concepts may be integrated within a family of theoretical models which posit dual levels of control of attention (e.g. Norman & Shallice, 1985). The "lower" level resembles the early, parallel processing stage of traditional selection theories in some respects. Processing is automatically and involuntarily triggered by incoming stimuli, and is not strongly limited by attentional capacity. Through practice, even certain complex skills may become automatised. Connectionism provides a framework for modelling processing at this level. The "upper" level supports voluntary processing specified by a plan or strategy, and its operations are limited by some fixed pool of capacity or attentional resources. It cannot influence response directly; rather, it biases the operation of lower-level processing. On any given task, the strategic or executive functions of the upper level must be specified in detail, to avoid the problem of explaining attention by recourse to an "homunculus", or little man in the head. There are two broad techniques for distinguishing automatic and controlled processing. The first is to test the sensitivity of performance to processing load; controlled processing should be more strongly impaired by increased load than automatic processing. The second is to investigate transient priming phenomena, in which prior presentation of a prime word enhances subsequent processing of words associated with the prime. Priming at short time intervals (< 300 msec) is believed to be automatic, but at longer time intervals controlled or expectancy priming predominates. Both techniques may require additional tests and checks to provide rigorous results.

The distinction between the automatic and controlled processing associated with lower and upper levels, respectively, has attracted criticism, largely due to conceptual and methodological difficulties in distinguishing the two types of processing. Answering these criticisms requires detailed specification of the ways in which the two types of processing interact in the course of processing. A useful approximation is to conceptualise processing as varying along a continuum of automaticity. Much processing is partially automatised, in that it requires both a triggering stimulus and voluntary intent to operate, although fine-grained analysis of performance may still differentiate influences of the two levels of control. Deficits in attention may be associated with either level of control, or with an interaction between the two levels. In the remainder of the book, we shall use the dual-level of control model as a framework for explaining relationships between emotion and attention, although much theoretical work remains to be done, not least in integrating mechanisms for voluntary control within connectionist theory.

The main implication for the clinician is that subjective experience of attentional disturbance is not in itself very informative. Abnormalities of attentional selection may be driven by abnormalities in the connections of the lower-level network, or by the person's voluntary plans and strategies for selection. Similarly, efficiency in intensive processing may depend on either the "wiring" of the lower-level processes involved, or the availability and deployment of upper-level attentional resources. Laboratory demonstrations of abnormality of attention in clinical patients are often of limited use because they fail to distinguish these broad alternatives. In subsequent chapters, we consider in detail what may be inferred from experimental studies about the exact mechanisms for relationships between emotion and attention.

3

ATTENTION

Selection of complex, personally significant and emotional stimuli

The studies of attention reviewed in the previous chapter were mainly concerned with simple stimuli such as letters and words. However, in everyday life, stimuli are often selected on the basis of their personal significance, rather than some well-defined stimulus attribute. Cognitive bias in clinical patients often seems to relate to abstract, high-level properties of the world, such as concerns about self-worth. In this chapter, we consider how the person's knowledge of the personal significance of stimuli in specific contexts may be used to guide attention, often to stimuli defined by quite complex configurations of attributes. Personally significant stimuli are often emotion-inducing, and so we also review studies of attention to emotional stimuli.

Selection by schemas

It is conceivable that, irrespective of whether selection acts on perceptual features, objects or responses, the sophistication of the selection process has been seriously underestimated. Neisser and Becklen (1975) showed that subjects could efficiently select one of two games presented as superimposed film displays, in spite of the absence of any simple cue for selection. They argue that selection reflects the top-down influence of a *schema* which directs the focus of attention. Schemas are perhaps best known from memory research, in which they are seen as organised representations of generic knowledge of a common concept, event or activity. There is considerable evidence for the role of schemas in encoding and retrieval (e.g. Alba & Hasher, 1983). For example, people have a schema or script for eating in a restaurant, which encodes the habitual actions of entering the restaurant, ordering food, eating and leaving (Schank & Abelson, 1977). Scripted events are normally better recalled than events irrelevant to the script, and people may falsely recall events which are part of the general script, but did not actually take place on the occasion recalled (e.g. Bower, Black, & Turner, 1979).

Schema theory has been less developed in the context of visual attention. The broad idea proposed by Neisser (1976) was that schemas act within a continual perceptual–cognitive cycle, during which the schema guides exploration of the external environment on the basis of the information anticipated. After information pickup, the schema may be modified to accommodate the new information obtained, and a new exploratory phase is initiated. Neisser emphasises that schemas function like plans (Miller et al., 1960) in directing the search for certain kinds of information on the basis of expectancies. However, in contrast to the levels of control models discussed previously, Neisser states that the schema is not only the plan but also the executor of the plan. Neisser also claims that attention is selective only when the activities directed by two schemata are conflicting or incompatible. Neisser's (1976) view of the person as an active interrogator of the external environment presaged many of the current concerns of attentional theory. The schema view fits well with the increasing emphasis on top-down control of attention, and the view that selective attention is an emergent property of more fundamental processes rather than a discrete mechanism (see Johnston & Dark, 1985). We may perhaps take issue with Neisser on two main points. First, although top-down processing displays much flexibility in selection of complex stimuli such as one of two superimposed scenes, Neisser (1976) under- estimates the role of bottom-up, stimulus-driven processing. There is good evidence that attention is particularly efficient in selecting between "objects" defined by simple perceptual grouping qualities (Duncan, 1984), in focusing visual attention on a single, approximately circular region of space (Johnston & Dark, 1985; Yantis & Johnston, 1990), and in reacting to emotional stimuli (Pratto & John, 1991). These characteristics may be no more than default values which can be overridden by appropriate strategies, but they appear to exert quite strong biasing effects. Second, Neisser (1976) overestimates the importance of the holistic functioning of schemata. As we shall see in Chapter 8, studies of errors and "cognitive failures" show dissociations between planning and execution phases of behaviour, for example. Even executive functioning itself may be modular, and capable of decomposition into constituent parts (Shallice, 1988). In general, the schema approach tends to blur the distinction between different kinds of information processing, and we shall consider in later chapters whether the detail of information processing can be disregarded in this way.

In the present context, special interest attaches to the control of attention by schemas representing relatively complex beliefs and attitudes, as described by Beck (1967) in the context of depression (see Chapter 1). For example, Markus (1977) proposed that self-knowledge is organised as a *self-schema*, a structured "internal working model of the self" (Markus & Cross, 1990), which represents both beliefs about the self, and relevant past experiences. The self-schema is said to influence the whole range of self-relevant processes. Markus (1977) was able to show that properties of the self-schema predicted speed of processing of self-descriptive words and other self-related tasks. Self-relevance of stimulus material appears to affect selective attention: Geller and Shaver (1976) found that self-relevant words interfered with ink colour naming in the Stroop test when subjects were made self-aware experimentally, implying that the manipulation may have activated the self-schema. The mechanism for superior recall of self-relevant material even when learnt incidentally (Rogers, Kuiper, & Kirker, 1977) has been a matter of some debate. Klein and Loftus (1988) present evidence suggesting that the memorial advantage for self-referent stimuli results from two processes: from greater elaboration at encoding, and from organisational processes. Although self-reference is not the only way to promote good recall, it may be unique in its enhancement of retention across different stimulus conditions.

Other high-level constructs which may also be associated with schematic knowledge and influence attention include beliefs about personality and emotional states. Several studies reviewed by Higgins (1990) show that subjects' impressions of a person described in an essay are expressed in terms of a set of highly accessible personality descriptors: other information about the person tends to be discarded. Person perception can also be primed by prior exposure to relevant information, even when the context is different. Higgins, Rholes and Jones (1977) demonstrated that subjects exposed to personality trait descriptors in a perception task tended to use the same traits in describing another person during a later, separate reading comprehension task. Higgins (1990) suggests that the available knowledge may be chronically accessible, in which case it will influence the person's selection in a variety of specific contexts, or it may be only temporarily activated by situational factors. As we shall see in Chapter 4, there is considerable evidence that people's evaluations of whether stimuli are positive or negative are biased by the pleasantness of their mood state (Matthews, 1992a). One interpretation of this is that evaluations reflect selective attention to mood-congruent elements of the stimulus, driven by a schema associated with the mood.

Problems of schema theory

Schema approaches to attention raise several issues and concerns. The main problem is the representation of self-related information in long-term memory. As Segal (1988) points out, a central proposition of schema theory is that individual knowledge elements are highly interrelated, so that they will tend to be activated or otherwise accessed as one. Segal's (1988) view is that this structural organisation has not been convincingly demonstrated in the case of the self-schema. Higgins, Van Hook and Dorfman (1988) used a semantic priming paradigm to test whether self-relevant constructs tended to be mutually activating: no evidence for schematic organisation was found. In one study, they did find evidence for structuring of knowledge about "problematic issues", implying individuals may have somewhat idiosyncratic schema-like organisation of knowledge about specific negative self-beliefs and personal concerns. Testability of hypotheses about the self-schema is also hindered by the proliferation of sets of self-schemas related to public and private selves, actual and ideal selves, and so on (see Markus & Cross, 1990). Williams, Watts, MacLeod and Mathews (1988) review other shortcomings of the schema concept, including the lack of agreement in detail between different theorists.

It appears to be possible to explain the priming effects of relatively complex items of knowledge without explicit reference to schemas. Higgins' (1990) knowledge activation theory is primarily concerned with the availability and accessibility of individual knowledge elements. Presumably, everyone would agree that knowledge in long-term memory is organised in some respect, but the nature of the organisation remains in doubt. Currently, there is a proliferation of schema-like concepts (see, e.g. Schank, 1982), but little data to distinguish their validity, except within a few, specific, highly constrained laboratory paradigms. Moreover, if we have a semantic network representation of the kind proposed by Bower (1981), where the associative strengths of links between individual elements vary freely, no simple description of organisation may be possible at all. At best, a "schema" may loosely correspond to a set of elements which tend to be strongly associated with each other, and weakly associated with other elements (see Rumelhart et al., 1986a, for a more sophisticated expression of this point). Our approach in this book is to use the term "schema" as a convenient shorthand for organised generic knowledge without commitment to a detailed theory of representation. In a later, theoretical chapter (Chapter 12), we shall argue that it may be particularly apt to see self-knowledge as represented in generic procedural form, specifying, for example, how attention should be directed in particular types of situation, or how self-relevant information should be processed. However, we emphasise at this point that the detailed nature of knowledge representation is somewhat obscure, and the use in theory of concepts such as schemas is liable to be somewhat speculative.

In addition to representational issues, we can ask the same questions about "schema-driven" selection as we have about selection in general. We would like to know whether schema function is constrained by the processing architecture, the level of control of selection, and whether selection guided by complex knowledge and expectancy is essentially the same as selection of the traditional targets of attentional research, features, categories and objects. Is attending to a blue mood or silver lining similar in kind to attending to a green numeral on a VDU? Answers to these questions are not, in general, forthcoming, but some research effort has been directed towards levels of control issues, in the contexts of social information processing and the emotional valence of stimuli. These two research areas are reviewed in the next two sections.

Automaticity and social knowledge

Priming effects

Higgins (1990) argues that the priming effects of social knowledge are often unconscious and automatic. Recent exposure to an item of knowledge leaves residual activation, which facilitates activation on subsequent occasions, across relatively short time intervals (perhaps a few days). Some of an individual's social constructs are also chronically accessible, so that they tend to be activated automatically by congruent stimuli. For example, a depressive may have chronically accessible negative beliefs, biasing pessimistic interpretations of vague or ambiguous stimuli. Conscious expectations also influence the activation process, though Higgins (1990) appears to say that the person is unable to distinguish automatic and conscious components of activation, implying constraints on what is actually conscious. Bargh (1984), in the course of an important critique of the concept of automaticity in social information processing, points out two weaknesses in Higgins' argument for automaticity of priming effects. First, lack of awareness is a poor criterion for automaticity, since people often seem unaware even of processes that they are actively controlling (Nisbett & Wilson, 1977). Second, priming effects require a number of logically distinct stages: encoding of the prime, activation of knowledge and processing of the later (primed) target stimulus. Even if activation processes are automatic, initial encoding may well have been conscious or controlled. Focus on the proximal cause of the priming (activation) at the expense of the distal cause (encoding) leads to a misleading neglect of the role of conscious intent.

It might also be added that priming over periods of weeks or days seems rather different from the more demonstrably automatic priming of the kind identified by Posner and Snyder (1975) and Neely (1977), in which automatic activation decays within half a second or so. On the basis of these studies, it is implausible that knowledge activation would persist over the time periods required. Graf and Mandler (1984) suggest that the prime automatically strengthens the internal organisation of the representation of the prime, increasing its subsequent accessibility. Logan (1988; 1990) has suggested that all automatic priming is memory-based, with the important proviso that it operates post-attentively, after stimulus identification. With repeated presentation of a stimulus, the person builds up a specific memory trace which also encodes relevant episodic information about how the stimulus was processed. Automaticity is then the obligatory retrieval of the memory trace together with the task-relevant information which speeds response. (It is currently unclear how successful this approach will prove to be as a general explanation of automatic processing in attention.) Long-duration priming of tasks such as word-stem completion is a reliable phenomenon in studies of "implicit memory" (Schacter, 1987), but it is unclear whether these priming effects are genuinely automatic. The main evidence suggesting automaticity is the insensitivity of implicit memory to the type of encoding (e.g. Schacter & McGlynn, 1989), but more rigorous tests would be desirable. For one variant of implicit memory, perceptual memory assessed by reporting of masked test words, there is evidence that priming depends on both awareness and attentional resource allocation at encoding (Hawley & Johnston, 1991). Hawley and Johnston cite several studies indicating that the related phenomenon of repetition priming of lexical decision is similarly constrained.

Studies of automaticity of encoding social information

We have seen that unconscious priming phenomena do not provide strong evidence for automaticity in social information processing. Implicit memory studies suggest that it is possible that social stimuli automatically modify long-term memory structures, but most studies of social priming have generally failed to test the role of encoding strategy. Some studies have sought to remedy this deficiency. Bargh and Pietromonaco (1982) presented word stimuli in a vigilance task below the threshold of conscious awareness to prevent voluntary encoding. The greater the proportion of words related to hostility, the stronger were ratings of hostility on a subsequent person perception task. A follow-up study (Bargh & Bond, 1983) showed that the effect was not dependent on stimulus emotionality, and that trait words only generated priming when the trait was a chronically accessible construct for the individual. As with implicit memory, the priming stimulus appeared to be strengthening pre-existing knowledge structures, rather than generating activation which persisted over time. Bargh and Thein (1985) demonstrated biases in impression formation associated with chronically accessible constructs even under conditions of information overload, implying that relatively little capacity was needed.

Roskos-Ewoldsen and Fazio (1992) report a series of studies investigating the role of attitudes in selective attention. In two experiments, objects associated with accessible attitudes were more likely to be reported from briefly presented displays composed of sets of pictures. For example, if a person rates their liking for a picture of an aeroplane rapidly, indicating accessibility of attitudes, he or she is also likely to perceive an aeroplane picture in a complex display. A third study showed greater incidental learning for attitude-evoking stimuli presented as irrelevant distractors. None of these studies demonstrated automaticity of selection, however. The final experiment reported by Roskos-Ewoldsen and Fazio used a version of Shiffrin and Schneider's (1977) search task to test for automaticity directly. Subjects were presented with two object names as targets, followed by a display of six pictures searched for presence or absence of the two objects. The targets appeared in only three out of the six positions, and the subjects were instructed to ignore the remaining three positions. The results showed that when attitude-evoking objects were presented in these irrelevant positions, they slowed speed of response on both negative and positive trials. These results are interpreted as showing that attitude-evoking objects automatically attract attention. This conclusion is probably too strong, in that it depends critically on the assumption that subjects did actually follow the instructions in ignoring irrelevant locations. A stronger test of the automaticity hypothesis would have tested search against Shiffrin and Schneider's (1977) criteria for automaticity in tasks of this kind. Nevertheless, the results of Roskos-Ewoldsen and Fazio's studies support the general conclusion that attitudes serve an orienting function in attracting selective attention, and the effect *may* be dependent on pre-attentive processing of the attitudes evoked by stimulus objects.

Bargh (1982) tested for automatic processing of self-relevant stimuli, within a dichotic listening paradigm. Subjects performed a shadowing task, in which trait words were presented to either the attended or unattended ear. A probe reaction time task was used to assess allocation of attentional resources. The results showed that self-relevance of the trait words affected probe RT. Subjects for whom the trait words were self-relevant showed speeded RTs when shadowing the trait words, but slowed RTs concurrent with presentation of trait words in the unattended channel. The results imply not just semantic processing of unattended self-relevant words, but also that self-relevant words capture a proportion of attentional capacity. The subjects appeared to be unaware of the non-shadowed words, however. Similarly, Bargh and Pratto (1986) showed that trait words related to chronically available constructs of the self interfered with colour naming on the Stroop task, though there was no compelling evidence to attribute this particular effect to automatic processing. At one level, these results are supportive of Bargh's central thesis that frequently encountered, consistently processed social stimuli automatically engage attention. Some scepticism is in order though, because of difficulties in establishing that perception is genuinely unconscious. Holender (1986) has demonstrated a number of methodological problems which seem generally applicable to Bargh's studies. Briefly, he concludes that dichotic listening studies cannot demonstrate the phenomenon of semantic processing without conscious activation, because subjects may have momentary awarenesses which cannot be detected by manipulation checks. Studies using stimuli attended but presented below threshold can in principle demonstrate unconscious processing, but in practice rarely do so, mainly because of the difficulties of establishing individual perceptual thresholds. Many of the studies of unconscious processing we review in this section and the next failed to take the elementary precaution of establishing subjects' individual thresholds, with due regard to the statistical confidence limits of sensitivity estimates (see Kemp-Wheeler & Hill, 1988). We return to these issues in detail in Chapter 5, in the context of studies of "unconscious" processing in anxious subjects. Recently, Bargh (1992) appears to have retreated from strong automaticity assumptions, emphasising the weakness of the "all-or-none" theoretical dichotomy between automatic and controlled processing. He suggests that some automatic processes may be contingent upon prior conscious experience or on intentional goals. It is questionable whether it is useful to label such processes as "automatic", though Logan's (1992) post-attentive mechanism for automatic access to stimulus-relevant information seems apt for explaining the priming effects of social knowledge.

Taking these studies together, it is evident that items of high-level knowledge can prime subsequent processing, interfere with concurrent processing, and guide the focus of selective attention. Little of this research explicitly requires the assumptions of schema theory concerning the organisation of knowledge in long-term memory (see Segal, 1988). It seems plausible that knowledge may be structured roughly as schema theory proposes, though perhaps around specific personal concerns rather than a single, central self-schema. The studies reviewed seem broadly consistent with Neisser's (1976) hypothesised perceptual-cognitive cycle. Priming apparently outside conscious awareness (Bargh & Pietromonaco, 1982) is suggestive of automatic activation of schemas, although such effects may operate through increasing schema accessibility rather than through direct activating effects. The top-down effects of activated schemas in directing attention to schema-congruent stimuli also appear to require rather little deliberate attention, though strong assumptions of automaticity are not yet justified by the data.

The role of voluntary attention

We should not understate the role of voluntary attention in high-level influences on attention. Clearly, strategies and plans for action influence attentional selection, and strategies are often retrieved from long-term memory, possibly in schematised form. For example, novice physics problem-solvers possess schemas for the typical objects of physics problems, such as pulleys, inclined planes and so forth. Such schemas are less well-suited for problem solution than the more abstract schemas, such as conservation of momentum, used by expert solvers. The novice often engages in lengthy deliberation, with many hesitations and false starts, before the schemas may be used successfully to guide the solver's encoding and elaboration of information contained in the problem (Chi, Glaser, & Rees, 1986). So, processing in the early stages of skill learning is generally top-down and controlled (see Ackerman, 1988), such that the problem-solving strategies adopted undergo considerable on-line modification. It is thus important to differentiate automaticity in the *initiation* and *execution* of strategies. Even if a schema for a strategy for some social action is activated automatically, the actual implementation of the strategy in the particular context may require extensive resource-limited controlled processing. Consider an example of a socially anxious individual in conversation with another. It might be that a schema which specifies that the conversation is threatening and should be terminated becomes automatically activated. To avoid a gross social *faux pas*, the person must still work out what excuse to use for breaking off the conversation, and how to introduce it into the dialogue, which will require controlled processing because of the variability of conversations across different occasions.

More subtly, schemas may also guide the person's strategic choice of the situations they enter, and the input to which they expose themselves (see Snyder & Ickes, 1985). For example, hypochondriacal patients may avoid situations which could "overtax" their bodies, and thus fail to obtain disconfirmation of negative beliefs about their health. Social phobics may be unwilling to expose themselves to certain public performance situations which might disconfirm their negative beliefs about their social competence. Overall, it is clear that attention is influenced by complex, high-level constructs, but there is limited evidence on the precise mechanisms by which this influence is effected. In any given situation, high-level knowledge may have both involuntary priming or activating effects, and voluntary effects associated with explicit task strategies.

Attention and affective information

Perception and priming and emotional stimuli

The role of affective information in attention is of special interest. It is essential to distinguish affect as a property of the person and a property of stimuli. We consider the role of the person's affective state, such as feelings of anxiety and depression, in the next chapter. Here, we consider how the encoding of affectively laden stimuli, such as pleasant or unpleasant words and pictures, influences subsequent attention and processing. Interest in this topic derived initially from studies of "perceptual defence", where subjects show raised perceptual thresholds to threatening words (N. Dixon, 1981), apparently unconsciously. Such findings suggest the operation of an automatic filter screening out weak but threatening stimuli. An obvious methodological difficulty is that subjects' failure to report threatening stimuli may result from a response bias. Kitayama (1990) reviews nine studies in which response bias effects were minimised, and concludes that effects of the affective tone of words on perceptual sensitivity are inconsistent across studies; some actually show enhanced perception of negative words. Moreover, differential sensitivity to positive as well as negative words, relative to neutral words, was reported by Broadbent and Gregory (1967). *Post hoc*, Kitayama (1990) suggests that outcomes of perceptual defence studies depend on expectations: thresholds of expected affective words are lowered, whereas thresholds of unexpected words are raised. Kitayama's (1990; 1991b) own work confirmed this hypothesis using manipulations of expectancy. He also showed that other factors affecting the strength of the perceptual code such as word frequency, word length and exposure time interacted with affect, such that perception of relatively "strong" affective stimuli tends to be enhanced, and perception of "weak" affective stimuli tends to be impaired (Kitayama, 1990; 1991a; 1991b). At a theoretical level, Kitayama (1990) hypothesises that affect is processed pre-attentively. If present, affective information narrows the focus of subsequent attention, enhancing its efficiency if the perceptual code for the target is strong, but impairing efficiency if the code is weak so that attention may be captured by other weakly activated codes. The whole sequence of processing is considered unconscious (Kitayama, 1990). The theory assumes late selection, permitting expectancies to influence the strength of pre-attentively processed perceptual codes.

Kitayama (e.g. 1990) did not test directly whether early processing of affective information is automatic: words were presented close to threshold in the more difficult task conditions, but not necessarily subliminally. In addition, the role of expectancy in perception of affective words implies that processing in the Kitayama studies cannot have been fully automatic. Other studies have addressed automaticity directly. Bargh, Litt, Pratto and Spielman (1988) presented trait adjectives at exposure times so brief that subjects could not tell whether or not a word had been presented. Subjects were able to evaluate the affective tone of the words, but were unable to make accurate synonym judgements. Niedenthal

(1990) reports experiments where perceptual discrimination and impression formation tasks were influenced by presentation of subliminal pictures of faces displaying emotion. In studies of priming, Kemp-Wheeler and Hill (1988; 1992) claim to have shown that lexical decision is speeded by prior presentation of an emotionally associated prime masked to the extent that the subject cannot determine whether or not a word has been presented. Subliminal priming by emotional content of the prime was distinguishable from semantic priming. The masking threshold for each subject was individually determined, so that the studies go some way to meeting Holender's (1986) methodological criteria for demonstrating subliminal processing. However, Kemp-Wheeler and Hill (1992) admit to some uncertainty over whether all primes were actually presented subliminally.

Another approach to determining the automaticity of processing of affective stimuli is to manipulate the time interval or stimulus onset asynchrony (SOA) between a supraliminal prime and a subsequent target word. As described previously, priming tends to be automatic at short SOAs but controlled at long SOAs (Neely, 1977). Matthews, Pitcaithly and Mann (in press) investigated priming of a lexical decision task at short and long SOAs. Positive, neutral and negative word pairs were used. Their results showed stronger short SOA priming for negative word pairs than for neutral and positive pairs, implying an automatic processing advantage for negative words only. Responses to negative words in unprimed lexical decision also tended to be faster. Fazio, Sanbonmatsu, Powell and Kardes (1986) showed that an emotionally toned prime could speed the subsequent evaluation of target words as "good" or "bad" in meaning, at an SOA of 300 msec, when affective valences of prime and target were congruent. However, priming was only reliable when the primes were objects towards which subjects had strong, accessible attitudes: attitude accessibility was indexed by evaluation latency on a separate series of trials. This pattern of priming failed to replicate at the longer SOA of 1000 msec. The results were taken as showing that affective evaluations of objects may be automatically elicited for objects with strong emotional associations. Replications and extensions of this effect have been reported by Bargh et al. (1992); for example, the short SOA priming effects are found irrespective of whether or not subjects try to hold the prime word in memory, as the automatic activation hypothesis would predict. These studies link emotional processing to knowledge-driven effects on attention reviewed previously in this chapter: affective content is a primary influence on activation of high-level knowledge and subsequent selective attention (Roskos-Ewoldsen & Fazio, 1992). Pre-attentive analyses may also generate experienced emotion: Kemp-Wheeler and Hill (1987) presented emotional words subliminally and found subsequent increases in state anxiety. It remains unclear why some of these studies show enhanced attention to negative words only (Matthews et al., in press; Pratto & John, 1991), and others show processing biases of equal magnitude for negative and positive words (e.g. Kitayama, 1990). Taken together, the studies reviewed provide reasonable support for the hypothesis that affective information may be extracted pre-attentively and automatically. However, further work is necessary to confirm that processing of this kind is truly involuntary or automatic.

Interrupts, emotion and stimulus significance

Considerable interest attaches to the idea that emotion is associated with an interrupt function. A classic paper of Simon's (1967) argues that adaption requires monitoring for significant stimuli, and replacement of concurrent goals with new goals following interruption, with emotion produced as part of the interruption process. Along similar lines, Oatley and Johnson-Laird (1987) propose that emotions are generated by changes in the perceived success or failure of a plan for action. Once generated, emotions serve as primitive but rapid means of biasing the current plan to be implemented. For example, anxiety is generated by threat to a self-preservation goal, and activates plans associated with vigilant attention to the environment and/or escape. Emotions are also important socially for signalling the current status of the mutual plans of groups of two or more people. Consistent with this general approach, there is some evidence that people show greater perceptual sensitivity to stimuli related to their current concerns (Parkinson & Rachman, 1981b), even when stimuli are presented on an unattended channel (Foa & McNally, 1986). We review evidence on affect and selective attention to affective stimuli in Chapter 4. However, few of these studies assess the level of control of attention directly.

More detailed evidence on early processing of motivationally significant stimuli is provided by studies of the orienting response (OR), a complex of phasic autonomic and central nervous system reactions to novel and significant stimuli. An important observation is that the OR to trivial stimuli habituates over time, whereas the OR to significant stimuli does not. The implication is that significant stimuli retain the capacity to interrupt, even when familiar (e.g. Barry, 1984), although orienting does not require conscious awareness (Dawson & Schell, 1985). Ohman (1979) has suggested an information-processing model for the OR, in which stimuli are analysed pre-attentively and automatically for novelty and significance. The OR is associated with a call for additional controlled processing for stimuli with these properties. Ohman's (1979) theory may be simplistic, but there is experimental evidence that the OR is associated with a redirection of processing resources to the OR-eliciting stimulus, possibly at the expense of allocation of resources to response-oriented processing (Shek & Spinks, 1986). Habituation of the OR appears to be blocked when the person is subjected to threats, such as threat of shock: the general state of anxiety appears to enhance sensitivity (O'Gorman, 1977).

Effects of this kind are not restricted to the OR. The defence reaction is a further psychophysiological response, which may protect the organism from intense or noxious stimuli, and tends to reduce perceptual sensitivity (Stern & Sison, 1990). Yet another response, the startle response, is also modulated by emotional state: a fear context enhances the response, whereas a pleasant emotional context reduces it (Lang, Bradley, & Cuthbert, 1990). Lang et al. (1990) suggest that emotional states generally tend to augment reflexes of similar affective valence, but inhibit contrary reflexes. In general, psychophysiological evidence broadly supports the notion that lower-level analysis of motivationally significant stimuli can interrupt or call upper-level processing. However, relationships between the reactions described and contemporary models of attention remain to be elucidated in detail.

Conclusions

High-level attentional selection processes

The laboratory studies of attention reviewed in Chapter 2 were concerned with the processing and selection of simple stimulus properties, such as distinguishing single-letter targets and distractors. However, clinical patients' concerns typically relate to more complex properties of their internal, social and physical environments, such as emotional experience and beliefs about the self and others. To understand abnormality of attention, we must consider how these rather abstract attributes of the person's life are handled by the information-processing system. An influential idea is that complex knowledge may be organised into *schemas* which represent important propositions in generic form (Beck, 1967). In particular, a self-schema encodes the person's general beliefs about himself or herself in long-term memory. Experimental studies show that schemas may guide selective attention, particularly when relevant and irrelevant stimulation cannot easily be distinguished on the basis of simple characteristics such as colour or position in space. In other words, the processing of complex inputs may be influenced by the person's prior knowledge of the input, as well as by current, "on-line" processing. The schema concept is useful as a general idea, but specific schema theories are poorly specified in information-processing terms, and difficult to test and falsify.

One of the weaknesses of schema theories is that they fail to distinguish the influence of generic knowledge on automatic and controlled processing. One technique for investigating the relationship between complex, social knowledge and processing is the *long-term priming* paradigm. Activating an item of knowledge by having the person engage in some task may influence or prime other processing weeks later. For example, presenting a person with words related to hostility may bias the person towards perceiving others as hostile on a subsequent occasion (Bargh & Pietromonaco, 1982). Effects of this kind seem to work through the prime increasing the subsequent accessibility of knowledge. Long-term priming should be distinguished from the short-term priming described in the previous chapter, operating over time periods of a few seconds or less. Short-term priming may be mediated by transient changes in activation of processing units, rather than by changes in knowledge accessibility. There is some evidence that long-term priming may operate even when the person has little conscious awareness of the initial priming manipulation. Strongly held beliefs and attitudes may influence involuntary attentional selection. However, although the evidence is suggestive of high-level knowledge influencing automatic processing, rigorous demonstration of automatic or unconscious selection is difficult to establish, and the data remain inconclusive. Furthermore, attentional selection in the real world is frequently voluntary, and may require a degree of skilled problem solving, and intentional accessing of knowledge, in deciding which inputs must be acted upon.

Similar principles apply to the processing of emotional stimuli. As with personally relevant information, experimental studies suggest that emotional words or pictures may be processed with relatively little voluntary control. Some theories propose that emotion is associated with the interruption of processing by a motivationally significant stimulus. Psychophysiological studies support the view that automatic processing evaluates the emotional significance of stimuli, and, temporarily at least, diverts upper-level processing effort and attentional resources to significant stimuli. Again, there is a lack of research on how automatic and controlled processing work together in the selection of emotionally charged information in everyday life.

The clinical assessment of attention

The complexity and multi-levelled nature of attention has somewhat pessimistic implications for clinical assessment. For example, a common technique for assessing bias in selective attention is to use a dichotic listening task, in which different messages are presented to the two ears, and one ear is ignored. High-level properties of the ignored message, such as personal relevance (Bargh, 1982), can influence processing of the attended message. Hence, we might wish to use breakthrough of material relevant to the patient's condition from the unattended ear as indicative of an abnormality in selective attention. But what is actually happening in such a case? Possibly, the patient's pre-attentive mechanisms are excessively sensitive to the stimulus material concerned, perhaps because of the underlying psychobiology. Alternatively, abnormality may reside in the upper level of control. The patient may be voluntarily activating the lower-level processing units associated with the stimulus material, or the patient may adopt a serial scanning strategy of periodically allocating full attention to the "unattended" ear.

Similar considerations apply to the Stroop test, which has become very widely used in studies of selective attention in clinical patients. In the original Stroop test (Stroop, 1935), the subject has to name the ink colour of a series of words. If the word is itself a conflicting colour name, such as the word RED in blue ink, colour naming is slowed. A broad explanation is that automatic processing of word meaning interferes with colour naming (e.g. Posner & Snyder, 1975). As we shall see in Chapter 4, clinical patients show analogous interference when naming the colours of words related to their pathology, such as WEB in spider phobics (Watts, McKenna, Sharrock, & Tresize, 1986a). An attractive hypothesis is that patients have enhanced automatic responses to material related to their condition. Again, detailed analysis of the standard Stroop test (e.g. MacLeod, 1991a) calls the interpretation into question. First, Stroop interference is affected by allocation of visual attention (Kahneman & Chajczyk, 1983) and provision of cues, which allows the subject to establish a performance-enhancing strategy (e.g. Logan, Zbrodoff, & Williamson, 1984), results which imply involvement of non-automatic processes. Even if automaticity is assumed, there are different possibilities for the locus of interference, depending on the architecture of the underlying system. Additionally, the assumption that similar processes underlie interference in the standard Stroop paradigm and in clinical versions itself requires more scrutiny. Finally, the clinical Stroop test has used word stimuli rather than the stimuli on which anxious patients may actually focus, such as bodily sensations, and so may not measure actual clinical bias.

In summary, we cannot rely on any single diagnostic test to provide us with definitive descriptions of attentional disorder in patients. We need not only evidence from different kinds of attentional task, but a suitable theoretical framework for interpreting the pattern of results. In subsequent chapters, we consider how the attentional theories discussed previously have been applied to clinical patients, and propose our own, alternative theory.

4

ATTENTIONAL BIAS IN EMOTIONAL DISORDERS

Several lines of evidence suggest that it may be worth testing for bias in selective attention in clinical patients. The first of these is the bias in conscious experience previously noted. If a patient experiences the world as a threatening place, perhaps this reflects a tendency to focus attention on threatening rather than harmless stimuli. At a theoretical level, Bower's (1981) influential network model of affect proposes that emotions are associated with the activation of emotion units in a semantic network. Emotion units in turn tend to activate concepts and events associated with the emotion. Hence, when a person is in a state of emotion, he or she is primed to perceive and attend to stimuli congruent with the emotion. A rather different theory, Beck's (1976) schema model of emotional dysfunction, makes a similar general prediction. The model asserts that anxiety and depression disorders result from the activation of specific dysfunctional schemas, and, once activated, they direct attention towards belief-congruent information (e.g. Beck, 1987). We consider these and other theoretical frameworks in more detail in a later section of this chapter.

A variety of experimental paradigms have been used to investigate attentional bias in clinical groups. For convenience, we loosely group these paradigms into three main types, termed the *encoding, filtering* and *Stroop test* paradigms, although the first two categories subsume a variety of specific tasks. In encoding paradigms, the person simply has to recognise or make a simple decision about a single stimulus, so that there is only one overt channel of attention, and no external source of distraction. An example would be perception of words of differing affective content presented briefly in a tachistoscope. The general mood-congruence hypothesis would predict that depressives should have a lower threshold for perceiving depression-related words, and a higher threshold for words related to happiness. Despite the lack of overt selection, such tasks may be theoretically informative, because selective attention bias may be a specific manifestation of a more general bias in processing. For example, within a network model, a bias in the strengths of connections between units, or a bias in their tonic activation levels, might influence both processing of a single input channel and selection between channels (e.g. Bower, 1981). Likewise, both single-channel encoding and selection may be controlled by the same upper-level schema or strategy. Studies of perceptual thresholds are particularly suited to investigating early, pre-attentive encoding processes, over which the person has little, if any, voluntary control, but other encoding tasks may engage more upper-level influence over processing.

In typical filtering paradigms, there are two or more sources of input or attentional channels, discriminated by a simple physical cue. One channel is to be attended, and the other ignored, which is fairly easy to do on this kind of task. Typically, emotional stimuli are presented on the unattended channel, and the interference of this material with focal attention is assessed. For example, in a dichotic listening task, with separate spoken messages presented to both ears, we are interested in whether patients pick up more information concerning emotional stimuli from the ignored ear. We also discuss tasks requiring switching of attention between discrete channels under the heading of "filtering", although other attentional processes will also be involved. A popular task devised by MacLeod, Mathews and Tata (1986) initially requires the subject to attend to one spatial location, and ignore a second. An emotional stimulus may be presented in either of the two channels. Response to a subsequent probe indicates whether the subject has maintained the initial filtering of channels, or whether attention has switched to the initially unattended channel. It is expected that the choice of location is influenced by the emotional content of the stimuli first presented. Use of these tasks is sometimes motivated by the early selection theories described in the previous chapter. If patients show greater awareness of unattended affective material, perhaps their attenuating filter (Treisman, 1964) is "tuned" to let such material into consciousness, to some extent.

The original Stroop test, requiring naming of the ink colour of colour words such as RED, was described in the previous chapter. In clinical versions, patients are required to name the colour of words related to their psychopathology: a spider phobic might be required to respond to words such as COBWEB and TARANTULA (Watts et al., 1986a). As in filtering tasks, we may assess the extent to which the to-be-ignored affective stimulus, typically a threat word, intrudes into ongoing processing and consciousness. The Stroop differs from encoding paradigms in that the subject must ignore some of the information encoded from the attended channel. The key distinction between Stroop and filtering paradigms is that in the former the subject is forced by task instructions to encode the emotional stimulus, whereas in the latter the subject has a choice of input channels. Often, the emotional stimulus need not be encoded at all to meet task instructions. We have seen in Chapter 2 that multiple properties of single perceptual "objects", such as the colour and verbal content of a Stroop word, tend to be selected or rejected together, as a single package. Hence, in the Stroop test, it is particularly difficult to ignore the distracting emotional information, which may disrupt performance of the primary colour-naming task. Some theorists would attribute Stroop test interference to an attentional mechanism operating after early selection, since no perceptual filtering is possible; late-selection theorists might see Stroop and filtering tests as dependent on similar underlying mechanisms.

In the first part of this chapter, we review experimental evidence on effects within these three attentional paradigms of (1) depression, (2) general anxiety and (3) other anxiety disorders such as phobias. Studies of bias on other tasks, not explicitly attentional, are also briefly described, because there may be common causes of bias across apparently dissimilar tasks. We focus primarily on clinical studies, but experiments on mood and attention in normal subjects will also be described. The main point of interest is whether patients show mood-congruent attention—heightened sensitivity to stimuli related to their clinical condition. It should be noted that bias of this kind is not the only feature of attention in clinical groups, which may also be impaired in overall efficiency of attention. Such effects are considered in Chapter 6. In this chapter, we aim to provide a fairly descriptive review of the main empirical findings. Theoretical implications of the attentional data are discussed at greater length in the next chapter.

Depression

Encoding tasks

Two main tasks have been used to study early perceptual and attentive processes in depressed subjects: accuracy of recognition of briefly presented words, and speed of lexical decision (recognising a letter string as a valid English word). Powell and Hemsley (1984) found only a non-significant trend towards depressives recognising a higher ratio of unpleasant to neutral words in a perceptual defence study. In normal subjects, Gerrig and Bower (1982) found no effect of induced mood on visual recognition threshold, but Small (1985) showed that, with carefully controlled stimulus materials, negative mood induction facilitated recognition of dysphoric content words. Small and Robins (1988) replicated the effect, and also found that induced depression lowered recognition threshold for elation content words. Matthews and Southall (1991) collected lexical decision data as part of a priming study, in which unprimed words were preceded by the non-informative word BLANK, providing subjects with a preparatory interval or foreperiod between this initial stimulus and the subsequent target letter string. With a brief foreperiod (240 msec), depressed patients were faster at making lexical decisions on both pleasant and unpleasant words, relative to neutral words, but matched controls were faster at neutral words. However, the effect was eliminated by extending the foreperiod to 1500 msec, implying that it was rather weak, and capable of being overridden if subjects were given sufficient warning. Mild depression in undergraduates appears to generate a somewhat similar pattern of results as clinical depression: faster recognition of depression-related words, but no differential priming effects (Spielman & Bargh, 1990). Failure to allow for the role of foreperiod duration may account for prior failures to find mood-congruence in lexical decision, in studies of mood induction (Clark, Teasdale, Broadbent, & Martin, 1983) and of clinical depression (MacLeod, Tata, & Mathews, 1987). Challis and Krane (1988) found a mood-congruent effect of induced elation, but not of induced depression. Matthews and Southall (1991) also tested depression effects on priming of associated word pairs, varying the prime-target interval or SOA to discriminate automatic priming (short SOA) and controlled, expectancy priming (long SOA). Depressed patients showed enhanced automatic priming of neutral words, and reduced priming of affective words, implying that this group may be impaired in the automatic association of emotional concepts. Overall, affective bias in perception and encoding is weak in depressives and in depressed moods. When bias is found, it often relates to the contrast between affective and neutral material, as much as to the contrast between positive and negative material, implying an effect dependent on general emotionality.

Filtering tasks

There is a surprising lack of studies of depression and filtering, particularly in clinical patients. Gotlib, McLachlan and Katz (1988) presented mildly depressed and non-depressed undergraduates with pairs of words varying in content: depressed, neutral or manic. Depression was measured with the Beck Depression Inventory (BDI; Beck et al., 1961). Pairs were always of differing content. Selective attention to the two words was assessed by simultaneously replacing the two words with two colour bars, and requiring subjects to state which colour bar appeared to be presented first. The expectation was that depressed students would select preferentially the input channel in which the depression words were presented, and so would perceive the colour bar following these words as occurring earlier than the other colour bar. In fact, depressives showed no attentional bias at all, but non-depressives showed enhanced attention to the manic words, compared with the other two types. Gotlib et al. (1988) suggest that depressives are actually "even-handed" in their attention, whereas normals show a bias towards positive material. It is difficult to infer the locus of selection in this study, however. Word pairs were presented for 730 msec, allowing time for strategy and conscious attention to override any automatic bias in attention. Gotlib and co-workers' task was a modification of one used by MacLeod et al. (1986) to investigate anxiety effects, which we shall discuss in detail in a subsequent section. MacLeod et al. (1986) found that anxious but not depressed patients showed a bias towards threat words. Hill and Dutton (1989) also failed to find any bias in selective attention in students selected for depression. Bower (1987) describes an unpublished dichotic shadowing study in which mood induction failed to influence distraction by happy and sad messages on the unattended channel.

Stroop test

Gotlib and McCann (1984) used a modified Stroop task, comprised of neutral, depressive or positive-manic content words, to explore selective attention in depression. They showed that while the colour-naming performance of non-depressed students was unaffected by word type, mildly depressed college students showed significantly slower colour-naming responses for negative words. In other words, depressed students appear to be distracted from the task at hand by the depression-related content of the words. Similar results were obtained by Klieger and Cordner (1990). In a further study of depressed patients, Gotlib and Cane (1987) demonstrated greater Stroop interference in this group for depression-related but not neutral or manic words, relative to controls. After recovery, the same subject groups were retested, and no significant biasing effects were found, although the recovered depressives were still significantly higher in state depression than controls.

Three studies have combined the emotional Stroop with priming manipulations. Gotlib and Cane found that a priming procedure, involving prior exposure to negative words not used in the subsequent Stroop test, had no effect on interference. Bargh (1992) describes an unpublished replication of the Gotlib and McCann (1984) studies in which BDI depression was associated with the predicted pattern of interference only when the BDI was administered before the Stroop test rather than after it. Bargh (1992) suggests that prior exposure to the questionnaire is necessary to activate depressive cognitions in vulnerable subjects. Possibly Gotlib and Cane (1987) failed to obtain a priming effect of this kind because completing the BDI is more likely to generate self-referent negative cognitions than simply reading negative words. Segal and Vella (1990) report an interesting study which investigated the role of self-awareness directly. There were three groups of subjects: depressed patients, normal controls and a group of normal subjects exposed to a self-focus manipulation (watching themselves perform in a mirror and listening to a tape-recording of their voice). The self-focus manipulation influenced self-awareness but not mood. The task used was rather different from the standard emotional Stroop in that subjects were required to colour-name adjectives previously classified as either self-descriptive or not. Each word was preceded by a prime, whose self-relevance was also varied. Related and unrelated pairs of ordinary nouns were used as control word pairs. All three subject groups tended to select more positive than negative words as self-descriptive, although the depressives selected a higher proportion of negative words (29%) than the other two groups (3–5%). The key result concerns interference on the self-descriptive adjectives. In depressed and self-aware groups, interference was increased by prior presentation of a self-descriptive prime, but prime type had no effect on interference in the controls. A further analysis of the depressed group showed similar effects were obtained for both positive and negative self-descriptive words. An important feature of the method is that the prime–target SOA was long in duration (1200 msec), implying that priming effects depended on expectancies and controlled processing (Neely, 1991). (Segal and Vella do not actually discuss the relevance of SOA.) Hence, among depressives and the self-aware, controlled processing of self-relevant prime words biases subsequent attention towards selection of self-relevant Stroop words. Since depressives tend to be self-focused (see Chapter 9), it may be self-awareness rather than negative affect *per se* which was responsible for the interference effects. A difficulty with this conclusion is that depressed patients, but not self-aware normals, also showed increased interference on semantically related ordinary nouns. The role of self-focus in depression-related Stroop effects requires further research.

Both Gotlib and McCann (1984) and Clore and Bower (Bower, 1987) failed to find Stroop interference congruent with mood induced in normal subjects, although an earlier study by Clore (Bower, 1981) found that both angry and happy subjects were more prone to interference from emotional words in general. Williams and Nulty (1986) also used the modified Stroop paradigm to assess the extent to which disruption in performance among depressives is related to mood state or underlying stable trait characteristics. In this study, groups of depressed and non-depressed subjects were compared; the groups were composed of subjects who had shown stable depression scores over a one-year period or subjects who were stable non-depressives. Stability of depression was assessed by two administrations of the BDI. The depressed subjects showed greater disruption in performance on the emotional Stroop task than non-depressed subjects. The first BDI score was a better predictor of disrupted Stroop performance than the BDI score at time of Stroop testing.

Depression: Key findings

The data reviewed show that attentional bias in depression is most evident on the Stroop test, in both patient and student groups. However, induced mood states do not seem reliably to generate mood-congruent interference on the Stroop. The Stroop studies have not, in general, attempted to test specific processing mechanisms as sources of bias, although the Segal and Vella (1990) study implies that interference is enhanced by self-referent processing, and by prior controlled processing of prime words. There is some evidence that depressed individuals are more sensitive to both pleasant and unpleasant words in encoding paradigms, although the effect is rather unreliable. Studies of depression and filtering have generally reported non-significant results, although there are too few studies, particularly of patient groups, for any strong conclusions to be drawn.

Generalised anxiety

Encoding tasks

Evidence for anxiety-induced affective bias on simple encoding tasks is limited. Watson and Clark (1984) reviewed studies of perceptual defence and personality characteristics related to a "negative affectivity" construct similar to trait anxiety and neuroticism, but judged the findings to be overwhelmingly negative. A more recent review provided by Mathews (1988) arrived at a similar conclusion, that anxious subjects do not appear to differ from non-anxious controls in their recognition thresholds for threat-related verbal and pictorial stimuli. Mathews (1988) also reported that anxiety failed to affect lexical decisions for threat-related words. A subsequent study (MacLeod & Mathews, 1991b) found that anxious patients did show relative speeding of threat-related lexical decision if words were accompanied by a concurrent nonword stimulus. It was inferred that anxiety biases are only apparent when there is a selection component to the task, a conclusion supported by studies of more complex attentional tasks reviewed in the following sections. However, Mogg, Mathews, Eysenck and May (1991a) failed to replicate this effect. They found an anxiety bias only when the word was presented below the fixation point, and the irrelevant stimulus was presented above the fixation point. Word position appears to have been a somewhat incidental feature of the design, so it is difficult to know what to make of this result. In any case, the bias appeared to be generated by controls responding particularly rapidly to neutral words in the double stimulus condition. In a study of the Stroop test, described in more detail below, Martin, Williams and Clark (1991) did not find any anxiety-related bias in speed of reading threat words.

One task which has been successful for demonstrating bias is homophone spelling (Eysenck, McLeod, & Mathews, 1987; Mathews, Richards, & Eysenck, 1989b). Mathews et al. played subjects a tape of spoken single words and required them to write down the word they heard. Some of the words were homophones and could be spelt in two different ways associated with different meanings. The assumption is that the subject will spontaneously attend to one or other meaning of the word. Homophones were chosen so that one word was threat-related (e.g. die), and one was neutral (e.g. dye). Anxious patients produced more threat homophones (85%) than did controls (68%). Mathews et al. (1989b) suggest that although subjects may process all possible meanings of the word unconsciously, anxiety patients are preferentially aware of the threatening meaning. They also recorded skin conductance responses to the words, but failed to find any group differences. State anxiety did not predict bias but the earlier study of Eysenck et al. (1987) found a comparable effect for trait anxiety. However, processing ambiguous words seems to depend on both automatic and capacity-limited processing (Simpson & Burgess, 1985), so, in the absence of information on the time-course of processing, the theoretical relevance of the homophone spelling results is unclear. Another difficulty with the paradigm is that the homophones were presented in a mixed list together with neutral and threatening unambiguous words. It is clear from Mathews and co-workers' (1989b) listing of the words used that the unambiguous threat words and threat homophones were considerably more semantically associated than neutral words and homophones. Highly associated pairs such as DISEASE (unambiguous) and FLU (homophone), and INFIRM (unambiguous) and WEAK (homophone), may be found. Hence (depending on word ordering), there appears to be considerable scope for *priming* of the threat homophones by the unambiguous words: anxiety patients may be more susceptible to priming by threat words, or to priming generally. Because priming may depend on a variety of mechanisms (Neely, 1991), this renders exact interpretation of the results difficult. The effect does not appear to generalise to *homographs*, words of more than one meaning. French and Richards (1992) obtained associative norms for homographs with both neutral and threat-related meanings in a study in which subjects were asked to produce a free word association for each homograph. Surprisingly, neither state nor trait anxiety predicted the number of threatening associates produced, although there was a small but significant negative correlation between trait anxiety and number of neutral associates.

Several studies have explicitly tested for priming effects using lexical decision tasks. Richards and French (in press) used homographs with both threatening and neutral meanings to prime words related to one or other meaning. Neutral homographs were used as primes as a control. Three different SOAs were used: 500, 750 and 1250 msec. At these SOAs, it would usually be expected that only controlled rather than automatic priming would be operative (see Neely, 1991), although Richards and French considered that automatic priming would take place in the 500 msec condition. High-trait anxiety subjects showed enhanced priming for threat-related meanings only at the two longer SOAs. Richards and French suggest that anxious subjects consciously "lock on" to a threatening interpretation if one has been made available by earlier automatic spreading activation. It would be useful to have data on shorter SOAs at which priming is unambiguously automatic, but the results do provide important evidence for anxiety effects on controlled priming. Matthews, Pitcaithly and Mann (in press) investigated priming for word pairs of similar emotional valence. They found that priming at a short SOA (240 msec) between prime and target was affected by neuroticism (trait anxiety) and word content, though not as a simple mood-congruence hypothesis would predict. All subjects showed more priming for negative word pairs and less for positive word pairs. More neurotic subjects also showed enhanced priming of neutral pairs. Matthews et al. concluded that the automatic processing system is generally sensitive to priming by threatening stimuli, but in neurotic subjects the activating properties of negative stimuli appear to generalise to neutral stimuli. Kemp-Wheeler and Hill (1992, experiment 1) also tested for effects of neuroticism on semantic priming of lexical decision, using a tachistoscope to present stimuli. The most interesting feature of the study was that primes were pattern-masked to prevent conscious recognition. They showed both semantic priming, and priming by emotional content, but there were no effects of neuroticism, implying that trait anxiety did not affect "unconscious" processing of word meaning. However, the study used a relatively long SOA (500 msec), and so would probably not have been sensitive to automatic priming effects. To ensure primes were not accessible to awareness, each subject's recognition threshold was individually determined, by requiring subjects to state whether or not a stimulus card had been presented, prior to a mask stimulus. Presentation time in the lexical decision task was then set to 95% of the threshold presentation time determined in this way. A second study failed to replicate the emotional priming effect: the authors admit to doubts about whether all primes were in fact presented subliminally.

Filtering tasks

One of the difficulties of using interference measures such as that provided by the Stroop test to assess attentional bias is that the emotional stimuli may generate arousal or stressful affect which causes the interference. MacLeod et al. (1986) addressed this problem by employing an innovative focused attention task which required a neutral response to a neutral stimulus. In this study, social and physical threat words were paired with neutral words and these word pairs were presented simultaneously at upper and lower positions on a microcomputer screen, for 500 msec. Subjects were required to name the upper word. The deployment of subjects' visual attention was assessed using a secondary task involving a key-press response on detection of a visual probe which appeared in the location of one of the words immediately after the display of words was terminated. By examining the effect of word type on probe detection time, it was possible to determine whether the subject's attention had shifted towards or away from the word. The task is initially one of filtering because the upper location is always attended first, but attention must be shifted to the lower position if that is where the subsequent probe is presented.

In this study, the performance of subjects with generalised anxiety disorder was compared with that of non-anxious controls. The anxious subjects were classified on the basis of whether they reported worrying predominantly about physical or social concerns, to test whether bias was associated with specific schemas. The results showed that anxious subjects consistently shifted attention towards threat words, whereas non-anxious subjects tended to shift attention away from threat words. Both physical and social threat words attracted equal attention in both worry subgroups. Mogg, Mathews and Eysenck (1992) report a replication of the effect, although in this instance patients tended to be more affected by words related to their predominant worries.

An important issue is the extent to which such effects are associated with mood state as opposed to underlying trait characteristics in anxious subjects. Since biased attention effects have been attributed to schema-based processing in anxiety disorders, it would be predicted that relatively enduring anxiety structures underlie the selective attention phenomenon. Conversely, mood state could bias the attention allocation mechanism in a transitory way. Three studies have investigated this question in non-clinical samples, using the probe detection technique. MacLeod and Mathews (1988) tested medical students high or low in trait anxiety 12 weeks before an annual examination when state anxiety was low, and they were tested again in the week preceding the examination when state anxiety was high. The students high in trait anxiety showed a shift in attention towards generally threatening stimuli on both testing occasions. These students showed an additional attentional bias towards test-related threat stimuli in the week preceding the examination only. In contrast, subjects low in trait anxiety showed increased attentional avoidance of threat stimuli closer to the examination. Broadbent and Broadbent (1988) also succeeded in replicating MacLeod and co-workers' (1986) attentional bias effect in volunteers drawn from the general population. As in MacLeod and Mathews's (1988) study, trait anxiety, measured using Spielberger, Gorusch and Lushene's (1970) STAI, was a stronger predictor of bias than state anxiety. They also demonstrated a curvilinear relationship between anxiety and bias: it appeared that anxiety becomes progressively more important as level of anxiety increases, implying that the effect will be particularly strong in patient groups. In the initial analysis, evidence was found for a trait × state interaction, but the interaction term was non-significant when the curvilinear effects of trait anxiety were taken into account. In three of their four experiments, they compared results across the first and second halves of the task, and showed that the strength of the effect increased with time on task. This is an important result, as it implies that the bias cannot be attributed to an automatic selection bias. Instead, experience of processing the threat words appears to modify the subject's attentional strategy. There is a statistical difficulty with this study, in that Broadbent and Broadbent (1988) only obtained significant results by using an RT difference score to index bias towards threat words. However, difference scores of this kind are confounded with the RTs from which the difference score is calculated, and so should not be used without correcting for this source of artifact (Cronbach & Furby, 1970), which Broadbent and Broadbent failed to do. In general, these data show that attentional bias in anxious subjects is not merely a mood state dependent phenomenon, although such biases may be exacerbated by anxious mood. Trait characteristics appear to be more strongly associated with biased attention than state factors in anxiety.

Mogg, Mathews, Bird and MacGregor-Morris (1990, experiment 2) report a failure to replicate the results of MacLeod et al. (1986) in a non-patient sample. In addition to selecting subjects for high and low trait anxiety, they manipulated stress by providing either positive or negative false feedback on an anagram task performed prior to the visual attention task. They found that subjects subjected to the stress of negative feedback tended to shift their attention towards general and achievement-related threat words, but there were no anxiety effects at either level of stress. Another essentially negative result was obtained by Mogg et al. (1991b), who used a task in which the word pair was followed by a pair of colour bars. Selective attention to position was assessed by asking subjects to state which bar seemed to appear first, but bias effects were weak and unreliable across two studies.

Mathews, May, Mogg and Eysenck (1990) used a rather different technique to investigate selective attention. They required subjects to discriminate by a button-press between the words LEFT and RIGHT. They manipulated presence or absence of distraction (a second word) and, if a distractor was simultaneously presented, they varied the emotional content of the distractor, and whether the locations of distractor and target were known or unknown. Their results showed (1) that anxious patients were slower to respond overall than controls, (2) anxious patients were generally more slowed by distracting words, and (3) anxious patients were particularly slowed by threatening words only if target location was unknown, so that visual search of the display was necessary. Recovered anxiety patients were slowed only by threatening words. Both social and physical threat words were used, but no differences between them were found. Trait anxiety predicted slowing effects of both threatening and control words, but state anxiety predicted distraction by control words only. Mathews et al. (1990) suggest that selective attentional attraction to threat cues is an enduring characteristic of people vulnerable to clinical anxiety, which may serve to generate or amplify anxiety states. They also suggest that anxiety effects on the Stroop test may differ in being related to current emotional disturbance rather than enduring characteristics.

Auditory tasks where input channels are discriminated by a single physical feature (left or right ear) have also been used in anxiety research. Mathews and MacLeod (1986) used a dichotic listening task in which both threat and non-threat words were presented. Subjects with generalised anxiety disorder or normal controls were required to ignore information presented on the left channel of a stereo headset and to concentrate on repeating aloud or "shadowing" everything heard on the right channel. At the same time, they watched for a "press" command which appeared on a screen directly in front of them and responded to it with a key press as quickly as possible. Both threat and non-threat words were presented in the unattended channel and the relative degree of interference produced by word type was assessed in terms of their impact on reaction time performance. Anxious but not non-anxious subjects were slower in performing the reaction time task when the unattended words were threatening rather than neutral. Neither group of subjects could recognise the words presented on the unattended channel when they were given a recognition task. A further group of subjects was run to test for momentary awareness of the unattended words: when the two messages were stopped unexpectedly, the subjects were unable to even guess at the last word in the unattended channel.

Stroop test

Mathews and MacLeod (1985) used the modified Stroop task to demonstrate selective processing in anxious subjects who had been referred by their physician for anxiety management training. The performance of these subjects was compared with that of non-anxious control subjects. In the Stroop task, physical threat (e.g. disease, coffin) and social threat (e.g. failure, lonely) words were printed in coloured inks. The subjects were asked to name the word colours as quickly as possible without making errors. The task was immediately followed by a test of recognition memory, which consisted of target and non-target words. The target words had previously appeared in the Stroop task. Anxious subjects were classified on the basis of whether they reported characteristically worrying about physical dangers or social dangers. This was done in order to test if anxious subjects show a greater tendency to process worry- or schema-congruent threat information represented in one of the Stroop tasks. Anxious subjects showed a general slowness in colour-naming for all types of words compared with normal control subjects. However, they were particularly slow with threat words. Subjects who reported worrying about physical concerns took longer to name the colours of physical threat words compared with social threat words. However, the converse did not apply. The study failed to show fully selective recognition effects for specific categories of words.

Subsequent studies have investigated the specificity of Stroop interference, the importance of situational anxiety and stress, and generalisation of the effect to non-patient groups. Mogg, Mathews and Weinman (1989) confirmed that threat words interfered with colour-naming performance in patients with generalised anxiety disorder but not in non-anxious controls. Moreover, they found selective interference effects for social and physical threat words which reflected subjects' predominant worries. Mogg et al. (1990, experiment 1) tested whether anxiety effects on the Stroop varied with situational stress. They found that stress induced by false-negative feedback on an anagram-solution task and trait anxiety had additive effects on colour-naming interference. Trait-anxious individuals were slower on both general threat and achievement threat words irrespective of the level of stress. Stress was related to amount of interference only on achievement threat words, implying a more specific attentional bias than that for anxiety. One difficulty with this study is that the increase in anxiety under stress was non-significant, with low-anxiety subjects showing a stronger trend in the expected direction than high-anxiety subjects. In contrast, Martin et al. (1991) found that the anxiety Stroop effect replicated for patient groups, but not for high-anxiety normal subjects, even when patients and non-patients were matched for trait anxiety. In the course of four studies, Martin et al. (1991) also demonstrated that anxious patients showed greater Stroop interference to positive emotional words as well as threat words. Unfortunately, the patients also had elevated depression levels, as assessed by the BDI, which may have contributed to this result. Mathews and Klug (1993) also found that both positive and negative valence generated interference in anxious patients who obtained higher BDI scores than the controls. Their data suggest that it is relevance to current concerns rather than either emotionality or valence *per se* which predicts interference.

Richards et al. (1992, experiment 1) compared trait anxiety effects on coloured word sequences blocked by emotional valence and on mixed-trial sequences in which valence varied from trial to trial. They predicted that if Stroop interference was due to short-term spreading activation, occurring on a trial-to-trial basis, blocking of presentation should have no effect. In fact, anxiety only predicted interference for threatening words in the blocked condition, implying that interference may depend on the build-up of mood over each block. A second study showed anxiety-dependent interference on a mixed-trial sequence when anxious mood was induced prior to the Stroop test with unpleasant photographs. It appeared that the anxiety effect was associated with an interaction between trait and state anxiety. The study also showed that trait-anxious subjects showed greater interference from *happiness-related* words following induction of a pleasant mood. It appeared in this study that trait-anxious subjects showed mood-congruent interference, but low-anxiety subjects were generally insensitive to word valence. Two studies of students also found affective bias associated with trait anxiety. Richards and Millwood (1989) obtained a straightforward mood-congruent effect, but Mogg and Marden (1990) found that trait-anxious students were differentially slowed by both negative and positive words.

Two intriguing studies have looked at effects of pattern masking the Stroop stimulus, as a means of assessing the role of automatic processing. MacLeod and Hagen (1992) used a Stroop test with threat words in a sample of women awaiting a gynaecological investigation. In one condition, the word was succeeded by a masking stimulus after 20 msec, to prevent conscious identification and strategic processing. In the unmasked condition, there was no relationship between anxiety and interference from the threat words. In the masked condition, both state and trait anxiety were correlated with threat interference. A difficulty with the study is that a difference score (i.e. response latency on threat trials – latency on control trials) was used as the dependent measure. As we have seen, use of uncorrected difference scores may introduce statistical artifact (Cronbach & Furby, 1970). MacLeod and Hagen also showed that their threat interference index predicted subsequent distress in women in whom cervical pathology was diagnosed. MacLeod and Rutherford (1992) obtained comparable Stroop test results in students. On the masked Stroop, high trait-anxious students showed greater interference from threat words prior to an examination, but not afterwards. There were no effects of anxiety on the unmasked Stroop. In both studies of the masked Stroop, periodic awareness checks were conducted: subjects performed lexical decisions on the masked stimuli, with some nonwords included. Accuracy of lexical decision was at chance, from which it was inferred that subjects were unable to perceive the content of the stimulus words. MacLeod and Hagen (1992) conclude that anxiety is associated with an unconscious and automatic tendency to process threat-related information selectively. Because of their important implications for theory, these studies are considered in more detail in the next chapter, and some difficulties with the automatic processing interpretation will be identified. The absence of effects on the unmasked Stroop in these studies is attributed to voluntary attempts to override the automatic bias. It is suggested that clinical patients are deficient in such voluntary control.

Generalised anxiety: Key findings

Evidence for anxiety-related bias was found in all three task paradigms. In studies of encoding and recognition, anxiety effects were largely confined to tasks in which stimuli were ambiguous words (homographs or homophones). Anxious subjects tend to select the more threatening meaning of words of this kind. However, it remains unclear whether anxiety influences automatic lexical access processes, or whether bias in recognition depends on the controlled processing of expectancies. The most direct evidence, the demonstration of stronger bias in homograph priming at long SOAs (Richards and French, in press), is suggestive of an expectancy-based mechanism. Studies of visuo-spatial attention suggest that anxious subjects tend to select input from locations where threatening stimuli have been presented in preference to non-threatening locations. The dichotic listening study of Mathews and MacLeod (1986) suggests anxious patients have difficulty maintaining filtering when threatening stimuli are presented on an unattended channel. However, the closest visual analogue of this study (Mathews et al., 1990) did not find any evidence for anxious subjects tending to divert attention to threatening stimuli presented at an unattended location; anxiety-related bias was found only when subjects were required to search the visual field.

Studies of filtering in clinical patients give the most reliable results; state anxiety alone doesn't appear sufficient to generate bias in visual attention. Clinical anxiety is associated with robust interference effects on the emotional Stroop test; trait and state anxiety effects have been reported, but seem less reliable. There is also uncertainty over the exact properties of threat-related words which cause them to interfere with colour-naming in anxious subjects; emotionality and personal relevance may both be important in some circumstances. Two studies using masked stimuli (MacLeod & Hagen, 1992; MacLeod & Rutherford, 1992) may provide evidence for a bias in automatic and pre-attentive processing. On the other hand, Richards and co-workers' (1992) demonstration of the role of trial blocking implies the effect may be enhanced by conscious expectancy.

Attentional bias in other anxiety disorders

Encoding and filtering tasks

Bias in simple encoding tasks in other disorders remains largely unexplored, although there is some evidence that agoraphobic patients (McNally & Foa, 1987) and panic patients (Clark et al., 1988) tend to interpret ambiguous material as threatening. There are more studies using filtering paradigms. A version of MacLeod and co-workers' (1986) visual attention task has been used to show that panic patients shift attention towards panic words and, curiously, positive words, but not neutral words (J.G. Beck et al., 1992). Burgess et al. (1981) required agoraphobic and social phobia patients simultaneously to shadow a prose passage and detect occasional instances of target words relevant to the individual's phobia on the unattended channel. Patients were better at detecting phobia-related words. Similarly, Foa and McNally (1986) showed a reduction in attentional bias in a dichotic listening detection task for contamination-related words (e.g. urine, faeces) in obsessive-compulsive patients following treatment. It is important to note that the studies of Burgess et al. (1981) and Foa and McNally (1986) differ from Mathews and MacLeod's (1986) study of dichotic listening in that there was an overt requirement to respond to stimuli within the unattended channel, which may have encouraged active monitoring of the unattended ear (in spite of instructions to the contrary).

Trandel and McNally (1987) attempted to test whether attentional bias in dichotic listening generalises to post-traumatic stress disorder (PTSD). They argued that the shadowing paradigm employed by Mathews and MacLeod (1986) to investigate anxiety may not have been stringent enough to prevent momentary awareness of threat material on the unattended channel. When the attended channel is silent (e.g. between words and sentences), the subject may switch attention to the unattended channel. In addition, as prose is meaningful, subjects can "chunk" together their shadowing responses which may free enough attention for switching between channels. In an attempt to control for these possibilities and to demonstrate semantic processing without awareness in anxiety, Trandel and McNally (1987) used a synchronised shadowing task comprised of unrelated word lists presented on both channels. Subjects in the study were Vietnam veterans with a diagnosis of PTSD, and were compared with alcoholic and normal control groups. Four categories of stimulus words were presented on the unattended channel: threat words, words phonetically similar to threat words, phobia words and neutral words. The threat words used consisted of Vietnam-related terms (e.g. napalm, bodybags) and these were matched in the phonetically similar category by words such as "maples" and "bodyweight". The phobia category consisted of words such as "dizziness" and "germs". If semantic processing of a stimulus word occurs without awareness, then the subject should commit a shadowing error on the first or second word following the one paired with the critical word. In fact, the results failed to show significant differences between subjects on any word type, although all subjects made significantly more errors when threat words were presented than when neutral words were presented. These results suggest that PTSD patients may not show semantic processing without awareness, in the dichotic listening paradigm at least. Research with other anxious patients should also adopt a more rigid dichotic listening paradigm in order to assess whether previous findings of this type of bias in anxiety reflect a true phenomenon or a methodological artifact.

Stroop test

Experimental studies of attentional bias in panic disorder and simple phobias have used variants of the modified Stroop task to demonstrate that panickers and spider phobics also show biased attention for threat-related stimuli. Ehlers, Margraf, Davies and Roth (1988b) report a study which employed a Stroop task consisting of three types of cards, containing words related to physical threat, separation and social threat. The cards were matched with three control cards containing neutral (non-threat) words or positive words. The colour-naming performance of 24 patients with panic disorder was compared with that of 24 control subjects.

The panic patients were found to be slower than control subjects in colour-naming physical threat words but there were no significant differences for other types of word. Gandy and Telch (1989) used a computer version of the modified Stroop and obtained similar results. They presented three different Stroop screens to 20 patients with panic disorder. The screens consisted of physical threat words (e.g. faint, death), social threat words (e.g. ashamed, rejected) or words related to loss of control (e.g. scream, trapped). The patients were also presented with two control screens consisting of neutral or general emotional words. Colour-naming times were found to be significantly slower for physical threat words compared with general emotional and neutral words. Other differences were non-significant. Unfortunately, a non-anxious control group was not included in the study and this compromises the validity of conclusions based on the data. However, taken together the results of these two studies suggest that panic patients show biased attention for physical threat-related stimuli. These findings are consistent with cognitive models of panic disorder, which consider panic attacks to result from the catastrophic misinterpretation of bodily sensations (e.g. Clark, 1988). Clearly, stimuli relating to physical catastrophes like those feared in panic will be highly emotional for panic patients and future studies should control for emotionality. Hope, Rapee, Heimberg and Dombeck (1990) showed that panic patients showed increased Stroop interference for physical threat words but not for social threat words, whereas social phobics showed the opposite pattern of interaction. Appropriate biasing on the Stroop test has also been found in further studies of panic disorder (McNally, Riemann, & Kim, 1990b; McNally et al., 1992), PTSD in Vietnam veterans (McNally, Kaspi, Riemann, & Zeitlin, 1990a), drug overdose patients (Williams & Broadbent, 1986) and rape victims (Foa et al., 1991).

Watts et al. (1986a) demonstrated selective attention for spider-related stimuli in spider phobics. This is a particularly interesting study from a clinical viewpoint, since it also investigated the effects of treatment on these selective attention effects. In this study, phobics and non-phobics were presented with three Stroop tasks consisting of spider-related words, general emotional words or neutral words. Phobics were slower than non-phobics in colour-naming spider-related words but there was no difference for other word types. The effect of exposure treatment (desensitisation) on Stroop interference was compared with the effect of a wait-list condition. The treated group showed a greater reduction in the amount of interference than the no-treatment group. Lavy, Van den Hout and Arntz (1993) report similar results. Spider-phobic children as young as 6 or 7 years old also show greater interference from spider-related words, implying, perhaps, that the selective attention bias is a fundamental characteristic of phobic emotion (Martin, Horder, & Jones, 1992).

Other anxiety disorders: Key findings

Studies of the emotional Stroop suggest that interference from words congruent with the patient's disorder is found across a wide range of anxiety-related conditions. The stimulus material generating interference effects is usually quite specific; spider-related words in spider phobics, and so forth. Other tasks provide somewhat mixed results, including some demonstrations of selective attention bias in phobics, obsessive-compulsive patients and panic patients, but such research is too limited for general conclusions to be drawn. The experiments reviewed are generally uninformative about the mechanisms for anxiety-related bias.

Anxiety and depression effects on other tasks

Affective bias has also been assessed on other tasks, notably tasks requiring complex evaluations or judgements, and memory tasks. The great majority of the studies concerned have investigated depression or pleasantness of mood, although there is increasing interest in anxiety, particularly with regard to bias in memory.

Evaluation and judgement

Several experimental studies confirm clinical observations that depressives tend to be unusually self-critical (Beck, 1976). Roth and Rehm (1980) videotaped depressed and non-depressed patients in an interview situation. Independent raters found that both groups showed equal frequencies of skilful, positive acts. However, depressives' judgements of their behaviours were predominantly negative, whereas non-depressives tended to rate themselves positively. Depressives show similar negative evaluations of task and interpersonal feedback (DeMonbreun & Craighead, 1977; Gotlib, 1983). Depressives are actually better than non-depressives at detecting lack of contingency and control in task performance (Alloy & Abramson, 1979). Butler and Mathews (1983) found that depressives assigned higher subjective probabilities to negative events, particularly as they applied to themselves. Effects similar to those of clinical depression are readily found in studies of induced mood in non-clinical subjects (reviewed by Forgas & Bower, 1987): Table 4.1 illustrates the range of effects found. In each case, judgements are broadly mood-congruent, although mood-congruence is not necessarily symmetrical across positive and negative moods. For example, Forgas, Bower and Krantz (1984) found that happy moods elevated perceptions of social skills in both self and a partner, but depressed moods mainly influenced perceptions of self. Bias in judgement and decision may also depend on social factors: perceptions of the self are generally more sensitive to negative moods than are perceptions of others (Forgas & Bower, 1988). Forgas (1989) found that sad subjects tended to select socially rewarding rather than competent co-workers in an experimental setting, particularly for themselves rather than for others, whereas happy subjects preferred competent co-workers irrespective of social context. He suggests that unhappy individuals are primarily motivated by the need to elevate their mood. There are also exceptions to the general trend of mood-congruent bias: thinking about pleasant past events may sometimes lower

TABLE 4.1 Examples of studies of mood-congruence in evaluation

Study	*Mood manipulation*	*Dependent variables*
Isen et al. (1978)	Induced by free gift (positive only)	Satisfaction with possessions
Bower (1981)	Hypnosis	(1) Content of TAT stories (2) Social skills (3) Judgements of significant others
Wright & Mischel (1982)	Imagery	Satisfaction with performance
Johnson & Tversky (1983)	Media descriptions of death	Subjective probability of death
Schwarz & Clore (1983)	(1) Descriptions of event (2) Sunny or rainy weather	Satisfaction with life as a whole
Forgas et al. (1984)	Hypnosis	Social skills of self and a partner
Forgas & Moylan (1987)	Happy, sad and aggressive films	Political judgements Future expectations Judgements of guilt Life satisfaction
Salovey & Birnbaum (1989)	Imagery	Severity of cold/flu symptoms

appraisal of current well-being through a contrast effect (Strack, Schwartz, & Gschneidinger, 1985a).

Generalisation of these effects to anxiety is unclear, although there are some indications that similar biases operate. Butler and Mathews (1983; 1987) found elevated ratings of likelihood of negative events in both anxious patients and high trait-anxious students prior to an examination. Anxiety also correlates with ratings of quantity of negative feedback received during a learning task, with depression effects statistically controlled (Kennedy & Craighead, 1988). Tomarken, Mineka and Cook (1989) showed that women high in fear of spiders or snakes overestimate the contingency between feared slides and shock: fear may be linked to biases in judgement that serve to confirm the fear. Agoraphobic and panic patients are prone to produce threatening interpretations of ambiguous scenarios, although only for scenarios involving internal stimuli such as chest discomfort in the case of panic patients (Clark, 1988; McNally & Foa, 1987). Greenberg and Alloy (1989), however, found differences in processing of personality trait adjectives in mildly depressed and anxious students. Both groups were more negative about themselves than about friends, and both groups endorsed more negative anxiety-relevant words than controls. However, depressives also endorsed more negative depression-relevant words than both controls and anxious subjects. The groups also differed in relative speeds of processing the different kinds of adjective.

Memory

There is a large literature on depression and memory, which is not reviewed in detail here (see Blaney, 1986; Dalgleish & Watts, 1990; Johnson & Magaro, 1987; Singer & Salovey, 1988; Ucros, 1989). In brief, two types of selectivity effect have been found, at least in some studies. The first is mood-state dependent memory (MSD): neutral material is better remembered when moods at encoding and retrieval are similar. Such effects are much easier to investigate using mood induction than in patient groups, because of the high degree of control of mood necessary. In one study, though, Weingartner, Miller and Murphy (1977) demonstrated apparent MSD in a group of manic-depressive patients, required to recall free associations. Recall was better when their state at recall (manic or depressive) matched their state when generating the associations. The second effect is mood-congruence (MC): memory is better for items whose affective content is congruent with mood at encoding and/or retrieval. Again, there are difficulties in using patient groups for studies of these kind. For example, depression appears to influence the speed or frequency of sad autobiographical memories (Clark & Teasdale, 1982; Lloyd & Lishman, 1975): an apparent MC effect. However, the event recalled may have influenced mood at encoding. Hence, a depressive showing good recall of an unhappy event may be displaying MSD rather than MC. A few studies show MC in laboratory studies, such as recall of material from stories (e.g. Breslow, Kocsis, & Belkin, 1981). Effects of this kind tend to be generated by depressives recalling fewer positive memories, rather than more negative memories (see Singer & Salovey, 1988).

Influences of affective bias on memory are most readily investigated within mood induction studies. It is apparent that MSD and MC effects are only of moderate replicability at best (Bower, 1987), and some research effort has been devoted to investigating the factors controlling the incidence of these effects. The most thorough attempt is a meta-analysis conducted by Ucros (1989), based predominantly on mood induction studies, with a few studies of naturally occurring mood also included. Several factors have been identified from the work of Ucros (1989) and others:

1. *Task factors*. Ucros (1989) identifies several task and design factors which influence the strength of memory bias. Effects are stronger for intentional rather than incidental learning, and, for MSD, for free recall rather than for recognition. For MSD, mood manipulation at input produces stronger effects than at output. There are too few studies which have manipulated mood at encoding only to make a similar comparison for MC. However, Ucros (1989) did show that the overall effect size for MC studies using experimental materials was only 0.28, and non-significant. The general impression is that effect sizes increase with the amount of active processing of material required.
2. *Strength of mood*. Not surprisingly, studies in which subjects are selected for hypnotisability or success of the manipulation are more successful than those

in which subjects are unselected (Ucros, 1989). One difficulty here is that such selections are confounded by personality traits such as neuroticism (Blackburn, Cameron, & Deary, 1990; Larsen & Ketelaar, 1989). Ucros (1989) also found that studies of natural mood, predominantly studies of depressed patients, gave relatively large effects.

3. *Subject involvement.* Effect sizes are larger for real-life memories than for experimental materials, for longer rather than shorter sessions, and for studies in which subjects are paid (Ucros, 1989). Studies using more direct manipulations such as false feedback appear to generate stronger effects than cognitive manipulations such as hypnosis and Velten mood induction (Singer & Salovey, 1988). These findings loosely imply that personal involvement affects bias in memory. More conclusive evidence is provided by studies of the role of self-reference. Blaney (1986), referring to studies of naturally occurring mood and MC, cites five studies in which there was a self-reference set condition, such that subjects were required to focus on the personal relevance of the stimulus material. MC effects were consistently found under these, but not other, contrasting conditions. For example, Bradley and Mathews (1983) showed that depressives recalled more negative words encoded with reference to themselves, but more positive words encoded with reference to others.

The extent of memory bias in anxiety is somewhat controversial. Breck and Smith (1983) and Claeys (1989) showed enhanced recall of self-referent negative trait words in socially anxious subjects. O'Banion and Arkowitz (1977) obtained a non-significant trend in the same direction. Similar results have been reported for neuroticism, which do not seem to be mediated by depression (Martin, Ward, & Clark, 1983). However, studies of test-anxious students (Mueller & Courtois, 1980) and anxious patients (Mogg, Mathews, & Weinman, 1987) fail to replicate the effect: Mogg et al. (1987) actually found a trend in the reverse direction. Bradley and Mathews (1983) also failed to find the expected memory bias in anxious patients with secondary depression, but there were only four patients in this group. Ingram et al. (1987b) screened 2000 students to obtain groups of non-anxious depressives and test-anxious but not depressed subjects, and controls. Depressives showed better incidental recall of self-referent depression-related trait adjectives, but anxious students showed better recall of anxiety adjectives. Greenberg and Beck (1989) obtained similar results in a study of patients, with the exception that depressed patients also endorsed and recalled more negative anxiety words, as well as negative depression words. MacLeod and Mathews (1991a) criticise the Greenberg and Beck (1989) study on the grounds that the anxious subjects endorsed more anxiety words in the first place. Ingram et al. (1987b) checked for differential endorsement in their study, and found it was not responsible for their findings. Two studies of autobiographical memory suggest that anxious normal subjects and generalised anxiety disorder patients are faster to generate anxious memories, and/or more likely to recover anxious memories

(Burke & Mathews, 1992; Richards & Whitaker, 1990). Trait anxiety and neuroticism are also associated with affective bias in recall of personal experiences, irrespective of mood state (Mayo, 1989). As with studies of depression and autobiographical memory, it is difficult to identify the exact mechanisms for these effects. Eysenck et al. (1991) showed that anxious patients showed a bias towards recognising threatening interpretations of previously presented ambiguous sentences, although the bias might be in either encoding or retrieval.

Mathews, Mogg, May and Eysenck (1989a) obtained ambiguous results in a study of cued recall. Trait anxiety predicted bias towards recall of threat words, but patient and control groups did not differ significantly. On an "implicit memory" task, where subjects were required to complete word stems with the first word which came to mind, anxious patients produced more threatening words only for words they had been exposed to in the prior, learning phase of the study. Trait anxiety did not predict this effect. Mathews et al. (1989a) see the data as indicating that anxiety is associated with the automatic priming of threatening words, as a result of greater threat schema integration and accessibility. However, there was no chronic activation of threats in anxious patients, and, on the basis of the cued recall data, no enhancement of elaboration of anxiety words. There also seems little direct evidence for priming being automatic rather than under voluntary control. However, Eysenck (1992) refers to an unpublished study by Mathews and others which failed to find anxiety-related bias in implicit memory. Richards and French (1991) did find an anxiety-congruent effect, using a slightly different implicit memory task, but only when subjects had previously generated a self-referenced image for each of the words used. The dependence of the bias on use of this elaborative strategy makes it unlikely that it was automatic in nature. More plausibly, elaboration facilitated subsequent controlled priming.

Several studies of more specific forms of clinical anxiety also provide conflicting data. Three studies of panic disorder patients (Cloitre & Liebowitz, 1991; McNally, Foa, & Donnell, 1989; Norton et al., 1988) showed enhanced memory for threat-related words in these subjects, although the effect was found only after presenting subjects with a written description of a panic attack in Norton and co-workers' (1988) study. Cloitre and Liebowitz (1991) showed that the effect generalised across perceptual recognition memory and free recall from semantic memory. Memory for threat-related words correlated significantly with trait but not state anxiety. The members of the panic group in this study were also more depressed than controls, but the correlations between anxiety and recall were unaffected by statistical control for level of depression. On the other hand, two studies using verbally cued recognition failed to find bias in panic disorder patients (J.G. Beck et al., 1992; Ehlers et al., 1988b). These null results may reflect the choice of task, as recognition paradigms tend to be ineffective in demonstrating memory bias in depressives (Ucros, 1989). Nunn, Stevenson and Whalan (1984) demonstrated the expected memory bias in agoraphobics, but Pickles and Van den Broek (1988) failed to replicate the effect. Watts, Tresize and Sharrock (1986b) found that spider phobics showed poorer recognition memory for larger, presumably more anxiety-provoking, spiders, contrary to the mood-congruence hypothesis. Foa, McNally and Murdock (1989) failed to find a mood-congruent effect of state anxiety in speech-anxious subjects. One factor contributing to these findings may be "cognitive avoidance", a reluctance to process the threatening stimulus following identification (Foa & Kozak, 1986), but, if so, the phenomenon is clearly rather unstable (Cloitre & Liebowitz, 1991).

Evaluation and memory tasks: Key findings

Both anxiety and depression are associated with mood-congruence in judgement and evaluation. The extent of bias may vary with the person evaluated (self or others), implying that it is generated by the processing of social and self-related knowledge, rather than some general sensitivity in forming negative opinions. Bias in memory requiring explicit recall or recognition is a more reliable feature of depression than of anxiety. However, even within depressed groups, the incidence of effects depends on a variety of methodological factors, whose role in anxiety studies has not been adequately investigated. Stronger memory biasing is expected when the task requires active processing of material, moods are strong, and the subject is personally involved.

It is somewhat unclear whether bias in evaluation and memory is controlled by the same processing mechanisms which influence selective attention. Clearly, selective attention may play some part. Many of the studies use complex stimuli, such as videotapes of social interaction, so the depressed person may simply attend to more negative stimulus elements. For example, Forgas and Bower (1987) presented subjects with realistic person descriptions on a computer display, and the time taken to read each descriptive statement was recorded. Subjects in an induced sad mood spent longer processing negative details than subjects in a good mood. Not surprisingly, such subjects made more negative judgements about the target person described, and showed better subsequent memory for negative details. In this case, an input bias provides a simple explanation for a whole range of mood-congruent effects. However, it is unlikely that a simple selection bias is the whole story. Derry and Kuiper (1981) found negative recall bias for negative self-referent words in depressives even though they spent more time encoding positive than negative words. Furthermore, a simple processing advantage for mood-congruent stimuli cannot explain the contrasting effects of depression on complex judgements and on simple encoding tasks, or differences in evaluations of self and others. In general, as discussed in more detail in the next chapter, the context-sensitivity of bias is suggestive of the operation of controlled processing strategies (Forgas & Bower, 1988).

Factors moderating the incidence of emotional bias

The studies reviewed leave little doubt that processing bias congruent with the person's emotional condition is an important phenomenon. Bias generalises across a variety of clinical conditions, relatively mild emotion in normal subjects, and across a variety of tasks. However, while the incidence of emotion-related bias is not in doubt, the nature of the underlying processing biases responsible requires further consideration. We have seen that well-designed studies sometimes fail to demonstrate bias, implying restriction of the processes susceptible to emotional biasing. Identification of the task and subject factors which moderate bias may provide clues to underlying mechanisms. Next, we consider some potential moderating factors. A general possibility (e.g. Williams et al., 1988) is that multiple biasing mechanisms are operative, associated with different clinical conditions. Hence, bias effects will be moderated by task and subject factors: bias within differing subject groups will influence tasks of differing information-processing characteristics. Later in this section, we compare bias in anxious and depressed subjects, review the role of stimulus materials, and consider whether bias is a function of clinical disorder, trait emotion or state emotion. We also consider some of the methodological weaknesses of experiments, which may hinder comparison of biasing effects across subjects and tasks.

Our primary concern in this chapter is the nature of the inferences which can be made relatively directly from the data at hand, such as whether or not anxiety influences bias in memory. The evidence reviewed does offer a few direct tests of hypothesised processing mechanisms, such as MacLeod and Rutherford's (1992) study of the masked Stroop, and some rather weaker clues to mechanisms provided by the *post hoc* assessment of studies. Detailed evaluation of the theoretical implications of the evidence is delayed until the next chapter.

Methodological problems in studies of bias

The first methodological problem is the confounding of different aspects of anxiety and depression: patients are frequently, though not always, higher in both the appropriate personality trait and emotional state. Moreover, depressed patients tend to be anxious, and anxious patients depressed. As Ingram et al. (1987b) point out, the two conditions are strongly correlated empirically, and there is a dearth of studies including both anxious and depressed subjects (Greenberg & Beck, 1989). Clark and Watson (1991) report a large-scale review of anxiety and depression measures, in which discriminant validities were only slightly smaller than convergent validities. For example, in patients, the convergent validity, or mean inter-correlation, of five measures of depression (such as the BDI) was 0.73. However, the comparable discriminant validity for paired anxiety and depression scales from the same instrument (e.g. Beck anxiety and depression scales) was 0.66. Similar results were obtained for non-patients, showing that depression scales measure anxiety almost as well as they measure depression. The converse also applies. Clark and Watson (1991) point out that the widely used state anxiety scale of the STAI (Spielberger et al., 1970) measures depressed as well as anxious mood.

Second, it is difficult to characterise and compare the semantic properties of the various word sets used. Threat-related, depressive and emotional characteristics of words are often incompletely differentiated. A third difficulty is that in studies of clinical patients in particular, sample sizes are typically small, so that the power of the design is weak. A sample of, say, 20 patients is simply not adequate to establish the *absence* of an effect of the clinical condition on some performance measure unless it is of large magnitude (1 SD or more). For a more likely effect size of 1/2 SD, say, the probability of a Type II error on a *t*-test comparing patient and control groups is 0.67 for groups of 20, 0.53 for groups of 30 and 0.40 for groups of 40 (see Cohen, 1988). For an effect of this size, groups of 64 subjects would be required for the power of the design to reach Cohen's (1988) suggested conventional level of a 0.20 probability of a Type II error. Fourth, as the reader will have noticed, some task paradigms are more popular than others, so that there is a paucity of data on some important questions, such as whether depression affects visuo-spatial attention. Not surprisingly, the most popular tasks are those which give the most reliable results, such as the Stroop test, so that it is doubly difficult to assess the evidence pertaining to the more unreliable paradigms, such as simple encoding tasks, because there are relatively few studies. It is also unclear whether attentional bias to verbal stimuli is representative of bias towards threatening stimuli in real life. Nevertheless, we can draw some general, if tentative, conclusions about the influence on bias of factors such as the type of emotional disorder, and the specificity of the stimuli which attract attention in anxiety and depression.

Anxiety and depression: Similarities and differences

How, then, do anxiety and depression compare as predictors of affective bias? Are the two syndromes associated with different kinds of abnormality of processing? Williams et al. (1988) claim that attentional tasks are only reliably sensitive to anxiety. As we have seen, studies of filtering tasks provide some support for this claim: positive results seem to be limited to studies of generalised anxiety patients or trait anxiety (e.g. MacLeod et al., 1986). However, we found only three published studies of depression and filtering, and none is ideal for comparison with the anxiety studies. Gotlib et al. (1988) and Hill and Dutton (1989) used student samples, so that the high depression groups may not have been as depressed as clinical patients. Gotlib et al. used a somewhat different task to that of MacLeod et al. (1986), and they did show bias towards positive words in low-depression students. Depression effects on memory are also inconsistent in student samples (Singer & Salovey, 1988), and so such groups are not suitable for establishing null results. MacLeod et al. (1986) tested for sensitivity to threat words only, in a relatively small sample (n=16 patients): a stronger test might have used depression- and happiness-related words also (although the distinction between depression and social threat words is not clear-cut). A more convincing null result would require manipulations of word content and self-reference as well as a large sample. On other attentional tasks, anxiety and depression effects are broadly comparable. Neither seems to have very reliable effects on encoding tasks, although some significant findings have been reported for depression (e.g. Small & Robins, 1988). Both conditions appear to affect colour-word interference on the emotional Stroop task, although evidence on depression effects is limited. More specific anxiety disorders such as panic also seem to affect the Stroop. Induced depressed mood does not appear to affect Stroop interference, but the only comparable anxiety study showed that manipulated anxiety only affects the Stroop in interaction with trait anxiety (Richards et al., 1992).

It is also claimed that memory is more sensitive to bias in depressives than in anxiety patients (Williams et al., 1988), but the evidence may not justify strong conclusions. We have seen that one group of researchers (Mathews, Mogg and others) generally fail to find enhanced recall of anxiety words in generalised anxiety patients, but studies of autobiographical memory (e.g. Burke & Mathews, 1992), other forms of clinical anxiety (e.g. Cloitre & Liebowitz, 1991) and of anxious students (Ingram et al., 1987b) do show anxiety-congruence of recall. The Cloitre and Liebowitz (1991) study is particularly important because of its use of tasks related to Williams and co-workers' (1988) analysis of affective bias, discussed in more detail in the next chapter. It is possible that close attention to methodological factors may resolve the inconsistency between studies. For example, Mogg et al. (1987) asked their subjects to continue thinking about each word in relation to self or other during the 10 sec inter-stimulus interval. It may be that the explicit strategy required here obscured differences in spontaneous strategies which might otherwise have occurred, and affected subsequent recall. Ingram and co-workers' (1987b) paper demonstrating anxiety effects in a similar paradigm to that of Mogg et al. makes no mention of subjects being asked to rehearse material. There are also inconsistencies in the literature on depression and memory: Roth and Rehm (1980) failed to find any effect of clinical depression on recall of self-referent adjectives. Again, fine detail of the method may be important in controlling the incidence of the effect (see, e.g. McDowall, 1984). Hence, we cannot be confident that the incidence of bias, in the expected direction, is genuinely more frequent in depression than in anxiety, although there does seem to be a trend in that direction. It is possible that there is a stronger anxiety-related bias in implicit memory (Mathews et al., 1989a) than in depression. Roediger and McDermott (1992) review studies of clinical depressives, in which no mood-congruent implicit memory bias was found in two out of three studies, despite evidence for bias in explicit memory in the two studies. However, Tobias, Kihlstrom and Schachter (1992) have argued that typical implicit memory tasks such as completing a three-letter word stem provide such strong cues that they may be insensitive to mood effects. Roediger and McDermott (1992) present evidence which suggests that implicit memory is insensitive to practically every external influence, including amnesia. Tobias et al. (1992) used alternative tasks to demonstrate mood state-dependent and mood-congruence effects on implicit memory. Explicit memory was insensitive to the happy and sad mood inductions used, however.

Overall, it is difficult to argue with confidence, as Williams et al. (1988) do, that anxiety and depression effects can be linked to separate information-processing stages associated with selective attention and elaborative memory. The evidence is far from decisive, because of the lack of direct comparative studies, although future work may possibly sustain conclusions of this kind. Two of the more promising paradigms for establishing differences between anxiety and depression seem to be controlled priming and elaboration in memory. We have seen that in addition to overt anxiety effects on priming of negative material at long SOAs (Richards & French, in press), anxiety effects on tasks such as homophone spelling and implicit memory may also be associated with voluntary priming mechanisms. There is little evidence for this kind of effect in depressives (e.g. Matthews & Southall, 1991). Although the data do not seem to show a reliable general distinction between depressives and anxious patients in more active, elaborative aspects of memory, there may be some specific differences. For example, there is no obvious parallel in the anxiety literature to the tendency of depressives to produce more negative false-positives on memory tasks (Matthews & Southall, 1991; Zuroff, Colussy, & Wielgus, 1983). Possibly, anxious subjects have more insight into the origin of their elaborations than depressives.

The evidence for differences in information-processing should not obscure the similarities between affective disorders. None seem to evoke strong or reliable effects on simple encoding tasks, and all seem to be associated with greater interference from appropriate words on the Stroop test. Both depression and anxiety are associated with stronger bias for self-referent material (e.g. Greenberg & Beck, 1989), although evidence on this point is more extensive for depression. Self-reference is also implicated in interference on the Stroop test (Segal & Vella, 1990). However, overt self-reference is neither necessary nor sufficient for either type of bias. As in the standard emotional Stroop test, bias has been demonstrated for tasks where no processing of attributes of the self is required, although subjects may do so spontaneously. Conversely, there are instances of memory studies which failed to find affective bias, despite self-reference, for both depression (Pietromonaco & Markus, 1985; Roth & Rehm, 1980) and anxiety (Mogg et al., 1987).

Specificity of bias

A second empirical question concerns the specificity of the stimuli to which attention is diverted. For example, in spider phobics, it appears to be specifically spider stimuli which draw selective attention (Watts et al., 1986a). This degree of specificity seems to apply most strongly to conditions linked to specific events and stimuli such as phobias and PTSD. Studies of generalised anxiety disorder using both social and physical threat words have not reliably established that the bias of individual anxious patients reflects their particular concerns (e.g. MacLeod et al., 1986), although some studies are suppportive of the hypothesis (e.g. Mathews & Klug, 1993; Mogg et al., 1992). There is even some evidence that generalised anxious patients may be sensitive to all emotional words (Martin et al., 1991), although other studies have failed to show a bias towards positive emotional words in such patients (e.g. Mathews et al., 1990). On the other hand, there is evidence that anxious subjects are more sensitive to threatening stimuli, whereas depressed subjects are sensitive to stimuli with depression content (e.g. Gotlib & Cane, 1987). Depressives, too, may encode both positive and negative emotional words more efficiently than neutral words (Matthews & Southall, 1991), although the effect does not generalise to memory and evaluation tasks, and depressives' selective attention to positive material has hardly been investigated. There may be more than one biasing mechanism in operation. Tasks on which performance is unequivocally post-attentional, such as explicit memory, tend to show straightforward mood-congruence effects. However, simple selective attention tasks sometimes show biases associated with (1) emotional stimuli in general and (2) the specific concerns of the individual.

Trait, state or clinical disorder?

We may also ask whether it is the clinical condition of anxiety or depression, associated "normal" personality traits such as neuroticism, or the immediate unpleasant emotional state, which is responsible for affective bias in processing. Clinical patient groups may differ from normal controls not only in trait and state characteristics, but in cognitive qualities, such as knowledge structures, poorly measured by questionnaires. For depression, the evidence we have reviewed is rather unhelpful, since few studies have attempted to distinguish between the different aspects of the condition. In the memory literature, it is clear that all three aspects of depression may on occasion be sufficient to generate mood-congruence effects, although trait studies using students allocated to depressed or non-depressed groups on the basis of BDI scores give weak results (see Singer & Salovey, 1988). Williams and Nulty (1986) found that prior depression was a stronger predictor of Stroop interference than current depression, implying that the trait (or some persistent vulnerability to depression) is more important than the state. Teasdale (1988) reviews evidence suggesting that people characterised by depression-proneness are particularly vulnerable to negative cognitive processes when in depressed mood, although Williams et al. (1988) review evidence suggesting that the mood state is the primary influence on self-referential memory. The anxiety literature provides more overt comparisons between trait, state and clinical condition: the strongest effects are obtained by contrasting anxiety patients with controls. For example, Mathews and MacLeod (1986) showed bias in dichotic listening in anxiety patients, even though they did not differ from controls in state anxiety, and neither state nor trait anxiety predicted bias. Similarly, Martin et al. (1991) showed that clinical anxiety rather than trait anxiety was responsible for Stroop test effects, although other studies suggest that individual differences in trait anxiety in normal subjects may be sufficient to generate bias, possibly in interaction with state anxiety (Broadbent & Broadbent, 1988; MacLeod & Mathews, 1988). There is little evidence that state anxiety *per se* is sufficient to induce attentional bias (e.g. Broadbent & Broadbent, 1988;

Martin et al., 1991). Stress manipulations may induce bias, but, apparently, in the absence of significant changes in state anxiety (Mogg et al., 1990). Hence, information processing in clinical anxiety, and possibly in clinical depression too, cannot be explained solely in terms of the trait and state characteristics of the subject. As we shall see, there may be relatively stable abnormalities of processing peculiar to clinical patients.

Conclusions

Emotional bias is a robust phenomenon

The evidence reviewed shows that there is abundant evidence for emotion-related bias in attention. Emotional bias is particularly evident in clinical anxiety, depression and other affective disorders, but is also sometimes found in normal groups of high trait and/or state emotion. The emotional Stroop test appears to be particularly sensitive to the concerns central to the patient's disorder. Anxious, depressed, phobic and PTSD patients are all slower at colour-naming words related to their condition. Anxious patients are slow in naming the ink-colour of threat-related words, and so forth. In anxiety patients, there is also convincing evidence for selective bias in other tasks. On visual attention tasks, in which words are presented at different locations on a visual display, anxious subjects are prone to attend to locations associated with threatening stimuli. In studies in which subjects are presented with ambiguous words, with two possible meanings, anxious subjects are more likely to react to the threatening interpretation of the word. The threat-related meaning of an ambiguous word is also more likely to prime subsequent verbal processing in anxious subjects. In contrast, simple encoding tasks, in which no overt selection of stimuli is required, tend to be rather insensitive to emotion-related bias, although there are a few reports of significant effects. Hence, emotion is not simply associated with enhanced processing of all emotion-related stimuli; effects are most robust when the task requires selection of one input and rejection of others. Bias is not restricted to selective attention tasks, but is also found with tasks requiring complex judgements and evaluations, and with certain memory tasks. Selective attention may play some part in these effects, but there are probably other mechanisms also involved.

Factors which control the incidence of attentional bias

At one level, the results reviewed provide impressive testimony to the importance of attentional bias as a symptom of affective disorder, but two kinds of issue require further attention: (1) the role of moderating variables and (2) the nature of underlying information-processing mechanisms. By *moderating variables* we mean factors which influence whether or not a bias effect is found in a given study. Bias is a common but far from universal finding, so we must consider which properties of subjects, tasks and experimental designs determine whether or not bias is found. One class of moderating variables is made up of various methodological factors. We have seen that in the case of memory studies, bias effects are more likely when subjects experience intense moods and the stimulus material has some personal relevance. Bias effects may be obscured by insufficient sample sizes, and suboptimal measures of emotion and sets of emotional stimuli. In addition, the fine detail of experimental procedure may be important, such as whether or not subjects rehearse experimental material, or whether the sequencing of stimulus words generates priming across experimental trials.

Another class of moderating variable is the nature of the subject's emotional condition. Bias in clinical patients may be different from biases associated with emotion-related traits and states in non-clinical samples. In general, patients show stronger biases than normal subjects high in trait or state anxiety. Bias is not necessarily an outcome of high state or trait emotion. Likewise, different clinical syndromes—generalised anxiety, depression, obsessional-compulsive neurosis and so forth—may be associated with qualitatively different biases. If so, we might expect the types of task on which bias is evident to vary with the type of patient. For example, Williams et al. (1988) have proposed that in generalised anxiety bias is strongest on selective attention tasks, but depressives show bias predominantly on tasks requiring explicit recall from memory and elaboration of stimulus material. The evidence reviewed suggests that although there are some suggestive trends in the literature, it is hard to assert such distinctions with much confidence. Part of the problem is that some combinations of tasks and clinical conditions have been insufficiently investigated. For example, it is true that bias in visual attention to spatial location is largely restricted to anxious subjects. However, there are very few comparable studies of other emotional disorders with which such data may be compared. At the same time, the pervasiveness of bias on the emotional Stroop implies that at least one type of bias is common to a variety of affective disorders. Further research is required to determine whether or not this rather general emotion-related bias is the only effect of interest, or whether there are additional bias effects related to specific clinical disorders and task types.

Explaining attentional bias

The second general issue to be addressed is the nature of the information-processing mechanisms influenced by emotion. We saw in Chapters 2 and 3 that a variety of qualitatively different mechanisms may contribute to attentional selection. Simple demonstrations of bias on tasks such as the Stroop are important in establishing empirical phenomena. However, they provide only weak indications of the underlying attentional mechanisms because, in principle, selection bias may depend on several independent processes. Specifically, both (1) controlled and automatic processing and (2) pre- and post-attentive processing may contribute to interference on the emotional Stroop, and we cannot distinguish the roles of these qualitatively different types of processing without further investigation. A few studies have explicitly manipulated relevant task variables. For example, Richards and French (in press) showed that anxiety-related priming effects increased with the time-lag between prime and target word, implying the mechanism was associated with voluntary rather than automatic processing. Conversely, MacLeod and Rutherford (1992) showed emotional Stroop effects in anxious subjects using stimuli masked to prevent conscious recognition, which are suggestive of an automatic bias operating at a pre-attentive stage of processing. We can also obtain clues to the mechanism from the nature of the task and subject moderator variables, of the kind just discussed. Clinical anxiety effects do not seem to be directly mediated by emotional state, which implies that attentional bias in anxiety is generated by some relatively stable characteristic of the processing system. Resolution of theoretical issues is essential for determining causes of attentional bias in patients, its aetiological significance (if any), and its relevance to therapy. However, we cannot move directly from the data reviewed to a satisfactory theory. In the next chapter, we review the theoretical implications of selected studies of attentional bias in more detail, and attempt to draw some general conclusions.

5

AFFECTIVE BIAS IN ATTENTION

Theoretical issues

Theoretical accounts of affective bias typically make two kinds of proposition. The first concerns categories of tasks or subjects which show or do not show affect-congruent bias. It might be argued that bias is stronger in selective attention than in perception, or that clinical patients show stronger bias than anxious normals. Observations of this kind have fairly direct implications for theory. For example, Williams and co-workers' (1988) identification of anxiety with bias in pre-attentive processing and depression with bias in post-attentive elaboration is in part a direct extrapolation from their reading of the relevant data. A scientifically valuable theory like that of Williams et al. does more than just redescribe the data though. The second kind of theoretical proposition goes beyond the data to some degree in introducing concepts such as pre-attentive processing, which are not directly observable, and make sense only within a wider conceptual framework for understanding attentional phenomena. In principle, answering questions such as whether anxiety affects bias in memory is relatively straightforward, and issues of this kind were dealt with in the previous chapter. Deciding whether anxiety effects are pre-attentive is more difficult, because the criteria for establishing a pre-attentive effect are themselves uncertain and subject to debate. In this chapter, we tackle these more problematic theoretical issues. This is partly a matter of matching predictions from theory against data, and partly a matter of assessing the validity of the implicit or explicit criteria used by theorists for deciding whether effects are pre-attentive, unconscious, automatic and so on.

We consider two major theoretical approaches which are particularly apt for explaining attentional phenomena. The first is network theory, exemplified by Bower's (1981) network model, in which bias is attributed to the states of activation of nodes in the network. The second is information-processing theory, exemplified by Williams and co-workers' (1988) model, in which stimulus input undergoes a series of stages of processing, with different types of bias located at pre-attentive and post-attentive processing stages. This theory defines pre-attentive processing as the stage following stimulus input at which stimulus elements are processed automatically and in parallel, prior to strategic elaboration of stimuli activated and entered into consciousness by pre-attentive processing. Williams et al. appear to conceptualise pre-attentive processing as automatic, and post-attentive processing as controlled, but, as discussed in Chapter 2, these two processing characteristics are not necessarily identical, and we shall consider them separately.

Network models of affective bias: Bower (1981; 1987)

The essence of Bower's (1981) original network model was that emotions may be represented by discrete network nodes or units just as propositions and events may be in conventional cognitive psychology (e.g. Anderson & Bower, 1973). Emotion nodes may be activated either by appropriate external inputs, or through activation of network nodes associatively linked with the emotion, such as the nodes representing the memory of an unhappy event. Once activated, emotion nodes influence the course of future information-processing through the spreading of activation to associated nodes. The general prediction is that emotional states *prime* processing congruent with the emotion. Nodes associated with the emotion node become weakly activated, though probably not to the extent of altering conscious awareness, so that they are more readily activated by stimulus input, or by inputs from other nodes in the course of processing. Bower (1981) describes three distinct effects of this kind. The first is mood state-dependent retrieval (MSD), as previously described. At encoding, nodes for the material to be remembered become associated with nodes for contextual features, including the person's emotional state. When retrieval takes place in the same emotional state, the emotion node partly activates, or primes, the nodes for the material remembered, rendering it more or less accessible. The second is mood-congruent retrieval (MC). There are stable associative links between emotion nodes and nodes for affectively valenced concepts or events. Hence a depressed mood tends to activate nodes for unpleasant concepts and sad events in the person's life, again increasing the ease with which they can be recalled. Third, a similar priming mechanism is predicted to cause mood-congruence in various additional cognitive processes, such as generating free associates, interpreting pictures and people, and perception and selective attention.

One of the great strengths of the Bower (1981) paper was that it set out a range of falsifiable predictions, which subsequent research has duly tested. Bower (1987) expresses considerable pessimism about the success of such tests, and states, with unusual candour, that the theory is "badly in need of repairs—or in need of a replacement theory" (p. 454). In some respects, the evidence reviewed suggests that this is an excessively pessimistic view. Ucros' (1989) meta-analyses suggest that many of the failures to replicate MC and MSD may be attributed to methodological factors. Likewise, we have seen that the Stroop test shows reliable attentional bias across a range of emotional disorders, although, as Bower (1987) states, induced moods do not give reliable effects. Anxiety effects on other attentional tasks are broadly consistent with the model. The most serious problem is the general failure to find mood-congruence in simple perceptual and encoding tasks, in both mood-induction studies, and in anxious and depressed patients. Tasks of this kind are relatively easily modelled in terms of network activation processes (e.g. McClelland & Rumelhart, 1981), and it is hard to explain the absence of effects, particularly when more complex evaluation tasks do show mood- congruence. Similarly, the strength of effects on memory seems to increase with the need for active processing of the material, when a simple priming model would predict the opposite. Another general difficulty, at least for studies of anxiety, is the failure of state anxiety differences to explain the cognitive differences between patients and controls. There appears to be more to anxiety disorders than just over-activation of an anxiety node.

A number of other, more specific criticisms may be made. Forgas and Bower (1987) describe evidence that positive moods have more robust effects on judgement than negative moods, that semantic similarity between the mood source and the judgemental target does not necessarily contribute to bias, and that perceptions of the self are more strongly affected than perceptions of others. Asymmetry between positive and negative moods is also found in memory studies (Singer & Salovey, 1988). In the context of memory research, Williams et al. (1988) point out that the network model ignores important retrieval processes. The response of network theorists to problems of this kind has been to elaborate the Bower (1981) model to accommodate higher-level cognitive and social influences on affect. For example, associative links between an emotion and a stimulus may form only if the person causally relates their emotional reaction to the occurrence of the stimulus (Bower, 1987). Bower and Cohen's (1982) blackboard model postulates a working memory or "blackboard" which integrates emotional information from a variety of sources. It allows the strength of emotion to be modified by interpretational rules so that the person's emotional response is (at least approximately) socially appropriate. These rules may be applied either automatically or through deliberate reasoning. In principle, such a model can account for some of the difficulties noted. For example, mood asymmetry may be caused by the application of rules concerned with regulating and controlling negative moods. As Singer and Salovey (1988) state, people are generally motivated to "repair" unpleasant moods through a variety of cognitive strategies. We could also argue that clinical patients are characterised by maladaptive interpretational rules as well as abnormal affect, particularly with regard to self-perceptions, so that state mood measures are not a reliable guide to the emotion-related cognitions of patients. The general disadvantage of the blackboard model is that it is difficult to falsify, since a new "emotional interpretation rule" can always be invoked to account for awkward data. It then becomes more a general framework than a testable theory (Williams et al., 1988).

More recently, Bower (1992) has proposed that emotions may activate not just isolated semantic concepts but rule-based action plans which have proved useful in similar previous situations. We shall argue in Chapter 12 that the action plan concept is better suited to explaining the experimental data on attentional bias than the original associative network model. However, Bower's (1992) formulation of the concept is too general to lend itself to prediction of attentional bias. In particular, he does not specify the extent to which action plans are automatic or controlled. As discussed in Chapter 2, rule-based processing systems may meet the operational criteria for either type of processing (Ackerman, 1988), and theoretical discrimination of the two modes of control is essential for explaining attentional phenomena (Norman & Shallice, 1985).

A network model for clinical depression: Ingram (1984)

Ingram (1984) has elaborated network theory specifically to explain information processing in clinical depression. Like Bower (1981), Ingram sees depression as associated with activation of a depression node, caused, in general, by appraisal of life events associated with loss. Ingram extends the theory by considering also the *maintenance* of depression. He suggests that the depression node becomes associatively linked in a *loss-associated network* with nodes representing recent events and cognitions related to prior episodes of depression. Activation may generate a "cognitive loop" (Clark & Isen, 1982), whereby activation spreads through the network and feeds back into the depression node, maintaining its activation. In non-depressives, the activation level of the network decays over time, so that the person only experiences a mood, of short duration. In clinical depressives, there are various exacerbating factors which tend to prevent decay of network activation. For example, if the loss-associated network is particularly large and interconnected, neutral events may be appraised as depressing (see Teasdale, 1988, for related points). Recycling of activation through the network is described as automatic, with the proviso that it generates conscious cognitions which demand attention and engage attentional capacity. Ingram also emphasises the importance of volitional control in interrupting or modifying the recycling cognitions. The Ingram (1984) model accounts straightforwardly for the effects of depression on memory, since recycling serves to elaborate the representation of the material in memory. It also explains the importance of self-reference and active processing of the material, since both will tend to strengthen associations with the loss-associated network. Qualitative differences between individuals in the complexity of the loss-associated network explain why mood states are not necessarily equivalent to traits or clinical disorders. Qualitative aspects of network function may also account for asymmetries between positive and negative mood effects. Isen (e.g. 1990) suggests that information associated with positive affect is represented as a more extensive network, leading to stronger effects of positive moods, and performance enhancement on tasks related to network complexity, such as creativity test performance.

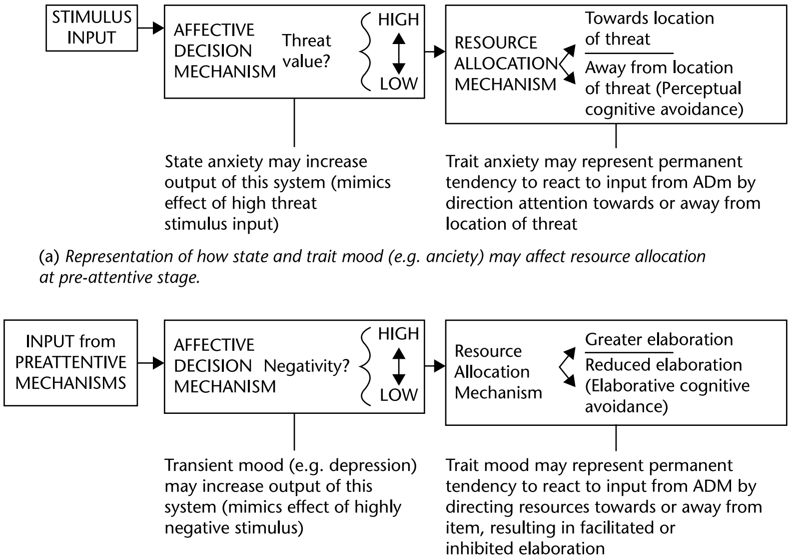
Application of the model to attentional studies is more difficult, though it can reasonably explain greater distraction by stimuli likely to be activated by the network, as in the Stroop test. It remains unclear why depressives do not reliably show stronger facilitation of processing unpleasant stimuli in simple perceptual tasks. There is also a theoretical difficulty in describing "automatic" recycling as partly accessible to consciousness, and attention-demanding. On the face of it, the process described by Ingram might better be seen as partially automatised, at an intermediate stage of a continuum of automaticity. It would appear fairly simple to extend the model to anxiety, with worrying serving to recycle activation through a network associated with threats in general or one particular threat.

Current status of network models

In conclusion, Bower's (1981) network theory is of limited use in predicting which types of information-processing task are most sensitive to affective bias. It also fails to explain why trait and state emotion may have distinct effects on processing. We have seen that a more sophisticated network model such as Ingram's (1984) may be able to serve these purposes. The two main stumbling blocks appear to be distinguishing the roles of automatic spreading activation and controlled or strategy-driven processing, and explaining the weakness of affective bias effects on low-level encoding. Moreover, patients and controls may differ in network properties other than chronic activation of emotion. Ingram (1984) rightly draws attention to the likelihood of differences in the strength and extent of excitatory links between emotion and other nodes. As Matthews and Harley (1993) have shown, there are a variety of specific network parameters which may account for individual and group differences in information processing, including parameters governing rates of decay of activation, level of random noise in the network, and strengths of connections between different sets of units. The effects of different parameters can only be distinguished by integrating simulation and experimental studies, which has yet to be done for affective bias.

Information-processing models of bias: Williams et al. (1988)

The most fully developed alternative to network theory is the model of Williams et al. (1988). They distinguish differing biases associated with trait and state depression and anxiety, and locate them at different stages within an information-processing model of attention and memory. A schematic representation of the model is shown in Fig. 5.1. Anxiety effects are pre-attentive: state anxiety increases the threat value assigned to the stimulus, whereas trait (and clinical) anxiety bias subsequent resource allocation. Anxious subjects tend to divert resources to stimuli evaluated as threatening, whereas non-anxious subjects preferentially allocate resources to non-threatening stimuli. Depression influences processing only after stimulus identification, when attended stimuli are elaboratively processed; that is, further processing of the relationships between stimuli, and between stimuli and context. State depression biases negative evaluations of stimuli, whereas trait/clinical depression facilitates elaboration of negative



(a) *Representation of how state and trait mood (e.g. anciety) may affect resource allocation at pre-attentive stage.*

(b) *Representation of how state and trait mood (e.g. depression) may affect resource allocation of elaboration stage.*

FIGURE 5.1 A processing stage model of anxiety and depression effects on attention (Williams et al., 1988).

material, again through a resource allocation process. Because this model is the one which distinguishes most explicitly between different attentional processes, it deserves special consideration. We also discuss briefly a somewhat similar alternative model of this kind, Eysenck's (1992) hypervigilance theory.

There are three broad types of prediction from the model to be considered. Two of these are relatively straightforward empirical predictions, which were examined in detail in the previous chapter. The third prediction concerns the attentional mechanisms sensitive to trait and state emotion, and requires more detailed discussion. First, Williams et al. predict that anxiety and depression will affect qualitatively different tasks. Anxiety should influence perception and attention, whereas depression effects should be restricted to tasks requiring elaboration, particularly memory tasks. We have seen previously that anxiety and depression effects are less distinct than the Williams et al. model predicts. Second, trait and state effects should be distinct, though interacting under many circumstances. Ideally, it should be possible to demonstrate double dissociations between trait and state effects on suitable tasks. For example, state but not trait anxiety should affect ratings of the threat value of stimuli, whereas trait but not state anxiety should predict allocation of resources to a stimulus of a subjective threat value controlled across individuals. In general, evidence on this aspect of anxiety effects is lacking. We have seen that the prediction of interaction between trait and state anxiety receives some support, but the evidence is not fully convincing. For example, in Broadbent and Broadbent's (1988) regression analyses, the interaction term was non-significant when the curvilinear effects of trait anxiety were controlled. MacLeod and Mathews (1988) and Richards et al. (1992, experiment 2) showed biasing effects of trait anxiety were stronger in conjunction with an anticipated threatening event (an exam) and/or an experimentally manipulated event (unpleasant photos). It is unclear whether the key factor was the priming of threatening information associated with the events, or state anxiety *per se*. As stated previously, there is insufficient evidence on differences between state and trait depression effects.

The third prediction is that anxiety should affect pre-attentive and unconscious selection of threatening material, but not post-attentive, voluntary selection. This prediction is less than straightforward to test because of the slippery nature of the concepts of pre-attentive processing and consciousness. Next, we consider these aspects of the model in more detail because of their theoretical significance. The evidence comes from studies of anxiety, but the general argument may also apply to other affective disorders, for which evidence is currently lacking. The original view of Williams et al. (1988) seems to have been that automatic, pre-attentive processes were generally prone to bias. However, the model must account not only for positive findings of bias, but also failures to find bias on measures of simple encoding, such as perceptual thresholds and speed of word reading. Furthermore, bias effects have been detected primarily through measures sensitive to attentional resource allocation, which is also influenced by voluntary control and post-attentive processes. Hence, the claims that effects are (1) automatic rather than strategic or controlled, and (2) pre-attentive, in operating after entry of stimuli to later, capacity-limited processing, require particularly careful scrutiny.

Bias in anxiety: Automatic or controlled?

We consider the claims that attentional bias is automatic and pre-attentive separately, because the two characteristics are logically and perhaps actually distinct (Logan, 1992). As discussed in Chapter 2, there are several criteria for automaticity, which are sometimes dissociated. We may ask whether the bias is *accessible to consciousness*, whether it is under *voluntary control*, and whether it affects *attentional resource allocation*. A strong definition of automaticity would require that bias was unconscious, involuntary and independent of the supply of resources to encoding. We are primarily concerned with those automatic processes which initially bias selection, rather than subsequent stages of processing which may follow any automatic selection of information.

With the great majority of studies, it is impossible to assess the role of consciousness, because all stimuli are easily perceived. The three exceptions are the dichotic listening study of Mathews and MacLeod (1986) and the two studies of normal studies using the masked Stroop test (MacLeod & Hagen, 1992; MacLeod &

Rutherford, 1992). All three studies made a reasonably thorough attempt to check for conscious awareness, with negative results. A fourth study (Kemp-Wheeler & Hill, 1992) failed to find any effect of neuroticism on processing masked stimuli. On the face of it, the apparent demonstration of bias generated by subliminal stimuli is a remarkable finding. However, there are a number of pitfalls lying in wait for researchers in this area, and, to assess the validity of the claims made for the studies, we must consider in detail the rather convoluted methodological issues arising from studies of unconscious processing.

The dichotic listening study of Mathews and MacLeod (1986) showed significant bias effects on probe RT and shadowing errors. Conscious awareness of stimuli presented to the unattended ear was assessed by recognition memory for the unattended stimuli, and by a check on momentary awareness when the tape of stimuli was unexpectedly stopped, in a further group of subjects. Recognition memory provides only a weak test of awareness: failure of retrospective measures to indicate awareness may result from a lack of episodic memory for instances of momentary awareness (Holender, 1986). There are also difficulties with the momentary awareness check, particularly as it was conducted at a fixed point in the sequence of stimuli, about half way through. Awareness of the unattended channel in shadowing studies tends to vary over time as attentional demands vary (e.g. Underwood & Moray, 1971). It may also take time for subjects to fix their attention exclusively on the attended ear: Treisman, Squire and Green (1974) showed interference from the unattended channel early in the run, but not later on. Hence, lack of awareness at a fixed point during the story used by Mathews and MacLeod is no guarantee of lack of awareness throughout the run. Holender (1986), in reviewing the evidence on "unconscious" processing of the unattended message in dichotic listening, concludes (1) that semantic activation is almost always accompanied by diversion of conscious attention from the attended channel, and (2) that dichotic listening tasks are fundamentally ill-suited for demonstrating unconscious semantic awareness. Hence, although the Mathews and MacLeod (1985) study provides an interesting demonstration of anxiety bias, it does not conclusively demonstrate that bias was unconscious. The study of Trandel and McNally (1987), which attempted a more stringent demonstration of unconscious processing, failed to show affective bias, though it might be that bias is associated with generalised anxiety but not PTSD.

Evidence from masked Stroop studies

The masked Stroop studies of MacLeod and Hagen (1992) and MacLeod and Rutherford (1992), in which Stroop stimuli are presented subliminally, are superficially more promising than dichotic listening. A forced-choice lexical decision task was used to assess conscious awareness, with subjects apparently unable to distinguish words from nonwords. Holender (1986) concluded that masking studies are in principle capable of demonstrating semantic activation without awareness, because there is no division of attention across attended and unattended stimuli. However, he also cautioned that few, if any, studies had taken the necessary methodological precautions. MacLeod and Rutherford (1992) claim that they followed Holender's (1986) guidelines for demonstrating unconscious semantic processing. In fact, this is a somewhat optimistic gloss on the procedure actually followed in the two studies. Specifically, Holender (1986) states that detection or identification thresholds of masked stimuli should be determined by modern psychophysical methods. This in turn requires determination of thresholds for each individual subject. This was not done in either Stroop study, with all subjects given the same, 20 msec exposure time, although broadly comparable studies (e.g. Marcel, 1983) suggest considerable individual differences in threshold. The two studies also appear to have omitted two additional tests. First, it is important to check that probabilities of the two possible responses on the lexical decision task should be roughly equal for each subject, since strong response bias may artifactually lower discrimination performance (Merikle, 1982). Second, to test for individual differences, performance on awareness trials should be correlated with performance on test trials: a positive correlation indicates that there may be some individuals for whom stimuli are above threshold (Kemp-Wheeler & Hill, 1992). A positive feature of the studies was that "awareness" trials were interspersed with Stroop trials, providing some control for variation with time on task. However, there were only 12 trials at each time point, too few for statistically reliable determination of sensitivity (Kemp-Wheeler & Hill, 1988).

Another difficulty is the use of a lexical decision task to assess threshold for awareness. It appears that use of different detection judgement tasks gives rise to different thresholds (Dagenbach, Carr, & Wilhelmson, 1989), whose rank ordering is not obvious. For example, Marcel (1983) found that in subjects adopting a passive, "intuitive", approach to the task, threshold for judging semantic similarity of a masked word to a second, supraliminal word was lower than the threshold for judging whether or not any stimulus had been presented at all. Subjects may also have conscious awareness of the emotional valence without awareness of other information about the word (Bargh et al., 1992). Hence, as Cheesman and Merikle (1986) indicate, lexical decision is an imperfect task for assessing subjects' awareness of semantic and emotional properties of words. In the masked Stroop studies, all subjects may have had some awareness of threat in the absence of conscious word recognition, but only anxious subjects were slowed by this awareness. A better procedure might have been forced-choice discrimination between the word presented, and a suitably matched distractor word of opposite threat valence. The two studies showed only that mean levels of performance on lexical decision were at chance: no tests are reported for the different subject groups, for individual subjects, or for changes in performance over time. There is some reason to expect temporal changes, when stimuli are repeatedly presented supra-threshold, as they were in both studies. Johnston and Dark (1985) describe an "identity- priming artifact", whereby near-threshold stimuli become progressively easier to discriminate with repeated presentation.

Another problem is the small magnitude of bias effects on the masked Stroop. In MacLeod and Rutherford's (1992) key high-stress condition, anxious subjects were 7 msec faster on threat words than on non-threat words, whereas non-anxious subjects were 6 msec slower. This effect size may be compared with standard deviations of colour-naming latencies of around 100 msec. (The critical interaction showing that anxiety-related bias varied with presence or absence of masking was in fact only marginally significant, at $0.05 < P < 0.06$.) That is, we do not require a general slowing of response to threat words in anxious subjects to account for the findings: a few slow responses would be sufficient to explain the effect. MacLeod and Hagen (1992) fail to report effect sizes at all, presenting only correlational data for an uncorrected difference score measure, which, as previously discussed, may be sensitive to statistical artifact.

Of course, the studies do not show the absence of an unconscious bias. Cheesman and Merikle (1984) draw a useful distinction between the subjective threshold, at which the subject believes discrimination is impossible, and the objective threshold, at which forced-choice discrimination falls to chance levels. Their data showed Stroop interference below subjective, but not below objective threshold, so an unconscious bias seems conceivable, and a rigorous demonstration of anxiety effects at either threshold would be of interest. However, studies of priming of lexical decision conducted by Dagenbach et al. (1989) suggest that the implications for information-processing models of near-threshold processing are limited. They showed that even at threshold, the type of judgement required for the threshold task biased the direction of subsequent priming. Even without conscious awareness, there was a carryover of strategy from the judgement task to the lexical decision task. Hence, it cannot be argued that "unconscious" processing bias is indicative of a strongly automatic process disconnected from intentional strategies. Even an unequivocal demonstration of bias without awareness would not in itself provide very much information about its basis in information processing.

Hence, the masked Stroop studies do not compel us to accept the hypothesis of pre-attentive bias: there are two alternative explanations. The first is simply that results were generated by occasional awareness of the stimuli, or of their threat value. Awareness might be general, or restricted to certain individuals with low perceptual thresholds, or towards the end of the task. The second is that bias was generated by an interaction between unconscious activation of processing generated by the masked stimuli and the subject's voluntary strategy, in line with Dagenbach and co-workers' (1989) evidence that the outcome of unconscious processing interacts with strategy. For example, presentation of threat stimuli above threshold in the studies might plausibly elicit active search for further threat in anxious subjects. The key point is that even if this search failed to detect the masked threat stimuli, it may have added sufficiently to the activation elicited by the threat stimuli to generate the 7 msec Stroop interference effect. The studies fail to show that anxiety influenced automatic activation of processing rather than strategy.

Voluntary control: Studies of spatial attention

The second criterion for automaticity is that the subject should lack voluntary control over initiation and cessation of the response. There have been few direct tests of this criterion. Ideally, the subject's strategy would be manipulated experimentally, and the dependence of the bias effect on the subject's strategy assessed. If the bias was strongly automatic, it should not be influenced by strategy (although subsequent controlled processing might be affected). There is no compelling reason to suppose that effects on visuo-spatial attention are involuntary. The filtering task developed by MacLeod et al. (1986) assesses attention *after* the subject has responded to a word pair. Within a continuous flow (Eriksen & Schulz, 1979) or PDP model of processing, additional stimulus analysis may proceed in parallel with production of the initial verbal response. Hence, it may be post-attentional processing of threat which maintains or directs anxious subjects' attention to the threat word following or in parallel with verbal response. Broadbent and Broadbent (1988) attributed anxiety bias to a post-attentive mechanism of this kind because bias increased during their experimental run. If threat words involuntarily capture attention in anxious subjects, we would expect breakdown of filtering in task conditions where a threat word is presented in an unattended location. In fact, it is rather uncertain that this is the case. In particular, Mathews et al. (1990) found that anxious subjects were only excessively distracted by threat words when target location was unknown, forcing searching of the visual field. In other words, the threat word may only be reliably attention-engaging when it is deliberately attended.

Visual attention studies are important for the Williams et al. (1988) model because it is claimed that they show that anxiety and threat interactively affect an involuntary trade-off in the allocation of attentional resources across two locations, consistent with the Williams et al. model. That is, resources which anxious patients allocate to processing the threat location are withdrawn from the non-threat location. This claim rests on the assumption that anxiety effects on attention to the two locations are mutually interdependent, a view which requires further consideration of the role of the position of the probe stimulus. Response to lower probes is normally slower than to upper probes, implying that subjects typically follow a strategy of waiting to see if the probe appears in the initially attended upper position, and shifting attention to the lower position if not. Hence, it is misleading to interpret the probe task as providing a direct indication of the deployment of attention during word presentation: detecting the lower probe appears to involve active reorienting of the attentional focus, but detecting the upper probe requires maintenance of the original attentional focus. (Word-probe SOAs of at least 500 msec allow ample time for strategic shift of attention.) We can use the existing data to assess whether maintenance and shifting of attention are both controlled by a single mechanism, such as Williams and co-workers' (1988) resource trade-off setting, or whether there is some dissociation between the two processes. We can do this by looking at whether threat position influenced bias differentially for upper and lower probes in anxious subjects, assuming that bias is primarily associated with the anxiety rather than the control group. (Bias towards avoidance of threat within control groups seems unreliable: Mogg et al., 1992.) If we find a threat effect only for upper probes, the implication is that the mechanism is associated with filtering efficiency, because the person should be maintaining attention to the upper location throughout. If the threat bias is stronger for lower probes, the implication is that it is generated by the shift of attention from the upper to the lower position.

Three studies provide suitable data, summarised here in Fig. 5.2. Regrettably, none of the studies concerned report any significance tests for comparisons between pairs of means, so the analysis is based on the overall appearance of the data. In both the studies of clinically anxious patients (MacLeod et al., 1986; Mogg et al., 1992), threat bias was only replicable across the two studies when the probe is presented in the upper position. Mogg et al. (1992) found virtually no bias with lower position probes. In the MacLeod et al. (1986) study, the magnitude of bias with lower probes is about half the size of bias with upper probes, and it is uncertain whether the weaker lower position effect is independently significant. That is, patients maintain attention to the upper location following presentation of a threatening word more strongly than when a non-threatening word has been presented. However, when the task requires shifting of attention, patients and controls do not differ consistently in rapidity of switching attention to the lower location following presentation of threat there. Across the two studies, there is no reliable trade-off between slowing of response to the upper probe and faster

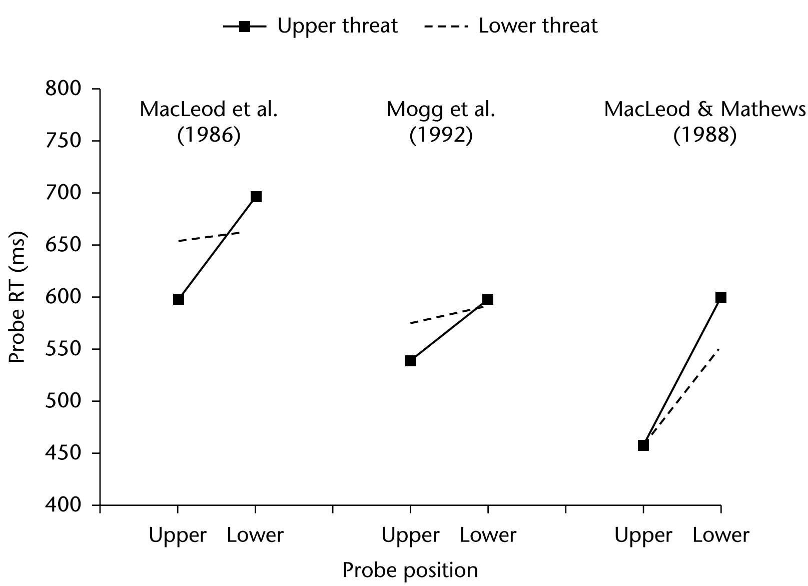


FIGURE 5.2 The effects of threat and probe position on RT in the dot-probe paradigm in anxious subject groups, in three studies.

detection of the lower probe, contrary to the prediction of the Williams et al. (1988) model. In contrast, the data of MacLeod and Mathews (1988) obtained from students show the opposite pattern of results. In trait-anxious students, threat in the initially attended upper position slowed the shift of attention to the lower probe, relative to the lower probe/lower threat condition, but no bias was evident in the upper probe condition. Anxious students appeared to find it difficult actively to shift from a threat location to a non-threat location, but had no difficulty maintaining filtering efficiency over time. The dissociation in the role of probe position across patient and student samples suggests the operation of two distinct mechanisms, rather than a simple resource trade-off.

An alternative explanation is that anxiety patients adopt a strategy of efficiently maintaining attention to threat locations to which they have attended voluntarily, speeding response when both threat and probe are in the upper position. In the upper probe/lower threat condition, in which response is slow, anxious subjects have difficulty maintaining focused attention after the initial response because the upper word is of no special significance. There is little biasing of response to lower probes because, in this paradigm, anxiety does not specifically generate active search for threat, or affect the voluntary attentional shift which ensues following failure to detect the probe at the upper position. This hypothesis also explains the findings from the Mathews et al. (1990) paradigm, which showed evidence for bias in search but not in filtering in anxious patients. The Mathews et al. (1990) task assesses the initial attentional response rather than subsequent change in attentional focus. In the filtering condition of that study, anxious subjects appeared to be as efficient as controls in deploying attention to a fixed location containing a neutral stimulus, even when a threatening stimulus was presented elsewhere in the visual field. Threat stimuli were never deliberately attended, so the strategic mechanism described never came into operation. In the search condition, on those trials in which anxious subjects allocated attention to the "wrong" location (in series or parallel), attention would be held briefly before shifting to the correct location, slowing response. The mechanism may be different in the trait-anxious students of MacLeod and Mathews (1988), where the data are suggestive of the threat stimulus influencing the speed of the shift of attentional focus to a specific location.

Voluntary control: Studies of the Stroop test

Studies of the Stroop test provide perhaps more suggestive evidence for involuntary effects, by analogy with the standard Stroop test, where colour–word interference is very difficult or impossible to suppress. However, as the degree of interference is affected by strategy (see MacLeod, 1991a), it is unfortunate that none of the emotional Stroop studies have manipulated voluntary intention explicitly. The masked Stroop studies are suggestive of an involuntary effect, but if momentary or partial awareness is possible in these studies, so too is voluntary intention. MacLeod and Rutherford (1992) make the interesting suggestion that trait-anxious normals are able to suppress interference voluntarily when stimuli are unmasked but patients are unable to do so, implying that bias is only strongly automatic in the latter group. However, as some studies do show interference with unmasked stimuli in normal subjects (e.g. Richards & Millwood, 1989), it is unclear how robust the finding is.

A general concern with the Stroop and other studies is the possibility of voluntary priming effects, explicitly demonstrated by Richards and French (in press). Priming at time lags of 500 msec or more, as between successive trials of an attentional study, is generally strategic (Neely, 1991). The subject generates an "expectancy set" of likely targets, which are serially compared with visual input (Becker, 1985). In the case of the masked Stroop studies, the same threat words were presented above and below subjective threshold during the course of the study. It may be that activation generated by the subject's expectancies summated with activation automatically generated by the prime, with anxious subjects distinguished by heightened expectancy of negative stimuli, rather than by the automatic activation elicited by masked negative words. Segal and Vella's (1990) study of long SOA priming of the emotional Stroop test implies that depression-related bias may also be associated with controlled processing of expectancies.

Attentional resources: Evidence lacking

The final criterion for automaticity is that processing should require few, if any, attentional resources. It is difficult to apply this criterion to the Williams et al. (1988) model, because, while anxiety bias is essentially automatic, it affects a resource allocation mechanism, leading to the somewhat paradoxical prediction that (trait anxiety) bias effects should be confined to resource-limited task performance. The dependence on resources of the "spotlight" of visual attention (Eriksen & Yeh, 1985) and of Stroop interference (Kahneman & Chajczyk, 1983) make resource-limitation plausible, but few studies relevant to resource allocation processes have been conducted. Tests of the Williams et al. (1988) resource allocation model have generally been confined to testing for changes in response time, which may or may not reflect changes in resource allocation. We have seen already that attentional shifts in the MacLeod et al. (1986) task may reflect the subject's strategy rather than resource usage *per se*. Studies of attentional allocation during dual-stimulus lexical decision (MacLeod & Mathews, 1991b; Mogg et al., 1991a) have similarly been interpreted as supporting the Williams et al. (1988) attentional allocation hypothesis, but again the methods used fail to indicate whether a resource mechanism is involved. The rather complex effect obtained by Mogg et al. (1991a), in which anxiety-dependent bias depended on word position, may again indicate strategy dependence of effects. More rigorous investigation of resource allocation using techniques such as constructing Performance Operating Characteristics (Wickens, 1984) is required.

Automaticity of anxiety-related bias: Conclusions

To conclude, the studies conducted to date do not establish that bias associated with anxiety is automatic. A similar conclusion applies to the much smaller database of studies of attentional bias in other affective disorders. In most studies, the bias could equally well be automatic or the outcome of voluntary strategies, working through expectancy priming in some cases. It is possible, of course, that both types of bias operate. It should also be emphasised that there may be a continuum of automaticity versus control, rather than a rigid dichotomy. Possibly, anxiety biases may be partially automatic, with conscious, voluntary involvement reduced rather than absent. We have argued that studies purporting to demonstrate unconscious bias (e.g. MacLeod & Rutherford, 1992; Mathews & MacLeod, 1986) are methodologically flawed, but they do suggest that the bias may operate with rather little conscious awareness of stimuli. However, even if stimuli are inaccessible to consciousness, it may be the operation of voluntary strategies elicited by presentation of supra-threshold threat words which is responsible for the interference evident in anxious subjects: strategic intervention may interact with automatic processing even when it fails in its intent (Dagenbach et al., 1989).

Bias in anxiety: Pre- or post-attentive?

The other issue arising from the Williams et al. (1988) model is whether anxiety (and perhaps other) effects are genuinely pre-attentive, a logically distinct problem from the automaticity of effects. This is a difficult question to tackle, because it is only meaningful to describe processes as "pre-attentive" in the context of specific models of attention (the term is essentially architectural). Williams and co-workers' use of Graf and Mandler's (1984) memory theory as the basis for the model results in a lack of detail concerning the architecture of attention. The best we can do is to consider how early and late selection models of attention might accommodate the Williams et al. theory. We saw in Chapter 2 that there is a reasonable consensus on the existence of two domains of information-processing—an early, parallel, involuntary domain, and a later, serial, strategy-driven domain (Johnston & Dark, 1985). Theoretical disagreements centre on the loci of selection within such a system. What we require is a reasonably detailed model of attention which allows the early domain to be more sensitive to threat in anxious patients, and predicts that this pre-attentive bias affects tasks such as the Stroop and visual filtering tasks, but does not affect simple encoding tasks.

Compatibility of early selection and pre-attentive bias

It is apparent that early selection theories such as Treisman's (1988) are unsuitable for this purpose. The information processed by the involuntary domain is coded in the form of maps of elementary features such as line segments and colours, and it is unlikely that complex attributes such as word meaning can be coded in this way. Analysis of meaning requires attentionally demanding conjunction of features, such that any individual differences in further processing of meaning are by definition post-attentional (though not necessarily intentional or conscious). For example, in a spatial attention task, post-attentional analysis of threat content may feed back to the perceptual filter by prioritising analysis of the location where the threat has been detected (see Cave & Wolfe, 1990, for a detailed model of how search may be biased by top-down influences). Early selection attributes the breakthrough of unattended information to priming of an expected stimulus by features extracted pre-attentively. However, it is unlikely that the feature information associated with individual words is sufficiently predictive of the word for this process to operate. In general, adoption of an early selection model forces us also to assume that any selective call for resource allocation to threatening material is post-attentional.

Compatibility of late selection and pre-attentive bias

Late selection theory is superficially more promising because word meaning may be extracted pre-attentively. Traditional late selection theories (e.g. Deutsch & Deutsch, 1963) suggest that Stroop interference is associated with a response selection stage: verbal and colour stimuli generate conflicting responses. For the emotional Stroop, the problem is that there is no overt response associated with the threatening stimulus (in contrast to the traditional colour–word Stroop test), and so no obvious basis for interference between responses. Threat must elicit some processing prior to response selection which somehow interferes with colour-naming. We can assess the likelihood of such interference by examining further one of the more detailed contemporary late selection models, that of Duncan and Humphreys (1989). The question is whether some pre-attentive enhancement of threat encoding necessarily generates enhanced selective attention. As described in Chapter 2, full pre-attentive stimulus analysis segments the visual field into structural units or objects, which then compete for entry into a limited-capacity visual short-term memory (VSTM) system. Threat is an attribute of an object, not an object itself. If the person is searching for a non-threatening target, there is no reason for distractor objects which possess this threat attribute to be prioritised for selection. Hence, even if threat is somehow preferentially encoded pre-attentively by anxious subjects, this process should only affect selection of objects where the target specification directing selection explicitly includes threat as an attribute. Anxiety might enhance search for threatening targets, but it is difficult to explain why anxious patients are distracted by threatening non-targets, as demonstrated by Mathews et al. (1990). If anything, increased salience of threat in the non-target makes it more distinct from the target specification, and so makes the non-target *less* likely to engage attention. On a task such as the Stroop test, the perceptual grouping of colour and word makes it likely that both will be selected together, as part of the same object, and selection must take place post-attentively, after entry into the limited-capacity processing system.

Threat as a pre-attentive interrupt

Alternatively, we might perhaps argue that threat is similar to rapid visual onset, in prioritising or increasing the attentional salience of the threatening object. If so, prioritisation might be stronger in anxious subjects, explaining bias on tasks such as filtering, where selection between objects is required. This is an *ad hoc*, but reasonably plausible, extension to late selection theory, given psychophysiological evidence for early analysis of stimulus significance (Ohman, 1979). The difficulty here is that the data are suggestive of an explicit dissociation between (1) the general bias in processing threatening and emotional stimuli and (2) anxiety-specific biases. The simplest evidence for the dissociation is that the affective content of stimuli does reliably affect simple perceptual and encoding tasks in unselected samples, in studies of perceptual defence (e.g. Kitayama, 1990) and single-task lexical decision (Matthews et al., in press). However, affective bias effects on these tasks are weak and unreliable, particularly in the case of anxiety. Conversely, the selective attention tasks which are sensitive to anxiety-related bias (e.g. MacLeod et al., 1986) do not usually show any general tendency across subjects for affective stimuli to capture attention. Selective attention in these paradigms is more sensitive to subject than to stimulus variables. Another line of evidence concerns the effects of masking on emotional bias. Kitayama's (1990) theory of pre-attentive processing of affect successfully predicts that visually degraded affective words should be more difficult to perceive. However, in studies of anxiety, stimulus degradation appears to have the opposite effect, of *enhancing* processing of threatening stimuli in anxious subjects (MacLeod & Rutherford, 1992), implying that the mechanism is different.

Priming studies also suggest a dissociation between effects of stimulus emotionality and subjective affect. Such studies are of particular interest because manipulation of SOA, the time-lag between onsets of prime and target stimuli, provides a relatively clean way of distinguishing automatic and voluntary processing (Neely, 1991). We have seen that emotional priming near perceptual threshold seems to be associated with stimulus rather than subject characteristics (Kemp-Wheeler & Hill, 1992). In addition, emotional priming has been demonstrated at the very short SOA of 50 msec, which is suggestive of an automatic activation mechanism (Hill & Kemp-Wheeler, 1989). The results of this study show a decrease in emotional priming magnitude from 62 msec at the 50 msec SOA to 34 msec at the longer SOA of 1250 msec, though the temporal change was non-significant. The results of Fazio et al. (1986) are stronger, in that emotional priming was significant only at the shorter of two SOAs. In contrast, priming in anxiety seems to be more expectancy-based in nature. Using a homograph priming task, Richards and French (in press) found significant increases in anxiety-related bias with increasing SOA. It is possible that the difference in the role of SOA relates to differences between the homograph and emotional priming tasks. The data are not conclusive, because there are too few studies comparing anxiety and stimulus valence affects on the same tasks. However, the evidence does imply that pre-attentive processing is rather similarly tuned to environmental threat across different subject groups. Bias may be stronger in post-attentive analysis and regulation of attention.

Bias in pre-attentive selection of threat: Conclusions

In summary, we must distinguish between the general availability of threat information pre-attentively, and whether that information actually guides selection. Within a contemporary, object-oriented late selection theory, it is not immediately obvious why selection in anxious subjects should be sensitive to threatening attributes of non-targets, in the absence of some top-down prioritisation of threat. We might argue for some extra intrinsic prioritisation of threatening objects in anxious subjects, but it is then difficult to explain qualitative differences between effects of subject anxiety and emotional stimulus properties on encoding and priming tasks. In principle, it may be that either anxious subjects are more likely (1) to continue to allocate post-attentive processing effort to threatening objects after entry of the object into the limited-capacity system, or, more speculatively, (2) to search actively for threatening stimuli.

Hypervigilance theory: Eysenck (1992)

Eysenck has proposed an attentional theory of anxiety with a somewhat similar basis in information-processing theory to the Williams et al. (1988) model, but which differs to some extent in the predictions it makes. The theory states that trait-anxious individuals are excessively prone to scan the environment for threat, and this hypervigilance acts as a latent cognitive vulnerability factor for clinical anxiety. Hypervigilant behaviour is elicited by stress and state anxiety, and is liable to cause generalised anxiety disorder. Hypervigilance may manifest itself as excessive distractibility to any task-irrelevant stimuli, heightened selectivity of attention to threat-related stimuli, rapid environmental scanning and broadening of attention prior to detection of a salient stimulus, and narrowing of attention during processing of a salient stimulus. The theory predicts bias in attention much as the Williams et al. (1988) model does, but has the additional advantage of explaining anxiety effects on non-threatening stimuli (reviewed in Chapter 7). Eysenck concurs with Williams and co-workers' (1988) view that selective attention to threat is associated with anxiety but not depression, but also emphasises the importance of distinguishing different kinds of anxiety disorder. However, the theory is not explicit about the respective roles of automatic and controlled processing in hypervigilance, or about the extent to which bias is pre-attentive. Eysenck accepts the existence of pre-attentive bias, but also emphasises the importance of control processes. The Eysenck (1992) theory refers to two elements of bias in anxiety which may be particularly significant omissions from the Williams et al. (1988) model. The first is the search of the environment for threat. Although Eysenck does not say so explicitly, it is difficult to see how active scanning can be anything other than strategic in nature. Second, Eysenck highlights the importance of "secondary appraisal", the evaluation of the coping strategies available for dealing with a threat, which may contribute to anxiety-related bias. Hence, Eysenck identifies anxiety biases with a wider range of processes than Williams et al. (1988), but the theory has yet to state how specific sources of biases account for specific phenomena.

Status of attentional theories of anxiety

This is a timely point in the review to emphasise that studies conducted by Mathews, MacLeod, Eysenck and others to test the relationships between anxiety and attention posited by Williams et al. (1988) constitute a very impressive body of research. Anxiety-related bias has been clearly demonstrated across a range of tasks. It is stronger on tasks with a selection element, and it does not appear to require strong deliberate attention to prioritise specific threatening task stimuli. The problems emerging are those inherent in moving from a general impression of this kind to a rigorous, falsifiable theory. They are compounded by considerable and unavoidable methodological difficulties in demonstrating processing characteristics such as lack of consciousness and automaticity. We have argued that neither the automaticity nor the pre-attentive locus of the bias has been convincingly established. The hypothesis of a pre-attentive mechanism raises considerable theoretical difficulties. It remains plausible that the bias is partially automatised and that it may be located relatively early in processing, prior to extended elaboration of stimulus material. In general, research on anxiety and attention has neglected the role of strategic processes.

Conclusions

Summary

It was concluded at the end of Chapter 4 that the theoretical implications of studies of attentional bias in patients require careful scrutiny. As discussed in Chapters 2 and 3, a major theoretical issue is whether attentional bias is associated with lower or upper levels of control of processing. On the one hand, bias might be generated reflexively, by the sensitivity to incoming stimuli of network units representing emotional concepts, or by the way in which emotion-associated units are interconnected with other units. Alternatively, bias may be associated with the person's voluntary control of processing, which in turn is influenced by their store of knowledge about handling emotional and personally significant encounters. Bower's (1981) original network theory assumed that over-excitement of emotion units generated a variety of bias effects automatically. More recent network theories have placed more emphasis on strategic processing. For example, Ingram (1984) highlights the failure to exert effective voluntary control over lower-level processing as an important feature of depressive cognition.

However, it is difficult to derive clear-cut predictions concerning bias in selective attention from elaborated network models of this kind. The information-processing model of Williams et al. (1988) is more explicit about attentional processes. Anxiety is said to influence a resource allocation mechanism which functions automatically and pre-attentively in diverting resources to threatening stimuli. Depression affects a separate post-attentive mechanism which controls elaboration of unpleasant stimuli.

Assessment of whether selection bias is automatic or strategic in nature requires separate consideration of three criteria for automaticity: involuntary control, little use of attentional resources, and unconsciousness of processing. As described in Chapter 2, these criteria do not always agree, perhaps because some processing is jointly influenced by both levels of control, giving rise to an apparent continuum of automaticity. A few studies purport to show automaticity of attentional bias by elimination of conscious awareness of emotional stimuli, but their findings are vitiated by methodological problems. For example, MacLeod and Hagen (1992) showed anxiety-related bias in Stroop interference even when stimuli were strongly masked, so that subjects could not perceive whether or not stimuli were threatening. However, these results are inconclusive because of various technical deficiencies with the masked Stroop paradigm, such as failure to determine individual subjects' detection thresholds, which make it difficult to assess whether subjects genuinely lacked awareness of stimulus threat content. Even if stimuli were genuinely inaccessible to awareness, it may be the interaction between automatic activation of threat words and the subject's voluntary strategy for scanning for threat which generates the interference effect. In the majority of studies of selective attention, stimuli are easily perceived, and subjects have sufficient time to choose a strategy voluntarily, so that either lower or upper levels of control may have been responsible for bias. Some of this work provides indications of upper-level involvement, such as Broadbent and Broadbent's (1988) observation that anxiety-related bias in visual attention increases with the subject's exposure to the task. A detailed review of shifts in visuo-spatial attention in anxious subjects suggested that there is no simple trade-off of attention between locations associated with threat and non-threat. Subjects' strategies for maintaining and shifting attentional focus must be taken into account.

A related (though logically distinct) theoretical issue is whether or not bias is *pre-attentive*, generated by early, lower-level parallel processing, prior to stimuli accessing upper-level capacity-limited processing. This issue can only be tackled in the context of specific theories of selection (see Chapters 2 and 3), which differ in the scope afforded to pre-attentive stimulus analysis. Our review of selective attention theory concluded that emotion-congruent bias in pre-attentive selection of threat is difficult to accommodate within either early or late selection theory. Suppose, for example, we adopt a late selection model, in which the system selects between perceptual objects fully analysed by pre-attentive processes. In this case, increased salience of threat will increase the distinctiveness of targets and non-targets making selection of a non-threatening object or channel *easier* rather than more difficult as the pre-attentive hypothesis supposes. In contrast, there is some evidence that the emotional content of stimuli is pre-attentively encoded. Stimulus emotion seems to influence encoding tasks such as recognition of degraded stimuli, which are generally insensitive to the effects of subject emotion (see Chapter 4). The subject's emotional state may affect processing at a later stage than does stimulus content. Overall, it is difficult to explain the results of studies of emotion and selective attention in terms of subject emotion influencing pre-attentive processing. It seems more likely that bias in selection is predominantly influenced by the subject's voluntary strategies for searching for potential threat and maintaining focused attention on sources of threatening or negative information. For example, anxious subjects may be particularly prone deliberately to keep their attention directed towards an attentional channel in which a threatening stimulus has been presented.

Prospects for theories of emotional bias

The common element of much of the theory we have reviewed in this chapter is its attempt to find a locus for bias at a discrete stage of on-line information processing. The tacit assumption is that the structure and integration of processing units is much the same in patients as it is in normals. Anxiety bias in particular is generated by essentially quantitative differences in the functioning of key units: greater tonic activation of anxiety-associated nodes in the Bower (1981) model, assignment of higher threat values to stimuli and more resources to threatening stimuli in the Williams et al. (1988) model. Our assessment of the evidence is that this approach is unlikely to succeed, in that it neglects qualitative differences in processing between anxiety patients and normals, particularly in strategy selection and application. We have seen that network theory provides a better fit to the observed data (on depression) if it is supposed that patients are distinguished both by ineffective volitional control, and by network structures which promote recycling of negative information (Ingram, 1984). We have seen also that the arguments for an automatic pre-attentive anxiety bias are suspect, and there are some positive indications of strategic bias, such as long SOA priming effects (Richards & French, in press; Segal & Vella, 1990), and trial block effects (Broadbent & Broadbent, 1988; Richards et al., 1992). Much of the data on anxiety and attention is compatible with attention tending to fixate on threatening material following detection. Broadly, we suggest that threatening stimuli tend to elicit a strategy of prolonged inspection, particularly when the subject is primed for threat, by informational cueing or by state anxiety. This is not the same as Williams and co-workers' (1988) elaboration mechanism; in the simplest case it is no more than allowing more time for perceptual evidence to accumulate. Stroop test data suggest this process is common to all or most of the affective disorders, although anxiety disorders may be associated with additional strategies such as hypervigilant scanning for threat (Eysenck, 1992).

If we identify bias primarily with strategic control of attentional deployment, we must consider the causes of strategy differences between patients and normal subjects. A general possibility is that strategy use is influenced by the person's self-beliefs and knowledge. This is, of course, the central idea of Beck's (1967) schema theory, which proposes that maladaptive schemata systematically affect a whole range of processing functions. For example, Beck et al. (1985) state explicitly that in anxiety patients schemas are responsible for hypersensitivity to harmful stimuli and scanning for threat. Experimental evidence for enhancement of attentional bias by self-referent processing is provided by Segal and Vella's (1990) study of the Stroop test. However, as we have seen in Chapter 3, schema theory does not mesh particularly well with the concerns of information-processing psychology, particularly in its failure to specify in detail how schema functioning impinges on specific attentional processes. What we require is an attentional theory which states in more detail the role of the permanent store of knowledge about threats and their personal significance in biasing strategy selection, and hence simple attentional functions. We continue with this task in Chapter 12.

6

EMOTIONAL DISORDERS

Attentional deficit

This chapter is devoted to discussing the impact of emotional disorders and sub-clinical affective disorders on the efficiency of performance, particularly of attentional tasks. First, the chapter reviews the effects of clinical depression, anxiety and obsessive-compulsive disorder, and then covers the effects of three elements of stressed mood: anxiety, depression and fatigue. Non-clinical studies of subjects with compulsions are discussed in the first part of the chapter because the cognitive characteristics of clinical and non-clinical compulsives are very similar (Frost, Sher, & Geen, 1986; Rachman & de Silva, 1978; Sher et al., 1989).

Attention deficits in depression

Both endogenous and non-endogenous forms of depression are associated with performance deficits on a wide range of tasks, including memory tasks such as free recall and high-level problem-solving tasks (MacLeod & Mathews, 1991a). Miller (1975) argues that psychomotor retardation is present in both forms of depression, but cognitive retardation is found only in endogenous depression. This specificity could result from greater rumination or lower arousal in endogenous relative to non-endogenous depression. The reader is referred to the papers cited, and to Johnson and Magaro's (1987) review of memory phenomena, for a more detailed review than that presented here. MacLeod and Mathews (1991) argue that memory deficits are associated with state rather than trait depression. Similar deficits can be produced in normal subjects by mood induction. As discussed later in this chapter, degree of memory impairment is often correlated with level of depressed mood, and recovery from depression is accompanied by memory improvement. It remains unclear whether severity of pathology affects memory independently from effects of mood state (Johnson & Magaro, 1987).

Memory research also suggests strategic differences between depressives and controls. MacLeod and Mathews (1991a) cite several instances of depressives showing specific impairments on strategy use, in the structured organisation of material in memory, for example. Kuhl and Helle (1986) asked hospitalised depressives to clean up a messy table, and then required them to perform a memory-span task. More severe depressives, as shown by BDI score, were impaired in short-term memory, and reported more thoughts about the messy table. Severity of depression had no effect in the control group, whose attention was directed towards the table but who were not asked to clean it up. Kuhl and Helle suggest that depressives are vulnerable to intruding thoughts generated by unfulfilled intentions. That is, they have difficulty in strategic control of their motivations and sequencing of goals. Johnson and Magaro (1987) specifically implicate lack of effort as an important mechanism. A general motivational deficit may be responsible for lack of effective use of rehearsal and organisational strategies. One expression of lack of effort seems to be the adoption of conservative response strategies, but reluctance to respond cannot fully explain the overall decrement in memory (MacLeod & Mathews, 1991a).

Studies specifically of attention present a more complex picture of deficit in depression. Several studies have demonstrated that adding a secondary task to the performance of a primary task *improves* the speed of primary task performance in depressives. Foulds (1952) gave subjects the Porteus Maze task under normal conditions, and then again under distracting conditions in which subjects had to repeat digits after the experimenter. Subjects with depression, anxiety states or obsessional problems performed more slowly than hysterics or psychopaths on the normal version of the task but not on the distraction version of the task. In a further study, depressives and normals were tested with the usual and distraction version of the maze task before and after electroconvulsive shock therapy (ECT). Both distraction and ECT were reported to have similar beneficial effects on task performance. However, a later study by Shapiro, Campbell, Harris and Dewsbury (1958) demonstrated that while distractors improved performance, ECT actually reduced performance speed.

The facilitatory effect of secondary task performance has been termed the "distraction" effect and Foulds (1952) accounts for this effect in terms of the secondary task blocking depressive worries, and thereby freeing attentional capacity for the primary task. Consistent with this proposal, distraction has been shown to reduce the frequency of depressive thoughts in depressed patients (Fennel & Teasdale, 1984; Fennel, Teasdale, Jones, & Damle, 1987; see also Chapter 10). Task engagement induced through instruction, and performance of difficult tasks, both seem to block positive and negative moods (Erber & Tessler, 1992), so it is possible that distraction directly relieves depression. However, the capacity interpretation raises the question of why the secondary task does not lead to performance decrements in the same way that depressive rumination does. There are several possible explanations: (1) the secondary task is not as attentionally demanding as depressive rumination; (2) improved primary task performance following addition of a secondary task may result from increased effort as depressives attempt to compensate for the deleterious effects of negative thoughts. Thus the secondary task could also have motivational properties for depressed individuals who are often undermotivated. A pure capacity explanation of this effect is not entirely consistent with the finding that the secondary task *improves* speed of maze performance while increasing the number of errors committed on the task. A modified capacity explanation offers a more parsimonious account of these results. This explanation proposes that change in performance observed in the dual-task situation results from a change in the attentional strategy adopted by depressives. Williams et al. (1988, pp. 36–37) explain that depressives may adapt a conservative attentional strategy which sacrifices speed for the maintenance of the accuracy of performance. With increased task demands, however, speed of performance may be increased at the expense of accuracy.

Whereas attention and memory deficits in depression have been attributed to disruption of controlled processing produced by depressive self-preoccupations (e.g. Hasher & Zacks, 1979), disruption may not be limited to tasks requiring controlled processing. Attentional deficits in certain tasks could be the result of the adoption of controlled processing strategies when automatic processing strategies are more efficient. Brand and Jolles (1987) investigated automatic and controlled processing in unipolar and bipolar depressives, subjects with anxiety states and normals. Two visual search tasks were employed, one involving the detection of target digits among an array of letters and the other requiring detection of target letters among letters. The number of targets to be detected varied from 1 to 4 (the memory set size). Searching for digits among letters is thought to give rise to automatic detection and reaction time performance in this condition is thus independent of memory set size, or nearly so. Searching for letters among letters, in contrast, requires controlled processing and reaction time increases linearly with memory set size (Shiffrin & Schneider, 1977), as illustrated graphically in Chapter 2.

Brand and Jolles (1987) demonstrated a significantly higher slope on the automatic detection task for unipolar depressives compared with normal controls. This finding is significant for understanding attentional strategies in neurotically depressed patients, in that these patients seem to use controlled processing in automatic detection tasks. This result could reflect the adoption of a more cautious performance strategy or a reduced learning of automatic responses in depressives. The mechanism underlying disruptive effects of increased cautiousness could be heightened self-monitoring of performance. Other features of Brand and Jolles' (1987) data were suggestive of more general decrements in efficiency. Unipolar depressives were generally slower than other groups. In addition, this group tended to show steeper slopes for the RT-memory load plot on more demanding versions of the controlled search task, implying a deficit in attentional resource availability.

In summary, depressives show a general slowness in performance of attention tasks. This slowness may result from the reduction in attentional capacity produced by depressive rumination, similar to the purported effects of anxious cognitions on performance in test-anxiety. It may also reflect lack of effort. Sometimes, however (Brand & Jolles, 1987), depressives may adopt more cautious controlled processing strategies in an attempt to compensate for reduced attentional capacity incurred by negative self-preoccupation. This effect may not be limited to tasks requiring controlled processing; preliminary data suggest that depressives may use controlled processing strategies in situations which normally involve automatic detection. Self-focused attention characteristic of depressed individuals may be responsible for interference on automatic tasks by transforming them into conscious controlled processing activities. The anagram performance of depressives is improved by lowering self-focused attention (Strack, Blaney, Ganellen, & Coyne, 1985b), so that the addition of a secondary task may improve primary task performance in such individuals by reducing the intensity of self-focused attention. The concept of self-focus used to account for these strategy effects is more parsimonious than the concept of depressive rumination. Although both processes may be operative, the latter cannot account for an over-reliance on controlled processing strategies. Moreover, if resources are taxed as they are supposed to be by rumination, the depressed subject is more rather than less likely to rely on automatic processing if these have been learned in the first instance.

Obsessive-compulsive states

Cognitive attentional deficits thought to characterise depressive states and states of test anxiety may also be features of obsessive-compulsive disorder. At this point, it is necessary to distinguish between obsessive-compulsive disorder and obsessional personality, since they both can affect performance but the underlying mechanisms may be different. Obsessive-compulsive disorder is marked by recurrent obsessions or compulsions. Obsessions are intrusive ideas, thoughts or impulses which the individual tries to ignore or suppress. Compulsions are repetitive, purposeful and intentional behaviours performed in response to obsessions. These behaviours are designed to neutralise or prevent some feared event and the individual recognises that the behaviour is excessive or unreasonable (DSM-III-R; APA, 1987). In contrast, obsessive-compulsive personality does not consist of true obsessions or compulsions, but this disorder is characterised by enduring perfectionism and inflexibility about morals and ethics, excessive devotion to work and indecisiveness (APA, 1987). We will be concerned here with the cognitive-attentional aspects of obsessive-compulsive disorder and not obsessional personality. The research reviewed in this section on obsessive-compulsive disorder and compulsive behaviour in non-clinical compulsives is suggestive of an attentional deficit in these individuals which is characterised by everyday failures of memory, action and attention, slowness in certain information-processing tasks, and heightened self-focused attention.

A series of studies of attention reported by Broadbent, Broadbent and Jones (1986) found that obsessive personality, but not obsessive symptoms, predicted one out of 19 measures of attentional functioning across six studies. Obsessives were relatively faster in performance on a filtering task requiring attention to a single location, relative to performance on a task requiring visual search. The implication may be that obsessive personality is associated with an advantage in fixing rather than moving the searchlight of attention, consistent with clinical observation, but there are some problems with this work, as discussed in the section on cognitive failures in Chapter 8.

Enright and Beech (1993) report an alternative approach to attentional function in obsessive-compulsive-disordered patients. They argue that selective attention requires both facilitation of task-relevant stimuli and inhibition of task-irrelevant stimuli. Obsessional patients may be prone to obsessive thought because they are deficient in inhibitory processes. Enright and Beech tested this hypothesis using a "negative priming" version of the standard Stroop task. On some trials, the colour word predicted the ink colour on the next trial: so the word RED in green ink might be succeeded by the word BLUE in red ink. Ink-colour naming ("red" in the example) is particularly slow under these conditions, because, it is hypothesised, the colour name has been actively suppressed on the previous trial. The results of the study showed that obsessives showed less negative priming than a heterogeneous group of anxiety patients, who showed similar levels of negative priming to controls (Enright & Beech, 1993). Enright and Beech (1993) also found reduced negative priming in obsessives in a letter detection task, implying that the effect generalises to inhibition of simple physical codes. The exact mechanism for the effect is not entirely clear. If the obsessives were simply deficient in inhibition, they would be expected to show greater standard Stroop interference, but, as Enright and Beech (1993) point out, this effect was not found. Instead, obsessives seem less likely to maintain inhibition over time than anxiety patients, but it is unclear whether the inhibition process is "automatic" or strategically controlled.

The searchlight analogy has been used to describe attentional deployment in obsessional patients, who are viewed as using broad scanning but a narrow intense beam (Schachtel, 1969). Similarly, Gordon (1985) suggests that obsessional patients have a tendency to be generally hyperattentive and invest excessive effort under normal conditions. Under conditions of adverse mood, therefore, they will quickly show signs of attention failure, which will produce decrements in controlled tasks whereas automatic tasks will be unaffected. The inefficiency of controlled processing would be manifested as prolonged rumination and slowed actions as seen in obsessional patients (Gordon, 1985, p. 101). In a study to test the prediction that obsessionals are hyperattentive under normal situations, Gordon (1985) compared the performance of obsessionals, phobics and normals in non-stressful and stressful conditions. Subjects were presented with tasks of varying attentional demands with and without stressful noise. Both controlled search and automatic detection tasks were employed in which subjects attempted to detect letter or digit targets among letter distractors presented on a visual display unit. Memory set size (one or two targets) and speed of presentation were varied to manipulate attentional demands. These subjects received all experimental conditions in random sequence under conditions of noise and no-noise. The results of the study failed to support the hypothesis that obsessionals are hyperattentive and therefore show superior performance under no-stress conditions. While obsessionals were slightly more accurate on automatic tasks, their reaction times for controlled tasks were slower than the other groups under non-stressful conditions. In the stress condition, the accuracy of obsessionals' performance on the automatic task decreased, but accuracy increased slightly in the controlled tasks compared with other subjects. The obsessionals' reaction times and accuracy of performance were adversely affected as speed of presentation increased.

These results only provide partial support for an attentional deficit in obsessionals. Moreover, it is possible that these patients adopt specific attentional strategies under stress which could account for these results. The slowness observed in controlled processing resembles that found in depressives, but since depressed affect was not assessed in Gordon's study, it is not possible to rule this out as a possible confound.

Slowed performance in obsessionals has been attributed to an abnormality of decision making, as well as to attentional factors. Milner, Beech and Walker (1971) suggested that obsessive-compulsives may defer decision making to an abnormal extent, so that further information can be gathered. The slower performance of obsessionals (e.g. Frost & Sher, 1989; Persons & Foa, 1984) could be accounted for in terms of other cognitive mechanisms underlying decision making. One possibility is that these individuals have more elaborate definitions of concepts, especially those related to their fears such as contamination or danger. As a result, in order to decide if an object is dangerous, the obsessional patient would have to make detailed observations of the object, and decision making would be deferred during this process. Card-sorting tasks have been employed to test the prediction that obsessive-compulsives have more elaborate concepts of feared stimuli. When clinical and non-clinical compulsives are asked to sort decks of cards containing names and descriptions into categories such as size, contamination, temperature, etc., the compulsives are slower than the non-compulsives, especially when sorting fear-related cards (Frost, Lahart, Dugas, & Sher, 1988; Persons & Foa, 1984). Persons and Foa (1984) showed that compulsives used a greater number of categories than non-compulsives, consistent with the cognitive complexity hypothesis. However, Frost et al. (1988) failed to replicate this effect in non-clinical compulsives.

Two studies by Sher and others have tested for memory deficits in compulsive checkers (these individuals feel compelled to go over tasks to ensure they have been performed correctly). Sher, Mann and Frost (1984) used the Wechsler Memory Scale to detect global memory deficits in non-clinical checkers. Subjects were also given a free-recall test of the tasks performed during the experiment. Checking was negatively associated with performance on logical memory requiring recall of semantically meaningful sequences: this effect was not mediated by state anxiety. There was also a near significant trend for checkers to show poorer memory for actions. However, the finding of a logical memory deficit was not replicated in a subsequent study of clinical compulsive checkers (Sher et al., 1989). In this study, checkers performed worse only on visual memory performance. Consistent with other studies, checkers also recalled fewer of the experimental tasks than non-checkers (see Sher et al., 1983; 1984).

Across the studies reviewed, there is a weak general tendency towards less accurate or slower performance in obsessive-compulsive subjects, although even with patient groups there are several failures to obtain significant results. State anxiety, depression and worry have generally not been controlled in these studies, and may be partially responsible for results by reducing resource availability in obsessives (though see Sher et al., 1984). As with affective disorders generally, self-focus of attention may also be a mediating factor. The salience of self-focus is indicated by cognitive-behavioural formulations of the disorder. It consists of the occurrence of unwanted and abhorrent thought intrusions to which the individual feels compelled to respond by covert neutralising or overt restitutional behaviours in order to reduce anticipated harm and negate responsibility (Salkovskis, 1985; 1989). It follows from this that an important requisite for neutralising responses is likely to be consistent self-monitoring of thoughts and heightened self-attention. Dispositional self-focus is significantly higher in checkers than in non-checkers (Frost et al., 1986), and may be responsible for diversion of attention away from the task performed. Another sign of a general performance deficit in obsessives is the finding of a negative correlation between obsessive symptoms and scores on the Cognitive Failures Questionnaire (CFQ: Broadbent, Cooper, Fitzgerald, & Parkes, 1982), which measures self-reported individual differences in everyday errors of perception, action and memory (e.g. Broadbent et al., 1982; 1986). However, as discussed in more detail in Chapter 8, the relationship between the CFQ and objective measures of performance is weak, so the import of its correlation with obsessionality is unclear. At one level, then, obsessive-compulsive disorder is broadly similar to anxiety and depression in its association with general performance deficit, although the contributions of resource deficiency and attentional strategy have not been clearly distinguished. In addition, we have reviewed some attributes of processing which may be more pronounced in obsessionality than in anxiety and depression, including reduced cognitive inhibition (Enright & Beech, 1993) and increased cognitive complexity (Persons & Foa, 1984). Evidence for a distinctive style of selective attention is perhaps less unconvincing (see Broadbent et al., 1986; Gordon, 1985).

Anxiety, depression and the efficiency of attention in non-clinical samples

Anxiety, performance and cognitive interference

The reader is referred to reviews by Mueller (1992) and Eysenck (1992) for a more detailed survey of studies of anxiety and performance than is possible here.

Studies using questionnaire measures of anxiety, such as the State-Trait Anxiety Inventory (Spielberger et al., 1970), have arrived at two broad conclusions. First, there are different types of anxiety, with different implications for performance. In general, anxiety is associated with deficits on a wide range of tasks, although the literature is somewhat inconsistent (MacLeod & Mathews, 1991a). Measures of the immediate mood state are stronger predictors of performance deficit than measures of trait anxiety, the underlying predisposition to anxiety (Spielberger, 1972). In addition, questionnaire items concerning worry and intrusive thoughts predict poor performance more strongly than items concerned with emotional and physiological aspects of anxiety (Matthews, 1986; Morris, Davis, & Hutchings, 1981). It appears also that people's anxiety may be specific to particular domains, such that social anxiety, test anxiety and mathematics anxiety are distinguishable (Mueller, 1992). However, it is unclear whether the use of these very specific dimensions improves the capacity of anxiety measures to predict performance (Schwarzer, 1990). A second broad conclusion is that anxiety, and particularly worry states, tend to *interfere* with task processing (e.g. Wine, 1982). In some way, processing capacities (in the general sense of the term) are diverted from the task at hand to self-evaluation and other worries. As stated, this principle is rather vague with respect to the attentional mechanisms involved, and a variety of more specific theories have been proposed. Interference of this kind may be linked directly to the cognitive appraisals elicited by the situation at hand. Test anxiety, for example, is associated in particular with beliefs that the task is too difficult, or the person is inadequate, leading to an expectation of failure on the task (Sarason, 1978).

Perhaps the most direct expression of cognitive interference theory is the hypothesis that worry diverts attentional resources from task processing to processing task-irrelevant information, with a consequent decrement in performance. As discussed in Chapter 2, we cannot automatically infer a resource mechanism from observations of performance deficit. There have been few studies of anxiety which have used rigorous tests of resource theory, using the POC method for example. Many studies have performed the relatively weak test of looking for stronger anxiety effects with more difficult, and thus more attentionally demanding, tasks. In fact, the evidence in favour of an interaction between anxiety and task difficulty is fairly strong. Eysenck (1982) reports a literature search in which 22 out of 54 studies showed this interaction, 30 studies showed no interaction and 2 studies showed the reverse interaction. In 8 out of the 22 supportive studies, anxiety actually facilitated performance on easy tasks, implying that anxiety effects cannot be completely understood in terms of interference.

Other data are also suggestive of a link between anxiety and attentional resources. Eysenck (1992) reviews studies where a secondary probe detection task has been used to assess the availability of resources in a dual-task situation. Two out of three studies showed that anxiety was associated with a slower response to probes, even when high- and low-anxious groups were equated for primary task performance. Anxious subjects are also more easily distracted by neutral stimuli (Eysenck, 1988), which (within a late selection model of attention) might be attributed to lack of attentional resources for rejecting irrelevant stimuli. Eysenck (1988) puts forward an alternative explanation, that anxious subjects may be more prone to scan the environment to detect threats and this diverts attention from task performance.

If results of this kind justify a tentative resource explanation of performance deficits, the next issue is whether the resource is general or multiple. Revelle (1989; Humphreys & Revelle, 1984) has considered this question directly. His model of stress effects distinguishes two types of resource: one for attentional tasks (sustained information transfer or SIT resources), and one for short-term memory (STM). Anxiety states interact with motivational and cognitive factors to reduce on-task effort, which in turn impairs performance of tasks limited by SIT resources, but not STM tasks. Deleterious effects of anxiety on STM are attributed to an arousal mechanism: arousal and allocation of effort are quite separate in the model. In other words, worry-driven interference mainly influences tasks requiring attention rather than memory. Leon and Revelle (1985) and Geen (1985) provide evidence in support of purely attentional interference.

An alternative view is that anxiety specifically affects short-term recall. Deleterious effects of state anxiety on digit-span recall seem to be particularly reliable (Eysenck, 1982). Eysenck (1982) has argued that anxiety is associated with a specific deficit in working memory capacity, where working memory refers to a system performing both processing and short-term storage functions. Some studies support this view. Eysenck (1985) showed from a fine-grained analysis of a letter-processing task that anxiety impaired rehearsal and temporary storage of letters, but did not affect other processes such as letter transformation. Darke (1988) compared tasks requiring mainly memory storage, and both storage and processing; the latter task was more sensitive to anxiety, implying that anxiety reduces active, working memory capacity.

Anxiety and motivation

The nature of relationships between anxiety, motivation and strategy is problematic. Theoretical accounts differ sharply, with Humphreys and Revelle (1984) relating anxiety to diversion of effort from on-task to off-task processing, whereas Eysenck (1982; 1992) claims that anxious subjects often devote *more* effort to the task, to compensate for their lack of short-term memory. Depending on task demands, the compensatory effort may or may not be successful in maintaining processing effectiveness. Consistent with this hypothesis, incentives tend to benefit performance in subjects low in anxiety, but not those high in anxiety (Calvo, 1985; Eysenck, 1985). An alternative explanation is that anxious subjects may be more likely to appraise the levels of performance required to gain the incentive as being beyond their personal competence. Eysenck (1992) also refers to unpublished studies by Dornic (e.g. 1977), in which anxious subjects reported higher effort during task performance. Unfortunately, anxiety was confounded with extraversion, so it is difficult to draw strong conclusions from them. Two more recent studies (Matthews et al., 1990b, experiment 1A; Westerman & Matthews, 1992), with 100 and 49 subjects respectively, tested the effects of both anxiety and extraversion on effort in a neutral testing environment. The tasks were demanding, a capacity-limited vigilance task, and a visual memory search task. Effort was assessed twice within each study by a 9–item task motivation scale, with a reliability (alpha) of about 0.8, and by a single rating of effort. No significant linear or interactive relationships between extraversion, anxiety/neuroticism and either effort measure were found. The specific comparison tested by Dornic (neurotic introverts versus stable extraverts) was also non-significant. Analysis of mood, measured with the UMACL (Matthews et al., 1990b), showed that task motivation was consistently negatively related to depressed mood (range of correlations for the motivation scale were −0.30 to −0.44), but there were no significant correlations between tension and motivation.

Other evidence is supportive of the Humphreys and Revelle (1984) hypothesis of reduced on-task effort in anxious states. A series of studies by Mueller (e.g. 1978; 1979) found that anxiety consistently reduces the spontaneous reorganisation of material to be memorised, implying that anxious subjects are reluctant to use demanding, effortful strategies in encoding and/or rehearsal during memory tasks. Schonpflug (1992) also found no evidence for a correlation between anxiety and a more active processing style: subjects low in both anxiety and intelligence were distinguished from other subjects by an energetic and motivated approach to the task used. Evidence from studies of cognitive content in anxiety are also suggestive of reduced motivation in anxiety. Test-anxious subjects seem to set lower levels of aspiration for themselves (Trapp & Kausler, 1958), which implies lower motivation. Geen (1987) points out that the thoughts of test-anxious subjects are often characterised by wishes to escape from the situation. Studies of stress (see Chapter 8) show that neuroticism is associated with the reduced use of active, task-focused strategies (e.g. McCrae & Costa, 1986).

Psychophysiological data provide some support for Eysenck's (1992) hypothesis of increased effort in anxiety. Fowles (1992) reviews studies showing that states of acute anxiety, such as panic attacks, are associated with physiological mobilisation for action, and readiness for active avoidance. However, heart rate, the main index of mobilisation in this context, is substantially elevated during panic attacks, but not during anticipatory anxiety matched for rated intensity (Taylor et al., 1986). We would expect anticipatory anxiety to be more common than panic in experimental situations. Test anxiety, characterised by Geen (1987) as being associated with passive rather than active avoidance, is indeed usually unrelated to autonomic activation, even in evaluative settings (Holroyd & Appel, 1980).

Overall, it appears that anxiety is only positively associated with on-task effort under rather special circumstances, where there is a strong and immediate perceived threat, or, perhaps, where task performance is appraised as instrumental in effecting avoidance or escape (see Eysenck, 1982). There is also evidence from test anxiety research (e.g. Sarason, Sarason, & Pierce, 1990) that anxious subjects may perform better under reassuring instructions, possibly because non-anxious subjects find them demotivating. Under evaluative conditions, a degree of withdrawal from the task and reduced on-task effort seems more typical of anxiety reactions. In general, the research reviewed has rather neglected the role of the anxious person's appraisal of the task in moderating the anxiety–effort relationship.

Theoretical issues

In sum, there is theoretical disagreement over the exact nature of anxiety decrements in performance. Mueller (1992) discusses other possible mechanisms, including the hypothesis that test-anxious subjects are deficient in study skills and so tend to be poorly prepared for examinations. Similarly, socially anxious subjects might be deficient in social skills, and so forth. That is, anxiety may be associated with decrements in skill and knowledge, which are the true causes of poor performance. However, it appears that even test-anxious subjects with good study skills show performance decrements in evaluative conditions (Naveh-Benjamin, McKeachie, & Lin, 1987). Similarly, social phobics may show performance deficits only in certain situations, such as speaking in public, yet their speaking skills are intact. It is likely that in such situations self-monitoring and worry use attentional resources. In addition, behavioural coping responses in these situations—for example, avoiding eye contact, not allowing pauses in conversation and so on—can produce interference in executing the speaking task.

Assuming that anxiety has a genuine causal effect on performance, it seems that neither the Humphreys and Revelle (1984) nor the Eysenck (1982) explanations can account for the data; they predict a task-specificity of effects which is not actually found. The Humphreys and Revelle model cannot explain the effects of anxiety on pure memory storage functions (e.g. Eysenck, 1985), except by attributing them to arousal, and the working memory hypothesis cannot explain effects on pure attentional tasks, such as Geen's (1985) vigilance task. Another difficulty is that performance of short-term memory tasks may be limited by factors other than working memory capacity, rendering anxiety effects ambiguous. Dempster (1981) reviews evidence suggesting that individual differences in digit span are associated with item identification and encoding processes, rather than with capacity *per se*. Complex working memory tasks such as that used by Darke (1988) probably require attentional resources, central executive processes and strategic control, in addition to short-term storage. Anxiety also affects tasks which are unlikely to be limited by either SIT resources or working memory. Anxious subjects, for example, use muscular energy inefficiently in ball-throwing (Weinberg, 1978) and show deficits in fine motor control (Calvo & Alamo, 1987).

Difficulties also arise in assessing the level of control individuals have over anxiety effects on performance. One of the more reliable anxiety effects on attention is impaired secondary task performance when two tasks are performed concurrently (Eysenck, 1982). This finding has been taken as evidence for Easterbrook's (1959) cue utilisation hypothesis, the idea that the arousal associated with anxiety leads to an automatic reduction in the range of stimuli processed. However (see Eysenck, 1988), it could equally be the case that the attentional narrowing observed is controlled by the subject's active attempts to compensate for reduced capacity by allocating a higher proportion of capacity to the primary task. Lacking manipulations of task priority, the dual-task studies are uninformative in this respect. Furthermore, anxiety tends to affect the speed–accuracy trade-off in performance, with anxious subjects tending to be more cautious and hence slower to respond (Geen, 1987). Low-level neural behavioural inhibition mechanisms may contribute to this effect (see Wallace & Newman, 1990), but the primary mechanism seems to be cognitive. Response withholding is often though not invariably used as a coping strategy by anxious subjects to avoid committing errors (Geen, 1987). However, strategy choice depends on perceived demands of the experimental setting: Leon and Revelle (1985) showed a more risky speed–accuracy trade-off in anxious subjects under time pressure. More generally, as discussed in the next section, anxious subjects appear to be conscious of some attentional impairment, implying a higher- rather than a lower-level mechanism.

In summary, anxiety, particularly state worry, appears to be associated with fairly general performance decrements. The data are suggestive of a resource mechanism, but there have been few rigorous tests of the resource hypothesis, and it is difficult to associate anxiety effects with any specific type of resource. There may also be a variety of mechanisms for anxiety effects (Mueller, 1992). The strategic effects observed by Leon and Revelle (1985) imply that anxiety affects executive control of performance, although there may also be lower-level effects.

Performance deficit and cognitive content: Test-anxiety research

We have identified worry as the most detrimental component of anxiety, but worry may adopt a variety of specific forms. A programme of research conducted by Sarason over a 40-year period provides more detailed information on the relationship between objective performance deficits and the self-reported content of the performer's cognitions. Sarason et al. (1990) point out that worry, preoccupation and self-preoccupation should be distinguished. Neither preoccupation nor self-preoccupation is necessarily negative in content, and preoccupation may not be self-focused. Worry or anxious self-preoccupation is specifically associated with heightened concern over one's perceived inadequacies. Hence, the following cognitive events are characteristic of anxiety-provoking situations (Sarason et al., 1990, p. 2):

1. The situation is seen as difficult, challenging, and threatening.
2. The individual sees himself or herself as ineffective, or inadequate, in handling the task at hand.
3. The individual focuses on undesirable consequences of personal inadequacy.
4. Self-deprecatory preoccupations are strong and interfere or compete with task-relevant activity.
5. The individual expects and anticipates failure and loss of regard by others.

Sarason et al. (1986a) have devised three questionnaires to measure the various kinds of trait and state cognitive activity generated by test situations. The Cognitive Interference Questionnaire (CIQ) is a state measure of interfering thoughts that occur in a specific, recent situation. It measures both task-relevant and task-irrelevant "worries". The Thought Occurrence Questionnaire (TOQ) measures a trait of cognitive style, associated with frequently intruding thoughts: as with the state measure, task-relevant and -irrelevant intrusions are discriminable. The Reactions to Tests (RTT) questionnaire is a development of earlier test anxiety scales, with cognitive scales of Worry and Test-Irrelevant Thinking, and non-cognitive scales of Tension and Bodily Reactions. The subscales of each questionnaire tend to be mutually positively intercorrelated; the total scores on the three questionnaires also correlate, at about 0.3–0.5 (Sarason et al., 1986a).

Experimental work establishes at least some differential validity of the subscales. The worry scale of the RTT appears to be associated with poorer performance on tasks of anagram solution (Sarason & Turk, 1983), digit-symbol substitution (Sarason, 1984, study 2) and general knowledge (Sarason et al., 1986a, study 2B). The task-relevant thoughts subscale of the CIQ was also negatively related to performance in the latter study. No other RTT scales were consistently related to performance across the three studies cited. Relationships between worry and performance vary with situational characteristics as predicted by the hypothesis that it is specifically negative self-preoccupied cognitions which interfere with performance. RTT worry is most strongly related to performance impairment when instructions are ego-involving (Sarason et al., 1986a, study 2B): the correlation between worry and CIQ score is about 0.5. When instructions are of this kind (Sarason, 1984, study 2), worry is most strongly related to the CIQ scale of task-related interference (Sarason et al., 1986a). Conversely, high worry subjects may perform at the same level as low worry subjects (Sarason & Turk, 1983; Sarason, 1984, study 2; Sarason et al., 1986a, study 2B) when instructions are reassuring or direct the subject's attention to the task at hand. In these studies, the instructions also tended to reduce CIQ scores in high worry subjects. Sarason and Turk (1983) found that general reassurance seems to impair the performance of non-worry subjects, possibly because the instructions were demotivating to these subjects. However, attention-direction instructions generate high performance levels in all groups. The provision of social support also seems to reduce performance decrements, cognitive interference and self-preoccupation in test-anxious subjects (Sarason, 1981).

Performance correlates of the other trait measure, the TOQ, are similar in some respects to those of worry: the TOQ is negatively related to performance in motivating and neutral conditions, but positively related to performance under task-orienting conditions (Sarason et al., 1986a, studies 4, 5). In one study, Sarason et al. (1986a, study 5) asked half of their subjects to perform a dual-attention task of responding to specified clock times while proofreading. There was no interactive effect of TOQ score and the dual-task condition on the primary task of proofreading, but, on a subsequent anagrams task, TOQ score was positively related to performance in those subjects who had previously participated in the dual-task condition, but the relationship was negative in subjects participating in the single-task condition. That is, the dual-task manipulation appears to have produced a persistent reorienting of attention towards the task in the high TOQ scorers. This result would seem to be broadly comparable with distraction effects obtained in studies of depression discussed previously in this chapter. Sarason (1988) notes that the dual-task manipulation generally lowered cognitive interference, thus implying that it may shift the focus of attention from the self to the task.

A recent unpublished study by Matthews and Noble links cognitive interference to cognitive process variables believed to generate stress, as discussed in Chapter 8. Eighty-six drivers completed a battery of state measures, including the CIQ, immediately before and after a drive. Primary and secondary appraisal and coping questionnaires were also completed after the drive. Primary appraisal measures were concerned with the initial evaluation of the situation, whereas secondary appraisal related to perceived capability to deal with the demands of the situation. Specific coping strategies were also assessed, as listed in Table 6.1. The table shows that following the drive, both task-relevant and task-irrelevant thoughts were related to dimensions of emotional stress measured by the UMACL (Matthews, Jones, & Chamberlain, 1990c), such as depression and tension, and to a state measure of private self-focus, similar to that of Sedikides (1992). However, task-relevant thoughts were more strongly related than task-irrelevant thoughts to cognitive process measures of primary appraisal and coping. A multiple-regression testing influences on *change* in task-relevant cognitive interference across the drive showed that only the coping measures contributed significantly to the regression, implying that the main causal influences on interference are active attempts at coping, particularly reappraisal strategies directed towards changing emotional reactions. That is, although coping is often necessary to deal with stressful events, it may also generate cognitive interference likely to impair task performance. Kanfer and Stevenson (1985) demonstrated directly that cognitive self-regulation and coping strategies can interfere with performance, as discussed in more detail in Chapter 10.

The work of Sarason and his colleagues is limited by its neglect of the information-processing characteristics of the dual-attention task employed. This work would also benefit from more explicit tests of the causal effects of states of self-preoccupation. However, it amplifies the basic proposition that worry impairs

TABLE 6.1 Relationships between cognitive interference (Sarason et al., 1986a) and emotional stress, state private self-focus, appraisal and coping strategy, measured after vehicle driving (n = 86; Matthews & Noble, unpublished)

		Cognitive interference	
		Task-relevant	*Task-irrelevant*
Emotional stress	Tension	48**	28*
	Depression	33**	24*
	Fatigue	21*	31**
	Private self-focus	34**	47**
Primary appraisal	Threat	45**	19
	Loss	30**	18
	Challenge	44**	13
Secondary appraisal	Perceived control	−11	−13
Coping	Direct	30**	21*
	Confrontive	43**	39**
	Positive reappraisal	58**	36**
	Suppression	−10	16

**$P < 0.01$; *$P < 0.05$

performance in important ways. It shows that theories deficit must make some reference to cognitive content: not all intrusive thoughts are associated with performance decrement. People often seem to time-share task processing and task-irrelevant thoughts quite efficiently, possibly because the latter are relatively low in priority, intruding into the intervals between processing activities. Task-relevant thinking seems particularly damaging to performance, perhaps because it generates self-evaluative processing, which takes priority over task processing. Furthermore, self-relevant cognitive interference may be associated with a general disposition towards intrusive thoughts (assessed by the TOQ) as much as with a disposition towards negative intrusions (assessed by the worry scale of the RTT). Finally, Sarason et al. (1990) suggest that social anxiety generates self-preoccupation, which may disrupt and impair social perceptions and behaviours.

Depressed mood

Although depressed patients show a general performance deficit across a range of tasks, there has been rather little work in non-clinical samples on the effects of depressed mood on attentional performance. The most important research of this kind has been conducted by Henry Ellis and various collaborators, in studies of induced mood on memory. Ellis and Ashbrook (1987) propose that depressed mood has effects similar to state anxiety, in diverting attentional capacity and cognitive effort to task-irrelevant processing. Evidence for the hypothesis comes from studies of memory. In several studies, induced depression impaired memory tasks requiring elaboration, or effort, but failed to affect memory for highly organised material, considered to require little capacity. Clearly, depressed mood impairs demanding memory tasks, but it is unclear that a resource mechanism is involved. Hertel and Hardin (1990) suggest that depressive deficit is one of initiative, and so is most evident in tasks requiring spontaneous use of new strategies, a hypothesis supported by their studies of induced and natural depression and recognition memory.

The most direct test of the resource hypothesis has been reported by Griffin, Dember and Warm (1986), who looked at the performance on a demanding vigilance task of undergraduates obtaining high or low scores on the Beck Depression Inventory (BDI). Depression had no effect on either overall level of performance or on vigilance decrements, implying no group difference in the availability of attentional resources. However, depressives made less use of probability information than non-depressives. Griffin et al. (1986) infer that depression affects task strategy, with depressed subjects failing to process task information actively. This hypothesis can readily explain the memory data reviewed by Ellis and Ashbrook (1987). It also suggests a parallel between depression effects and anxiety effects on elaboration (Mueller, 1992): both conditions seem to be associated with a reduction in active processing.

Deficits in problem-solving and meta-cognition

There is also evidence for adverse effects of mild depression on complex, skilled performance, though the studies concerned are not very informative about the information-processing mechanisms involved. Klein, Fencil-Morse and Seligman (1976) showed that high scorers on the BDI were generally slow on anagram solution, an effect they ascribed to the motivational and cognitive consequences of learned helplessness. Consistent with this hypothesis, non-depressed subjects showed deficits similar to those of depressed subjects following exposure to insoluble anagrams. Depressed subjects' performance improved to the same level as that of non-depressed subjects if they were instructed that their prior failure was due to the difficulty of the problem rather than their own incompetence. Comparable effects have been demonstrated in clinical depressives (Price, Tryon, & Raps, 1978). A series of studies reviewed by Nezu and D'Zurilla (1989) suggest a general deficit in problem solving in mildly depressed subjects, although, unfortunately, the measures of problem solving are somewhat indirect. For example, Nezu and Ronan (1987) used ratings of the effectiveness of solutions to a series of interpersonal problems, derived and validated in prior research. Students with high BDI scores not only produced less effective solutions but also fewer alternative solutions, suggesting a cautious problem-solving strategy. Other studies showing a deficit in mild depression used a self-report measure shown to predict observational ratings of problem-solving behavioural competence. Nezu (1986) showed a comparable deficit on this measure in clinical depressives. Two of the studies reviewed by Nezu and D'Zurilla (1989) also showed anxiety deficits in self-appraised problem-solving competence.

Slife and Weaver (1992) attempted to distinguish depression effects on cognitive and meta-cognitive skills. Meta-cognitive skills can be divided into at least two components: knowledge about cognition such as the estimated accuracy of one's own cognitive performance, and the ability to monitor and regulate cognition (e.g. Brown & Palinscar, 1982). In one study Slife and Weaver (1992) manipulated mood and in the other they measured depression with the BDI, using college students as samples in both. Only severely depressed students, as indicated by BDI scores, showed impaired cognitive skill on a task requiring solution of mathematics problems. However, both mild BDI depression and induced depressed mood were associated with meta-cognitive deficits of decreased accuracy of pre- and post-test ratings of personal performance, indicating deficiencies in both knowledge and monitoring/regulation of cognitions. Cognitive and meta-cognitive skill measures were empirically independent, but it is possible that a more fine-grained analysis of performance than that of Slife and Weaver (1992) would show relationships between meta-cognition and strategy choice and regulation of cognition. Self-report deficiencies in meta-cognition are also related to stress proneness. Wells (1994a) reported significant positive correlations (n=96) of 0.68 between a measure of "meta-worry" and trait anxiety, and of 0.60 between "meta-worry" and neuroticism (see Chapter 7 for a more detailed discussion).

Deficits in basic information processing

Depression effects are not confined to task strategy and meta-cognition. Yee and Miller (e.g. 1988) provide evidence from a series of studies of event-related potentials (ERPs), suggestive of deficits in basic information processing. Their work uses subjects selected from the normal population for dysthymia, chronic but relatively mild depressive symptoms associated with elevated BDI scores. Yee, Deldin and Miller (1992) demonstrated a reduced N1–P2 response in dysthymics, which they attribute to a deficit in early stimulus processing. On the basis of earlier research on late ERP components, they also suggest that dysthymics are deficient in later "cognitive" processing during controlled processing. However, they caution that it is difficult to identify dysthymics' lack of responsiveness with any specific ERP component.

Lack of energy

In this section, we consider lack of energy or fatigue as an element of stressed mood, the polar opposite of feelings of energy and vigour (for other approaches to fatigue, see Craig & Cooper, 1992). Traditionally, subjective energy has been seen as an expression of the person's state of cortical arousal (e.g. Lindsley, 1952). According to the Yerkes–Dodson Law (Yerkes & Dodson, 1908), cortical arousal is related to performance by an inverted-U curve, such that the optimal level of performance is inversely related to task difficulty. More recently, several lines of evidence have conspired to undermine this simple view of the energetics of performance. First, both cortical and subjective arousal appear to be multidimensional (Thayer, 1989; Vanderwolf & Robinson, 1981), as is performance efficiency. Second, as Hockey's (1984) analysis of stress effects demonstrates, the effects of arousal on performance depend on both the source of arousal and the information demands of the task. Third, measurement of physiological arousal is fraught with difficulty because different indices fail to intercorrelate (Fahrenberg et al., 1983), and there are individual differences in the responsivity of different physiological systems (Lacey, 1967). Fourth, arousal manipulations may be confounded with other influences on performance, such as distraction (Naatanen, 1973). Fifth, there is surprisingly little direct empirical evidence in favour of the inverted-U curve (Matthews, 1985; Neiss, 1988). A recent study of approximately 180 subjects performing a battery of 10 tasks found little evidence that EEG arousal was a reliable predictor of performance (Matthews & Amelang, 1993). Relationships between EEG measures and performance were weak and task-specific. Contemporary research on the energetics behaviour tends to reject the inverted-U hypothesis in favour of more sophisticated theoretical frameworks in which arousal systems are seen as more circumscribed both physiologically and in terms of their influence on performance (see Hockey, Gaillard, & Coles, 1986). The arousal concept may still be useful as a unifying principle (Anderson, 1990), but both the operational definitions of arousal adopted and the range of cognitive processes sensitive to arousal dimensions must be specified more carefully than has often been the case in previous research.

Matthews (1992a) reviews a programme of research on the relationship between lack of energy and performance of attentionally demanding tasks. Studies of single-task performance (e.g. Matthews et al., 1990b) show that energy is positively associated with performance efficiency on tasks which are both demanding and purely attentional in nature. For example, controlled visual search (i.e. searching for a letter target among letter distractors) is sensitive to self-reported energy, but automatic search (searching for a letter target among digit distractors) and controlled memory search (matching a single displayed letter against several letter targets held in short-term memory) are not. Matthews et al. (1990b) interpret these findings as support for the Humphreys and Revelle (1984) hypothesis that arousal is related to availability of attentional resources. There is also some evidence that the effect generalises to a complex skill, operating a post-office coding desk (Matthews et al., 1992). Energy is also more strongly related to dual-task performance than to the performance of single tasks (Matthews, Davies, & Westerman, 1990d; Matthews & Margetts, 1991). Matthews and Margetts (1991) used the POC technique discussed in Chapter 2 to examine the relationship between energy and resource utilisation. Comparisons of POCs for groups high and low in energy showed that: (1) energy was associated with greater resource availability, and (2) high energy subjects allocated their additional resources only to high-priority task components. In other words, deployment of their extra resources depended on their strategy for selective attention.

Energetic aspects of stressed mood states have been rather neglected in the clinical literature. The data reviewed imply that depressed patients in particular, who tend to be low in subjective energy (Matthews & Southall, 1991), are likely to be deficient in attentional resources as a result. Matthews (1992a) argues that the energy data can most easily be explained by a biological mechanism—activation of a cholinergic system ascending to the cortex (see also Thayer, 1989).

Conclusions

We have seen that the effects on attentional efficiency of state anxiety and depression are associated with intrusive thoughts and worries. There are few clear-cut differences between the effects of negative emotional states in normal subjects just reviewed, and those of clinical anxiety and depression described in the first part of this chapter. Clinical deficits are perhaps somewhat more severe, particularly in the lack of compensatory effort shown by depressed patients, but few qualitative differences have been established. A possible difference is the relative enhancement of performance by distraction in clinical groups, although as we have seen, the addition of a secondary task to a primary task tends to enhance anxiety deficits in normal groups.

Obsessive-compulsive checkers appear to show particular deficits in memory for actions and also of attention, although these data are far from conclusive at the present time. These effects could be attributable to a failure to encode material in memory perhaps due to resource limitations, or a failure in retrieval of memories. The simplest explanation is that cognitive rumination in these individuals interferes with the processing and encoding of action-relevant material. However, *meta-cognitive* deficits may exist rather than actual general memory deficits which exert an influence on performance and action in these individuals. Metacognition refers to higher-level cognitive processes which involve abilities to think about thinking, monitor one's thought and modify cognitive processes (e.g. Nelson & Narens, 1990). We have seen how depression is associated with metacognitive deficits in which subjects are inaccurate at estimating their cognitive performance efficiency both before and after certain tasks (Slife & Weaver, 1992). Obsessive-compulsives may in a similar way doubt the accuracy and efficiency of their memories, although objective accuracy may show little or no general impairment. We return to this issue in Chapter 14.

Appraisals of the self as unable to cope effectively with task demands seem to play a special role in generating worries and thoughts which interfere with task processing. It is somewhat unclear whether the interference effect is associated with a simple diversion of resources to task-irrelevant processing, or whether it is strategic in nature, or both. Strategically, the anxious or depressed person may fail to allocate resources to processing, even though they are not allocated to task-irrelevant processing, perhaps because of a motivational or a meta-cognitive deficit. Lack of perceived control over task performance might produce a motivational effect of this kind; in the extreme case, the person is resigned or apathetic rather than anxious or depressed. From this perspective, the anxiety deficit may be greater on more difficult tasks not because they are more resource-demanding, but because successful performance is appraised as less attainable even with investment of mental effort. There is some evidence that the deficit of anxious subjects on difficult tasks can be reversed by providing success feedback (Weiner & Schneider, 1971), although, unfortunately, the design of the study confounds anxiety with achievement motivation. The two alternatives are not exclusive, and it may be that the nature of the processing deficit depends on the person's appraisals. Variations in the relationship between anxiety and motivation may depend on the extent to which good performance is perceived as instrumental in reducing anxiety. The safe (if bland) conclusion is that both direct resource interference and motivational effects may mediate the effects of anxiety on performance. Motivational effects are likely to depend on the person's appraisals, which could account for the difficulty in relating anxiety deficits to a single information-processing mechanism. It is possible, too, that depression and anxiety differ in their motivational effects, even if they do have some common effects on the availability of resources (Eysenck 1992), in that depressed mood seems to be more reliably related to low motivation.

We have also seen that subjective energy is correlated with attentional efficiency, and there is some fairly direct evidence supporting a resource mechanism. Although the effect may be attributable to psychobiological processes correlated with energy, it may well contribute to cognitive deficits in clinical conditions characterised by fatigue and lassitude. In addition, analyses of stress effects on strategy use (e.g. Hockey, 1986) suggest that energy effects may be modified by the persons's appraisals and beliefs about his or her feelings of tiredness. A person who believes he or she is too tired to cope with a task will probably perform more poorly as a result. The performance of depressed patients suffering from chronic fatigue may be particularly impaired because the adverse consequences of their genuine resource impairment will be amplified by their lack of belief in their personal efficacy. On the other hand, as studies of sleep deprivation show (Johnson, 1982), tired but highly motivated people may well perform normally.

PART II

Cognitive content and process in emotional disorder

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7

ATTENTIONAL CONTENT

Distressing intrusive thoughts

The most intensely considered aspect of attention in cognitive theories of emotional dysfunction has been the content of attention. This has been given various labels, such as appraisal (Lazarus & Folkman, 1984), self-statements (Ellis, 1962), worry (Borkovec, Robinson, Pruzinsky, & DePree, 1983), negative automatic thoughts (Beck, 1967), intrusive thoughts (Rachman, 1981) and catastrophic misinterpretations (Clark, 1986). While it is not clear if these labels refer to a single class of cognitive event, it is accepted that these events occur in the stream of consciousness. They also interfere with concurrent effortful processing (see Chapter 6), and thus by definition rely on attention.

Varieties of thought in emotional disorders

In anxiety disorders, three types of thought have attracted research interest; these have been termed worry, automatic thoughts and obsessions (also referred to as intrusive thoughts). The term automatic thoughts has also been used to refer to negative thinking in depression (e.g. Beck, 1967).

The concept of worry has gained heightened prominence since its use in the context of Generalised Anxiety Disorder (GAD), in which it is the central defining feature (DSM-III-R; APA, 1987). In early work, Borkovec et al. (1983, p. 10) defined worry as "a chain of thoughts and images, negatively affect-laden and relatively uncontrollable". Moreover, they view the worry process as an attempt at problem solving: "The worry process represents an attempt to engage in mental problem solving on an issue whose outcome is uncertain but contains the possibility of one or more negative outcomes. Consequently worry relates closely to fear processes" (p. 10). Borkovec's theorising has evolved to the point of suggesting that worry reflects a way in which some individuals, especially GAD patients, cope with the world by the predominant use of conceptual activity

(Borkovec, Shadick, & Hopkins, 1991). Borkovec and colleagues define worry as a predominantly conceptual, verbal linguistic, as opposed to imaginal activity in both normals and GAD clients.

Beck (1967) used the term automatic thoughts to refer to the thoughts which seemed to characterise the stream of consciousness in anxious and depressed patients. The term was intended to reflect the nature of such thoughts which occur without deliberation and seem involuntary. Beck et al. (1985) assert that negative automatic thoughts are experienced as intrusive, repetitive and intuitively plausible. Moreover, they may occur so rapidly that the individual is often unaware of their occurrence, though the thoughts are amenable to conscious introspection. The description of automatic thoughts offered by Beck et al. (1985) suggests a different class of events from that defined as worry by Borkovec and colleagues. Negative automatic thoughts seem to be more telegraphic and less consciously mediated than worry. Kendall and Ingram (1987) argue that many of the cognitive products associated with anxiety take the form of "What if . . ." questions. Each question represents a sense of impending incompetence. Perhaps automatic thoughts represent well-rehearsed negative answers to "what if" questions, while worry is an attempt to examine new answers and formulate coping responses.

The other class of cognitive products to be considered here are intrusive thoughts. Intrusive thoughts resemble clinical obsessions (Parkinson & Rachman, 1981a). Rachman (1981, p. 89) defines intrusive thoughts as "repetitive thoughts, images or impulses that are unacceptable and/or unwanted. They are generally accompanied by subjective discomfort". He also specifies the criteria which are necessary and sufficient for defining a thought as intrusive:

1. The subjective report that the thought interrupts ongoing activity.
2. The thought, image or impulse is attributed to an internal origin.
3. The thought is difficult to control.

However, there are limitations to this definition because a variety of cognitive phenomena aside from obsessions, such as worry and automatic thoughts, can be classed as intrusive thoughts. Nevertheless, a feature of obsessions which differentiates them from worry and automatic thoughts is that they are often experienced as senseless and unacceptable, for example having the thought of harming one's child even though one would not want to do so.

There also appear to be differences between intrusive thoughts, images and impulses. Parkinson and Rachman (1981a) asked 60 adult subjects to rate their intrusive thoughts, images and impulses on several characteristics such as intensity, discomfort, unacceptability and distraction. The following differences emerged:

1. Intrusive images were more unacceptable than intrusive thoughts but were easier to dismiss and control. Subjects found it easier to distract themselves from intrusive images.

2. Intrusive impulses were more intense than thoughts and also more distressing. They were also more frequent than intrusive thoughts.
3. Impulses were significantly more intense, more stressful and more difficult to dismiss than images.

Turner, Beidel and Stanley (1992) reviewed the literature on worry and obsessions and concluded that there were several differences between these types of event. First, the content of worries is typically related to normal daily experiences, whereas obsessions include themes of dirt, contamination, etc. Second, worry in patient groups is more often perceived as triggered by an internal or external event compared with obsessions. Third, worry usually occurs as thought, whereas obsessions can occur as thoughts, images and impulses. Fourth, worry does not appear to be resisted as strongly as obsessions and it is perceived as less intrusive. Finally, the content of clinical worries is not perceived as unacceptable as is typical of intrusive thoughts in obsessive-compulsive disorder. While these data suggest particular differences between worry and obsessions, the conclusions are somewhat tentative due to the scarcity of empirical data directly comparing these types of event in the same individual. In an attempt to overcome this problem, Wells and Morrison (in press) investigated dimensions of naturally occurring worry and intrusive thoughts in 30 normal subjects. The subjects were asked to keep a diary over a 2-week period and to record in it the first two worries and intrusive thoughts which they experienced. They were also asked to rate each thought on the following dimensions:

(i) Degree of verbal thought/imagery involved
(ii) Intrusiveness
(iii) How realistic the thought was
(iv) How involuntary the thought was
(v) How controllable it was
(vi) How dismissable it was
(vii) How distracting
(viii) How much the thought grabbed attention
(ix) Degree of distress associated with the thought
(x) Intensity of compulsion to act on the thought
(xi) Degree of resistance to the thought
(xii) Degree of success in controlling the thought.

The subjects were provided with a general definition of worry and intrusive thoughts on the diary, in order to make discrimination possible. Given the definitions, the subjects were able to make a reasonably valid distinction between the two types of thought. The inter-rater agreement (kappa-coefficient) was 0.63 for the subjects' classification and that of an experienced clinical psychologist using clinical judgement alone and not the definitions given to subjects. Figure 7.1. shows all significant differences between the two types of thought. The dimensions not displayed did not differ significantly.

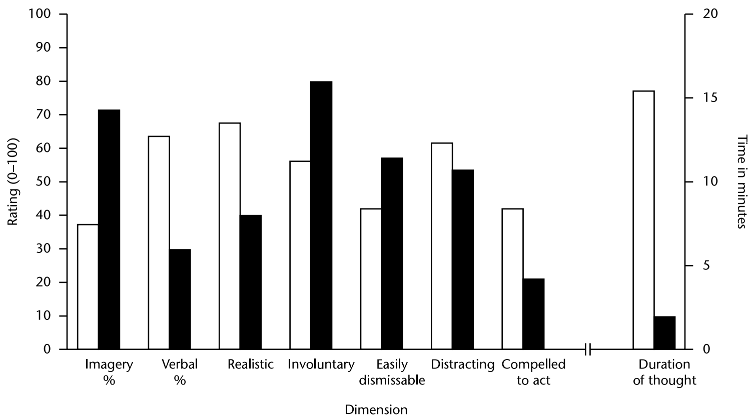

FIGURE 7.1 Significant differences in the characteristics of naturally occurring worries and intrusive thoughts in normals (n = 30) (Wells & Morrison, unpublished). □, worry; ■, intrusive thought.

These data show that normal worry was experienced as predominantly verbal rather than imaginal, whereas the converse was true for normal intrusive thoughts. Worry was also rated as more realistic, less involuntary, harder to dismiss, more distracting and of longer duration than intrusive thoughts. In addition, worry was associated with a greater compulsion to act than intrusive thoughts were. Traditionally, obsessions and not worry have been linked to compulsive or restitutional behaviours. However, if we accept that worry is a problem-solving activity, it is reasonable to assume that it has motivational properties for the implementation of problem-solving strategies, and this may underlie its compulsive quality. An alternative explanation for the contrast in compulsion to act, could be that worries were appraised as more realistic than intrusive thoughts and therefore they could not be discounted as easily. However, the correlation between realism and compulsion was not significant for particular types of thought or when all thoughts were combined.

In summary, it appears that there are differences between worry and intrusive thoughts, and perhaps differences between these events and negative automatic thoughts. These varieties of thought do, however, share certain characteristics, which leads to difficulties in discrimination. An important question concerns whether or not a discrimination would prove useful for better conceptualising cognitive processing in emotional disorders. As we shall see later in this chapter, there is reason to believe that different varieties of thought may be related to stress in different ways and they may serve different functions. Moreover, an interaction between certain types of thought may account for the maintenance of certain emotional problems. In view of this, a differentiation between varieties of thought in emotional dysfunction seems warranted.

The content of thought in anxiety and depression

In anxiety the content of negative thoughts is concerned with the themes of danger (Beck, 1976; Beck et al., 1985), whereas in depression thoughts concerning loss and self-devaluation predominate (Beck et al., 1979). This different attentional content is termed "content specificity" and has been validated by the Cognition Checklist (Beck et al., 1987). Structured interview studies with patients suffering from panic or generalised anxiety disorder have demonstrated that all patients interviewed report the experience of negative thoughts in verbal or imagery form occurring just prior to or during an anxiety episode. These thoughts were concerned with the themes of physical and psychosocial threat (Beck, Laude, & Bohnert, 1974; Hibbert, 1984). In patients with panic disorder, the most frequently reported sequence of events was the perception of an unpleasant body sensation followed by negative thoughts representing catastrophic misinterpretation of symptoms and then full-blown panic (Hibbert, 1984). The patients in Hibbert's study reported that their thoughts were more intrusive, more credible and harder to dismiss the more severe their experience of anxiety. Consistent with these findings, Ottaviani and Beck (1987) demonstrated that patients with panic disorder had thoughts concerning physical catastrophe such as dying, having a heart attack, fainting, suffocating and having a seizure. In addition, patients also feared mental catastrophe such as losing control or going crazy. Almost half of the patients also feared social humiliation as a result of physical or mental calamity. Rachman, Lopatka and Levitt (1988a) exposed panic disorder patients to feared situations and showed that thoughts about passing out, acting foolishly, losing control and fear of panic were among their most common cognitions. Other self-monitoring studies have sought to elicit patients' cognitions during a panic attack. Westling, Stjernbof and Ost (1989) asked panic disorder patients to record their cognitions during an attack in a diary. All patients had at least one attack associated with catastrophic cognitions.

Agoraphobia has been viewed as developing from panic attacks. Moreover, panickers who go on to develop agoraphobia appear to be more sensitive to body sensations and interpersonal situations than those who do not (de Ruiter & Garssen, 1989). Chambless, Caputo, Bright and Gallagher (1984) developed the Agoraphobic Cognitions Questionnaire to measure thoughts about the negative consequences of anxiety. Two factors have been empirically derived from the scale: physical concerns (e.g. heart attack, choke to death) and social concerns (e.g. go crazy, act foolish). Comparison of panic disorder, agoraphobic with panic, social phobic, obsessive-compulsive, generalised anxiety, and depressed patients showed that patients with panic had significantly higher scores on the physical concerns factor than the other groups, but the groups could not be distinguished on thoughts that anxiety would lead to social embarrassment or loss of control (Chambless & Gracely, 1989).

Fear of bodily sensations appears to discriminate between anxious groups of patients, with panickers reporting more fear than other anxious patients or normal controls (Foa, 1988). However, other anxious patients do report health concerns. Craske, Rapee, Jackel and Barlow (1989a) compared 19 patients with generalised anxiety disorder with 26 normal controls on responses to a questionnaire. The subjects were asked to complete the questionnaire as soon as possible after they noticed themselves worrying. The types of worries reported were categorised by independent judges. The most frequently reported GAD worries concerned illness/health or injury followed by family/home and personal relationship issues.

In social phobia, negative thoughts are more common than positive self-statements in social encounters, and they centre on the themes of self-deprecation and fear of negative evaluation by others (e.g. Beidel, Turner, & Dancu, 1985; Glass, Merluzi, Biever, & Larsen, 1982). Several protocol analysis and questionnaire measures of cognitions (both cognitive products and beliefs) in social anxiety have been developed (see Arnkoff & Glass, 1989, for a review).

Turning to depression, the content of cognition is characterised by what Beck and associates refer to as the negative cognitive triad (e.g. Beck et al., 1979), in which the depressed individual has negative thoughts about the self, the world and the future. These thoughts are concerned with the themes of loss and failure (Beck, 1976; Beck et al., 1979; Beck & Clark, 1988). Studies using questionnaires such as the Automatic Thoughts Questionnaire (Hollon & Kendall, 1980) and the Cognition Checklist (Beck et al., 1987) have produced evidence confirming that depressed patients show a predominance of negative thoughts of this type. Moreover, the cognition checklist is capable of reliably distinguishing between the thoughts characteristic of anxiety and those characteristic of depression.

Dimensions of worry and their measurement

The endorsement of worry as the primary feature of generalised anxiety disorder (GAD) has stimulated research attempts aimed at elucidating and measuring dimensions of worry. Questionnaires have been developed which measure worry as an undifferentiated variable or as a multidimensional variable (e.g. Meyer, Miller, Metzger, & Borkovec, 1990; Tallis, Eysenck, & Mathews, 1992; Wells, 1987; 1994a).

Meyer et al. (1990) devised the Penn State Worry Questionnaire (PSWQ) to measure the tendency to worry. The scale contains items relating to the frequency and intensity of worry in general, for example: "my worries overwhelm me; once I start worrying I cannot stop". While principal components factor analysis of the scale yielded one general factor, several smaller factors also emerged reflecting the following themes: concern over health and physical safety, social evaluation, belief in worry as a positive coping strategy, depression, and concerns about future success in relationships. The PSWQ shows favourable psychometric properties in normal samples and also samples of GAD patients (Brown, Antony, & Barlow, 1992; Meyer et al., 1990). However, it is limited in its potential for exploring contrasting characteristics of normal and pathological worries because it measures a single undifferentiated tendency to worry. Moreover, some of the items confound the distress associated with worry with dimensions of the worry process itself, for example controllability.

Tallis et al. (1992) constructed a general worry questionnaire based on a wide range of worries listed by 71 subjects. The questionnaire was completed by a sample of 95 subjects and the data subjected to cluster analysis. Six clusters were obtained reflecting different worry content: relationships; lack of confidence; aimless future; work incompetence; financial concerns; socio-political concerns. These clusters formed the basis of a final Worry Domains Questionnaire (WDQ) intended to measure different content domains of worry. Although this measure assesses multiple dimensions of worry, it focuses exclusively on the content of worries and it neglects potentially important process dimensions. It is also uncertain whether the dimensions are genuinely distinct; several of the inter-scale correlations are as high as 0.6–0.7 (Tallis et al., 1992).

The PSWQ and the WDQ represent two different approaches to worry measurement, the former based on the assessment of the frequency and intensity of worry in general, and the latter based on the content of worries. The content of normal and GAD worries are highly similar, and they tend to differ more in terms of their process dimensions such as degree of controllability (Craske et al., 1989a; Turner et al., 1992). As a result, undifferentiated measures and measures of content alone are potentially less informative about pathological versus normal worry distinctions than process measures. In view of this, Wells (1987; 1994a) developed the Anxious Thoughts Inventory (AnTI) to measure individual differences in proneness to multiple dimensions of worry, including both content and process dimensions. The first set of items used in questionnaire construction was based on the worries elicited in a structured interview with 33 GAD patients. Six rationally derived worry dimensions were obtained: worry about minor issues; health worries; worry about loss of cognitive and behavioural control; social worry; anticipation of calamities such as accidents; and thoughts of personal failure and helplessness. Forty-four items were devised to sample these domains, and an initial factor analysis was performed on the responses of 101 undergraduate students. A six-factor solution was chosen based on the results of the Scree test (Cattell, 1978). One of the factors was uninterpretable but the remaining five factors suggested that the questionnaire was assessing the following worry dimensions: general worry over minor issues; worry about health; worry about future calamities; worry about repetitive thoughts and helplessness; social worry. Subsequent revisions and two further factor analyses of the questionnaire with samples of 110 and 239 students, respectively, produced a final three-factor solution accounting for 37.2% of the total variance. Factor one reflected *social worry* (e.g. "I worry about making a fool of myself"), and factor two reflected *health worry* (e.g. "if I experience unexpected physical symptoms I have a tendency to think the worst possible thing is wrong with me"). The third and last factor reflected a preoccupation with meta-cognition in terms of worrying about worrying and experiencing worry as uncontrollable. This dimension was labelled *meta-worry*. Both the social and health worry subscales showed good internal consistency (Cronbach alphas of 0.84 and 0.81, respectively).

The meta-worry subscale has a slightly lower internal consistency (0.75) and appears more heterogeneous, since it contains items which relate to more than one process dimension. It consists of items such as: "I have difficulty clearing my mind of repetitive thoughts" and "I worry that I cannot control my thoughts as well as I would like to". The three worry subscales correlated significantly with trait anxiety (r = 0.36–0.68), and meta-worry and social worry demonstrated a significantly greater correlation with trait anxiety than health worry did. The three subscales were also significantly correlated with neuroticism (r = 0.52–0.62). All subscales were significantly intercorrelated: social and health worry 0.30, social and meta-worry 0.54, health and meta-worry 0.39. The size of these intercorrelations supports a distinction between health and the other worry dimensions, although social and meta-worry seem less distinct.

The meta-worry construct could be particularly useful in assessing factors which contribute to pathological as opposed to normal varieties of worry. Meta-worry appears to reflect both a subjective appraisal of the significance of worry and also difficulties with the regulation of thought. It may represent dysfunctional beliefs about one's own cognition, and/or deficits or excesses in cognitive regulation. In the next section, we turn to a fuller consideration of the self-regulation of thought.

Thought management: Are some strategies counterproductive?

The importance of controlling certain thoughts in the maintenance of emotional well-being is implicit in psychological treatments such as thought stopping (Wolpe & Lazarus, 1966), self-instructional training (Meichenbaum, 1977) and other cognitive approaches (Beck et al., 1979; 1985). Worry and intrusive thoughts are, however, difficult to control. Moreover, some initial studies on thought suppression indicate that deliberate attempts made by subjects not to think certain thoughts can lead to an immediate and/or delayed increase in thought occurrence (Clark et al., 1991; Wegner, Schneider, Carter, & White, 1987; Wegner, Shortt, Blake & Page, 1990; Wenzlaff, Wegner, & Roper, 1988). The intentional suppression of thoughts involves distraction from the target thought by thinking about something else. The delayed resurgence of suppressed thoughts, termed the *rebound effect*, which appears to be more reliable than an immediate enhancement effect, has been explained in terms of the effect of distractors on the accessibility of unwanted thoughts (Wegner et al., 1987; Wenzlaff et al., 1988). In one study, Wegner et al. (1987) asked subjects not to think of a "white bear" but to report their stream of conscious thought for 5 min and ring a bell each time the target thought occurred. Subjects were unable to suppress the thought as instructed and when subsequently asked to think about a white bear for 5 min, they reported significantly more thoughts about the bear than subjects who were asked to think about the bear from the outset. Wegner et al. (1987) suggested that suppression was difficult because subjects were left to search for distracting material in memory which lead to confronting task-related information which reminded them of white bears. In a second study, they tested the prediction that the provision of a single distractor could reduce the rebound effect. The second study included suppression, expression and distraction conditions. Subjects in the distraction condition were instructed to distract themselves during initial suppression with a single thought of a "red Volkswagen". This produced a significant reduction in the rebound effect. The delayed rebound effect has been replicated by Clark et al. (1991), who controlled for possible methodological weaknesses in Wegner and co-workers' (1987) study.

In a subsequent series of experiments, Wenzlaff et al. (1988) explored the mental control abilities and strategies of college students with higher or lower self-report depression scores. Depressed subjects, although initially successful at suppressing negative material, showed a delayed resurgence of unwanted negative thoughts. Moreover, these subjects used more negative thoughts as distractors than positive thoughts, although they acknowledged that positive distractors were more effective than negative ones. The use of positive distractors was increased when they were provided and hence made more readily accessible. Wenzlaff et al. (1988) interpreted these findings in terms of an associative network theory of memory. Such a theory suggests that distraction by material which is far removed emotionally from unwanted material would produce the best effects. If depressed subjects choose negative distractors, suppression may fail because it maintains activation of related unwanted negative material. The choice by depressed subjects of negative rather than positive distractors may reflect poor strategic choice of distractors or the easier accessibility of negative thoughts. Alternatively, their focus on negative thoughts may represent a strategy of defensive pessimism in preparation for negative events which they predict will happen in the future.

The effect of suppression on subsequent thought frequency has implications for understanding mechanisms underlying the difficulties encountered by obsessional patients in controlling unwanted thoughts. Their attempts to neutralise thoughts and distract from them, could paradoxically increase thought frequency. Moreover, distractors could themselves become triggers for future intrusions through a process of repeated association in memory. In this way, potential triggers for obsessional thought would increase and the problem could escalate. It should be noted, however, that attempts at thought control using distraction are not always unsuccessful (see Chapter 10) and any model of the effects of distraction will have to specify the conditions under which distraction is and is not effective. The existing literature on thought suppression has used analogue populations and similar studies need to be conducted with patient populations to test if similar responses exist in this group. There are also problems operationalising the concept of suppression because it is unclear whether there are different methods of accomplishing suppression aside from the use of distraction strategies. If different strategies do exist, some individuals may be predisposed to adopt particular strategies. Certain strategies could turn out to be more effective than others.

Wells and Davies (in prep.) have attempted to distinguish types of thought control strategy. They initially interviewed patients with a range of anxiety disorders (generalised anxiety and obsessive-compulsive disorder) and normal controls to determine the types of strategy used to control unpleasant and/or unwanted thoughts. Seven types of strategy emerged from the pilot interviews based on the following classification: cognitive and behavioural distraction; punishment; distancing; re-appraisal; mood changing activities; exposure to the thought; worrying about more trivial things. Some subjects also reported neutralising activities such as cancelling-out the thought, but when questioned about the reasons for doing this, they clarified that it was aimed at preventing bad things represented in the thought from actually occurring rather than aimed at controlling the thought itself. These strategies were therefore not included in the initial item pool. Extra items were generated based on the seven-dimension classification, and a questionnaire was constructed to assess the types of strategy that individuals generally use to control their thoughts. Factor analyses of questionnaire responses in two studies of undergraduate and postgraduate students demonstrated a replicable five-factor pattern. The five dimensions of thought control assessed by the final version of the questionnaire were: distraction; social control; worry; punishment; re-appraisal. These preliminary data suggest that it is possible to distinguish empirically between different thought control strategies, and assess these different strategies using self-report measures.

Multiple dimensions of emotional control strategy have been found in other studies of non-patients. For example, Mayer et al. (1991) identified three dimensions of emotion management distinct from dimensions of mood, labelled "suppression" (including distraction), "thoughts of action" and "denial". It remains to be seen whether the dimensional structure of emotional control differs between patient and non-patient groups, and whether patients show excesses or deficits in specific control strategies. Further work is required to determine if, as we predict, some strategies are problematic for the long-term effective control of thoughts and emotion. It is clear that future studies of suppression may need to specify more precisely the types of strategy employed by subjects in experimental settings.

So far we have considered the possibility that difficulty in controlling thoughts may be associated with the use of certain thought management strategies. Dysfunction could also arise at a different level, involving the individual's motivation for controlling certain thoughts. More specifically, some individuals may hold beliefs and appraisals concerning the dangerous consequences of experiencing certain thoughts, and this may lead to subjective distress and excessive attempts at control. Certain beliefs and appraisals concerning worry may contribute to the transformation of normal worry into pathological worry. A similar process may operate in normal and abnormal obsessions. Thus metacognitive self-knowledge is likely to be important in the pathology of intrusive and ruminative thinking.

Meta-cognitive beliefs and negative thinking

Following from the conceptualisation of worry as a problem-solving or future-oriented coping response (e.g. Borkovec et al., 1991), it is likely that some chronic worriers believe that worry is an effective coping strategy. Moreover, they may also believe that their coping skills are deficient in some way and attempt to overcome this by anticipating threats and rehearsing coping strategies. Thus worry may have a paradoxical desirability for some individuals. This was evident in the results of an exploratory interview study conducted by Wells and Hackmann (1993). They used a structured interview to elicit the beliefs of 10 hypochondriacal patients who reported intrusive negative images and worries about their health. Three of these patients believed that worrying about their health served as a safety strategy, for example: "worrying about my health will keep me safe"; "If I tell myself I'm well I'll be tempting fate". For other patients negative thoughts about health were especially aversive because they believed that the thoughts predicted the future. Of course, we cannot determine at present if these types of belief are involved in the pathology of worry, but this is certainly an area worthy of future investigation.

While some individuals might believe that worrying keeps them safe from the harmful effects of optimism, or may believe that thinking bad thoughts can make bad things happen, more general meta-cognitive beliefs may also be involved in pathological worry. In particular, worry patients believe that their worries are uncontrollable, but as we have seen the controlled processing requirements of worry execution implies that this is not the case. In Chapter 10, we present further evidence that worry can be displaced by distracting cognitive activity, thus supporting its potential controllability. It is likely that some worry patients have dysfunctional beliefs concerning the efficiency of their thought control skills when objective efficiency may or may not be impaired. While the initiation of worry might be involuntary, its continued execution appears to be controllable. Involuntary initiation could be appraised by some individuals as evidence that their worries are generally uncontrollable. However, other mechanisms could also underlie perceptions of uncontrollability. For example, if individuals use worry to distract from the intrusion of more distressing material in consciousness, this may impede the accessing of fear structures and their modification. The experience of intrusive thoughts has been viewed as evidence of this type of failure in "emotional processing" (e.g. Rachman, 1980). Worry could therefore contribute to the maintenance of involuntary emotional thought intrusions as the cognitive system repeatedly attempts emotional repair.

In general, it appears reasonable to assume that meta-worry processes, involving the appraisal of negative thought and execution of thought control responses, may have an important role in the aetiology of certain types of emotional dysfunction. Moreover, cognitive-processing models of unwanted and uncontrollable thought must begin to examine the content and influences of *meta-cognitive knowledge and control strategies* in the aetiology and maintenance of worry and obsessional problems (see Wells, 1994b, for a further discussion).

Intrusions, obsessions and thought control

Strategies for the management of unpleasant thoughts may also be implicated in the transformation of everyday intrusions into pathological obsessional conditions. As Carr (1974) and McFall and Wollersheim (1979) have pointed out, beliefs in obsessive-compulsive neurosis are characterised by negative appraisals or evaluations of events. Obsessional individuals both tend to experience events as unusually threatening (primary appraisal) and perceive themselves as unable to cope with the threat adequately (secondary appraisal). These observations in themselves do not explain the characteristic cognitive content of obsessionals. As discussed in Chapter 8, negativity of appraisal is a normal part of cognitive processing in stressful situations, which does not necessarily lead to clinical disorders. Obsessionality cannot be explained by the intrusiveness of negative thoughts, since intrusions, including negative intrusions, are common in normal individuals (e.g. Parkinson & Rachman, 1981a).

Salkovskis (1985; 1989) developed a cognitive-behavioural model of obsessional thought which emphasises the role of active attempts to *neutralise* unpleasant thoughts. Salkovskis suggests that it is normal for stimuli to trigger intrusions which tend to be attentionally demanding. Two types of process contribute to the maintenance of processing of intrusions. First, the personal importance of the intrusion is appraised. The normal person will tend to dismiss intrusions as unimportant and processing will cease. Obsessional subjects tend to maintain further processing through such appraisals as believing that the intrusion is likely to "come true" and that they are personally responsible for the harmful consequences of the intrusion. Such appraisals are amplified by negative mood, and by schemata which preserve irrational beliefs about intrusions in accessible form. Further processing initially takes the form of negative automatic thoughts, often related to dire future consequences for which the person is directly responsible. The second process characteristic of obsessions is the initiation of neutralising responses, which may be internal, as in trying to think positive thoughts, or external, as in compulsive hand-washing in response to thoughts about contracting disease. Such efforts may bring short-term relief, but, as demonstrated empirically by Salkovskis (1989), neutralising in fact tends to increase the frequency and discomfort of intrusive thoughts, rather as in the studies of thought suppression (e.g. Wegner et al., 1987) described previously. Hence, it is the subject's strategies for evaluating and coping with intrusive thoughts which generates pathological obsessional conditions. These strategies are linked to the peculiar beliefs of obsessionals which attribute particular importance to attending to intrusions and attempting to neutralise them.

Re-experiencing phenomena

The nature of an individual's appraisal of thought intrusions is also likely to play a role in the emotional sequelae of post-traumatic stress disorder (PTSD). A characteristic symptom of PTSD is re-experiencing of the traumatic event in various ways such as recurrent intrusive recollections or distressing dreams (DSM III-R; APA, 1987). Negative appraisals of this type of intrusion may exacerbate distress and provide increased motivation for thought control attempts. For example, the individual who appraises re-experiencing as a sign of mental instability, or following sexual assault misinterprets them as a sign that they must really have wanted sex to happen, may be more likely to develop other general affective problems. Moreover, as discussed above, this type of worry concerning intrusions may actually block normal emotional processing, and incubate intrusions in other ways as well.

The role of attention in theoretical accounts of worry

Memory and attentional processes are thought to be crucial in several theoretical accounts of the role and maintenance of worry. In general, these approaches have adopted the position that worry either serves no useful function (e.g. Barlow, 1988) or that in some forms it is functional (e.g. Tallis & Eysenck, cited in Eysenck, 1992).

Barlow (1988) views worry as resulting from a series of cognitive events, which stem from the accessing of anxiety propositions. Certain situations or the presence of arousal can "tap" propositions of anxiety. This leads to a shift in the focus of attention away from external information towards internal evaluative information. The activation of memory propositions leads to the activation of associated negative affect, and attention is focused on the affective qualities of this distress. Self-preoccupation intensifies the negative affect and associated arousal, and it also produces a narrowing of attention. One consequence of attentional narrowing is hypervigilance for threat-related stimuli. According to Barlow (1988, p. 259): "In its extreme state, narrowing of attention of apprehensive concerns leads to runaway, out-of-control, intense worry that individuals are unable to shut-off or control in any effective way". In turn, worry disrupts performance which can exacerbate negative affect. The model accounts for the uncontrollable experience of worry in terms of the narrowing of attention, although it is not specified how this works. Presumably, such narrowing reduces the amount of attention available for processing worry-incongruent information and/or reduces the attention available for control operations such as switching attention away from self-preoccupation. It is also difficult to see how attentional narrowing and hypervigilance can co-exist as attentional strategies. It is more likely that attentional narrowing follows hypervigilance after a threat stimulus has been detected (Eysenck, 1992).

Borkovec and colleagues (e.g. Borkovec et al., 1991) offer an interesting theory of worry, based in part on evidence that worrying may distract attention from other varieties of mental event, namely distressing images (Borkovec & Inz, 1990), and can reduce physiological activity (e.g. Borkovec & Hu, 1990). For example, this assertion is supported by the results of a study by Borkovec and Hu

(1990), in which subjects were exposed to phobic imagery under relaxing, worrysome thinking or neutral thinking conditions. The relaxing group showed large heart rate reactions to images indicative of emotional processing. Subjects who thought about neutral situations showed significantly less reaction and subjects who engaged in worry showed virtually no reaction to the image. This theory is a development of original theoretical ideas proposed by Borkovec, Metzger and Pruzinsky (1986). Borkovec et al. (1991) argue that worry reflects avoidance of perceived threat, and it contributes significantly to the maintenance of pathological anxiety. Anxiety is viewed as an interacting process involving cognitive, physiological and behavioural systems, which increase anxiety in response to threat until the source of threat is removed. Once the danger is removed, the episode including response elements and behavioural and environmental consequences is stored in memory, thereby strengthening the fear network. These networks prime the individual to detect threat cues readily and generate habitual and inflexible responses to threat. Particular individual differences are linked to the development of pathological worry like that in GAD. These patients tend to respond to threat in a conceptual mode of processing. This conceptual worry activity serves to anticipate and avoid potential threats in the future. It therefore primes the individual for long-term avoidance. In addition, worry may constitute cognitive avoidance of imagery and the physiological arousal associated with images. Imagery is considered to be a direct route to representational links between memory and affective response. More specifically, GAD patients may actually fear the experience of somatic arousal and emotion, and under perceived threat may shift their attention to conceptual activity. This reduces the amount of attention available for processing the somatic-affective response. Worry is reinforced by its somatic-anxiety reducing effects and it therefore becomes difficult to change. It is also proposed that worry may maintain anxiety in a further way, by preventing emotional information from being fully processed. Worry may reduce the accessing of fear structures in memory and thus emotional processing (e.g. Foa & Kozak, 1986) cannot take place.

The approach of Tallis and Eysenck (cited in Eysenck, 1992) is based on the premise that worry serves at least three main functions. First, it acts as an *alarm* by introducing threat-related information into consciousness. Second, by re-presenting threat-related thoughts into awareness, it serves to *prompt* the individual. Finally, it allows the worrier to anticipate future situations and thereby serves a *preparation* function. The degree of threat associated with a stimulus is thought to determine whether or not worry occurs and the duration of worry. Threat value is associated with the subjective likelihood of the event occurring, its imminence, perceived aversiveness, and the extent to which the individual perceives that he or she has adequate coping strategies. An additional factor which determines whether or not worry will be initiated by threat, and is also involved in the cessation of worry, is the nature of non-worry-related processing. Since worry is executed within the limited capacity working memory system, threat will only initiate worry if there is sufficient attention available for processing the threat. Worry will be terminated, on the other hand, by environmental processing demands which require the same limited capacity of working memory. In this theory, worry leads to arousal and self-absorption, which in turn lead to "catastrophising" and attempts to problem solve and cope. When these attempts fail, threat is maintained and worry continues. However, worry is terminated by appropriate problem solving and selection of a coping strategy.

In summary, these theories concur that worry depletes processing resources. Eysenck (1992) views worry as part of a strategic central executive or working memory function. The idea that worry may suppress other forms of thought is intriguing and is based on the notion that different types of thought involved in emotional states have to compete for attentional supremacy.

Conclusions

In spite of the clinical importance of negative thoughts, a number of unresolved issues remain. The first is *taxonomic:* how different types of thought should be classified. We can to some extent distinguish worry, intrusive thoughts and negative automatic thoughts on criteria such as intensity, unpleasantness, realism, intrusiveness and controllability, but these thought types are somewhat fuzzy. Different disorders are distinguished by content of thought in a cognitive framework (with some overlap), but it is unclear whether there is any association between type of disorder and type of negative thought. Rather more rigorous work has been carried out on dimensions of worry, but as yet there is only limited agreement between different structural models. The second type of issue concerns the *attentional* basis for negative thoughts: the relationship between subjectively experienced thoughts and information processing. The data reviewed suggest that negative thoughts possess some attributes indicative of automatic processing, and some of controlled processing. A degree of automaticity is implied by the spontaneous nature of at least some negative thinking (particularly intrusive and "automatic" thoughts) and difficulty in controlling or dismissing thoughts. Indications of a link between negative thoughts and controlled processing include their accessibility to consciousness, interference with other types of thought, and partial amenability to modification by thought control strategies. The case for automaticity seems strongest for the initiation of thoughts, and weakest for their continued processing or elaboration. Of course, the evidence reviewed can be no more than suggestive in addressing the automaticity issue. More satisfactory tests using performance measures are discussed elsewhere in this book.

The third issue is the functional significance of negative thoughts and worries. Although early work on worry focused on its detrimental effects on attention and performance (see Chapter 7), there is a growing belief that worry may be adaptively useful in some circumstances. A common theme is that of worry as a strategy for coping with threat, assisting both avoidance of threat and problem-solving responses (Borkovec et al., 1991). Worry may also be related to maladaptive coping, such as implementing essentially superstitious meta-cognitive beliefs about the relationship between worry and objective safety (Wells & Hackmann, 1993). In addition, worry may be associated with enhanced appraisal of threat, as well as preparation for coping with threat (Eysenck, 1992). (The distinction between appraisal and coping is discussed further in Chapter 8.) It is uncertain whether different types of worry associated with different functions should be distinguished. Possibly, we might discriminate maladaptive worry associated with ruminative appraisal from adaptive worry associated with efforts at active coping, but this view may be over-simplified. Of potential importance is the concept of meta-worry processes, which may be involved in vulnerability to pathological worry and other forms of thought intrusion. It is also unclear whether the processing associated with worry acts as a cause or effect of the functions described. For example, Eysenck (1992) suggests that worry has an alarm function, but it could equally be the case that some other and perhaps unconscious set of processes detect threat and generate intrusive thoughts, so that worry is an effect rather than a cause of threat perception.

8

INTERACTIONIST APPROACHES TO STRESS

In this chapter, we selectively review research on stress relevant to the relationship between attention, information processing and unpleasant emotion. We consider in turn the cognitive theory of stress as an interaction between person and environment, the roles of personality and social influences, and the relationship between stress and objective measures of attention.

The transactional theory of stress

Prior to the "cognitive revolution" in psychology, definitions of stress centred on stimuli thought to provoke stress, such as serious life events, and responses to such stimuli, such as Selye's (1976) General Adaptation Syndrome. Selye (1976) identified various physiological symptoms of chronic stress, such as increased secretion of corticosteroid hormones. However, neither stimulus- nor response-based definitions explain satisfactorily the role of the individual's perceptions or coping efforts in exacerbating or reducing stress symptoms (Cox, 1978). The most popular contemporary cognitive approach to conceptualising stress reactions is the interactionist or transactional approach (Cox, 1987; Lazarus & Folkman, 1984). Stress reactions arise out of a constant dynamic interaction between the individual and the environment. According to Lazarus and Folkman (1984, p. 21), psychological stress is "a relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being". The judgement that a particular person–environment relationship is stressful depends on cognitive *appraisal*, the individual's evaluation of the personal significance of events and his or her capacity to react to them. A key aim of appraisal is the integration of personal values and agendas with environmental realities (Lazarus & Smith, 1988). Appraisal processes also determine the implementation of coping responses. Lazarus and Folkman

(1984, p. 141) define coping as "constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person". This perspective differs from clinical theories of emotional distress in de-emphasising the role of stable cognitive structures such as Beck's (1967) schemata. Hence, in this chapter, we use "stress" to refer to the general syndrome of appraisal and coping identified as a theoretical construct by Lazarus and Folkman (1984), stress "outcomes" or "symptoms" to refer to measurable stress-related responses, and "stressors" to events or experimental manipulations likely to provoke the stress syndrome.

Appraisal and emotion

Two categories of appraisal are important in determining emotional experience and influencing subsequent coping efforts: primary and secondary appraisal. *Primary* appraisal is the process of evaluating the personal meaning and significance for well-being of events, which may be irrelevant, benign-positive or stressful (Lazarus & Folkman, 1984). Stress appraisals may be further subdivided into harm/loss, where the person has sustained physical or psychological damage; threat, where harm/loss is anticipated; and challenge, where successful coping may lead to gains. *Secondary* appraisal is concerned with what can be done to deal with a situation, and includes reviewing the range of coping options available and their likely success in the situation at hand. A third form of appraisal delineated by Lazarus and Folkman (1984) is reappraisal, which refers to the changes in appraisal which follow as the event unfolds and new information is acquired, including feedback on the success of attempts to cope. Lazarus and Smith (1988) point out that appraisal of the personal meaning of an event is influenced by beliefs and expectancies concerning the context for the transaction, although such knowledge is not necessarily available to consciousness. That is, appraisal may be guided by top-down cognitive processes in a similar way to selective attention, as discussed in Chapter 3.

A basic assumption of transactional theory is that emotions derive from the content and quality of appraisals. In the original Lazarus and Folkman (1984) theory, threat appraisals were loosely related to anxious emotion, loss appraisals to depression, and challenge appraisals to positive, excited emotion. They pointed out that emotion will also be influenced by secondary appraisal and reappraisal. Lazarus and Smith (1988) offer a slightly different perspective on this basic idea. They suggest that emotions are associated with *core relational themes*: molar abstractions from primary and secondary appraisals which signify some basic relationship between the person and the environment. Anxiety relates to potential or future harm, sadness to irrevocable loss, and happiness to personal gain in a secure context. They further suggest that relationships between core relational themes and emotion are invariant, whereas the relationships between knowledge and appraisal and emotion vary with individual and cultural differences. The importance of this reformulation of the aetiology of emotion is that there is no simple mapping from basic appraisals onto emotions. The emotion reflects a high-level synthesis of several appraisals relating to the individual's adaptational status in the current environment. It remains unclear how this general hypothesis can be tested rigorously.

Once generated, stress may set in train a cascade of symptoms, including short- and long-term physiological reactions, cognitive defence and behavioural responses, as well as emotion (Cox, 1978). These symptoms are not necessarily correlated: a stressed person may suffer health problems without serious psychological disturbance, and vice versa. However, affective disturbance is common and it is this element of stress reactions with which we are primarily concerned. Research on stress often does not distinguish sharply between "normal" and "pathological" affective reactions, and we shall follow suit for the time being. It is clear that stress is sometimes implicated in the development of clinical depression and anxiety (e.g. Paykel & Dowlatashi, 1988). As Cox (1978) also points out, a person's appraisal of his or her stress symptoms influences the development of the transaction over time.

Coping strategies

Once an event is appraised as potentially stressful, the individual initiates coping efforts aimed at minimising distress and negatively appraised consequences, and maximising positive outcomes if possible. Several broad categories of coping have been distinguished. Folkman and Lazarus (1980) and Moos and Billings (1982) differentiate between emotion-focused coping and problem-focused coping. Emotion-focused coping is directed towards regulating the emotional response to situations without actually influencing external events. In contrast, problem-focused coping is directed at managing and changing the problem which is causing distress, typically by taking action in the external world. In general, emotion-focused coping is more likely to be used in situations appraised as unmodifiable, problem-focused coping in situations where there is scope for changing the course of events. Other forms of coping have also been identified, such as suppression (Parkes, 1984), defined as the selective ignoring of threatening stimuli, and seeking social support from others. Endler and Parker's (1990) three-factor model of coping is probably the strongest psychometrically, and discriminates task-orientated, emotion-orientated and avoidance strategies, which correspond to problem- and emotion-focused coping and suppression, respectively. There appears to be a reasonable consensus on the three-factor structure (Cox & Ferguson, 1991), although it may be useful to investigate more narrowly defined strategies in specific research contexts.

There are a wide variety of specific emotion-focused coping strategies. Cognitive emotion-focused strategies include positive reappraisal of the situation or self-criticism. Behavioural emotion-focused strategies include engaging in activities which will improve subjective well-being, such as relaxation, exercise and drug use, and emotional social support seeking. Problem-focused coping is most often directed outward towards the environment, but can be directed inward also. Outward strategies are primarily efforts at problem solving: defining the problem, generating solutions, assessing their advantages and disadvantages, choosing one to implement, and responding to feedback following implementation. Inward strategies are intended to help the person solve the problem by increasing personal competence, by learning new skills and procedures, for example.

Various environmental and person factors influence the nature of coping. There is some evidence that the nature of the event influences the type of coping adopted (see Lazarus & Folkman, 1984, pp. 83–116, for a more detailed discussion). For example, problem-focused coping tends to be used more in situations appraised as controllable, and in situations related to work. Emotion-focused strategies, on the other hand, tend to be used more in non-controllable situations, and in coping with personal health-related stress (Folkman & Lazarus, 1980; Folkman, Lazarus, Gruen, & DeLongis, 1986). Suppression strategies appear to be preferred in situations appraised as less important. However, Lazarus and Folkman (1984) emphasise that it is the individual's perceptions of specific situations which counts, so such relationships are no more than broad trends.

Coping and appraisal as causes of stress in the transactional model

The core of the transactional model is defined by the appraisal processes described above. Next, we consider how characteristics of coping and appraisal influence the person's success in dealing with the stressful encounter, and minimising maladaptive outcomes. According to Lazarus and Folkman (1984), it is difficult to generalise about the relationship between coping and the various types of adaptational outcome—social functioning, subjective well-being and health. Coping effectiveness depends critically on how the individual can apply a particular strategy within a particular encounter, and all or most of the individual's strategies may be effective in some circumstances. Furthermore, there may be trade-offs in adaptational outcomes: a strategy may be effective in the short-term, but harmful in the long-term, or it may improve outcome in one sphere at the expense of outcome in another.

In spite of such qualifications, it seems that active behavioural coping tends to be rather more effective than wishful thinking and self-blame (e.g. Steptoe, 1991), as discussed in more detail in Chapter 11. For example, although depressives tend to favour emotion-focused coping, severity of depression is inversely related to frequency of use of problem-focused strategies (e.g. Billings & Moos, 1985; Mitchell, Cronkite, & Moos, 1983). In work contexts, the use of active strategies for managing role stresses and other potentially stressful demands reduces stress symptoms (Latack, 1986; Parkes, 1990). However, passive or avoidant coping may sometimes be efficacious: it appears to reduce anticipatory anxiety in blood donors, for example (Kaloupek & Stoupakis, 1985). Suppressive strategies may be beneficial in situations affording little opportunity for active coping (Parkes, 1990). Roger, Jarvis and Najarian (1993) distinguish passive avoidance from detached coping: strategies of lowering personal emotional involvement without attempting to deny that there is a problem. They suggest that detached coping is predominantly beneficial, but avoidance may be harmful.

Coping style is associated with characteristic psychophysiological reactions: Frankenhaeuser (1987) links effortful coping to increased secretion of catecholamines from adrenal medulla, and helpless passivity to increased secretion of cortisol from the adrenal cortex. Anxious and depressed patients tend to show elevated cortisol levels (Sachar, 1975), and phobic patients show increased cortisol secretion when exposed to pictures of the feared object (Fredrikson, Sundin, & Frankenhaeuser, 1985). The release of corticosteroids may be implicated in the association between passive or suppressive reactions and impairment of the immune system (Fawzy et al., 1990), which in turn may mediate the health correlates of coping style. For example, Frese (1987), in a longitudinal study of occupational stress, found that level of psychological stress influenced somatic complaints more strongly in individuals who used a "repressive" coping style associated with suppressing stress reactions. The extent of active coping may in turn relate to appraisals that the situation is changeable or controllable (Lazarus & Folkman, 1984), and coping will modify appraisal through evaluation of feedback and reappraisal, so it is difficult to isolate any single factor which determines coping success. Perceived control itself is typically beneficial, but not necessarily so. Folkman (1984) points out that some choices, such as whether to undergo major surgery for illness, can be highly stressful. High expectancies of control may generate frustration when the environment offers little scope for exerting control, and opportunities for control may be stressful for individuals with little motivation or ability for exercising control (Evans, Shapiro, & Lewis, 1993).

A transactional perspective on life events

The transactional approach offers a fresh perspective on the role of life events in stress. It is fairly well established that major personal upheavals such as divorce, job loss, marriage and so forth are associated with a wide range of physical health problems and stress symptoms, and prospective studies indicate a causal effect of life events, even with initial mood controlled (Johnson & Sarason, 1979; Smith & Allred, 1989; Tausig, 1982). Life events may be one of the causes of clinical mental disorder, particularly depression and suicidal behaviours, with interpersonal losses being one of the strongest sources of depression (Paykel & Dowlatashi, 1988). The relationship between life events and anxiety has been neglected, although there is evidence of a link from retrospective studies (Smith & Allred, 1989). One of these studies (Finlay-Jones & Brown, 1981) showed that depression tended to be associated with past loss-involved life events, whereas anxiety was associated with danger events, those which raised the possibility of future problems. This result is consistent with the loose equation of threat appraisals with anxiety and loss appraisals with depression suggested previously. Monroe, Imhoff, Wise and Harris (1983) report a prospective study of undergraduates, which showed that when initial emotional distress was controlled, life-event frequency predicted depression but not anxiety. Since threat involves anticipation of a future event, it may be that life events more often involve loss than threat, which might explain why depression is, perhaps, more strongly related to overall measures of life events than is anxiety.

Correlations between life events and stress outcome measures are modest in magnitude, rarely accounting for more than about 10% of the variance (Thoits, 1983). Relationships are even smaller when health outcome measures are used—usually between 0.1 and 0.2 (see Tausig, 1982). Brown and Andrews (1987) claim that the weakness of the association between depression and life events is because depression rarely occurs in the absence of a major loss, but a major loss often fails to lead to depression. This analysis emphasises the role of individual differences in vulnerability to depression. Alternatively, the weakness of life-event effects may reflect the importance of the individual's appraisals: some people will appraise even major disturbances as manageable, whereas others will be stressed by trivial events. DeLongis et al. (1982) argue that the relatively minor "daily hassles" of living appear to be as good or better predictors of health outcomes as serious life events, because they may elicit appraisals out of proportion to the importance of the minor event. The relationship between life events and stress outcomes may even be mediated by hassles (Weinberger, Hiner, & Tierney, 1987). Lazarus and Folkman (1984) make the further point that the relationship between hassles and stress is likely to be reciprocal: high levels of reported hassles may be a sign that the person is generally coping ineffectively. A programme of research on the emotional consequences of minor life events has been reviewed by Zautra, Guarnaccia and Reich (1989). They conclude that minor life events have non-specific stress-inducing effects, increasing both anxiety and depression, with neuroticism statistically controlled. We assess studies of the causal role of cognitive variables on stress outcomes in more detail in Chapter 11.

Causes of stress: Personality

Folkman et al. (1986) claim that personality influences on coping are relatively weak. Mean autocorrelations of appraisal and coping collected from the same sample across five different occasions were typically about 0.2. These results may well reflect the unreliability of single observations (see Eysenck & Eysenck, 1980), and in other work a variety of personality predictors of coping have been identified. From the transactional perspective, it is important to test not only whether personality predicts stress indicators, but also the role of appraisal and coping processes in associations between personality and stress symptoms. The most important personality dimension in this context is probably neuroticism (or trait anxiety), which correlates with a wide range of indices of stress (Deary & Matthews, 1993). Other personality dimensions related to stress proneness include cognitive failures (Broadbent et al., 1982), external locus of control (Cox

& Ferguson, 1991) and dispositional self-focus (Ingram, 1990). All these traits can be linked to characteristic coping styles, which may affect dispositional vulnerability to stress. More neurotic subjects report greater use of emotion-focused and avoidance strategies (Dorn & Matthews, 1992; Endler & Parker, 1990; McCrae & Costa, 1986), and particularly those strategies which are rated as ineffective (McCrae & Costa, 1986). These cognitive characteristics of neurotic subjects may explain their increased vulnerability to life stress (Denney & Frisch, 1981). Self-reported cognitive failures tend to be associated with less direct coping and more emotion-focused coping (Parkes, cited in Broadbent et al., 1986; Matthews et al., 1990a). External locus of control also seems to be associated with reduced direct and problem-oriented coping (Parkes, 1984). Locus of control may have stress-buffering effects: there is some evidence for an internal locus of control reducing the effects of adverse life events on negative stress outcomes, although the data are not very consistent (Cox & Ferguson, 1991; Hurrell & Murphy, 1991). As discussed further in Chapter 9, a further influence on coping is dispositional self-focus, the tendency to engage in prolonged self-appraisal (private self-focus) or to appraise others' perceptions of the self (public self-focus). For example, Wood et al. (1990) showed that highly self-focused men report using more passive and ruminative coping styles than low self-focused men.

Neuroticism influences appraisal as well as coping: neurotic individuals tend to interpret benign somatic symptoms as a cause for concern (Costa & McCrae, 1980), and to encode selectively negative physical symptoms (Larsen, in press). Findings that neuroticism is associated with poorer self-reported health may be mostly due to neurotics' health perceptions, rather than an association between neuroticism and objective ill-health (Watson & Pennebaker, 1989). Gallagher (1990) reports a correlation of 0.45 between neuroticism and threat appraisals of academic stressors in a sample of 371 undergraduates. Parkes (1986) found not only that neuroticism was related to maladaptive coping, but also that relationships between neuroticism and other forms of coping vary with characteristics of the stressful episode. Neuroticism was associated with less direct coping in moderately demanding work environments, but with less suppression of stress in high demand environments, implying that neuroticism effects are modified by appraisal. Similarly, Parkes (1990) found that more neurotic subjects only reported more stress symptoms when the work demands were appraised as high; neuroticism and perceived demands were also positively correlated. That is, neuroticism may affect the cognitive transaction between person and environment.

The role of appraisal processes in stress effects of other personality dimensions, such as locus of control, is somewhat obscure. Locus of control often fails to predict perceptions of controllability of life events (Nelson & Cohen, 1983), and it has been claimed that domain-specific measures may be more predictive of control beliefs (Phares, 1976). Lazarus and Folkman (1984) discuss how specific control beliefs and existential beliefs about God, fate and justice may influence appraisal and coping. Parkes (1991) showed that the relationship between locus of control and a general stress measure depended on perceived work demands and discretion: people with an external locus were particularly vulnerable to a combination of high work demands and low work discretion. The relationship between cognitive failures and appraisal has yet to be investigated; an unpublished study of dispositional self-focus and appraisal is discussed in the next section.

In general, there is satisfactory evidence that personality measures predict both stress outcomes and cognitive processes, though much of the research reviewed has failed to test for confounding between the various personality and cognitive measures. It is unclear, for example, the extent to which locus of control effects are mediated by the trait anxiety/neuroticism with which it correlates (see Hurrell & Murphy, 1991). We discuss whether neuroticism directly causes stress in more detail in Chapter 11. Also uncertain is the extent to which choice of coping strategy varies with attentional capabilities. We might expect that individuals with worry-prone personalities, and people exposed to high information-processing demands, would tend to adopt strategies which would reduce cognitive load (c.f. Schonpflug, 1986).

Two recent studies of personality and appraisal

Recent work conducted by the authors provides additional evidence on the relationship between personality and appraisal, and the role of secondary appraisal processes in moderating personality effects. We discuss two studies in some detail, because (1) they illustrate the methods typically used in transactionally based research, and (2) they demonstrate that coping and stress outcomes depend on a complex interplay between personality and situational appraisal factors, which can only be accommodated satisfactorily within the transactional approach. Wells and Matthews (1994) studied the types of coping strategy used in stressful situations by 139 female nurses. They predicted that active coping strategies would be more capacity demanding than passive suppression, and would therefore be affected more by self-focus in attentionally demanding situations. The subjects briefly described a recent stressful episode, rated the importance and controllability of the event, and rated their use of a set of coping strategies. Coping strategy items comprised the Billings and Moos (1981) measure of problem- and emotion-focused coping, and a suppression subscale developed by Parkes (1984) from the Lazarus and Folkman (1984) coping measure. The subjects also completed measures of private self-consciousness (Fenigstein, Scheier, & Buss, 1975) and cognitive failures (Broadbent et al., 1982). The results showed that high self-consciousness was generally associated with reduced use of problem-focused coping, and with reduced use of emotion-focused coping in mixed controllability situations. Consistent with the capacity hypothesis, the results suggest problem-focused coping is generally impaired by self-attention because it requires allocation of attention to external stimuli and, usually, to control of action. Emotion-focused coping is less demanding, but may be disrupted in situations where appraisals themselves are particularly demanding, as when situational control appraisals are mixed or ambiguous. As with neuroticism (Parks, 1986), the impact of self-focus on coping depends on the type of appraisal elicited by the situation. The dependence of the personality relationship on secondary appraisal provides some insight into the instability of individual differences noted by Folkman et al. (1986). On some occasions, coping may be largely driven by situational factors, whereas personality may play a stronger role when the situation is appraised as ambiguous or novel.

Matthews, Mohamed and Lochrie (1994) conducted an unpublished study to test how personality influences the full range of appraisal and coping variables, as well as stress outcomes, in a sample of postgraduates (n=141). The subjects completed standard personality questionnaires, and also rated their appraisal and coping styles with respect to nine events commonly stressful to postgraduates. Measures of current levels of chronic stress included the General Health Questionnaire (GHQ: Goldberg, 1978), Fisher's (1989) homesickness questionnaire, mean overall stress rating across the nine events, and Fenigstein and co-workers' (1975) social anxiety scale. The first three columns of Table 8.1 show uncorrected correlations between the personality variables and the stress outcome and appraisal and coping measures. Stress symptoms, such as a high GHQ score, tended to be associated with higher neuroticism (N), lower extraversion (E) and greater public self-focus (PU). Subjects high in N and PU tended to appraise situations as more threatening and loss-associated, and all three variables were correlated with secondary appraisals of changeability of the situation. High N and high PU subjects tended to use more self-criticism and detachment, and less problem-focused coping, as in prior research (e.g. McCrae & Costa, 1986). The last three columns show the corresponding partial correlations, controlling for the other personality factors, and demographic variables such as age and sex. These data show that neuroticism and public self-consciousness have some independent effects on the dependent measures. Public self-consciousness predicted GHQ total score, social anxiety, self-criticism, threat and changeability measures even when N was controlled. Likewise, introversion was specifically associated with homesickness, social anxiety and appraising situations as difficult to change.

Perhaps surprisingly, private self-consciousness was not generally predictive of stress outcome or appraisal measures. Matthews et al. (1994) also tested for interactions between secondary appraisal and private self-consciousness of the kind found by Wells and Matthews (1994). In this case, changeability averaged across situations was treated as a continuous variable, and tests were made for an interaction between (1) self-consciousness and (2) linear and curvilinear quadratic terms representing appraisal and coping. Interaction terms made significant contributions to the regression equation linking self-consciousness, demographic variables and appraised changeability to appraisal and coping for the dependent variables shown in Table 8.1. As explained by Parkes (1986), results may be illustrated by the regression lines which would be drawn for subjects 1 SD above or below the mean for self-consciousness. Regression lines also reflect linear

TABLE 8.1 Relationships between personality, stress and appraisal, expressed as (1) Simple correlations, and (2) Partial correlations with other personality and demographic variables controlled

		Simple correlations			*Partial correlations*		
		N	*E*	*PU*	*N*	*E*	*PU*
Stress outcomes	GHQ: Total score	0.57★★	−0.26★★	0.37★★	0.49★★	—	0.20★
	Homesickness	0.33★★	−0.40★★	0.23★★	0.35★★	−0.31★★	—
	Social anxiety	0.52★★	−0.56★★	0.34★★	0.29★★	−0.52★★	0.23★★
	Stress ratings	0.52★★	−0.16	0.31★★	0.45★★	—	—
Primary appraisal	Threat	0.43★★	−0.13	0.35★★	0.26★★	—	0.22★★
	Loss	0.36★★	−0.08	0.26★★	0.33★★	—	—
	Challenge	0.09	0.09	0.13	—	—	—
Secondary appraisal	Changeability	−0.25★★	0.30★★	−0.29★★	—	0.34★★	−0.27★★
	Personal control	−0.35★★	0.20★	−0.09	−0.30★	—	—
Coping	Problem-focused	−0.20★	0.19★	−0.19★	—	−0.18★	—
	Confrontive	0.15	−0.12	0.23★★	—	—	0.22★
	Positive reappraisal	0.05	0.19★	−0.11	—	—	—
	Self-criticism	0.47★★	−0.24★★	0.43★★	0.32★★	—	0.31★★
	Social support	−0.06	0.16	0.00	—	—	—
	Detachment	−0.04	0.02	0.06	—	—	—
	Distraction	0.17★	−0.07	0.18★	—	—	—

★★$P < 0.01$; ★$P < 0.05$

N = EPQ (Eysenck & Eysenck, 1975) neuroticism; E = EPQ extraversion.

PU = Public self-consciousness (Fenigstein et al., 1975).

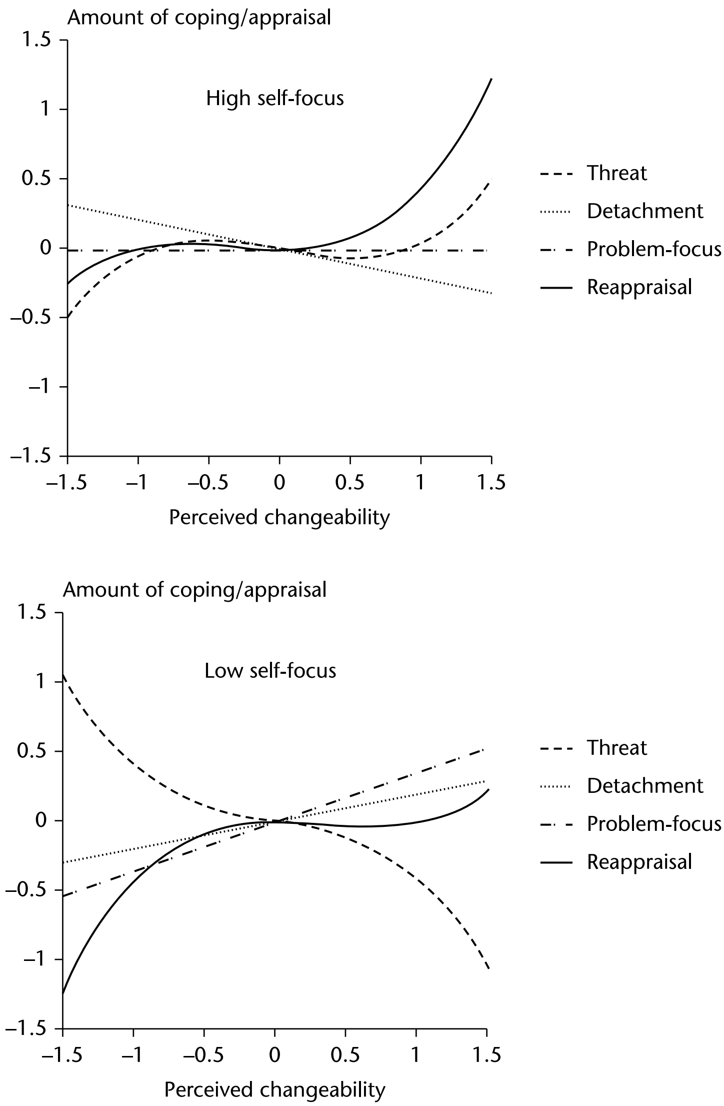

FIGURE 8.1 Regression lines relating appraisal and coping variables to perceived changeability in high private self-focus subjects (upper panel) and low self-focus subjects (lower panel). Repressions are calculated for subjects 1 SD above and below the mean level of self-focus (Matthews et al., 1994)

effects of changeability, which was significantly positively related to problem-focused coping, and significantly negatively related to positive reappraisal (an emotion-focused strategy) and to threat appraisals, results in line with transactional theory. Figure 8.1 shows regression lines for a low self-consciousness subject. Use of all three coping strategies increases with changeability, and problem-focused coping most of all, consistent with transactional theory. There is a corresponding decrease in threat appraisals also. Regression lines for a high self-consciousness subject are shown in Fig. 8.1. As changeability increases, there is a large increase in the use of reappraisal, decreased detachment, and increased threat appraisal. Contrary to the general trend, problem-focused coping is virtually constant. That is, in a changeable situation, the subject appears unable to generate the appropriate strategy of increased problem-focus. The preferred strategy of reappraisal does not seem to be efficacious, as threat appraisal tends to be elevated.

The role of self-focus of attention in the stress process

In summary, both neuroticism and public self-consciousness appear to be associated with a general predisposition towards stress-related cognitions and symptoms. Kuiper, Olinger and MacDonald (1988) argue that public self-consciousness is especially associated with stress vulnerability because of the self-conscious individual's overriding concern with being evaluated by others. In Matthews and co-workers' (1994) data, the association between public self-consciousness and coping through self-criticism may result from comparisons with others and activation of self-discrepancies, leading to stress symptoms even when the external event is relatively minor.

The influence of private self-consciousness on the stress process is more subtle, in that it seems dependent on the person's secondary appraisal. We propose that private self-focused subjects who realise that something can be done about the situation often become stuck in a perseverative cycle of reappraisal, in an attempt at self-regulation, and fail to show the level of problem-focused coping the situation demands. The substitution of reappraisal for problem-oriented coping is likely to be maladaptive when the event is changeable. Effects of private self-focus appear to depend also on the level of information-processing demands. In Matthews and co-workers' (1994) study, stressors were events familiar to postgraduates such as work or financial problems, and possibly hassles rather than major life events. Attentional demands may have been insufficient to impair coping in individuals high in private self-focus. In contrast, the events reported by subjects in the Wells and Matthews (1994) study tended to be serious and somewhat unusual crises, such as being physically attacked. Appraisal and coping of these events probably required more attentional capacity, rendering the person more vulnerable to cognitive overload, depending on self-focus and the nature of the appraisal.

Social aspects of stress processes

Other people can be both a source of potentially stressful demands and a coping resource. Leaving aside the case where others are directly hostile or threatening, the most potent social demands derive from social roles, such as those prescribed for the workplace or within the family. Lazarus and Folkman (1984) point out that roles can be stressful because of conflict between the demands of different roles, because of role ambiguity, or because the requirements of the role overload the person's coping resources. Life events are often stressful not just because of their impact on well-being, but because the person must adjust to a new role, such as being sick rather than healthy or unemployed rather than working. Even essentially positive events such as marriage are liable to involve role demands. However, the particular nature of role conflict may be important in determining its impact on stress. Longitudinal data reported by Brown and Andrews (1987) show that role conflict predicted depression only when role conflict was accompanied by a congruent life event. They give the example of a woman with a conflict between work and motherhood who became depressed only when she discovered her daughter stealing money from her purse. Role demands may be associated not just with discrete events, but with persistent, relatively minor maladaptation to roles, such as job dissatisfaction (Pearlin & Lieberman, 1979). Lazarus and Folkman (1984) identify chronic role dissatisfaction with sociological concepts of alienation and anomie (Kanungo, 1979).

A striking example of role demands is provided by job transfer to another country, with its attendant risks of stress and "culture shock" (Brett, Stroh, & Reilly, 1992). Greater stress following international transfer is associated with factors increasing role uncertainty, such as lack of information prior to moving about the new job (Brett & Werbel, 1980) and perceived job novelty (Pinder & Schroeder, 1987). The importance of specifically social roles is demonstrated by the influences on stress and adjustment of interpersonal conflict (Black, 1990) and the attitudes of the employee's spouse (Brett et al., 1992). Less dramatically, job stress may be associated with lack of "person–environment fit" (French, Caplan, & Harrison, 1982), where the job role does not match the employee's motivations and/or abilities (see Jackson & Schuler, 1985). It is likely that cognitive appraisal processes are implicated in the stressful effects of role change. Fisher (1990) reports that homesickness in undergraduates, which is typically accompanied by symptoms of anxiety, depression and obsessionality, is higher in those who perceive themselves as lacking in control over academic demands. In addition, self-focus of attention tends to increase with the strangeness of a new environment (Wicklund, 1982), which, as argued elsewhere in this book, tends to exacerbate negative cognitions and emotions.

Studies of depression suggest a causal role for social variables. Barnett and Gotlib's (1988) review of longitudinal studies of depression concludes that both lack of social integration and marital distress are predictive of subsequent depression. Barnett and Gotlib (1988) point out that it is unclear whether marital distress simply acts as a trigger for pathology generated by other influences, or whether it lowers self-esteem and coping resources. Quality of social interaction also seems to be a strong influence on the moods experienced in everyday life (Clark & Watson, 1988). Oatley and Bolton (1985) have put forward a social-cognitive model of role stress and clinical depression. The central assumption is that well-being requires "self-definitional roles", which may be lost as a result of life events, with consequent stress. Clinical depression can be averted by finding an alternative role, as in an unemployed person who takes up voluntary work, for example. This hypothesis predicts that "social exits" or loss of a social role should be specifically related to onset of depression. The evidence has been reviewed by Stokes and McKirnan (1989), who found that different studies report different outcomes. For example, Slater and Depue (1981) found that social exits were particularly frequent in the life events reported by suicide attempters. In contrast, Schaefer, Coyne and Lazarus (1981) reported that exit events failed to predict depression and morale in a longitudinal study. It seems reasonable to suppose that loss of social role does at least render the person vulnerable to stress and depression, but the suggestion that exit events are central to the causation of depression may be overstating their importance.

Social support

One way of coping with stress is to seek social support, which appears to have a causal effect on both well-being (Barnett & Gotlib, 1988; Turner, 1983) and health (House, Landis, & Umberson, 1988). Cohen and Wills' (1985) authoritative review of the area points out a number of inconsistencies between different conceptualisations of social support. One distinction they draw is between structural social networks and specific support functions. The extent to which the person is integrated within a social network, and so has many social contacts, seems to have a *main effect* on well-being. Measures of frequency of interaction with neighbours, community and so forth are associated with fewer feelings of depression and other minor affective symptoms. However, social integration does not appear to have a *buffering* effect with respect to potentially threatening events. The relationship between integration and well-being does not usually increase with level of stressful events, although Cohen and Wills caution that there are methodological problems with many of the studies which reduce the chances of detecting the interaction. Various social support functions such as enhancement of self-esteem, providing specific information or material help, and social companionship have been identified (see Schaefer et al., 1981). Studies using measures of this kind provide somewhat inconsistent results. Cohen and Wills claim that the more methodologically sound studies show a buffering effect, such that provision of specific forms of social support reduces the depression and other stress symptoms elicited by threatening events. Their review shows that availability of an intimate confidant, such as a spouse or close friend, has quite a reliable stress-buffering effect, which may be attributable to feelings of increased self-esteem and personal efficacy. They suggest that the quality of social support and its relationship to the needs of the situation may also be important.

Some of the conclusions of Cohen and Wills' review have been challenged. Social integration is not always unequivocally beneficial: Hobfoll and London (1986) report several instances of *positive* relationships between social support and distress. They argue that the effects of support vary with the situation and the person. For example, a high level of social integration may expose the person to the problems of others. Kessler, Price and Wortman (1985) point out that not all efforts at social support are well received by the recipients. Cheerful behaviour and optimistic remarks may make the stressed person feel more isolated, and offers of material support may suggest to recipients that they are incapable of dealing with their own problems. There is evidence, too, that over-dependence on others may be a source of stress vulnerability (Becker, 1977). Freden (1982) has proposed that social exits are particularly damaging to people who are dispositionally more socially dependent. It is possible that more dependent individuals build up larger social networks, which might help to explain the conflicting evidence on social support. Stokes and McKirnan (1989) have questioned the stress-buffering hypothesis of social support, on the grounds that measures of outcome and social support are generally confounded in the studies concerned. Perceptions of social support during a stressful episode may be biased by the severity of the stress outcome.

Explaining the role of social factors in stress

The data show that the importance of social factors is indisputable, but there is rather little direct evidence concerning the underlying mechanisms for the effects. It is possible to accommodate social demands and social support within the transactional framework, as influences on appraisal and coping, respectively (Lazarus & Folkman, 1984). Some types of appraisal may have a specifically social character: anger, for example, may be generated by the secondary appraisal that another is to blame for an event (Lazarus & Smith, 1988). Dunkel-Schetter, Folkman and Lazarus (1987) have shown that receipt of social support is related to coping strategy. They suggest a reciprocal relationship between support and coping. Social support probably influences coping through providing information, aid and emotional support. Conversely, carrying out a coping strategy signals to others that support is needed, and may elicit or discourage particular types of support. In principle, we might argue that social events have no special status, in that transactions involving other people are influenced by the same processes of appraisal and coping as any other stressful encounter. Social influences are potent only through their perceived importance to the person. Alternatively, a "pure" social psychological interpretation might be developed, in terms of hypothesised needs for being regarded favourably by others (Harre, 1980), or the role of others and of society in the social construction of the self (e.g. Turner, 1978), for example. Analyses of these kinds are beyond the scope of this book. Our approach is essentially cognitive, in that we see social influences on stress as governed by stable knowledge structures, activation processes and attention as is processing in general. Special features of social influences are associated with the special content of social knowledge, particularly as it pertains to personal and social standards, and the reciprocal nature of social interactions, as discussed by Dunkel-Schetter et al. (1987).

Of particular relevance is the way in which social interaction may affect the person's attention in stressful encounters. Felson (1985) has discussed the idea of *reflected appraisal*, the idea that beliefs about the self are influenced by beliefs about other people's judgements of the self. Reflected appraisals are often beliefs about how one is perceived by people in general, Mead's (1934) "generalised other", rather than specific individuals. There is considerable evidence for the operation of self-fulfilling prophecy in social interaction: people tend to behave so as to confirm others' expectancies (Miller & Turnbull, 1986). If we suppose that beliefs about the self are stored in memory in some structured way which we can loosely call a schema (see Markus, 1977), the implication is that social interactions may bias accessibility of different parts of the self schema or schemas. Markus and Kunda (1986) see the self as composed of an arrangement of several schemas related to different aspects of personal experiences and characteristics. In general, it is reasonable to suppose that cues received from others help to activate or suppress more or less positive self-related schemas, which in turn will influence attention. As discussed in Chapter 9, the self-evaluations of social phobics may be particularly sensitive to negative cues of this kind.

Some social effects may involve fairly straightforward effects on primary appraisal. For example, others provide direct feedback on the qualities of the self, although acceptance of feedback depends on a variety of factors such as perceived competence of the other (see Shrauger & Schoeneman, 1979). Adverse effects of marital conflict may in part simply reflect the negative evaluations of the self communicated by an important other. Social comparisons with others are also an important source of self-appraisals, and are a potential source of threat if others are perceived as superior in important attributes (Festinger, 1954; Wood, 1989).

Dynamic factors in social stress

It is difficult to gauge the nature of the causal relationship between negative social cues and negative beliefs about the self. Marital conflict is one of the most reliable predictors of future depression in longitudinal studies (Barnett & Gotlib, 1988). However, Brown and Andrews (1987) found that negative interaction in marriage and negative self-evaluation were highly associated. Both variables acted as vulnerability factors for depression in longitudinal data, but their causal influences could not be satisfactorily separated. A further confound of poor marital adjustment is neuroticism (Cramer, 1993; O'Leary & Smith, 1991). It is likely that social and cognitive processes in depression tend to be linked reciprocally and dynamically. Coyne (1976; 1985) has described an interpersonal cycle in which the social behaviours and verbalisations of the depressive elicit progressively more negative reactions in people interacting with the depressive, which in turn is likely to strengthen the depression syndrome, particularly when the cycle culminates with interpersonal rejection of the depressed person. Evidence relating to the model is broadly supportive, although there are some difficulties in detail

(McCann, 1990). The empirical data are inconsistent on whether people experience mood impairment as a result of interacting with a depressive, and it is unclear which specific depressive behaviours elicit negative reactions in the non-depressed interacting person. McCann (1990) suggests that negative interpersonal expectancies may play a critical causal role in maintaining the negative interpersonal cycle. Depressives have a general anticipation of negative outcomes to interaction with others which generates a self-fulfilling prophecy, as a result of their information-processing tendencies. Negative affectivity (neuroticism) and negative mood have similarly negative effects on perceptions of social encounters (Campbell & Fehr, 1990; Forgas & Bower, 1987). In addition to general negative bias in evaluation, depression increases the frequency with which social comparison information is sought following negative outcomes, leading to greater exposure to negative feedback (Swallow & Kuiper, 1992). Returning to marital conflict and depression, it may be that both negative self-beliefs and specific disputes between partners are prone to generate cycles of dysfunctional interaction whose tendency towards self-maintenance may eventually lead to full-blown depressive symptoms. It has been demonstrated that distressed couples tend to interpret their spouses' statements and behaviour more negatively than is warranted, and tend to reciprocate negative behaviours on a tit-for-tat basis (O'Leary & Smith, 1991). Eysenck (1992) raises the possibility that anxious individuals interpret other people's behaviour as more threatening than it actually is, leading to aggressive or defensive behaviour which actually elicit the feared behaviour.

The role of social knowledge

Other, more subtle effects depend on the reactivation of latent social knowledge. We have seen in Chapter 3 that selective attention may be influenced by what are essentially social constructs, such as attitudes (Roskos-Ewoldsen & Fazio, 1992) and personality trait terms (Pratto & John, 1991). Higgins' (1987; 1990) knowledge activation theory explains such effects in terms of an activation model of social knowledge. Higgins (1987) relates negative affect to activation of *self-discrepancies*. One type of social knowledge is guides, standards about the value of attributes held by the self and other individuals and groups. Higgins has proposed a fairly elaborate taxonomy of guides. Simplifying somewhat, negative affect is associated with discrepancies between the appraisals of actual attributes of the self, and appraisals of ideal and ought self-guides. Ideal self-guides represent the person's hopes and aspirations, ought self-guides beliefs about duties and obligations. Discrepancies arise when the self is appraised as falling short of either or both of these guides. For example, a student who fails exams may experience actual–ideal discrepancy through perceived failure to realise educational and career aspirations, and actual–ought discrepancy through failure to study diligently. The type of negative affect generated depends on the nature of the discrepancy: actual–ideal discrepancies are associated with dejection and depression, actual–ought discrepancies with agitation and anxiety. Studies reported by Higgins, Bond, Klein and Strauman (1986) and Strauman and Higgins (1987) confirm that measures of discrepancy predict the negative affect elicited by imagining an unpleasant event some weeks later. Emotional change is also appropriately primed by activation of self-guides (Higgins et al., 1986). In other words, discrepancies may constitute a fairly stable vulnerability to stress, liable to be elicited by stressful events. Self-focus of attention, discussed in detail in Chapter 9, increases the accessibility of self-guides, and so exacerbates emotional problems in vulnerable individuals. Higgins (1987) suggests that discrepancies may often arise in childhood, through negative interaction with parents. Another class of guide, normative guides, which represent general social standards, may also be implicated in stress associated with role demands. For example, expatriates will be exposed to social demands which conflict with their normative guides for doing business, forming friendships and so on, producing self-evaluative conflict and emotional distress (Higgins, 1990). Presumably, the beneficial effects of social support in part reflect reductions in discrepancies. For example, a supportive spouse or confidant may provide cues which activate positive self-beliefs, or which encourage downward reappraisal of self-guides.

Perceived social support may also be associated with stable organised schema-like knowledge structures resembling, but distinct from, those implicated in depression (Beck, 1967). In support of this hypothesis, Lakey and Cassady (1990) show that much of the association between social support and psychological distress can be statistically explained by individual differences in negative cognitions such as dysfunctional attitudes and control beliefs. Low perceived social support was associated with biases in perception of supportive attempts by others, and in memory for instances of helpful supportive behaviour. Experimental evidence reported by Lindner, Sarason and Sarason (1988) showed that the availability of help on a performance task was sufficient to change the content of cognition from worry to less attentionally engaging cognitions, even though the help was never actually utilised. Lindner et al. (1988) suggest that social support activates schemas and cognitions with a stress-buffering effect. Biases in perception of social support may in turn be caused by stable personality characteristics. Sarason, Sarason and Shearin (1986b) demonstrated first, that perceptions of social support are stable over 3 years, and, second, that there is little relationship between perceived social support and objective social support. Furthermore, perceptions seem to be related to personality characteristics associated with negative affect such as trait anxiety and depression (Stokes & McKirnan, 1989). The size of social networks of subjects high in neuroticism seems to be similar, but neurotic subjects are more prone to loneliness (Stokes, 1985). Stokes and McKirnan's (1989) analysis implies that much research on social support may overestimate the direct effects of social interaction, through neglect of the personality factors which may influence both perceptions and stress outcomes. However, measures of person variables and social support are not always strongly correlated (Dunkel-Schetter et al., 1987), so it is likely that there are additional, genuine direct effects of social support on well-being. Also, social support interventions delivered by health care professionals seem efficacious in assisting adjustment to life crises, although the mechanisms of such effects are poorly understood (Kessler et al., 1985).

Social factors and the stress process: Conclusions

In general, social factors may influence stress through generating, reactivating or ameliorating conflicts between the persons's appraisals, particularly reflected appraisals, and beliefs about personal and social standards. It appears that appraisals are of more importance than the objective nature of social events, and may be influenced by stable knowledge structures as well as by the immediate event itself. Theoretically, an integration of Higgins' (1987) knowledge activation theory with transactional approaches to stress (Cox, 1987; Lazarus & Folkman, 1984) provides a suitable explanatory framework. It is plausible that appraisal is influenced by activation of social knowledge, particularly self-discrepancies. It may be too restrictive to suppose that discrepancies in self-knowledge are the only or even the main source of stressful emotion, however. Actual–ideal discrepancy may generate depression because it biases appraisal towards evaluating the stressful encounter as loss-related, and, similarly, the relationship between actual–ought discrepancy and anxiety may be mediated by threat appraisals. If type of appraisal is the major causal influence, it may also influence mood in the absence of activation of self-knowledge. Transactional theory also implies that the consequences of the activation of self-discrepancies will be modified by secondary appraisal of coping competences. The role of coping has been somewhat neglected by knowledge activation theory, although Higgins (1990) indicates a role for stress control strategies as a further type of knowledge.

Stress, arousal and performance

There is a vast experimental literature on the effects of stress-inducing agents on performance, which will not be reviewed here (see Smith & Jones, 1992b, for a comprehensive review). Many of the studies use physical stressors such as noise, heat and so on, and it is often unclear whether their effects on performance are mediated by the cognitive processes associated with the aetiology of stress, or by lower-level psychobiological mechanisms. In recent years, attempts to provide general theories for stressor effects have largely disintegrated. The traditional approach has been to use arousal as a unifying construct for the field, and to attempt to explain stressor effects in terms of the inverted-U hypothesis to link arousal to performance (e.g. Duffy, 1962). This enterprise appears to have failed: Eysenck (1982) and Hockey (1984) provide full critiques. In brief, both arousal and performance appear to be multidimensional, stressors affect many other functions in addition to arousal, and arousal measures are just not very reliably related to performance (Matthews & Amelang, 1993; Neiss, 1988). More sophisticated general theories have also either failed empirically, or have not been adequately tested: the complexity of the data is such that it is difficult to make any general statements about stressor effects on performance. Hockey (1984; 1986) has provided one of the more successful contemporary syntheses of the area. He claims that stressor effects vary with both the source of stress and the type of task. Stressor effects are best described as a pattern of changes in the operation of multiple cognitive processes. For example, noise is said by Hockey (1984) to increase alertness and selectivity of attention, and to impair accuracy of fast responding and short-term memory. Some stressor effects are directly driven by the effects of the external or internal environment on cognitive states, whereas others reflect the active attempts of a regulative executive system to control the efficiency of cognitive processing. This approach does represent something of a retreat from theory, though, in that it provides no general basis for predicting stressor effects; each individual agent must be investigated in detail.

A transactional approach to performance effects

In the present context, work on laboratory stressors provides no general principles which can be used to predict the information-processing characteristics of a person who has lost a partner or job, or feels otherwise menaced by life events. More relevant are the studies of affective distress and performance deficit reviewed in Chapter 6. We cannot equate stress outcomes simply with unpleasant mood and affect, but affect is a primary stress symptom. Matthews, Jones and Chamberlain (1990c) have argued that relatively mild stressors are often characterised by specificity of stress responses. There appear to be three fundamental bipolar mood dimensions, contrasting energy with fatigue, tension with relaxation, and happiness with depression. Specific stressors may only affect one of these dimensions of mood, or perhaps fail to affect mood at all. However, severe stressful events appear to elicit a common pattern of stressed mood states, characterised by depression, tension and fatigue. In addition to mood, common elements of stress states likely to affect attention include intrusive thoughts and worries, self-focus of attention, specific beliefs and cognitions, such as causal attributions, and the extent of active coping and effort. The transactional model of stress implies that we must assess how the subject appraises the source of stress, and tries to cope with its demands. Jones (1984) has suggested that noise affects the person's perceptions of competence to perform the task, and efforts to compensate for the demands imposed by the noise depend on the exact nature of the beliefs and attributions elicited. Noise may impair performance even after the noise has been switched off, particularly if it is perceived as unpredictable and uncontrollable (Cohen, 1980). One explanation for this effect is that the subject's appraisal of the noise as uncontrollable leads to the adoption of low-effort strategies which carry over into the quiet period following exposure to noise. In other words, stress effects cannot be satisfactorily explained without looking in some detail at the person's cognitive and affective reactions to the stressor.

Research on effects of mood and other common elements of stress states reviewed in Chapter 6 allows us to compose a plausible picture of the likely effects on attention of relatively high levels of stress. It is probable that cognitive processing associated with stress may affect both the upper- and lower-level attentional control mechanisms discussed in Chapter 2, through effects on resource availability and executive control (upper level), and lower-level network processes triggered by stimulus input. Specifically, stress may have some or all of the following consequences:

1. Overall *attentional efficiency* is likely to be impaired. The primary mechanism for efficiency decrements is through loss of attentional resources for processing the perceptual environment and controlling action. The main way in which resources may be "lost" is through diversion of processing capacity to worry and appraisal, an effect associated with both anxiety (Wine, 1982) and depressed mood (Ellis & Ashbrook, 1987). A second type of drain on resources is the decrease in total capacity associated with fatigue (Matthews et al., 1990b). We should not overlook the possibility of changes in lower-level functional efficiency additional to the upper-level effects just described. Matthews and Harley (1993) showed from semantic priming and simulation studies that extraversion and arousal appear to influence the level of random noise in a connectionist network for word recognition, a mechanism which may explain why extraverts tend to perform better under stress than introverts during the working day (Matthews, 1992b). It is unclear whether anxiety and depression may have effects of this kind; the bulk of the evidence suggests an upper-level mechanism.
2. *Selectivity of attention* is affected in addition to efficiency. If the stressful event raises arousal, increased selectivity of attention is expected. One of the few consistent effects of arousing stressors which generalises across different sources of stress is narrowing of attention (Hockey & Hamilton, 1983). The stressed individual is likely to attend preferentially not just to the stressor, but to the dominant features of the stressful event. This may be maladaptive if important subtleties are missed; for example, a test-anxious student might misinterpret an exam question through failing to encode its meaning fully. Effects of this kind might operate at either lower or upper levels (see Eysenck, 1982), although most of the evidence suggests an upper-level mechanism affecting deployment of resources. For example, the rather complex effects of loud noise on performance can only be explained by supposing that noise affects task strategy (Smith & Jones, 1992a). We have seen in Chapter 4 that unpleasant affect may also be associated with biasing of selective attention towards mood-congruent stimuli. However, state anxiety alone does not appear to be effective in biasing attention, unless, perhaps, the person is already so predisposed by virtue of high trait anxiety or clinical disorder. Hence, it has yet to be shown that mood-congruence of attention is a general feature of stress states, although there is some limited evidence that stress biasing is distinct from anxiety effects (Mogg et al., 1990). A difficulty with evidence of this kind is the possibility of confounding affective content of the material

attended with its importance or priority to the person. A stressed individual may attend to stress-congruent stimuli because they are of primary importance, and so engage the narrowed focus of attention, rather than because of congruence *per se*.

3. Changes in *motivation* and effort due to stress are also likely, but are more difficult to predict. We saw in Chapter 4 that a motivational deficit is well-established in even mild depression (e.g. Griffin et al., 1986), but theoretical accounts of anxiety and motivation conflict sharply with each other (Eysenck, 1982; Humphreys & Revelle, 1984). From the perspective of transactional models of stress, motivational effects are driven by the coping strategy adopted. Effort may be reduced when the person tries to suppress or avoid the stressor, or tolerate it passively, but increased when an active coping strategy is adopted. Choice of coping strategy in turn reflects secondary appraisal. Because depression is associated with perceptions of the self as helpless and lacking in efficacy, depressed mood is particularly likely to generate avoidance of active coping, and reduction in effort. Such appraisals are a weaker feature of anxiety, and appear to be more contextually dependent. An evaluative setting appears to be important for generating negative self-beliefs in test-anxious subjects (e.g. Sarason, 1978). Perceived task difficulty may have similar effects. Hence, anxiety may be associated with more active coping and effort when there is little overt ego-threat and success is perceived as relatively easily attainable, but with less active coping and effort under other circumstances.

We would also expect some interaction between these effects when present simultaneously. For example, a reduction in effective attentional capacity may interfere directly with the implementation of active coping strategies. The worried individual's perceptions of the self as lacking in competence for task performance may affect secondary appraisal and coping independently of actual capacity. Increased selectivity may be favoured as a strategy for reducing workload under these circumstances. Hence, it may sometimes be desirable to see stress states as syndromes of impaired performance and coping, such that a variety of different, functionally independent processes are affected through the interaction between direct effects of mood and other aspects of state, and efforts to cope with the perceived consequences of state change (see Hockey, 1986). The exact expression of the syndrome will depend critically on the individual's self-beliefs and self-perceptions, which may explain some of the inconsistencies in information-processing studies of stress effects.

Error and cognitive failures

A rather different approach to performance is the study of human error. In real-life settings, one of the most important aspects of performance is the rare but potentially catastrophic mistake, such as the failure to close the bow doors which was the immediate cause of the Zeebrugge ferry disaster. It is difficult to examine errors of this kind in laboratory settings. On the basis of field and diary studies, Reason (1990) has developed a sophisticated taxonomy of errors, which proposes that errors can be generated at both automatic and controlled levels. "Automatic" errors take two general forms: skill-based slips and lapses, in which control of performance is "captured" by a strong but inappropriate low-level schema, and rule-based mistakes, where a familiar but inappropriate rule for action is applied. Errors in controlled processing are referred to as "knowledge-based errors": the person commits one of the many errors to which high-level reasoning is prone. In the present context, we are interested in how errors can be related to stress and affective disorder. Some lines of evidence suggest that stress increases error likeliood. For example, life stress seems to increase the risk of motor vehicle accidents (Matthews, Dorn, & Glendon, 1991; Selzer & Vinokur, 1974). Case studies of accidents sometimes show that stress was a contributing factor, as in the case of the near-meltdown at the Three Mile Island nuclear plant. Operators showed the narrowing of attention typical of stress to the point where they were unable to diagnose the system faults correctly (Sheridan, 1981). Studies of this kind tell us little about the intervening role of cognitive mechanisms though.

Questionnaire measures of cognitive errors and failures

The most usual experimental approach has been to investigate individual differences in self-reports of error proneness. Several questionnaires have been developed to investigate both error-proneness in general, and failures of specific functions, particularly memory (see Herrman, 1982, for a review). It appears that such measures are not actually very successful in predicting objective performance (Herrman, 1982): Rabbitt and Abson (1990) list seven methodological and logical reasons why this may be the case. For example, laboratory tests may not adequately measure the cognitive processes contributing to everyday errors, people may fail to detect their errors or forget them, and people have no objective standard for gauging their error-proneness and cognitive efficiency. In contrast, many questionnaire measures of errors show consistent correlations with measures related to stress (e.g. Broadbent et al., 1982). A fundamental question is whether error questionnaires simply pick up the negative self-appraisals of individuals prone to stress, or whether the questionnaires are actually reliably correlated with objective performance. In the latter case, the higher error scores of people vulnerable to stress may be accompanied by genuinely greater error-proneness. We address this issue by considering the two questionnaires most directly geared to assessment of everyday errors in attention, the Cognitive Failures Questionnaire (CFQ: Broadbent et al., 1982) and the Attentional Experiences Questionnaire (AEQ: Davies et al., submitted).

The CFQ as a predictor of performance

The CFQ asks about failures of perceptual, attentional and memory functions. A single score is obtained, which Broadbent et al. (1982) relate to some defect in overall control of processing. Scores are internally consistent, and stable over time, so that the questionnaire seems to measure an aspect of personality. There are several possible ways in which a high CFQ score might be interpreted (see Broadbent et al., 1986):

1. A poor self-image or lack of self-confidence.
2. A general deficit in executive control of performance.
3. Deficits in specific cognitive processes such as short-term memory.
4. A preferred method of cognitive organisation effective for some tasks but not others.

To distinguish these possibilities, several studies of the performance correlates of the CFQ have been conducted, with mixed results. In studies of selective attention, Tipper and Baylis (1987) showed that the CFQ predicted susceptibility to distraction on a word-naming task: a second study provided some limited evidence that the CFQ was related to difficulty in inhibiting distractor items. On the other hand, Martin (1983) failed to find any CFQ effects in three studies of the Stroop effect, a dichotic listening task and the Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971). Broadbent et al. (1986) tested CFQ effects in six studies of two selective attention tasks, one requiring visual search and one requiring "filtering" of information at a fixed location. Nineteen dependent variables were investigated, of which only one was related to CFQ scores. High CFQ scorers were relatively slow at the filtering task relative to the search task. Further analysis showed that this relationship only seemed to hold for subjects high in anxiety. Broadbent et al. (1986) interpret the results as showing that cognitive failures are related to mode of attentional control under stress, but there are some problems with the research. Uncorrected difference scores were used, which, as stated previously, are subject to artifact (Cronbach & Furby, 1970). Differences were computed from very similar dependent measures, which were probably statistically unreliable because it is likely that the original measures were highly correlated (see Cronbach & Furby, 1970). Possible confounding of CFQ scores with anxiety was not analysed: anxious high CFQ scorers may have differed from other groups because they were particularly high in anxiety. Broadbent, Broadbent and Jones (1989) report further studies of multiple measures of selective attention, which replicated the effect of CFQ score on the difference score measure just described. Broadbent et al. (1989) also investigated the "Eriksen effect" (Eriksen & Schulz, 1979), the tendency of conflicting distractor stimuli to interfere more strongly with a focal target stimulus as target–distractor separation decreases. High scorers on the CFQ showed a greater Eriksen effect in the morning, but low scorers did not. These results are difficult to interpret, because there is no theoretical rationale for linking the CFQ to time-of-day effects. A replication study has been reported by Smith (1991), who also found a significant CFQ × time of day interaction, though only when a one-tailed significance test was used. Smith (1991) failed to replicate the effect of CFQ score on the speed difference between filtering and search tasks, although the trend was in the predicted direction. Overall, these studies suggest that there may be some reliable relationships between attention and propensity to cognitive failures, but the mechanisms involved are obscure. The effects are also so complex that it is difficult to perceive much relevance to the kinds of everyday error reported by high CFQ scorers; there is no evidence for a general deficiency in any aspect of selective attention.

Martin and Jones (1984) report that the CFQ predicted impaired dual-but not single-task performance in a small sample (*n*=14). However, Broadbent et al. (1982, p. 12) refer to two studies which failed to find any relationship between the CFQ and dual-task performance. Several studies using conventional memory tasks have failed to find associations between CFQ score and recall (Broadbent et al., 1982; Rabbitt & Abson, 1990). Maylor (1990) found that the CFQ did predict errors on a realistic prospective memory task, remembering to make a telephone call. Harris and Wilkins (1982) also found that the CFQ was related to prospective memory, but Wilkins and Baddeley (1978) failed to do so. Obsessional symptoms, which correlate with CFQ score, are also associated with prospective memory failures (Sher et al., 1989). The strongest feature of these data is their inconsistency. Various *post hoc* explanations are offered in the papers cited, but none are very convincing.

In contrast, the CFQ is a reliable predictor of various measures related to stress, including trait anxiety, neuroticism and BDI depression (Broadbent et al., 1982; Matthews & Wells, 1988; Maylor, 1990). CFQ score is also related to measures of obsessional symptoms, such as compulsive checking, but not to obsessional personality (Broadbent et al., 1986; Sher et al., 1984). There may be some limited degree of specificity to these relationships: Gordon (1985) found that obsessional patients obtained high scores on the CFQ but phobics did not. Matthews and Wells (1988) showed that the relationship between the CFQ and trait anxiety was statistically mediated by self-focus of attention, implying that habitual self-focus may predispose the individual to both emotional disturbance and perceptions of error-proneness. Further studies suggest that the CFQ may be related to coping strategies, but again the results are conflicting. Parkes (see Broadbent et al., 1986) found that nurses high in cognitive failures reported less use of direct coping in controllable situations. However, Wells and Matthews (1994) found no effects of the CFQ on active problem- and emotion-focused coping in a further sample of nurses. Instead, CFQ scores predicted reduced suppression of stress in "mixed-controllability" situations, in which the person was unsure of whether or not the situation was controllable.

Multiple dimensions of self-rated attentional efficiency

One reason for the unreliability of correlates of the CFQ may be the variety of failures covered by the questionnaire. Although the items do intercorrelate positively, it may be that different types of failure should be discriminated. Broadbent et al. (1982) reported that there was no factor structure stable across different groups apart from the general factor, but their sample sizes were quite inadequate for comparison of factor solutions (see Guadagnoli & Velicer, 1988). Matthews, Coyle and Craig (1990a) factor-analysed the CFQ in a sample of 475 respondents. On the basis of objective criteria for the number of factors to be extracted, a seven-factor solution was obtained, demonstrating that a number of specific types of cognitive failure can be discriminated. Using similar techniques, Maylor (in press) obtained five broadly comparable factors in a sample of 3500 elderly people. Matthews et al. (1990a) also related their seven CFQ factors to personality and coping strategies, in a fresh sample. The results suggested that personality and coping correlates of the CFQ were largely associated with one factor only, lack of concentration. Subjects scoring high on this factor were more neurotic, and reported greater use of self-control and escape-avoidance coping strategies. In other words, the CFQ may be too blunt an instrument to be useful in predicting cognitive reactions to stress in detail.

The multifactorial nature of the CFQ motivated Davies et al. (submitted) to develop a new questionnaire measure, the Attentional Experiences Questionnaire (AEQ), to discriminate different aspects of people's subjective experience of their attentional failures and efficiency. Factor-analytic studies identified six replicable dimensions, labelled "concentration", "distractibility", "auditory attention", "absent-mindedness", "social monitoring" and "spatial competence", which were factorially distinct from neuroticism. Absentmindedness and spatial competence were moderately correlated with the CFQ, but correlations between the CFQ and the other four scales were small (0.21–0.34), showing that the CFQ is a poor measure of a number of aspects of self-report attentional efficiency. Davies et al. identified a general tendency for the scales to be associated with neuroticism, and most of the scales also predicted stressed mood state. Several studies of the performance correlates of the AEQ were also run, which tended to confirm that it is difficult to predict objective measures of attention from questionnaires. Some tasks, such as the Stroop test and sustained attention tasks, were not reliably related to AEQ scores. However, absentmindedness was the only predictor of working memory, as expected, and distractibility and absentmindedness predicted error frequencies on a task requiring selective attention, which used single digit targets and distractors. Blanco, Salgado and Alvarez (submitted) have translated the AEQ into Spanish and replicated its psychometric properties. As in the studies of Davies et al. (submitted), the CFQ only predicted performance of certain tasks. Distractibility was correlated with poorer selective attention, although response time rather than errors was the measure affected: absentmindedness predicted errors in one condition. In addition, spatial competence predicted speed and efficiency of visual search.

Overall, much of the error questionnaire data may be explained by supposing that negative beliefs about personal cognitive efficiency are primarily anchored in the person's general self-appraisals rather than in objective performance level. It may be that self-focus of attention serves to activate and maintain the negative beliefs concerned (Matthews & Wells, 1988; Wells, 1991). At the same time, there is sufficient evidence to show that people's beliefs partly reflect their objective level of performance on some tasks, particularly when specific rather then general measures of cognitive efficiency are used (Davies et al., submitted). The failure of some processing functions may be more conspicuous to the person than others, and tasks tapping these functions may be those predictable from questionnaire measures.

Conclusions

The transactional theory of stress (Lazarus & Folkman, 1984) provides a powerful and flexible framework for explaining stress-related phenomena. At the core of the theory are the appraisal and coping processes seen as the immediate causal influences on well-being. The transactional theory has been applied mainly to explaining how appraisal and coping influence stress outcomes, such as emotional disturbances, but it is also relevant to explaining the roles of personality and social support in influencing stress symptoms. Personality traits associated with stress vulnerability, such as neuroticism and dispositional private and public self-focus of attention, may be associated with characteristic maladaptive styles of appraisal and coping. However, personality effects may be modified by appraisal of the situation; for example, private self-focus may be most damaging when the situation is appraised as changeable, and when the attentional demands of appraisal are high. Social support acts as a "stress buffer", a factor mitigating the impact of potentially stress-inducing events. However, at least some of the beneficial effects of social support seem to result from its role in generating positive appraisals of events. The transactional approach may also contribute to the understanding of stress effects on performance, particularly the roles of strategy and motivational change. Interpreting the performance data is complicated by the likelihood of some stressors influencing processing efficiency directly, irrespective of appraisal, through arousal mechanisms, for example. We have seen, too, that stress may influence everyday errors and cognitive efficiency, although self-reports of error are of limited validity, because of limited conscious awareness of cognitive processes, and contamination of error questionnaires by overall appraisal of personal competence.

Our review of stress shows also that there seems to be no gross discontinuity between the cognitive symptoms of stress and affective disorder. It is quite common for people to experience negative beliefs about the self, in reaction to minor hassles, as well as major life events. Ineffective coping, excessive self-focus of attention and impaired performance are all readily observed in non-clinical samples. At one level, there may simply be a smooth gradation of severity of symptoms connecting non-clinical stress to affective disorder. Patients may be those individuals who appraise their symptoms as severe enough to require professional help, or people who are appraised by others as severely impaired in their everyday life. To the extent that there are qualitative discontinuities between patients and non-patients, they may relate to the presence in patients of dynamic syndromes or vicious circles which act to maintain affective and other symptoms, such as McCann's (1990) negative interpersonal cycle. Hence, theoretical accounts of emotional disturbance should aim to explain both normal and pathological stress symptoms. We shall see in subsequent chapters that we can identify a syndrome of excessive self-focused attention which allows us explicitly to link the transactional approach to stress to clinical approaches to emotional disorder.

9

SELF-FOCUSED ATTENTION

Kahneman (1973) proposed that enduring dispositions and arousal level influence the allocation of attention. Other researchers have sought to assess individual differences in attentional style. One such assessment concerns the degree of attention focused on oneself, which is termed self-consciousness. This is an important attentional trait variable since it is associated with stress vulnerability (Matthews & Wells, 1988; Wells, 1985), and heightened self-focus is found in a range of pathological reactions including anxiety states and depression (Ingram, 1990).

Duval and Wicklund (1972) first elaborated a theory of objective self-awareness in which they proposed a dichotomy in the direction of attention. They maintained that attention could be directed inward towards the self or outward towards the environment. Furthermore, they assumed that self-focus would instigate a process of self-evaluation and the identification by the individual of discrepancies between his or her present status on a salient self-relevant dimension and an ideal standard for that dimension. In an instance where the individual falls short of the ideal standard, self-focus is assumed to produce negative affect, with the result that attempts are made by the individual to reduce the discrepancy or to avoid self-focusing stimuli. This theory assigns a self-regulatory role to self-focus and was later elaborated by Carver and Scheier (1981). In their cybernetic model of self-regulation, self-focus constitutes a negative feedback cycle which serves the purpose of comparing an individual's current status on a salient behavioural standard with a particular goal. If a negative discrepancy exists between the current state and the salient standard, attempts are made by the individual to reduce the discrepancy. Such attempts are followed by further comparisons with the standard and further attempts at discrepancy reduction if the discrepancy is still perceived. An exit is made from this cycle when an individual meets or exceeds the salient standard. In this model, negative affect results when an individual perceives a *low probability* of successful discrepancy reduction. Under such circumstances, there may be withdrawal from further attempts to bring behaviour closer to the standard. A low expectancy of discrepancy reduction culminates in behavioural withdrawal from the situation, or if this is not possible, mental disengagement (Carver & Scheier, 1988). In this context self-focus is conceptualised as a situationally determined variable which functions to keep the individual "on track" in the pursuit of particular goals. The self-discrepancy approach to self-regulation of behaviour has been developed further by Higgins (1987) to account for individual vulnerability to specific motivational and emotional states. The theory is based on the tenet that specific emotions are influenced by the magnitude, accessibility and type of discrepancy that exists between an individual's self-concepts and self-guides. Support for this assertion comes from studies which show that depression is associated with actual-ideal discrepancies and anxiety is associated with actual–ought discrepancies (Higgins, 1987; Higgins et al., 1986; Strauman, 1989; Van Hook & Higgins, 1988).

Definition and measurement of self-focus

While Duval and Wicklund (1973) focused on self-focus as a situational variable, there also appear to be reliable individual differences in proneness to self-attention. It is possible to differentiate between a state of self-focus which has been termed *self-awareness*, and a personality disposition of self-focus which has been termed *self-consciousness* (Fenigstein et al., 1975). The trait measure of self-consciousness is derived from the 23-item self-consciousness scale (Fenigstein et al., 1975). Factor analysis of the scale has revealed three subcomponents of self-consciousness: private self-consciousness, public self-consciousness and social anxiety (Carver & Glass, 1976; Fenigstein et al. 1975; Vleeming & Engelse, 1981). Private self-consciousness represents the extent to which individuals have a tendency to focus on psychological aspects of themselves such as thoughts, feelings, moods and attitudes. Public self-consciousness assesses a respondent's awareness of the outwardly observable aspects of the self, such as physical appearance. A measure of social anxiety constitutes the third subscale and represents an individual's reaction to being focused on by others. Illustrative examples of items from each subscale are as follows:

- "I reflect about myself a lot" (private self-consciousness)
- "I'm concerned about my style of doing things" (public)
- "I have trouble working when someone is watching me" (social)

Subjects' responses to the self-consciousness items are made on a five-point scale ranging from "extremely uncharacteristic" to "extremely characteristic".

The private–public distinction of the self-consciousness construct has been applied to body consciousness (Miller, Murphy, & Buss, 1981). Dispositional tendencies to focus on bodily state in non-affective situations are measured by the body-consciousness scale (Miller et al., 1981). The scale has three subscales:

private body-consciousness (attention to internal bodily sensations), public body-consciousness (focus on observable bodily aspects) and body competence (perceived efficacy of bodily actions). Private and public self-consciousness correlate positively with focus on both public and private bodily aspects (Miller et al., 1981). However, these correlations are only moderate, suggesting that multiple dimensions of dispositional self-focus can be distinguished in terms of attentional content.

The self-attentional models of Duval and Wicklund (1972; see also Wicklund, 1975) and Carver and Scheier (1981) view self versus external attention as dichotomous variables, although attention may rapidly oscillate from one direction to the other. In this context, it is possible to speak of an increased or decreased state of self-focus in which an increase means an increment in the proportion of *time* spent in self-focus. This is based on the presupposition that at any one time attention is wholly focused in one particular direction, and does not include the possibility that attention can be simultaneously divided between internal and external processing. This approach is based on central limited capacity theory of attention, and does not allow for the possibilities that different varieties of internal or external attention may make different capacity demands, and that capacity may be allocated with some flexibility among competing processing activities. In contrast, a flexible limited capacity model (Hasher & Zacks, 1979; Kahneman, 1973) predicts that attention can be allocated to concurrent processing activities (e.g. self plus other-relevant processing) provided that processing demands do not exceed available resources. Thus, it is likely that self-directed processing and other-directed processing can co-occur to an extent determined by concurrent processing demands. This adds a second dimension to the definition of self-focus. In a flexible capacity model, self-focus can be said to occur when the amount of attentional resources allocated to self-directed processing exceeds the amount of resources allocated to other-directed processing. Ingram (1990) offers a similar analysis in which self-focus is viewed in terms of a continuum which is anchored at opposite ends by states of total internal and total external attention. It is possible, therefore, for individuals to invest resources in different simultaneous combinations of internal and external attention. Self-focus occurs when relatively more resources are focused internally than externally. The approach is useful since it adds the possibility that different degrees of self-attention ranging from mild to extreme could exist.

In terms of this model, persons scoring high in self-consciousness would be situated in the internally focused half of the distribution. In Ingram's (1990) model, the duration parameter of self-focus is still useful, but it is no longer the defining feature of self-attention. Shifts in attention from an external to a more internal focus can last from a brief amount of time to a long period of time. The duration of a particular focus is an important variable, since, as Ingram (1990, p. 168) states: ". . . it is not clear from many studies of self-focused attention whether merely a shift to a self-focused state (degree parameter) or a prolonged shift to a self-focused state (duration parameter) is of interest".

The duration and amount/intensity parameters are not the only defining features of self-focus. The content of attention is important in defining self-focus and in differentiating *self-focus* from *internal-focus.* In self-focus, attention is directed towards the self and the content of attention is self-relevant. Internal-focus, on the other hand, comprises internal-directed attention in which the content of attention may not be self-relevant. For example, an individual may be focusing on imaginal scenes which are not related to the self and involve other people. The public–private distinction in self-consciousness is also based on a differentiation in attentional content. In private self-consciousness, the content is characterised by processing of feelings and attitudinal information, whereas public self-consciousness content is characterised by the processing of information concerning one's physical and behavioural appearance.

A final parameter of self-focus concerns the flexibility of attention (Ingram, 1990). Although this does not constitute a defining feature of self-focus, it adds a dimension which could account for some of the deleterious consequences of self-focus on cognitive performance. The flexibility of self-focus refers to the extent to which subjects can shift from one direction of attention to another in response to situational requirements. In some situations, a particular balance of internal and external focus may provide optimal functioning. For instance, in a difficult test-examination situation, a predominance of external task-oriented attention is likely to be more adaptive than self-focused attention. Thus, individuals with reduced flexibility of self-focus are likely to be disadvantaged in executing cognitive processing in some situations.

Trait measures of self-focus

Several state and trait measures of self-focus have been used in experimental studies. Two of the most commonly used trait measures—the self-consciousness scale (Fenigstein et al., 1975) and the body-consciousness scale (Miller et al., 1981)—were described earlier. Both scales possess good test–retest reliability and discriminant validity and cross-cultural replication studies with the self-consciousness scale show that the inventory has a consistent factor structure (e.g. Carver & Glass, 1976; Fenigstein et al., 1975; Miller et al., 1981; Turner, Carver, Scheier, & Ickes, 1978; Vleeming & Engelse, 1981).

Although the self-consciousness scale and its subscales purport to measure individual differences in the dispositional tendency to self-focus, Fenigstein and co-workers' measure of private self-consciousness also appears to be sensitive to situational factors such as change in affect (e.g. Wood, Saltzberg, & Goldsamt, 1990a, experiment 2).

State measures of self-focus

State self-focus can be measured by questionnaire. Sedikides (1992) reports studies using a modification of the Fenigstein et al. (1973) measure, rephrased to ask about current attentional focusing. Matthews (unpublished) found a significant correlation of 0.34 between a similar state measure and dispositional self-focus (n=86).

Many of the techniques employed to measure the state of self-focused attention are indirect, so as not to promote self-focus in their own right. One problem with directly asking subjects how self-focused they are at a given time is that the question itself could heighten self-awareness. Four classes of test have been used to measure self-awareness: thought sampling, sentence completion, attributional measures, and a modified Stroop procedure.

Thought sampling

Csikszentmihalyi and Figurski (1982) used an Experience Sampling Method to explore the association between self-awareness and aversive experiences in everyday life. Subjects were given an electronic paging device which randomly emitted signals within 2-hour periods. In response to the signals, the subjects completed activity sheets and self-awareness was assessed by their response to the item "What were you thinking about when you were beeped?". Responses to the question were coded into self-thoughts or other-thoughts, the frequency of self-thoughts providing the index of self-awareness. A different thought sampling method used in laboratory settings consists of asking subjects to write down or verbalise any thoughts which they have during a specific time interval (e.g. Pyszczynski & Greenberg, 1986; Wood et al., 1990). For example, Wood et al. (1990, p. 903) investigated whether induced sad and happy moods evoked self-awareness by asking subjects to write down "anything that comes to mind" for 2½ minutes both before and after mood induction. The thought samples were coded by dividing them into units comprised of simple sentences or independent clauses and each unit was categorised as self-focused, external-focused or mixed (following Greenberg & Pyszczynski, 1986). Self-focus was defined as those units that involved (1) self-evaluations or (2) references to physical characteristics or states, personality traits, emotions, or the subject's own performance. Examples of self-focused and external-focused responses were: "I'm fat" (self) and "How long does this experiment go on?" (external). A self-focus and external-focus score was computed for each thought sample as a ratio of the number of these specific units to the total number of units. To test whether mood induction produced a general heightened state of self-awareness and not just an artifactual increased mention of moods, the self-focus units were further coded into mood-related or moodless categories.

Sentence completion

The technique most frequently used to assess self-awareness is the Sentence Completion Task (Wegner & Giuliano, 1980), the expanded version of which is known as the Linguistic Implications Form (McDonald, Harris, & Maher, 1983).

This task requires subjects to choose from among three alternatives the word which they feel best completes a sentence. For five of the sentences, the choice of words is drawn from a list of three pronouns, one of which is a first-person singular pronoun. A sample self-focus sentence is: "All of__answers matched the ones in the back of the book". The subject then selects a word from those provided (e.g. "our", "my", "his") in order to complete the sentence. The total number of first-person singular pronouns selected by the subject constitutes the measure of self-awareness.

A different type of sentence completion task has been used by Exner (1973). The task is comprised of 30 sentence stems, most of which contain the personal pronouns "I", "me" or "my", e.g. "I was happiest when__". A self-focused sentence completion response would be represented by "I was happiest when I was alone", whereas an external-focused response would be indicated by a response such as "I was happiest when my children graduated" (Exner, 1973, p. 441). Subjects are asked to complete the sentences and their responses are coded as self-focused, externally focused, ambivalent or neutral. In addition to rating responses as self-external related, it is possible to assess the number of negative (or positive) self-focused sentence completions.

Attributional and Stroop measures

Two further self-awareness measures which have been used in empirical studies are a causal attributions task (e.g. Duval & Wicklund, 1973; Fenigstein, 1984) and the modified Stroop paradigm (Geller & Shaver, 1976). The attribution task typically requires that subjects imagine themselves in a series of hypothetical scenarios, and estimate in percentage terms the extent to which they view themselves as personally responsible for the outcome. The degree of self-attributed responsibility is considered to reflect the extent of self-awareness—highly self-aware subjects attribute greater responsibility to themselves (see Fenigstein & Carver, 1978, for a further application of this technique). In a study of the cognitive effects of self-awareness, Geller and Shaver (1986) demonstrated that experimentally enhanced self-focus increased colour-naming latencies for self-evaluative words (e.g. proud, failure), but not neutral words in a modified Stroop task. Although this effect suggests that self-awareness is associated with an attentional bias towards self-evaluative stimuli, the validity of the self-referent Stroop as a measure of self-awareness requires further investigation.

Differentiating self-focus and self-concept

While self-focus is defined as attention directed inwards, the content of which is self-referent, self-focus refers conceptually to a cognitive process, whereas the term self-concept refers to the total stored knowledge that an individual possesses about him or herself and is thus a cognitive structure. The self-concept consists of beliefs and attitudes relating to the actual self as perceived by the individual, and relating to the ideal-self (as an individual would like to be). It also contains the communicated perceptions of others. These beliefs and attitudes have been termed the self-schema (Kihlstrom & Canter, 1983; Markus, 1977), and a system of self-schemata has been conceptualised as representing the whole self (Markus & Sentis, 1982). Activation of the self-schema (self-concept) network must underlie the self-referent informational content of self-focus.

Causes of self-focus

Any stimulus or object which reminds an individual of him or herself can increase the likelihood of self-focus. Typical self-focusing stimuli used in experimental studies are the presence of a mirror, video camera or an evaluative audience (e.g. Davis & Brock, 1975; Froming, Walker, & Lopyan, 1982; Scheier, Carver, & Gibbons, 1981). However, the presence and salience of external distractors will also have an influence on the level of self-focus in a given situation. External stimuli which produce a call for immediate attention will distract conscious attention away from the self.

Changes in internal states are likely to induce self-focus aimed at interpreting such events and reducing discrepancies. Studies have demonstrated that when an internal aspect of self (e.g. heartbeat) is rendered salient, it can be a powerful determinant of self-focus (e.g. Fenigstein & Carver, 1978). Similar effects have been reported in panic disorder and agoraphobic patients (e.g. Ehlers et al., 1988; Goldstein & Chambless, 1978).

Affect itself is an inducer of self-focus (Wood et al., 1990). Following the reasoning that affect could signal the presence of a discrepancy in self-regulation, and thereby activate self-attentional processes aimed at discrepancy reduction, Wood et al. (1990) tested for the self-focus inducing effects of affect. In the first of two studies, subjects were exposed to a mood-induction procedure comprised of guided imagery and designed to lead subjects to focus inwardly or outwardly. Self-focus was measured with a sentence completion task. The results showed that induced sad mood increased self-focused attention, indexed by the number of first-person singular pronouns ("I", "me", "my") used to complete the sentences. In a second study, a musical mood-induction technique was used to induce sad, happy or neutral moods, and self-focus was assessed by free-response thought samples during a 2½-minute post-induction period, and with the self-consciousness scale. While sad mood induced self-focus, happy mood did not. Moreover, self-focus was significantly negatively correlated with happiness ratings. These data were explained in terms of sadness being more emotionally salient than happiness for most people because their baseline state is normally fairly happy. An interesting extension of this idea is that for subjects whose mood is chronically low (e.g. dysthymics), happiness could be a salient inducer of self-focus. Such individuals may be motivated to avoid happy affect in an attempt to reduce potential negative concomitants of self-focused attention. Sedekides (1992) reports results similar to those of Wood et al. (1990) using a questionnaire measure of state self-attention.

Apart from negative affect, when internal physiological processes become salient by other means, they can also induce self-focus. Fenigstein and Carver (1978), for example, demonstrated that false heartbeat feedback produced an increase in self-focused attention. In their study, non-anxious subjects were required to complete an attributional measure of self-focus while hearing clicks which were supposed to represent their heartbeat or a simulation of "real-world noises". The attribution task required subjects to imagine themselves in a series of hypothetical situations and estimate in percentage terms the extent to which they thought they were responsible for the outcome. The subjects were also given a modified Stroop task consisting of self-relevant and non-self-relevant words. The subjects in the false heartbeat condition showed greater self-focus than the subjects in the "noise" group or the subjects in a "no-noise" control group. This was evident in their greater self-attributions of causality and slower colour-naming performance for self-relevant words.

As non-veridical feedback of physiological change can increase self-focus it seems plausible that actual physiological arousal could have the same effect. Empirical studies generally support this view. Wegner and Giuliano (1980) showed that increments in general arousal can induce self-focus. In their study, subjects were exposed to one of three different manipulations designed to vary their levels of general arousal (running on-the-spot, waiting in a chair, and reclining in an armchair). The subjects were then required to complete a sentence completion measure of self-focus. The subjects who had run were significantly more self-focused than the subjects who had waited, and reclining subjects were the least self-focused.

MacDonald et al. (1983) have, however, provided evidence for an alternative explanation of the Wegner and Giuliano results. They suggested that the arousal manipulation used by Wegner and Giuliano increased self-focus not because of the arousal it produced, but because of its unusual nature. However, Wegner and Giuliano (1983) responded to this possible confound in an experiment which demonstrated that physical exertion (fast or slow running) in a natural and non-unusual setting was also associated with heightened self-focus. However, in comparing the two exertion conditions, slow running was rated by subjects as significantly more unusual than fast running. This suggests that arousal may have mediated self-focus in the fast running condition, whereas unusualness mediated self-focus in the slow running condition.

These data show that increments in arousal can cause heightened self-focus. We have also seen that negative affect appears to increase self-focused attention; perhaps such affect signals a discrepancy in self-regulation and self-focus is an intermediate process aimed at facilitating appraisal and reduction of the discrepancy. Finally, when an internal physiological aspect of self such as heart rate is rendered salient by non-veridical feedback, this can also induce self-focused attention. This has parallels with the onset of self-monitoring in some patients with anxiety disorders. Panic, generalised anxiety and agoraphobic patients report selective attention for specific physiological processes such as change in heart rate, muscle tightness and breathing (e.g. Hibbert, 1984; Wells, 1987). Furthermore, the onset of generalised anxiety and panic disorder is often marked by the experience of physical disturbances other than the somatic arousal symptoms of anxiety (Hibbert, 1984). Beck (1976) has used the term "attention binding" to refer to anxious patients' preoccupation with the theme of danger, hypervigilance for stimuli relevant to danger and over-scanning of subjective feelings.

Consequences of self-focus

In this section, we review the effects of self-focused attention on subjective awareness of internal responses, and on behavioural and cognitive activity.

Intensification of sensations and affect

Research has demonstrated that self-focused attention increases subjects' awareness of somatic reactions. Pennebaker and Skelton (1978) have found a positive correlation between private self-consciousness and a summary index of 12 physical symptoms such as headache and muscle soreness. Others have utilised the placebo effect to study the relationship between self-attention and symptom awareness. These studies demonstrate that self-focused attention increases subjects' awareness of internal bodily states and as a consequence reduces the effect of suggestibility about those states (see Scheier, Carver, & Matthews, 1993, for a review).

Several studies have demonstrated that self-focus intensifies bodily sensations and emotion. However, it does not increase the accuracy of appraisals concerning the cause of sensations (Gibbons & Gaeddert, 1984), and subjects who tend to focus on autonomic changes not only show a high degree of autonomic reactivity but also have a tendency to overestimate the intensity of such arousal (Mandler, Mandler, & Uviller, 1958).

Self-focus not only intensifies awareness of somatic responses, it also intensifies emotional experience. Situationally or dispositionally self-focused subjects show stronger reactions to induced states of attraction, elation, depression and repulsion (Scheier & Carver, 1977). Experimentally enhanced self-focus and private self-consciousness intensify fear responses in phobic subjects engaged in exposure tasks (Carver, Blaney, & Scheier, 1979; Scheier et al., 1981). Subjects high in dispositional self-focus also show intensified stress responses to other forms of threat such as gruesome film stimuli (Wells, 1991).

The evidence shows that self-focus increases awareness of somatic and affective responses and it is also associated with an intensified experience of such responses. Moreover, self-focus can itself result from salient physiological and affective reactions, demonstrating that the relationship between intensified internal responses and heightened self-focus can be bidirectional.

Self-focus induces cognitive attentional deficits

In the test-anxiety literature, it is generally accepted that the performance decrements characteristic of high test-anxious individuals are attributable to the interference effects produced by off-task cognitive activity typified by worry (e.g. Sarason, 1972; 1975; 1988; Wine, 1971; 1982). Eysenck (1979) has proposed that task-irrelevant cognitive activities such as worry produce performance decrements because they pre-empt some of the limited capacity of working memory, as discussed in detail in Chapter 6.

In an evaluative situation, the performance decrements of high test-anxious subjects result from divided attention. That is, they focus on both self-evaluative cognitive activity and task-relevant matters. A study by Carver, Peterson, Follansbee and Scheier (1983) demonstrated the mediational role of self-focus in the relationship between test anxiety and performance. They divided subjects into those high and low in test anxiety, and found that experimentally enhanced self-focus interacted with the level of test anxiety, improving performance on an anagram task among low test-anxious subjects but impairing performance among high test-anxious subjects. Carver et al. (1983) interpreted these data in terms of self-focus interacting with subjects' confidence in their ability to perform the task. In subjects who were not confident self-focus impaired performance, but in confident subjects self-focus enhanced performance.

Although it appears that self-focus can have a performance-facilitating effect as well as a performance-debilitating effect, the extent to which these performance effects are mediated by an interaction between self-focus and personal expectancies is not altogether clear. For example, Strack et al. (1985b) conducted a series of studies testing the prediction that performance deficits in depression result from an interaction of expectancy and focus of attention variables. In their second study, they demonstrated a significant interaction between experimentally lowered performance expectancy and experimentally intensified self-focus in determining the performance of non-depressed subjects on an anagram task. The performance of subjects with lowered expectancy plus increased self-focus was worse than the performance of other subjects in a no-manipulation condition, or subjects in conditions where only the expectancy or self-focus variables were manipulated. While these data support the view that an interaction between expectancy and intensity of self-focus determines the impact of self-attention on performance, a third study by Strack et al. (1985b) provided data which are less consistent with this view. In this study, which used depressed subjects, expectancy was raised by presenting positive feedback concerning performance on a previous task, or self-focus was lowered by giving task-focus instructions prior to anagram performance. The results of the study showed that the only significant effect was for focus of attention, and no significant effect for expectancy or interaction between expectancy and focus was obtained. These data show that the performance of depressed subjects can be enhanced by reducing self-focus irrespective of expectancies. This suggests that in some situations expectancy may be relatively less significant than intensity of self-focus in determining performance effects seen in depressed subjects.

The mediational role of self-focus in the relationship between stress and performance is not limited to test anxiety and depression. In a series of experiments, Baumeister (1984) found that normal subjects high in private self-consciousness performed consistently worse than subjects low in self-consciousness on a task requiring visual–motor coordination. In addition, subjects instructed to focus on their hands during performance performed worse than subjects instructed to focus away from themselves. In one experiment, though, which required performance under pressure, subjects high in private self-consciousness actually performed better than subjects low in private self-consciousness. However, there was a failure to replicate this latter result. Generally, it appears that dispositional self-focus and situationally induced self-focus can have a disruptive effect on performance, although the effect may be stronger in anxious and depressed subjects. This effect may result from self-focus reducing the capacity available for the performance of attention-demanding tasks.

Symptoms of impaired concentration and memory are common in anxiety and depressive disorders (DSM-III-R; APA, 1987). Wells (1987) interviewed 34 patients with generalised anxiety and panic disorder and found that 91% reported impairment of concentration and memory when anxious. Similar deficits are also reported by depressed patients (e.g. Miller, 1975). The concurrence of this type of cognitive dysfunction and self-focus in stress disorders is consistent with the view that high levels of self-focused attention may be associated with cognitive deficits. Research with the Cognitive Failures Questionnaire supports this view (Broadbent et al., 1982; Houston, 1988; Matthews & Wells, 1988; Wells & Matthews, 1994), although its validity as a measure of cognitive impairments is uncertain (see Chapter 8).

In summary, it appears that at a state level self-focus is often—but not invariably—associated with impaired task performance. At a trait level it is associated with self-reported vulnerability to cognitive failures. Self-focused individuals appear to lack resources for efficient effortful performance and could have difficulty activating appropriate schemas for external action in certain self-engaging situations, leading to cognitive failures (e.g. Reason, 1984). The data linking self-focus to cognitive limitations and intensified symptoms/affect present implications for understanding possible links between self-attention, stress appraisal and coping behaviour.

Impairment of effortful coping and enhancement of avoidance

Since self-focus intensifies internal sensations and emotion, it should be associated with increased coping attempts aimed at managing emotion. However, as self-focus also pre-empts cognitive capacity, coping strategies requiring high attentional demands should be disrupted, at least in attentionally demanding situations. It follows from this that non-demanding emotion-focused forms of coping characterised by avoidance will be enhanced by self-attention, but active emotion-focused coping will not be.

Studies of the effects of self-focused attention on fear reactions confirm this prediction. Self-focus disrupts behaviour and increases the likelihood of behavioural withdrawal from threatening situations (e.g. Carver & Blaney, 1977; Carver et al., 1979; Scheier et al., 1981). Carver and Blaney (1977) asked subjects with snake phobia to approach a boa constrictor in the presence of accelerating or constant false heart-rate feedback. Subjects who had previously rated themselves as confident in their ability to perform the task approached more closely than doubtful subjects when hearing accelerating feedback rather than constant feedback. Carver and Blaney (1977) offered an explanation of this effect in terms of the arousal feedback causing heightened self-focus followed by subjects' assessment of their ability to match their behaviour with the desired goal. For subjects who doubted their ability to perform the task, such an assessment was aversive and withdrawal occurred sooner than with confident subjects. In a similar experiment, which used the presence of a mirror to increase situational self-focus (self-awareness), snake phobics withdrew from the approach task sooner in the presence of the mirror than with no mirror. Non-phobic subjects were unaffected by the mirror manipulation (Scheier et al., 1981). In a second study, Scheier et al. (1981) asked subjects with high and low private self-consciousness scores to submit to either mild or strong electric shocks. Subjects high in private self-consciousness were more responsive to fear and more likely to withdraw from the experiment.

Increased use of avoidance coping strategies in self-focused subjects could contribute to stress proneness in two main ways. When stressful situations are avoided, opportunities to test out and develop effective coping strategies are limited. In addition, avoidance could contribute to the maintenance of dysfunctional appraisals and beliefs, since it restricts individual exposure to disconfirmatory experiences. Empirical evidence that avoidance strategies are often, though not always, maladaptive is discussed in Chapter 8.

Wells and Matthews (1994) studied the types of coping strategy used in stressful situations by 139 female nurses. They predicted that active coping strategies would be more capacity-demanding than passive strategies, and would therefore be affected most by self-focus in attentionally demanding situations. The results of the study (presented in more detail in Chapter 8) showed that high private self-consciousness predicted reduced use of active problem-focused coping irrespective of controllability, and reduced use of emotion-focused coping in mixed controllability situations. The specificity of these results is consistent with a capacity explanation. Problem-focused coping is likely to be most demanding for self-focused subjects as it requires external attention. Emotion-focused coping, on the other hand, may be less demanding and it is therefore only disrupted in situations where cognitive appraisals themselves require more attention, as when, for example, situational control appraisals are ambiguous or mixed. There was also a significant negative association between self-focus and the use of passive suppression coping strategies in mixed controllability situations. However, this relationship appeared to be mediated by the level of self-report cognitive failures. Other evidence presented by Wood et al. (1990) suggests that self-focused men tend to use more passive and ruminative coping styles than men low in self-focus, implying that effects on passive coping may be rather unstable.

While these results show an impairment of certain coping attempts, the effect of self-attention on coping may be influenced by qualitative as well as quantitative dimensions of self-focus. Brown and Cash (1990) showed that non-clinical panickers used more emotion-focused coping (express emotion) than non-panickers. The panickers and non-panickers did not differ in degree of private self-consciousness, however, but the former did have significantly higher private body-consciousness scores. Private body-consciousness (Miller et al., 1981) may have different effects on coping than private self-consciousness. However, it is similar to the concept of interoceptive awareness, which has been linked to the development of avoidance tendencies in agoraphobia (Goldstein & Chambless, 1978).

If self-focus is problematic for coping, we should find that high self-focus interferes with coping in certain situations. Consistent with this proposal, Coyne, Aldwin and Lazarus (1981) suggest that inappropriate support seeking and negative self-focus may be the major source of indecisiveness and ineffectiveness seen in the depressed person's everyday life. In a study on college women coping with depression, Doerfler and Richards (1983) required subjects to describe their coping efforts and to complete a coping activities inventory. The subjects were divided into those who had successfully coped with depression and those who had been unsuccessful. The unsuccessful copers reported monitoring their problematic behaviour (e.g. insomnia) more often than successful copers. In a study described in more detail in Chapter 8, Wells and Matthews (1994) showed that high self-focus generally reduced problem-focused coping, and also reduced active emotion-focused coping in nurses in some situations. These results are consistent with the view that self-focus can interfere with successful coping.

In Chapter 10, we review evidence from psychological treatment studies which supports the view that reduced self-focus can facilitate "coping". External distraction techniques have been employed in the treatment of anxiety and depression (Beck et al., 1979; 1985; Craske, Street, & Barlow, 1989b; Wells, 1990). External distraction strategies have been found to be effective in reducing the frequency of upsetting thoughts in low endogenous depressed patients (Fennel & Teasdale, 1984; Fennel et al., 1987). Nevertheless, as discussed in Chapter 10, distraction may have deleterious consequences for emotional repair in situations where self-focus on emotional state is necessary for network activation and emotional processing.

Activation and elaboration of self-evaluative cognitive structures

Self-focused attention can be linked to the activation of specific cognitive structures on empirical and theoretical grounds. Theoretically, self-focus has been viewed as a self-regulatory process which functions to compare a person's current status on a salient behavioural standard with the content of self-regulatory structures or self-guides (Carver & Scheier, 1981; Duval & Wicklund, 1972; Higgins, 1987; Strauman, 1989). These approaches rely on the principle that self-focus is associated with the activation and/or increased accessibility of self-relevant cognitive structures.

Empirical evidence also supports this view. Private and public self-consciousness are positively correlated with state and trait worry, and reductions in perceived control over worrying on a self-report level (Meyer et al., 1990; Pruzinsky & Borkovec, 1990; Wells, 1985; 1991). As negative thinking is considered to result from the activity of certain underlying schemas (Beck, 1976; 1987), it appears that self-focus is associated with schema processing. More directly, Geller and Shaver (1976) showed that experimentally enhanced self-focus increased colour-naming latencies for self-evaluative words (e.g. proud, failure) but not neutral words in a modified Stroop task, suggesting that self-focus activates self-relevant cognitive structures. Rachman, Levitt and Lopatka (1988b) demonstrated that an increase in attention directed towards bodily symptoms increased the opportunity for catastrophic cognition and anxiety in claustrophobics confined to a chamber. This suggests that self-focus enhanced the activation of fear-relevant schemas.

Self-focused attention can also be linked to the architectural features of cognitive structures. Nasby (1985) tested for recognition memory of adjectives which subjects previously rated in terms of their self-descriptiveness. Subjects high in private self-consciousness committed more false alarms to highly self-descriptive distractor adjectives but not non-descriptive distractor adjectives compared with subjects low in private self-consciousness. This suggests that chronically self-focused subjects have more extensive self-schemas evidenced by the greater number of false alarms for self-descriptive distractors.

Self-focus and psychopathology

Self-focused attention is associated with a wide range of psychopathological states such as depression (Ingram & Smith, 1984; Smith & Greenberg, 1981; Smith, Ingram, & Roth, 1985), anxiety disorders (Gordon, 1985; Hope & Heimberg, 1988; Wells, 1987) and alcohol abuse (Hull, 1981). Moreover, the effects ascribed to self-focused attention are similar in several ways to the effects found in anxiety and depression. For example, self-focus is assumed to induce self-evaluation (Duval & Wicklund, 1972), and this is a central phenomenon in states of depression (Beck, 1967; 1987) and anxieties such as test anxiety and social phobia (e.g. Hope, Gansler, & Heimberg, 1989; Wine, 1971).

There are further parallels between the effects of self-focus and characteristics of abnormal stress reactions. First, depression and anxiety are characterised by intensified affect and this effect is also found with intensified self-focus (Scheier & Carver, 1977). Second, experimentally enhanced self-attention and private self-consciousness are associated with an increased tendency to make internal causal attributions (Buss & Scheier, 1976; Duval & Wicklund, 1973; Ross & Sicoly, 1979). In addition, public self-consciousness has been found to influence the extent to which subjects perceive themselves as targets of both positive and negative events, such as the probability of being chosen as a volunteer in a situation (Fenigstein, 1984, study 2), and also the extent to which a range of other persons' behaviours are perceived as directed towards the self (Fenigstein, 1984, study 3). Similar biases in information processing are considered to be central in depression and anxiety disorders (Abramson et al., 1978; Beck, 1976; Beck et al., 1979; 1985; Kuiper, 1978). For example, depressed patients show a tendency to make global and negative causal attributions involving the self (Abramson et al., 1978), and a number of "thinking errors" have been observed in anxiety and depression (e.g. Beck et al., 1979, p. 14). One such error, "personalisation", refers to "the patient's proclivity to relate external events to himself when there is no basis for making such a connection" (Beck et al., 1979, p. 14). These types of bias resemble the distortion in appraisal which accompanies self-focus; however, there appears to be an important difference—in psychopathology the self-attribution is likely to occur for negative situations rather than for both negative and positive situations. Pyszczynski and Greenberg (1987) suggest that depressed individuals have different self-focusing tendencies after success (which is presumably positive) and failure (presumably negative) experiences compared with normals. While depressives tend to self-focus after failure but not after success, the converse seems to be true for non-depressives. In this instance, the depressive self-focusing style is not viewed as a stable trait but occurs during the course of depression. Under these conditions, other negative self-evaluative processes are already engaged and these may shape the content of the self-focus egocentric bias.

In addition to the effects outlined above, the effects of self-focus on approach-avoidance tasks involving feared stimuli are strikingly similar to the effects obtained from manipulation of self-efficacy perceptions, a variable considered to be significant in determining phobic and anxiety reactions (Bandura, 1977; Bandura, Adams, & Beyer, 1977). Smith and Greenberg (1981) suggest on the basis of these types of parallels that self-attention mediates several phenomena associated with depression, including dysfunctional causal attributions, intensified affect, more accurate self-reports and lowered self-esteem. However, self-focus is not specific to depression (Ingram, 1990) and it may underlie a more general predisposition to stress reactions.

Self-focus and depression

The assertion that states of depression are associated with self-focused attention has received considerable empirical support. Correlational studies with non-clinical college samples show significant positive relationships between private self-consciousness and measures of depression such as the Minnesota Multiphasic Personality Inventory Depression Scale (Smith & Greenberg, 1981) and the Beck Depression Inventory (Ingram & Smith, 1984; Smith et al., 1985). College students scoring high and low on the BDI also differ in the expected direction in level of self-awareness measured by the self-focus sentence completion scale

(Ingram & Smith, 1984). Clinically depressed outpatients similarly show significantly greater levels of self-awareness than controls matched for age and sex (Ingram, Lumry, Cruet, & Sieber, 1987a).

Pyszczynski and Greenberg (1987) have advanced a self-attentional theory of depression which attempts to integrate many of the findings reviewed thus far. Their theoretical perspective on self-focus is similar to that of Duval and Wicklund (1972) and Carver and Scheier's (1981) self-regulation framework. While maintaining the notion that self-focus serves an adaptive self-regulatory function, they agree with Duval and Wicklund (1972) that self-focus on negative discrepancies produces negative affect irrespective of the probability of reducing the discrepancy. In addition, they assert that self-focus represents an initial response to disruptions, failures and frustrations and activates self-regulation in pursuit of important goals. In this theory, depression occurs following a significant loss, and when the lost object was a central source of emotional security, identity and self-worth for which there are few alternative sources. This situation leads to perseveration in attempts to recover the lost object and thus an inability to disengage the self-focusing cycle. The consequence of this is constant confrontation with the irreducible negative discrepancy. Moreover, the self-focused attention intensifies the negative affect being experienced and increases the internality of individual attributions for loss (self-blame). Positive experiences may be viewed as distractions that interfere with efforts to work out problems and self-focus may therefore be avoided after positive outcomes. Pyszczynski and Greenberg (1987) term this state of self-focusing after negative but not positive outcomes the *depressive self-focusing style*, and suggest that this maintains and exacerbates depressive symptoms. These effects contribute to a negative self-image which buffers against further disappointment. The negative self-image is itself maintained and reinforced by the depressive self-focusing style.

Pyszczynski and Greenberg (1985) provide experimental support for the concept of a depressive self-focusing style. In this study, depressed and non-depressed college students were induced to succeed or fail on a test supposed to be a test of verbal ability. They then worked on two puzzles, one of which was positioned in front of a mirror (self-awareness manipulation), and one which was not. Depressed subjects tended to like the self-focus enhancing puzzle more after failure than after success, whereas the non-depressed subjects liked the self-focus enhancing puzzle more after success than after failure. In a subsequent study, Pyszczynski and Greenberg (1986) showed that depressed subjects spent significantly more time working on the mirror-associated puzzle after failure than after success. While these studies provide results that are consistent with there being a depressive self-focusing style, they do not provide evidence for the assertion that failure induces self-focus in depressed individuals whereas success does not.

In a test of the hypothesis that failure induces self-focus in depressed subjects, Greenberg and Pyszczynski (1986) required depressed and non-depressed college students to work on solvable or unsolvable anagrams. Self-awareness was then measured with the Exner (1973) Self-Focused Sentence Completion Scale.

Unexpectedly, both depressed and non-depressed subjects had significantly greater self-awareness following failure than following success. This result was explained in terms of negative affect engendered by failure signalling the need for self-regulation and hence self-focus. In the second study, which procedurally replicated the first with the exception of measuring self-awareness immediately after the anagram task *and* after a time delay, both depressed and non-depressed subjects had greater self-awareness following failure than following success, but in the depressed subjects self-awareness was more likely to be maintained over time.

Pyszczynski and Greenberg (1987) conclude, on the basis of these studies, that the initial response to failure is an increase in self-focus among both depressed and non-depressed people. However, only depressed people dislike self-focus after success, avoid self-focusing stimuli after success, and persist in high self-focus after failure and low self-focus after success. Larsen and Cowen (1988) have also provided evidence consistent with the depressive self-focusing style. In their naturalistic study, subjects completed daily measures of depression and self-focused attention over a 3-month period. A positive association between subjects' BDI score (Beck, 1967) and level of daily self-focus following negative but not positive life events was found.

Why do depressed individuals prefer self-focus after failure than after success? Pyszczynski and Greenberg (1985) offer an explanation in which self-focus after success in depressed subjects produces feelings of anxiety and uncertainty concerning incorporation of the positive outcome into their "relatively safe, unassailable negative self-images" (p. 1073). Self-focus after failure may in contrast be relatively comforting because it does not require revision of negative self-images, and safeguards against the affective extremes that could result from attempts to maintain a more positive self-image.

Other theories have considered the role of self-focus in depression. For example, Kuhl's (1981) theory of action control is concerned with the processes which are required to ensure that intended actions are carried out. In the theory, a distinction is made between two self-regulatory orientations: action orientations and state orientations. Action orientations are strategic and change-promoting in which attention is primarily focused on information necessary for action. State orientations, on the other hand, involve focusing on some past, present or future state of the individual. Kuhl and Helle (1986) suggest that a dispositional tendency towards state orientation may increase vulnerability to depression, since state-oriented individuals are less able than action-oriented individuals to control ruminative cognitions.

In summary, empirical studies generally support the assertion that self-focused attention is positively associated with depressive states in both clinical and non-clinical samples. The most ambitious integrative theory accounting for the mediational factors underlying this relationship is that offered by Pyszczynski and Greenberg (1987). Most notably their concept of a specific depressive self-focusing style has received some support. However, studies of attributional biases associated with self-focus provide more equivocal results (see Ingram, 1990, for a review).

Future research is required in order to elucidate the cognitive-affective mechanisms that mediate the relationship between heightened self-focus and depression. One possible mechanism which is consistent with Kuhl's action-orientation theory is that self-focus could reduce cognitive control capabilities. Such an effect could have a negative impact on problem-solving capacity, cognitive reasoning and motivation, and these variables appear to be adversely affected in depressed patients (see Chapter 7). The potential role of self-attention in moderating cognitive control is discussed in more detail in Chapter 12.

Self-focus and anxiety

Self-focused attention has been described in clinical anxiety states such as panic disorder (Beck, 1988; Clark, 1986; Rachman et al., 1988b; Rapee, Mattick, & Murrel, 1986), agoraphobia (Goldstein & Chambless, 1978; de Ruiter & Garsen, 1989), social anxiety (Buss, 1980; Carver & Scheier, 1986; Crozier, 1981; Smith & Sarason, 1975), generalised anxiety disorder (Craske et al., 1989a; Wells, 1987) and test-anxiety (Carver et al., 1983; Deffenbacher, 1978; Sarason, 1988; Wells, 1985; Wine, 1971).

Studies of simple phobia

Studies with simple phobics show that experimentally intensified self-awareness and private self-consciousness are associated with increased fear arousal and behavioural avoidance in subjects exposed to phobic stimuli. In one experiment, Carver and Blaney (1977) asked subjects with snake phobia to approach a boa constrictor in the presence of accelerating or constant heartbeat feedback. Prior to the task, the subjects rated how confident they were in their ability to carry out the task. The results showed that confident subjects tended to approach more closely than doubtful subjects when hearing accelerating feedback rather than constant feedback. These results were explained in terms of autonomic feedback causing heightened self-focus followed by subjects' assessment of their ability to match their behaviour with the desired goal. For subjects who doubted their ability to perform the task, such an assessment was aversive and withdrawal occurred sooner than with confident subjects. In a different study with snake phobics, Carver et al. (1979) asked their subjects to approach and pick up a boa constrictor. In this study, self-awareness was manipulated by having subjects perform in the presence or absence of a mirror. The subjects in the self-aware condition withdrew sooner than non-self-aware subjects from the approach attempt. The confident subjects, although fearful, apparently focused attention on task completion, whereas the subjects doubtful of their ability to complete the task focused on physiological arousal. Within a self-regulatory framework of self-attention, subjects' expectancies (confidence) concerning their ability to complete the approach tasks were considered to interact with self-focus in determining the behavioural and affective consequences of self-focus. This model has been expanded to account for the effects of self-focus in test-anxiety (Carver et al., 1983), and is reviewed below.

The relationship between self-focus and anxiety also holds for analogue anxiety reactions as well as for phobic reactions. Scheier et al. (1981) asked subjects with high or low scores in private self-consciousness to submit to either mild or strong electric shocks. Subjects high in private self-consciousness were more responsive to fear and were more likely to withdraw from the experiment. Wells (1991) showed that subjects high in private self-consciousness reported significantly greater increases in state-anxiety, worry and self-report somatic symptoms when exposed to a gruesome film. These findings suggest that self-focused attention intensifies affective and behavioural responses to threat.

Panic disorder and agoraphobia

Cognitive-behavioural theories of panic disorder propose that panic results from the catastrophic misinterpretation of internal cues such as autonomic arousal symptoms or other sensations unrelated to anxiety (e.g. Beck, 1988; Clark, 1986; Goldstein & Chambless, 1978; Hibbert, 1984; Ottaviani & Beck, 1987). According to Beck (1988, p. 91): "Panic prone patients tend to fix their attention on any bodily or mental experiences that are not explicable as normal". Furthermore, he suggests that panic patients are hypervigilant for the experience of such sensations and that their fixation of attention is involuntary. Once panic attacks are established, the problem is maintained in part by selective attention to internal events such as bodily sensations (Clark, 1989).

Agoraphobia has been conceptualised as a response to panic (Goldstein & Chambless, 1978), and a variant of that disorder (e.g. Noyes, Clancy, Garvey, & Anderson, 1987), and is viewed as a subclass of panic disorder in DSM-III-R (APA, 1987). Thus, self-focus is likely to play a role in some forms of this disorder as well. Consistent with this view, evidence suggests that worry about bodily sensations and illness occurs in both panic disorder and agoraphobia. Goldstein and Chambless (1978) view the development of agoraphobia in terms of interoceptive conditioning in which the conditioned stimuli for panic attacks are internal bodily sensations. They maintain that having suffered one or more panic attacks, these individuals become "hyperalert for their sensations" (p. 55), and interpret feelings of mild to moderate anxiety as a sign of an oncoming panic. Since the feared stimulus in the form of physiological arousal symptoms is carried around with the individual, it generalises widely and different external situations then become anxiety-provoking. This "fear of fear" as it is sometimes termed constitutes a form of bodily self-focus which could be similar to private body-consciousness (Miller et al., 1981). Consistent with this view, Brown and Cash (1990) showed that non-clinical panickers had significantly higher private body-consciousness scores than non-panickers, although there was no difference in private self-consciousness. Thus increased interoceptive awareness can be viewed as a subtype of self-focused attention, which in panic subjects may be intense and relatively inflexible.

Questionnaire and interview data from panic and agoraphobic patients provides evidence which generally supports the "fear of fear" explanation of panic and agoraphobia. Chambless and Gracely (1989) examined the responses of anxious patients to the Agoraphobic Cognition Questionnaire (ACQ) and the Body Sensations Questionnaire (BSQ) (Chambless et al., 1984). The ACQ is comprised of two factors dealing with fears concerning the social/behavioural consequences of panic (e.g. loss of control, acting foolishly) and the physical consequences of panic (e.g. heart attack, fainting). The BSQ consists of a list of bodily symptoms that can occur in feared situations or when the patient is nervous (e.g. dizziness, nausea) and measures the degree of fearfulness associated with each symptom. Patients with agoraphobia showed significantly higher scores on fear of body sensations than other anxious patients (patients with social anxiety, generalised anxiety or panic disorder without agoraphobia). In addition, while the agoraphobics together with the panic patients were more concerned that physical illness would result from their anxiety, all of the anxious patients were more concerned than normals that their anxiety would lead to embarrassment or loss of control. Similar results have been obtained in a comparison study of panic patients and patients with panic plus agoraphobia (Ruiter & Garssen, 1989). In this study, agoraphobics reported greater fear of bodily sensations than panic patients, although they did not differ on the frequency of bodily sensations.

Apart from these correlational analyses and extant studies which show a co-occurrence of panic and self-focus, there is more direct evidence that self-focus increases anxiety in some patients with panic attacks. Rachman et al. (1988b) showed that intensified self-focus increased the opportunity for catastrophic symptom appraisals and thus anxiety in claustrophobic subjects who also had panic attacks. Subjects were exposed to a confined chamber, and, while one group of subjects were instructed to concentrate on their bodily sensations when in the chamber, a second group were asked to perform a distraction task. Although no differences were obtained between the groups on measures of reported fear and panic, this was probably due to the fact that subjects in both groups reported relatively low concentration levels overall. The subjects were subsequently divided into those with high or low concentration in each group, and high concentration subjects in the body-focus group showed significantly higher panic scores than low concentrators in that group. There were no differences between high and low concentrators in the distraction (control) group. In the distraction group, there was a significant negative correlation between concentration level and panic scores, whereas the association was significantly positive in the body-focus group. In a different study, Wells (1990) demonstrated that a relaxation procedure requiring self-focused attention (abbreviated autogenic training) exacerbated anxiety and panic attack frequency in a patient with panic disorder. The paradoxical anxiety enhancement effect of relaxation training has been observed in other anxious patients and non-anxious college students (Heide & Borkovec, 1983; 1984). Following the reasoning that intensified self-focus was responsible for this effect, Wells (1990) showed that a procedure requiring effortful external monitoring eliminated panic attacks and reduced self-report anxiety in the same panic patient.

In summary, the theoretical and empirical work on panic consistently points to a positive relationship between self-focus and panic attacks. The evidence suggests that self-focus may be an important cognitive variable involved in the initiation and maintenance of this disorder.

Test anxiety

The role ascribed to self-focus in explaining the phenomena associated with anxiety has been most prominent in the test-anxiety literature. As we saw in Chapter 6, the performance decrements of high test-anxious subjects have been viewed as the result of anxious self-preoccupation. More specifically, the reduction in attentional capacity for task performance produced by off-task evaluative cognitive activity, usually worry (Sarason, 1975; 1988; Wine, 1971). In this section, we focus on empirical studies and theoretical accounts which have more specifically dealt with self-focus rather than worry in test anxiety.

Deffenbacher (1978) asked high and low test-anxious subjects to perform a difficult anagram task under high-stress or low-stress conditions. The level of stress was manipulated by presenting different written instructions to the subjects prior to the task. High-stress instructions emphasised the intelligence-testing nature of the task, the low difficulty of the anagrams and the fact that the task was time-limited. Low-stress instructions, in contrast, were reassuring in nature and emphasised the great difficulty of the task and the probability of solving only a few anagrams. After the subjects had worked at the task they completed questionnaires assessing various parameters, including the extent to which attention had been directed towards physiological cues during testing, the extent to which attention had been directed towards worries such as the consequences of performing badly and negative self-evaluation, and the extent of task-generated interfering cognitions such as thinking back to anagrams which had not been solved. Consistent with self-preoccupation theories of test anxiety and performance, subjects in the high test-anxious/high-stress group spent less time on task, experienced greater task interference and reported greater attention to distracting cognitions, and greater attention to heightened physiological arousal and task-generated interference compared with low-anxiety/high-stress subjects.

As we have seen, the impact of self-focus on performance may not always be negative. Carver et al. (1983) showed that for confident subjects self-focus facilitated performance, whereas for subjects lower in confidence self-focus disrupted performance on an anagram task. However, these data contrast with those of Slapion and Carver (1981), who found performance facilitation in high test-anxious self-focused subjects. Carver and Scheier (1981, p. 20) propose that facilitation and disruption depend on the subject's expectancies: "The person with favourable expectancies remains task engaged, even when highly anxious and highly self-focused". Performance decrements, on the other hand, are viewed primarily in terms of task disengagement resulting from unfavourable expectancies. While they acknowledge that task demands plus anxiety can create a "bottleneck" in processing, they attach relatively little importance to the effects of self-focus in pre-empting the limited capacity attentional system. It is likely that a number of self-focus and task parameters moderate performance effects. For example, the interaction between task difficulty and the intensity/duration of self-focus is likely to be relevant. High-intensity self-focus could facilitate performance on simple tasks by reducing distraction by task-irrelevant stimuli. Eysenck (1982) discusses evidence that anxiety sometimes enhances the performance of simple tasks. With difficult tasks, high-intensity self-focus could leave too few resources for good performance.

Theories linking self-focus to test anxiety

Theories of self-attentional processes in test anxiety have tended to focus on the relationship between self-focus and worry (Sarason, 1988; Wine, 1982) and on self-focus as a mediational factor in the link between test anxiety and task disengagement (Carver & Scheier, 1986; 1988).

Wine (1982) and Sarason (1988) have made valuable contributions to the conceptualisation of self-focus as a factor producing performance decrements in high test-anxious subjects. However, they view self-focus as synonymous with worry. Sarason (1988, p.4) defines anxious self-preoccupation as "heightened concern over one's inadequacies and shortcomings". Further, he asserts that "patterns of self-preoccupying thought function as templates or schemas that direct attention to salient aspects of the environment and interpersonal relationships" (p. 4). This perspective is somewhat incongruent with cognitive taxonomies which have differentiated between levels of cognition comprised of cognitive products, processes and structures (e.g. Ingram & Kendall, 1986). Clearly, in this latter framework, self-preoccupying thought is a cognitive product which is conceptually distinct from the process of self-focus.

Carver and Scheier (1984; 1988) offer a different theory of test anxiety which is essentially a theory of how anxiety affects behaviour. Self-focus is viewed as a variable which can intensify engagement or disengagement in tasks. Carver and Scheier propose that as individuals act, they self-attentively monitor their actions with reference to specific goals and standards for behaviour. This is necessary for individuals to keep on track in pursuit of particular goals and is the basic process of self-regulation of behaviour. In the theory, anxiety is considered to interrupt behaviour and serve as a signal that conflict exists between standards. While they acknowledge that worry can impair performance, they propose that it is an individual's expectancy of her ability to cope with anxiety and the task at hand that determines her behaviour. The person who expects that she can cope responds to anxiety with renewed effort in the task, whereas the person who doubts her ability is likely to disengage from task-focused activity. The theory is not intended to be a theory of the role of self-focus in the aetiology of test anxiety, but rather a theory of the mediational effects of self-focus on behavioural responses to stress.

One possible limitation of the self-regulatory theory of test anxiety is that it does not consider that self-focused attention itself might influence the nature of expectancies adopted in certain situations. Consistent with this assertion, empirical studies show that self-focus can intensify affect (Scheier & Carver, 1977), influence attributional processes (Fenigstein, 1974) and activate self-evaluative constructs (Geller & Shaver, 1976).

Test-anxiety theories, in common with some other models of stress in which self-focus has been implicated, treat self-focus as a single undifferentiated construct. Such approaches to test anxiety do not adequately differentiate between worry and other potentially relevant processes involving self-focus.

Social anxiety and social phobia

Social anxiety and public self-consciousness constitute two empirically separate aspects of self-consciousness within Fenigstein and co-workers' (1975) questionnaire measure, although the two measures tend to correlate positively. Private self-consciousness is also positively correlated with social anxiety in some studies (Hope & Heimberg, 1988), but public self-consciousness is the stronger predictor of social anxiety, the negative social emotion of shame, and of general neuroticism (Darvill, Johnson, & Danko, 1992). Fenigstein et al. (1975) originally suggested that public self-consciousness was a necessary antecedent to social anxiety, but whether or not anxiety was actually caused depended on the nature of evaluation of the self as a social object. Social anxiety may depend on the person's beliefs about whether or not he or she will be perceived favourably (Buss, 1980). Experimental work broadly confirms this view. As we have seen, public self-focus appears to be associated with a kind of egocentricity, attributing oneself as more related to social events than is actually the case (Fenigstein, 1984). Such cognitions are specifically social, in that public self-consciousness is generally unrelated to attributions solely concerned with the self (Shaherwalla & Kanekar, 1991).

In experimental settings, public self-consciousness tends not to interact with the emotional content or valence of stimuli. Self-conscious people over-perceive themselves as targets for others irrespective of whether or not the experience of being the centre of attention is expected to be pleasant or unpleasant (Fenigstein, 1984), although they are especially sensitive to rejection (Fenigstein, 1979) and embarrassment (Edelman, 1985). Fenigstein and Vanable (1992) operationally distinguished public self-consciousness from a questionnaire measure of paranoia comprised of items concerning negative beliefs about others' attitudes to the respondent, such as feelings of persecution and being criticised, although the two measures were significantly positively correlated. In an experimental study, dispositional paranoia and public self-consciousness had significant but independent effects on feelings of being observed. Self-consciousness effects were contingent upon the presence of a two-way mirror, but paranoia effects were not.

In contrast, social anxiety does relate to the processing of emotional self-relevant stimuli. The socially anxious are slower to process the self-relevance of both positive and negative trait terms, probably because processing includes evaluation of the social implications of their responses (Turner, 1978). Public self-consciousness is not related to processing time in this paradigm (Turner, 1978). Results of this kind are generally consistent with Fenigstein's (1984) hypothesis that public self-consciousness tends to activate specifically social self-knowledge, so that anxiety will result only if that knowledge is predominantly negative in content. An alternative proposal (Froming, Corley, & Rinker, 1990) is that public self-consciousness and social anxiety are related to different aspects of social impression management. While those high in public self-consciousness are highly motivated to protect their public image, regardless of likely consequences, socially anxious people are generally pessimistic about their ability to present a favourable impression to others. Neither approach explains the causal relationship underlying the correlation between social anxiety and public self-consciousness. A reciprocal relationship is plausible. The negative beliefs associated with social anxiety are likely to bias attention towards the public self: if you believe that you generally make a good impression, there is no need to attend strongly to impression management. Conversely, attention to one's public image risks activating negative beliefs which might otherwise remain dormant.

Social phobia may be seen as extreme social anxiety. The information-processing approach to social phobia is similar to the cognitive interference model of test-anxiety performance. While social skills deficits may account for some of the difficulties encountered by some socially anxious persons in social interactions, a central component of social anxiety is the occurrence of self-relevant cognitive activity. This activity is characterised by focusing on physiological arousal (e.g. sweating, shaking), concern with self-presentation and the other person's evaluation of oneself (Hartman, 1983). Thus excesses rather than deficits in the cognitive domain are central in social phobia. This perspective underlies Hartman's (1983) meta-cognitive model in which sufferers of social anxiety are thought to be overly invested in cognitive operations concerning themselves. Combined with low self-esteem, preoccupation with thoughts about personal appearance and other people's evaluations compromise attentional capabilities in social situations, thereby interfering with performance, exacerbating arousal and promoting future avoidance. Following this reasoning, Hartman (1983) advocates the use of "other-centred therapy" techniques which are designed to disengage the meta-cognitive self-focusing by promoting externally focused thought.

Hope et al. (1988) review the evidence linking self-focus to attributional biases and apply this to understanding social phobia. They propose that increased self-focus resulting from physiological arousal leads socially anxious persons to make internal attributions for neutral and ambiguous feedback from the partner in the interaction. This non-ideal outcome is attributed to the self, which increases the aversiveness of the situation and makes avoidance more likely in the future.

Addictive behaviours: Alcohol and drug use

Several theoretical accounts of alcohol use and misuse have incorporated concepts pertaining to self-focus and self-perception. There is also an interesting line of research investigating the effects of drug use (e.g. marijuana) on attentional processes, which has potential implications for understanding any role that self-focus might have in maintaining this behaviour.

Alcoholics generally view themselves unfavourably: according to Rosen (1966), alcoholics see themselves as socially undesirable, unable to cope with stress, ineffective in their lives, and needing alcohol for relaxation and socialisation. It is not known, however, if these factors are of aetiological significance in the development of alcoholism or result from alcholism itself. Hull and Schnurr (1986) briefly review the literature on self-concept and alcohol consumption and summarise that a poor self-image is associated with alcoholic problems and that being intoxicated is not necessarily associated with an improved perception of oneself. This is somewhat inconsistent with popular explanations of alcoholism, which assume that alcoholics drink in order to feel better.

Hull (1981) has proposed a self-awareness model of alcohol use which suggests that alcohol reduces self-awareness and self-evaluation by interfering with the cognitive processing involved in the encoding of information in terms of its self-relevance. The avoidance of thinking about the self may be particularly desirable in certain situations, such as those involving failure or activation of negative self-constructs, and this effect is considered to underlie the motivation for drinking. Consistent with this model, Hull, Levenson, Young and Sher (1983) demonstrated that subjects who had consumed alcohol used fewer self-focused statements compared with subjects who had consumed a placebo beverage when they were asked to give a brief speech about themselves. The hypothesis that the self-awareness reducing effects of alcohol results from a reduction in the use of self-relevant schemas has also been evaluated using an incidental recall paradigm. In the third of a series of studies, Hull et al. (1983) showed that while subjects high in private self-consciousness recalled more self-relevant encoded words than low self-conscious subjects under placebo conditions, in the alcohol consumption conditions recall for self-relevant words was significantly reduced for subjects high in self-consciousness. These results confirm the hypothesis that alcohol interferes with the operation of self-referent encoding schemas. However, a question remains concerning whether this is the principal mechanism underlying the self-awareness reducing effects of alcohol consumption. Alternative explanations involving non-schema concepts could also account for these effects. For example, alcohol may have a simple effect on amount of processing capacity or may affect strategic deployment of attention as well as automatic schema-based processing.

Evidence that drugs can influence attentional strategies comes from research using the trait of "absorption" (Tellegen & Atkinson, 1974). Absorption is a state of total attention during which the person's perceptual and ideational resources are completely engaged. Such types of experience, which could also be termed "fascination", have been described in the literature on meditation and altered states of consciousness. An illustrative item from the absorption scale is "The sound of a voice can be so fascinating to me that I can just go on listening to it". Research with this construct demonstrates that different drugs may be associated with different effects on self-absorption. Marijuana users show an increased tendency to have absorbing experiences under marijuana intoxication. In contrast, exclusive alcohol users report having fewer absorbing experiences when referring to the intoxicated state compared with marijuana users (Fabian & Fishkin, 1981; Fabian, Fishkin, & Williams, 1983). The items which appear to characterise marijuana-associated absorption are those reflecting a profound experiential involvement, altered sense of self or consciousness, and enhanced intensity of emotional responding. Moreover, subjects who try the drug and then discontinue its use find the absorbing effects less pleasant than those who use the drug more (Fabian & Fishkin, 1991).

These data support the contention that different drugs can have a different impact on attention, and their effects on attention may have a reinforcing influence which promotes continued drug use. Theoretically, absorption could influence self-focus. If the object of absorption is the self, then self-focus will be intense; however, if the object of absorption is non-self-relevant, self-focus may be extremely low and susceptibilty to distraction by internal events is likely to be considerably diminished. Drugs such as marijuana and alcohol may affect several dimensions of attention, such as the intensity of self-focus and the propensity for attentional absorption. An understanding of the attentional concomitants of drug intoxication could be valuable in both conceptualising individual motivation for drug use, and in the design of treatments which could offer alternative means of providing reinforcing attentional experiences.

Conclusions

Self-focused attention is clearly a common feature of emotional dysfunction. In Chapter 11, we discuss evidence that self-focus has an aetiological role in emotional disorder. We have seen how self-focus influences affective, cognitive and behavioural processes, which may be important in mediating the effect of self-focus on psychopathology. There appear also to be reciprocal links between self-focus and negative beliefs, which may be important for the maintenance over time of affective disorder. A limitation of much of the existing self-attention research is the failure to link the concept with information-processing models of attention. For example, the respective roles of automatic and strategic influences on self-attention, and the influences of self-knowledge on the control of self-focus, are obscure. In addition, the impact of intense or inflexible states of self-focus on the elaboration and modification of cognition at the self-knowledge level is an important area for future research.

The literature tends to view self-focus in content terms. Self-focus is defined as awareness of information about the self. As we have seen, a more process-oriented view of self-focus may be required for theories of psychopathology, and in differentiating normal from dysfunctional varieties of self-attention. In particular, self-focus may become "adhesive" and the stress-prone individual may have difficulty reorienting attention away from self-relevant processing. Moreover, the identification of individual differences in self-attentional tendencies as predictors of stress vulnerability imply that the attentional "style" of the individual should be a target for therapeutic modification.

Self-focus as a state or a trait variable refers to a general configuration of the information-processing system. In Chapter 12, we offer an integrative cognitive-attentional model of emotional disorder in which self-focus is associated with dysfunctional attentional and cognitive mechanisms which cause emotional disorder.

10

ATTENTION MANIPULATIONS

Moderating influences in treatment?

Attentional manipulations used in the exploration and modification of the cognitive and affective components of emotional reactions have been based on distraction techniques. Such techniques appear effective in assisting patients in coping with the distress accompanying certain medical and dental interventions (e.g. Allen, Danforth, & Drabman, 1989). Distraction procedures such as playing video games also appear effective in the control of conditioned nausea in pediatric cancer patients (Redd, Jacobsen, & Die-Trill, 1987). Distraction also appears to have an impact on problematic behavioural responses. For example, the introduction of a distraction procedure involving the viewing of a poster about which a story was told during treatment reduced the anxious and disruptive behaviour of four children undergoing dental treatment (Stark et al., 1989).

Numerous similar studies have been conducted on the effects of distraction in the control of pain. Kanfer and Goldfoot (1966), for example, showed that increased tolerance of cold-pressor pain was facilitated by attention to external stimuli rather than by attention to pain sensations. However, results from this type of study are equivocal and McCaul and Haugtuedt (1982) demonstrated that on a cold-pressor trial of 4 min duration, distraction reduced distress for the first half of the trial but attention to sensations proved to be a superior strategy for the final 2 min. They concluded that the direction of attention may be differentially effective depending on the duration of the painful stimulus.

In this chapter, we present a review of findings on the impact of attentional procedures in modifying the characteristics of emotional disorders. Patients with depression and in particular anxiety report the use of distraction procedures in coping with their problem (e.g. Doerfler & Richards, 1983). These procedures may only be partially effective in some circumstances. They represent a short-term situational coping strategy but may not help in the long term. More specifically, it is possible that distraction is detrimental in cases where it diverts efforts away from confronting problems and engaging problem-focused coping. Furthermore, distraction may inhibit exposure to disconfirmatory information necessary for the modification of dysfunctional beliefs and appraisals, and in a behavioural perspective may moderate anxiety in a way which interferes with effective exposure. Notwithstanding these possibilities, distraction strategies form a component in anxiety management treatments (e.g. Butler et al., 1987), and while the distraction component is seldom evaluated separately from the overall efficacy of such procedures, clinical experience suggests it is a common technique employed by patients. There is some evidence to suggest that certain distraction procedures may be useful in the treatment of emotional disorders. Perhaps the effectiveness is moderated by the nature of the distraction procedure used, that is, the type of attentional shift which it accomplishes. Effectiveness could also be related to the stage in therapy at which these techniques are employed. For example, distraction could be useful in developing emotional control skills early in treatment, although it could be argued that in anxiety disorders such as panic this approach represents avoidance of anxiety sensations and could retard modification of negative beliefs about the catastrophic consequences of these sensations.

In depression research, the impact of attentional strategies on negative cognitive events, mood and coping has been investigated. In anxiety research, attentional procedures have been explored as remedial procedures for the deleterious effect of test anxiety on performance. Studies have also examined the effect of distraction on exposure treatments, and this literature will be examined closely, since it offers implications for conceptualising links between attention and habituation. By examining the effects of attentional strategies in the treatment of emotional disorders, it is possible to gain insight into attentional mechanisms which could moderate treatment effectiveness.

Distraction and depression

Distraction techniques are frequently employed in cognitive-behaviour therapy for depression to provide symptom relief. Beck et al. (1979, pp. 171–172) refer to these techniques as "diversion" and suggest that they are effective in relieving sadness. Diversion can be taught as a coping skill in which the patient is instructed to focus on an item in the consulting room, such as a piece of furniture, and then describe the item in detail. Diversion exercises can be set as homework practice in which feelings of dysphoria serve as the cue to begin diversion. Patients can also be encouraged to experience aspects of the environment with as many sensory modalities as possible. These techniques are considered to be effective in distracting from negative rumination. Clearly, this approach relies on distraction by concurrent cognitive processing, but distraction can also be accomplished through changes in behaviour. For example, activity scheduling in the early phases of depression treatment, in which patients are encouraged to engage in behavioural activities, also has distracting qualities.

Experimental studies of the effect of distraction show that it can reduce the frequency of negative thoughts and reduce depressed mood. Fennel and Teasdale (1984) predicted on the basis of the cognitive model of depression that reducing the frequency of negative cognition should reduce depression in patients with major depressive disorder. In their study, patients were presented with slides of outdoor scenes and were asked to describe them in detail. In the control condition, depressed patients sat quietly looking at a square of white light projected on a wall. At intervals during each presentation a tone sounded, at which point the patients reported whether or not they were thinking depressing thoughts. On three occasions, they reported their thoughts aloud so that the content could be rated by independent judges. Depressed mood was assessed via visual-analogue ratings before and after the intervention. While the results of this study were in the predicted direction—that is, distracted patients reported fewer depressive thoughts than controls—the difference was non-significant. It is possible, however, that distraction only works in patients with relatively low levels of depression, and following this reasoning patients at or below the median in depression were examined separately. In this subgroup, the distracted patients reported a significantly lower frequency of depressive thoughts compared with control patients. These data suggest that distraction reduces the frequency of negative thoughts in mildly depressed (low endogenous) patients. These results were replicated in a further study by Fennell et al. (1987), in which one group of low endogenous and one group of high endogenous depressed patients were exposed to slides of outdoor scenes or a rectangle of white light in a within-subjects counter-balanced design. Distraction significantly reduced the frequency of depressing thoughts articulated by low endogenous patients. These patients also reported feeling significantly less depressed following distraction than following the control condition. An analysis of thought content revealed that distraction significantly reduced the frequency of "life"-related thoughts in both groups of patients. However, there was no significant effect of distraction on "experiment"-related thoughts. This was interpreted as evidence for distraction reducing the frequency of memory-derived negative thoughts. In other words, distraction results in "redirecting attention towards the processing of externally derived information rather than towards internally memory-derived information related to problems" (Fennell et al., 1987, p. 449). There are other explanations which could account for these effects. In particular, the type of distraction task used in these studies required a strategic deployment of attention by the patients, and this may have reduced attentional capacity for elaboration of depressive memories. If this is correct, then the attentional demands imposed by distraction and individual differences in subjects' ability to sustain attention are likely to mediate the effectiveness of such procedures. It is possible that distraction effects are less effective for high endogenous depressed patients because they have attentional control deficits, or, once established, their negative mood deleteriously affects their attentional control capabilities. In other words, they are unable to redirect their attention as instructed.

Aside from studies of the effect of distraction on depressive thoughts and mood state, some studies have looked at the distracting effect of depressive thoughts themselves. These studies hypothesise that depressive thoughts use up cognitive capacity available for other tasks. Krames and MacDonald (1985) used a dual task requiring concurrent recall of visually presented numbers with auditorily presented words. Depressed patients were tested under varying short-term memory load conditions in which none, three and six of the digits had to be retained in short-term memory. By examining the effect of memory load size on recall of words, it was possible to infer how much spare capacity depressives had compared with non-depressed subjects. The depressed subjects recalled significantly fewer words than non-depressed subjects across different levels of memory load. Interestingly, while the memory performance of non-depressed subjects deteriorated as memory load increased, the performance of depressed subjects significantly improved as memory load increased. These data were interpreted in terms of increased memory load displacing negative depressive thoughts which normally interfere with performance. Krames and MacDonald (1985, p. 571) also claimed: "This also suggests that task-relevant cognitions are placed higher in the subject's cognitive hierarchy than depressive schemata". This explanation is consistent with the view that external task-oriented processing can have an ameliorative effect on depressive thoughts. As we saw in Chapter 6, several studies demonstrate that the addition of a distractor can improve task performance in depressives.

It is evident from the foregoing discussion that distraction involving external-focused processing can reduce the frequency of negative thoughts and improve negative mood in mild depressed states. It is not clear whether a shift in the direction of attention from an internal to external focus or a change in the content of attention or both of these produces this effect. For example, we do not know whether self-focused non-depressive distractions have the same or a different ameliorative impact compared with externally focused distractions.

Distraction and anxiety

Empirical studies of the effects of distraction in anxiety can be divided into those which focus on the efficacy of attentional manipulations as ameliorative strategies in the treatment of test anxiety and related performance deficits, and studies which have explored the effects of distraction on anxiety during exposure-based treatments.

Attentional manipulations and performance in anxiety

The central role hypothesised for self-preoccupying rumination in impairing performance in test-anxious subjects has stimulated studies of the impact of distraction in reducing performance decrements and alleviating anxiety. Studies of this type have produced mixed results. Doleys (1976) reviewed the literature on distraction and found considerable variability in the effects of distraction on performance. This variability was attributed to the heterogeneous nature of samples and performance measures used in studies, and the varying nature of distractors employed.

More recent studies have examined the effect of distraction when used as part of a treatment package for test anxiety. For example, Thyer et al. (1981) compared two groups of test-anxious subjects, both of which received a common core cognitive-behavioural treatment (CBT) consisting of progressive muscle relaxation plus biofeedback and training in the use of positive self-statements and imagery techniques. The subjects in the distraction group were also trained in directing their attention towards the task. This was accomplished by having these subjects practise their relaxation and cognitive coping strategies in the presence of distractors. Explicit attention-directing instructions were given and modelled by the therapist. The impact of both procedures was assessed in terms of post-treatment anxiety levels and performance on an anagram task. While both treatments produced significant reductions in all anxiety measures and significantly improved anagram performance under distracting conditions, there were no significant differences between groups. The failure of the added distraction procedure to improve the overall effectiveness of CBT could be due to the redundancy of the distraction procedure in a multi-component treatment which employed other strategies also likely to reduce task-irrelevant thinking.

Wise and Haynes (1983) studied the relative effectiveness of a cognitive restructuring procedure and an attentional training technique in the reduction of test anxiety and performance deficits. Five, 1-hour weekly treatment sessions were administered to two groups of test-anxious subjects. One group received rational-restructuring in which subjects were trained to identify and modify irrational beliefs. The other group received attentional training in which they were instructed to reduce their attention to task-relevant variables. Both treatments were presented in the same format involving imaginal exposure to testing situations in which subjects were encouraged to use rational responding or the attentional technique to reduce anxiety. Both cognitive treatments were superior to a wait-list condition in reducing anxiety and improving performance on digit-span tasks. There were no differential treatment effects. However, it is difficult to determine the contribution of the cognitive techniques to the improvement obtained, since both techniques were combined with imaginal exposure which itself can exert a therapeutic effect. Notwithstanding this limitation, the authors interpret these effects within the context of Bandura's (1977) self-efficacy concept. Both techniques may have been effective because each provided an active coping strategy which improved expectations of personal efficacy. In attentional terms, it is likely that both procedures facilitated a reallocation of attention away from ruminative self-statements which reduced anxiety and improved performance. It is interesting to note that following both treatments, the gains made were maintained at 8 month follow-up.

If negative thinking interferes with performance, it would be reasonable to assume that cognitive self-control and coping strategies like imagery and positive self-statements should have the same effect, since they will pre-empt attentional capacity. One reason this might not occur is that positive self-statements may be less emotionally salient than negative thoughts and therefore demand less attention. Nevertheless, this suggests that under some circumstances, such as those requiting greater amounts of attention, self-control strategies are likely to have a deleterious effect on performance. Consistent with this view, Kanfer and Stevenson (1985) demonstrated that cognitive self-regulation and coping strategies can interfere with performance. They asked subjects to perform self-regulation (self-monitoring of performance and goal-setting for subsequent trials) or a maths task which was interspersed with continuous performance on a paired-associates task. These conditions were compared with a condition in which there was a brief time delay in place of the secondary task. Within each group, the attentional demands of the primary task was varied by varying memory set size (the number of paired-associates to be rehearsed). Both self-regulation and the maths task produced disruption on the more demanding version of the primary task. The finding of a disruption in the maths group suggests that it is not the specific content of the secondary task but the attentionally demanding nature of the task which disrupts performance. From a clinical perspective, this finding has important implications, as self-regulation techniques are often employed in the treatment of anxiety and they could have negative effects in situations involving high attentional demands. Kanfer and Stevenson (1985) note the importance of examining the cognitive demands of situations in which self-regulation skills will be applied in an attempt to optimise the efficacy of self-regulation procedures.

Since cognitive self-regulation procedures are attentionally demanding, it may be better to use less demanding distraction techniques in situations which require high degrees of controlled processing. Identifying and challenging negative thoughts, a central component of cognitive interventions, is likely to be highly attentionally demanding, since it requires complex semantic processing and conflict between voluntary processing and partly automatised beliefs. These techniques may be difficult to implement in situations requiring high attentional demands. Moreover, the initial efficacy of these procedures in alleviating emotional distress may be a function of their distracting nature. Cognitive theory (Beck et al., 1985), however, predicts that for long-term effectiveness the content of dysfunctional emotional schemas has to be modified as well, and this is an aim of relapse prevention work in cognitive therapy.

Attention, exposure and habituation

Distraction has been investigated as a potential enhancer of effects in exposure therapy. It has also been used as a control for non-specific cognitive rehearsal factors in comparative treatment outcome studies.

Systematic desensitisation (Wolpe, 1958) has traditionally been employed by behaviour therapists as an exposure treatment for phobias. The procedure is derived from the principle that fear is a conditioned response which can be inhibited or "counterconditioned" by pairing the feared stimulus with a response incompatible with fear. Typically, relaxation has been used to inhibit the fear response in conjunction with graduated exposure to the feared stimulus in imagination or in real life. Desensitisation has been shown to be effective without the relaxation component (Kazdin & Wilcoxon, 1976), which calls into question the counterconditioning account of treatment effects.

Aside from the view that relaxation serves as a counterconditioning influence in desensitisation, it has been suggested that relaxation functions as a distractor from fear cues. Nawas, Fishman and Pucel (1970) suggest that the attention required to focus on relaxation prevents the development of fear by reducing attention to fear-evoking aspects of the stimulus situation. Wilkins (1971) claims that during desensitisation, subjects switch their attention back and forth from feelings of relaxation to the feared stimulus. If the subject becomes highly anxious, then attention is switched to relaxation. Weir and Marshall (1980) tested the prediction that the provision of a distractor in place of relaxation reduces fear in snake phobics undergoing desensitisation. The subjects who received imaginal desensitisation plus relaxation showed significantly greater improvements on self-report anxiety than subjects who received desensitisation plus distraction or subjects receiving a combination of relaxation, distraction and desensitisation. However, the relaxation and distraction groups did not differ significantly on a measure of increased phobic approach behaviour. An examination of the effect of distraction on the clarity of imagined scenes revealed that it reduced clarity, whereas relaxation increased scene clarity. Following from this, Weir and Marshall propose that relaxation does not function as a distractor in desensitisation therapy but it enhances scene clarity and thereby maximises exposure. Distracting stimuli in contrast appear to reduce exposure in imaginal desensitisation. The effect of relaxation can still be interpreted in attentional terms relating to the concept of distraction. Rather than relaxation providing a means of distraction from fear cues, it appears to reduce distraction, and it may thus facilitate intensive focused attention on anxiogenic images and thereby increase exposure.

Although the evidence on the efficacy of added distraction components in treatment is mixed, there is some evidence to suggest that the use of distraction in specific treatment protocols can be disadvantageous. In particular, distraction used in conjunction with exposure has been associated with increased return of fear following treatment. Sartory, Rachman and Grey (1982) showed that return of fear, which occurs in some phobics who have undergone flooding type treatments, is increased when distraction is used following exposure compared with when subjects are instructed to think about the phobic object following exposure. Thinking about the phobic object following exposure is likely to extend exposure and therefore improve outcome. Grayson, Foa and Steketee (1982; 1986) conducted two studies exploring the effect of attentional manipulations, including distraction on return of fear and habituation in obsessive-compulsives. In the first study, the impact of distraction or attentional focusing during exposure of individuals with washing rituals was compared. In a crossover design, the subjects received either exposure with distraction on the first day followed by exposure with attentional focusing or vice versa. Both conditions were associated with decreases in self-report within-session anxiety; however, fear only remained reduced on day 2 in subjects who had focused their attention on the stimulus during exposure on day 1. In order to determine whether this effect was the result of attention-focusing facilitating habituation or whether distraction had impeded habituation, a second study was conducted (Grayson et al., 1986). This second between-group study compared attention-focusing with distraction when both were used in conjunction with exposure to a most feared contaminant in obsessive-compulsives with washing rituals. In the attention-focusing condition, the therapist engaged the subject in conversation about the contaminant that the subject was holding and the discomfort it aroused. The most feared contaminant was used; for example, a subject fearful of contamination by urine held a paper towel dampened with urine. In the distraction condition, the subject held the contaminant in one hand while playing a video game with the other. Dependent measures were heart rate during exposure and subjective anxiety ratings. Distraction was associated with a greater (but non-significant) reduction in self-report anxiety on the first day of exposure than attentional-focusing. In contrast, the attention-focusing group showed significantly greater decreases in heart rate during the middle and later stages of exposure compared with the distraction group. That heart rate remains elevated throughout exposure under distraction suggests that distraction inhibits heart-rate habituation, but may facilitate habituation of subjective anxiety. In this particular study, the attention-focusing condition incorporated instructions to focus on both the external features of the stimulus and internally on discomfort. It is not known whether external or internal attention-focusing or a combination of both is associated with habituation.

In summary, the studies reviewed in this section suggest that distraction during exposure to feared stimuli can affect the degree of phobic avoidance, subjective anxiety and return of fear following exposure. In general, attentional strategies which divert attention away from external feared stimuli seem to be associated with a reduction in subjective anxiety during exposure. However, distraction following or during exposure appears to be associated with a greater return of fear compared with focusing on the feared stimulus. The causal mechanisms underlying such effects are currently unknown, and the comparative impact of within-modal distraction (e.g. external feared stimulus plus external distraction) and cross-modal distraction (e.g. internal feared stimulus plus external distraction) has not been investigated. A problem connected with this is the potential ambiguity of the nature of the feared stimulus. For example, a claustrophobic who fears elevators, may not actually be afraid of the external stimulus, but of internal bodily consequences of exposure to elevators. That is, he or she may fear suffocating or losing mental control when in the situation. Distraction may therefore be most effective when it is used to reduce attention to bodily sensations during exposure, rather than used to reduce attention to features of the elevator. In the next section, we examine evidence of the effects of internal versus external distractions.

Internal and external attention manipulations in anxiety

There is evidence from another source that external and internal attention have a differential effect on physiological responses to noxious stimuli (Epstein, Rosenthal, & Szpiler, 1978). In this study, subjects were exposed to a noxious stimulus consisting of six trials of 0.5 sec bursts of white noise presented on the count of 8 in a 12-point count up. The responses of four groups of subjects were compared: a control group, a distraction group, an external attention group and an internal attention group. The subjects in the distraction group were required to ignore the noise by carrying out a letter cancellation task, whereas the subjects in the external attention condition were asked to concentrate on external features of the experiment. The internal-attention subjects were asked to concentrate on their feelings and inner reactions to the noise. The results revealed that increased attention, especially inward attention, increased arousal (measured by intensity of galvanic skin response: GSR), whereas distraction reduced arousal during the anticipatory count-up to noise presentation. All the subjects showed habituation of GSR across trials with no significant differences between groups. External attention was associated with heart-rate deceleration, while internal attention was associated with increased GSRs during anticipation of the noxious stimulus. Non-specific GSRs have been viewed as a measure of anxiety (Szpiler & Epstein, 1976), and if this is correct, it suggests that internal attention intensifies anticipatory anxiety.

The anxiety-intensifying effect of self-focus, which has been demonstrated in other studies using phobic and analogue-stress stimuli (Carver et al., 1979; Wells, 1991), could be beneficially employed to maximise exposure effects in some subjects. More specifically, anxiety disorders which consist of a central "fear of fear" (Goldstein & Chambless, 1978) element—such as panic and agoraphobia, in which the fear is of bodily sensations, typically those accompanying anxiety—might respond favourably to self-attention plus exposure to situations invoking feared sensations. Distraction from internal cues in such subjects could feasibly reduce the intensity and duration of exposure, and thus compromise exposure effectiveness. Craske et al. (1989b) studied the effect of focusing on feared somatic sensations or the practising of a distraction task during *in vivo* exposure of patients with panic disorder and moderate to severe agoraphobia. The results did not confirm an advantage for attentional focusing over distraction. In fact, the distracted subjects tended to show superior outcome post-treatment, but at 6 month follow-up the attention subjects showed a tendency to improve over the follow-up period. None of these differences were, however, statistically significant.

Emotional processing and attention

Information-processing accounts of anxiety and fear reduction have been based on models of memory networks (Bower, 1981; Lang, 1977; 1979). These models hold that anxiety results from the activation of particular emotional memory structures, which contain propositional information about feared stimuli interconnected with information about psycho-physiological and behavioural responses. Activation of part of these networks is thought to spread to connected meaning, affective and response "nodes" (Bower, 1981). Lang (1977) suggests that images accompanying fear reactions are constructed from this propositional information stored in memory. Lang's (1977) analysis of fear structures as networks in memory suggests that they consist of information about (1) the feared stimulus situation, (2) verbal, physiological and behavioural responses, and (3) information about the meaning of the stimulus and response elements of the structure. The structure is considered to be a programme for escape and behavioural avoidance.

The fear network model has been elaborated by Foa and Kozak (1986) in an attempt to explain the process of fear reduction in anxiety disorders. In order for effective treatment to occur, fear structures have to be accessed and incongruent information incorporated in them. This "emotional processing" (cf. Rachman, 1980) is indicated by within-session and between-session reductions in anxiety, and more objectively by evaluating changes in psychophysiological responsivity to feared stimuli. Foa and Kozak (1986) suggest a number of factors which may interfere with emotional processing, such as high arousal and cognitive and behavioural avoidance. These may result in a failure to incorporate fear-incongruent information in the fear structure. Rachman (1980) suggests that neurotic symptoms like inappropriate fears, intrusive thoughts and sleep disturbances are examples of the failure to process emotionally, that is, a failure to incorporate fear-incongruent information in fear networks. He suggests other factors which may contribute to failures: repeated exposure to disturbing material under uncontrolled conditions, brief presentations, presentations that evoke no autonomic reactions, fatigue, irregular stimulation, and absence of perceived control.

Foa and Kozak (1986) hypothesise that waning of physiological responses during confrontation with feared situations generates interoceptive information about the absence of physiological arousal. This new information is thus available for encoding as response propositions that are inconsistent with those of the pre-existing fear structure and thus fear responses decline.

The fear network model predicts that attentional strategies during exposure could have either positive or deleterious effects on emotional processing. Directing attention away from the stimulus situation reduces the opportunity to incorporate safety information in the fear network, while diverting attention from the physiological self (i.e. response information) in fear situations reduces the subjective intensity of arousal and reduces the probability of appraising the arousal as harmful. In general, then, attention to external threat stimuli will have positive effects, whereas attention to internal response factors could be detrimental. This appears to be a simple external versus internal attention dichotomy. The picture is complicated, however, when we consider fear stimuli which are internal, such as bodily sensations which are the focus of catastrophic misinterpretation in panic disorder and health anxiety. In such cases, attention to sensations during prolonged exposure may be beneficial for emotional processing only if disconfirmatory information is implicit in the attentional procedure or is made available. This clearly happens in cognitive therapy, which employs interoceptive exposure exercises to modify misinterpretations in panic. We are left with the question of why corrective information is not in the normal course of panic encoded in the fear structure, even though these patients spend a great deal of time focusing attention on their sensations and feared catastrophes do not result. There are several possibilities. First, these patients attempt to avoid feared catastrophes by using covert safety behaviours and overt avoidance and so they reduce their exposure to disconfirmatory experience. Second, panic patients report using distraction from sensations as a means of maintaining self-control. And, third, disconfirmatory information is not present in bodily sensations in the same way that it can be in external situations. A potential problem with focusing on sensations in panic is that it could strengthen the relationship between trigger sensations and somatic anxiety responses in a way that the link was no longer moderated by propositions. That is, stimulus and response information could be stored in closely associated representations, since they are highly similar. Under these circumstances, the perception of sensations could automatically elicit anxiety responses through spreading activation.

Ideally, PDP models of network function might be used to explain the role of attention in the learning of fear-incongruent information. However, the PDP approach is insufficiently developed for this purpose; the PDP models of attention discussed in Chapter 2 are concerned with stable performance rather than with learning. The role of attention in skill theory does provide some pointers to how theory might inform use of distraction as a therapy. Ackerman (1987; 1988) proposes that attention facilitates learning mainly in the early stages of skill acquisition, when the person is replacing explicit declarative knowledge of how to perform the task with a set of lower-level procedures, or, in other words, replacing controlled with automatic processing. In support of this hypothesis, Woltz (1988) showed that a working-memory-based measure of controlled attention predicted the early but not the late stages of procedural learning. Attention appears to assist the initial formulation of a strategy for performance of an unfamiliar task, and in selecting and running the initial selection of procedures made (Matthews et al., 1992). However, subsequent strengthening and tuning procedures are not assisted by voluntary attention: Schneider (1985) suggests that attention may actually interfere with automatisation at this stage.

In the distraction-based therapies discussed previously, the patient has to learn a "task" which is novel in two respects. First, diversion of attention to the distracting stimuli in the therapeutic setting may be unfamiliar. Second, it is unlikely that patients are able to attend to the distractors so intensively that threat stimuli are completely excluded from awareness. In most cases, it is likely that the patient learns some time-sharing strategy for attending to both sources of stimuli. This process might alternatively be conceptualised as integrating fear and distraction stimuli within the same network. Hence, the patient is in effect learning a new skill for attentional control, which will require attentional resources (see Hirst, 1987, for a detailed analysis of divided attention as a skill). Learning will be disrupted by additional demands for resources, such as the strong intruding thoughts to which severely disturbed patients may be prone. Several predictions may be derived from this hypothesis. First, we may assume that relaxation tends to reduce calls for attention generated by intruding events such as arousal. Relaxation should then be more effective when combined with a therapy such as distraction, which restructures the patient's attentional strategy, and less effective on its own. Second, distraction will only be effective to the extent it promotes attentional restructuring. If, as in studies of return of fear (Sartory et al., 1982), it distracts from the restructuring process, it will have detrimental effects. Third, the effects of distraction will be modified by arousal. Because high arousal tends to reduce attentional selectivity (Eysenck, 1982), it will impair the distribution of attention across the two "task components" of attention to the distractor and attention to internal cognitions. If internal processing is prioritised, as is likely in more severely disordered patients, attention to the distractor will be reduced. Possibly, high arousal associated with panic impairs spontaneous processing of safety information in these patients. Fourth, attentional resource availability will be more important in the early stages of therapy. Once the patient has learnt how to control the focus of attention, the process is only weakly resource-limited, at most. The implication is that the distraction should perhaps be combined with relaxation early on, but combined with other cognitive-behavioural techniques intended to activate and modify maladaptive cognitions later in therapy.

Attentional training

Reports of heightened self-focused attention in a wide range of emotional disorders, especially anxiety states such as panic, generalised anxiety, health anxiety and social phobia, have led to theorising about the possible role of self-focus in these disorders. Rather than viewing self-focus as a consequence of anxiety, Wells (1991) has suggested that it can be an important factor in the aetiology and maintenance of anxiety disorders. This hypothesis was derived from data showing that individuals high in dispositional self-focus report greater anxiety in threatening situations (Wells, 1985; 1991), and appear to use fewer coping strategies when exposed to life stresses (Wells & Matthews, 1994), as discussed in more detail in Chapter 9. Similarly, Ingram (1990) suggests that self-focus may be involved in the intensification as well as the initiation of negative affect. In view of the potential role of self-focus in maintaining negative emotional states, Wells (1990) devised an attentional training procedure designed to reduce high degrees of self-focused attention. The strategy evolved in the form of treatment development work with panic and generalised anxiety disorder patients. Preliminary attempts to modify habitual self-focusing in patients using visual-based exercises proved to be disappointing. However, auditory-based external attention tasks seemed to produce better results. This latter task was designed to modify multiple dimensions of self-attention and involved three phases: a selective attention phase, attentional switching, and a divided attention phase. Within each phase, the task difficulty was incremental, so that the procedure was intended to require progressively greater attention. The rationale behind the different phases was that attention is multidimensional and any one or combination of dimensions could be involved in anxiety maintenance. More specifically, self-focus in anxiety could be excessive in terms of the degree of attention focused on the self as opposed to externally. In this case, a procedure requiring progressively higher degrees of external focus could be beneficial. Self-focus could be inflexible—that is, the individual lacks attentional control skills (perhaps because self-focus becomes automatic)—so that practice in attentional switching/control has an ameliorative effect. Finally, the individual may display very narrow, overly selective attentional focus, in which case practice in dividing attention could be helpful in modifying high self-focus. Moreover, divided attention would require the highest amount of attentional resources, and thereby distract most from self-focus. The impact of this procedure was evaluated in a single case study of a patient with panic disorder and relaxation-induced anxiety (Wells, 1990). The study showed that attentional training reduced self-report anxiety and eliminated panic attacks. Conversely, relaxation training (abbreviated autogenic training) which required bodily self-focus was associated with a return of panic and escalation of self-report anxiety. After a final phase of attentional training, the patient was followed up over a 12 month period, during which time she remained panic-free. Wells, White and Carter (in prep.) have obtained similar anxiety-reducing effects of attentional training in two patients with panic disorder and one social phobic in a single case series. Although it is premature to generalise from these studies, the results suggest that attentional training can produce decrements in anxiety that are stable over time.

Several mechanisms could underlie the ameliorative impact of attentional training on anxiety. A shift away from self-focus is likely to reduce the perceived intensity of affective and somatic responses. The use of distraction could also imply that such responses are harmless and to be ignored. While the procedure draws attention away from the physiological state, it will also reduce attention to negative thoughts in emotional states. A shift away from self-focus could have an effect on both the form and the content of cognition. In terms of processes, external-focus may free-up attentional capacity so that belief-incongruent information can be processed. It could also facilitate the patient's spontaneous development of self-regulatory or meta-cognitive processes capable of facilitating emotional and cognitive change. Such processes may be normally disrupted by an input of self-focused attention. Considering content parameters, the reduction in emotional intensity accompanying external focus is likely to increase coping appraisals and decrease the belief in negative thoughts. In a single case replication series, Wells et al. (in prep.) investigated the effect of attentional training on anxiety and belief levels in three patients with anxiety attacks who misinterpreted bodily sensations in a catastrophic way. All the patients showed clinically significant reductions in both anxiety and belief in misinterpretations following brief attentional training (up to four sessions plus daily homework practice). These results are consistent with the view that attentional modification can lead to change in dysfunctional beliefs, although there is insufficient evidence at present to determine whether this is the primary mechanism of change.

Eye-movement desensitisation

Eye-movement desensitisation (EMD) employs saccadic eye movements in the treatment of post-traumatic stress disorder, although the technique has also been used with other anxiety syndromes. The technique was developed by Francine Shapiro (1989a; 1989b) and involves eliciting from a patient periods of saccadic eye movements (tracking of rapid back-and-forth movements of the therapist's finger) while the patient maintains in awareness one or more of the following: an image from the traumatic memory; a negative self-statement or assessment of the trauma; and the physical anxiety response. The best response is reputed to occur when all three representations are held in consciousness (Shapiro, 1989a). Typically, at various stages during the procedure, patients are required to rate their anxiety level and validity of their negative cognitions. The EMD procedure has been shown to be more effective in treating traumatised subjects than a placebo condition used to control for length of exposure to the traumatic memory, and repeated administrations of anxiety and belief ratings (Shapiro, 1989b). While the technique appears promising in the desensitisation of traumatic memories, the mechanism underlying treatment effects is not understood. The procedure clearly involves the division of controlled processing resources. Subjects are required to simultaneously focus internally on images, verbal propositions and physical responses, and externally on finger movements. Attention to internal representations of both the stimulus and response features of the traumatic memory is likely to facilitate more complete activation of fear networks. However, external tracking could reduce the intensity of self-focused attention, by focusing on negative self-evaluative cognition and physical state. According to Duval and Wicklund (1972), motor activity (which could be eye movements in the EMD case) distracts attention away from the self by directing it outward. Thus under divided attention and saccadic eye-movement conditions, one would expect that self-evaluation would be more difficult and awareness of emotional arousal would be reduced. Activation of the trauma memory may thus become associated with gradual decrements in subjective stress, and this new information will be incorporated in the network.

Attentional training and EMD are particularly intriguing. They appear to cause long-term improvement simply by periodically changing the focus of attention, rather than by explicitly modifying the patient's self-beliefs. This finding is challenging to cognitive theory, which attributes psychopathology to the content of the permanent store of self-knowledge, which might be modelled by schema theory (Beck, 1967) or fear networks (e.g. Foa & Kozak, 1986). There are two broad ways in which externalising the focus of attention maybe beneficial. First, it may allow patients to learn strategies for attention control. When a negative thought intrudes into awareness, such as a panic patient's initial perception of a somatic symptom, the patient may be able to prevent full self-focusing and activation of pathological knowledge structures. In other words, the patient learns to decouple or disengage attention from negative beliefs and appraisals even though they remain latent in long-term memory. These approaches are likely to promote learning of attentional skills because their induction of external attentional focus prevents the drain of attentional resources associated with a self-focused worrying style of attention. Second, externalisation of attention may, somewhat paradoxically, facilitate patients' own spontaneous efforts to modify self-beliefs. External focus may allow patients to reason about their condition in a detached, problem-focused manner without being overwhelmed by their personal engagement with their difficulties. Moreover, the distress-reducing effect of attentional manipulation may lead patients to spontaneously revise their negative interpretations of the meaning of their problem. In view of the foregoing discussion, we might predict that cognitive therapies targeted at modifying dysfunctional beliefs and appraisals would be more effective if combined with an attentional manipulation. It should be emphasised, however, that more work is required on the therapies concerned before more than tentative hypotheses can be advanced.

Conclusions

In this chapter, we have examined the effects of attentional manipulations as moderators of treatment effectiveness, and attentional explanations of existing therapeutic effects such as those ascribed to desensitisation. We have discussed theoretical issues surrounding the use of attentional manipulation strategies in the treatment of anxiety. The studies reviewed provide a mixed picture of the effects of distraction-based manipulations in the treatment of anxiety and depression. In general, and in contrast with the view that distraction may compromise treatment effectiveness, distraction appears to have at least short-term beneficial effects on anxiety measures and on negative thinking and mood in depression. Task-focusing attentional instructions similarly produce positive results on performance and anxiety measures in test anxiety. There is some evidence, however, that distraction used *following* exposure may interfere with the effectiveness of exposure treatment and increase the likelihood of return of fear (Sartory et al., 1982). In contrast, other evidence suggests that distraction *during* exposure or attention to sensations during exposure do not produce significantly different outcomes in the immediate or longer term in panickers with agoraphobia (Craske et al., 1989).

There are a number of issues which compound the interpretation of the data reviewed in this chapter. First, it is difficult to disentangle the effects of attention manipulations from the broader treatment techniques which have been used in concert with attentional strategies in some studies. Second, attention has been treated as a relatively uncomplicated variable in most studies. For example, many of the studies reviewed use basic distraction from self-relevant information such as negative thoughts or emotional state, and fail to consider whether it is this shift from self to non-self processing or some other dimension of attention which underlies the effect observed. More specifically, the practice of distraction techniques may not only reduce awareness of internal events, but may also increase perceptions of the subjective control of attention, and counteract any "adhesiveness" of attention to particular stimuli. The third issue concerns the context in which distraction is embedded as a strategy. The context may determine whether distraction facilitates or impairs anxiety change. If distraction is used in a manner which enhances beliefs about coping and/or de-catastrophises the experience of internal events, then the outcome is likely to be positive. However, if distraction is used as avoidance, there may be reduced opportunity for belief change and associated changes in anxiety. Studies of the effect of distraction should attempt to explore its interaction with contexts so that the relative contributions of these dimensions can be assessed.

Attention modification techniques such as attention training (Wells, 1990) initially show promise as powerul and economical strategies for treating some anxiety problems. Interventions of this type could be employed both to enhance belief change and to modify attentional strategies of the individual which contribute to stress vulnerability.

11

ATTENTIONAL DISORDER

Cause or consequence of emotional problems?

An essential question in conceptualising attentional processes in emotional dysfunction concerns whether or not these processes have a direct causal or a contributory role in dysfunction, or are merely a consequence or epiphenomenon of such dysfunction. The causality issue can be approached from a longitudinal perspective by considering the development of emotional problems over a time-course. In this framework, relatively stable attentional factors could increase individual vulnerability to emotional disorders by their interaction with other person and environmental variables. In this scenario, attentional "disorder" may predate emotional problems. In contrast, attentional disorder may result from emotional disturbance. Nevertheless, even if emotional problems cause particular attentional phenomena, these phenomena could still play a role in transforming normal emotional reactions into pathological ones. More specifically, there could be individual differences in the type and intensity of certain attentional responses under states of stress, some varieties of which could contribute to the development of emotional disorders.

Several techniques, of varying directness, have been used to investigate questions of causality. The most satisfactory are the direct experimental manipulation of attention or emotion, and longitudinal observational studies of their relationship. Inference of causal relationships from regression or path analysis of cross-sectional data is possible but of reduced validity. An even less direct method is to compare trait and state effects. Usually, emotion is seen as a property of transient states, whereas personal characteristics of greater temporal stability are usually considered to be cognitive in nature (schemas, for instance). Thus, if trait "emotion" effects on attention are stronger than state effects, the data suggest that stable cognitive structures associated with the trait are the causal agents. (We must assume here that emotions are cognitively generated, which some theorists, such as Zajonc, 1984, would not accept.) If state effects are stronger, we must look at the exact nature of the state. For example, correlations between state anxiety and attention are uninformative about the causality question because state anxiety has both cognitive and emotional elements. In this context, we see both clinical disorders and trait questionnaire measures as indexing "traits", in the sense of characteristics enduring over several months or more. Finally, another technique is to compare current and recovered patients. If we find that recovered patients show normal emotional functioning but abnormal cognitive functioning, we can infer that cognitive impairment may be a stable "vulnerability" characteristic of the person which predisposes the individual to clinical disorder, but is not the sole cause. Eysenck (1992) distinguishes between a manifest vulnerability which is a persistent abnormality independent of mood state, and a latent vulnerability which is only apparent under stress or anxious mood.

Experimental studies

The studies which we have reviewed previously in this book reliably show that states of emotional arousal have an effect on several dimensions of attentional functioning. For example, sad mood increases the intensity of self-focused attention (Carr, Teasdale, & Broadbent, 1991; Sedikides, 1992; Wood et al., 1990). We have shown in Chapter 6 that anxiety states and depression are correlated with performance decrements and increased distractibility in certain types of task. Manipulations of depressed emotion also appear to impair performance of effort-demanding memory tasks (Ellis & Ashbrook, 1987). It is difficult to draw any conclusions concerning anxiety from manipulation studies, because the manipulations generally work by changing the person's cognitions. For example, evaluation manipulations used in test-anxiety research presumably affect the perceived importance of successful performance. Surprisingly, direct physical threats to the person, investigated primarily in field-based studies of fear and danger, have relatively minor effects on performance, perhaps because the person is strongly motivated to compensate for any loss in performance efficiency (Idzikowski & Baddeley, 1983).

While these findings are consistent with the hypothesis that emotion causes attentional disorder, there is also evidence to suggest that attentional factors could have a causal role in emotional disorder. Two sources of evidence support the causal hypothesis. First, there is evidence which shows that situationally intensified self-focus exacerbates existing emotional responses (Carver et al., 1979; Scheier & Carver, 1977; Scheier et al., 1981), and chronic self-attention tendencies interact with other situation and person variables in producing anxiety (Wells, 1985; 1991). This pattern of results is consistent with the view that self-focus: (1) predisposes to emotional stress; (2) is a response to certain negative emotions; and (3) may maintain negative emotional responses in a positive reciprocal relationship.

One limitation of many of the studies of self-focus and emotional reactions, however, is that they confound self-focus and emotionality effects. More specifically, as self-focus and negative affect measures are positively correlated, it is unclear whether the types of effects observed for high self-focus subjects are due to differences in level of self-attention or general negative affectivity. By controlling for the relationship between self-focus and depression/anxiety, Ingram, Johnson, Bernet and Rowe (1992) have provided particularly convincing empirical support for the view that the dispositional equivalent of self-focused attention, private self-consciousness, serves as a vulnerability factor for emotional distress. In the first of two studies, subjects were given a bogus intelligence test followed by success or failure feedback about their performance on the test. Only those subjects falling at or below the normal level of depression on the D30 depression scale (Dempsey, 1964) were selected for the study. Of those subjects selected, half scored at least one standard deviation above the mean for private self-consciousness (chronically self-focused group) and half scored at one standard deviation below the mean (non-self-focused group) on this measure. Using Beck depression scores at the time of testing as a covariate, the results showed that chronically self-focused subjects in the failure condition reported significantly more negative affect than self-focused subjects in the success condition. The self-focused failure subjects also reported more negative automatic thoughts than the self-focused success subjects. Interestingly, self-focused subjects in the success condition reported fewer negative automatic thoughts than non-self-focused subjects in the same condition. These data demonstrate that self-focused subjects show greater affective reactivity than non-self-focused subjects. In a second experiment, which employed a longitudinal and naturalistic design, subjects were monitored over a 10-week period to determine whether chronically self-focused subjects were more vulnerable to experiencing dysphoric affect than control subjects, while controlling for the number of life events and depression and anxiety levels. Although there were no differences in dysphoria—measured with the Beck Depression Inventory (Beck et al., 1961) and the "state" anxiety subscale of the STAI (Spielberger et al., 1970)—in the initial phase of the study, vulnerable subjects (non-dysphoric and high in private self-consciousness) showed greater variability and higher scores than non-vulnerable subjects (non-dysphoric and low in private self-consciousness) across the 10-week study period. In addition, at some point during this time period, nearly half of the vulnerable subjects reported depression scores above the cut-off for mild depression. In summary, these results support the view that dispositional self-focus is a risk factor for the development of emotional distress, and are consistent with the view that self-focus has a causal role in the aetiology of emotional disorder.

A related line of research concerns the effects on mood of rumination, thinking about one's emotions and their personal consequences (Nolen-Hoeksma, 1991). Laboratory studies reviewed by Nolen-Hoeksma (1991) suggest that induced rumination has little effect in non-depressed subjects, but serves to maintain induced or naturally occurring depressed moods. Diary and clinical studies also show an association between a ruminative response style and longer duration of depression. Rumination is said to activate negative cognitions, maintaining the vicious circle connecting depressive affect to negative beliefs. Nolen-Hoeksma (1991) distinguishes the role of rumination from that of self-focus of attention in depression. While self-awareness theories suggest that self-focus is induced by negative events, she argues that rumination should contribute to a prolongation of depressed mood even when there is no obvious cause for the mood. This is not strictly the case, however, since non-negative events can also induce self-focus (e.g. audience presence, increased physiological arousal) under which circumstances self-discrepancies may be activated. Nolen-Hoeksma (1991) further distinguishes her rumination theory from self-awareness theory of depression in suggesting that focusing on one's emotional state (and the causes and consequences of it), even in the absence of a self-discrepancy, is enough to maintain depression. This perspective is somewhat confusing, however, since it still specifies self-focus as an important variable and, moreover, the affective state could be viewed as one type of real–ideal discrepancy. Nolen-Hoeksma (1991) cites an unpublished study by Morrow which partially discriminated effects of rumination and self-focus. Rumination and focus on emotional state maintained an induced sad mood, but focus on non-emotional aspects of self did not. Although further work may be necessary to determine the exact relationship between rumination and self-focus, Nolen-Hoeksma's (1991) work demonstrates how attention to emotional symptoms influences the maintenance of emotion.

Longitudinal studies of depression, anxiety and cognition

Attributional style

Longitudinal studies tracking the interrelationships of pathology and cognitions over time are particularly apt for investigating causality. The great majority of these studies have investigated depression, but not anxiety, so in this section we are mainly concerned with the former disorder. In clinical contexts, there has been particular interest in the hypothesis that attributional processes are among the causes of depression. Since people show a degree of temporal stability in their attributions of the causes of events, it may be attributional style which is responsible for both the emotional and the attentional expressions of depressive psychopathology. The reformulated theory of learned helplessness and depression (Abramson et al., 1978; Peterson & Seligman, 1984) proposes a diathesis-stress model, which states that individuals who make internal, stable and global attributions for failure are particularly prone to develop depression following uncontrollable or negative life-events. Such individuals might, for example, believe that they are irredeemably worthless in every area of their lives. Cross-sectional studies do indeed show correlations between attributions and depression (Peterson & Seligman, 1984). Sweeney, Anderson and Bailey (1986) report a meta-analysis of 104 studies, which found that depression was more strongly related to attributions for negative rather than for positive outcomes. The attributional style of depressives for negative events was exactly as predicted by the theory, but depressives' attributions for positive events showed the opposite pattern of tending to be external, unstable and specific.

Perhaps more importantly, reviews of longitudinal studies run to test whether attributional style has a causal effect on depression have generally arrived at pessimistic conclusions. Barnett and Gotlib (1988) found that in studies controlling for depressive symptoms at the first occasion of measurement, attributional style generally fails to predict subsequent depression. Two out of four studies of post-partum depressive symptoms did provide support for the hypothesis of attributional causality. Tiggeman, Winefield, Winefield and Goldney (1991) report a 3-year longitudinal study, which showed that depressives' attributions were neither an antecedent nor a consequence of depressive affect. Parry and Brewin (1988) argue that the symptom model cannot fully account for the observed data. They suggest that both attributional style and life events may act as independent risk factors for subsequent depression. There is better evidence that attributional style predicts recovery from depression: Brewin (1985) cites three studies in which the attributions of already depressed patients predicted subsequent changes in depression. Manipulation of attributions in depressed patients also seems to affect mood appropriately (Miller & Norman, 1981).

Other cognitive measures

Longitudinal studies of attributional style may have been unsuccessful because they have failed to assess the cognitive variables which are the true causal agents. A variety of other cognitive measures have been used in studies of causality. For example, Brown et al. (1986) found evidence for a causal effect of negative self-evaluation on depression following a severe life event. Brewin and Furnham (1986) report a path analysis of a retrospective study which showed that negative beliefs predicted both attributions and depression, but there was no direct link between attributions and depression. The beliefs concerned were "consensus judgements" of negative outcomes, such as beliefs that the outcome was more likely to happen to oneself than to others. In experimental research, Greenberg, Pyszczynski, Burling and Tibbs (1992) showed that induced self-focus after a failure experience generated attributions typical of depressives in both mildly depressed and non-depressed subjects, implying that the relationship between depression and attributional style may be mediated by self-focus. Mearns (1991) reports cross-sectional and longitudinal data showing that beliefs in ability to regulate negative moods predict depression following the end of a romantic relationship. Positive beliefs are associated with active coping, but correlate with reduced depression and somatic complaints even when use of coping strategies is statistically controlled (Kirsch, Mearns, & Cantanzaro, 1990). Marshall and Lang (1990) used structural modelling of cross-sectional data to show that self-mastery or personal control seemed to affect symptoms of depression directly, but generalised optimistic beliefs did not. Ineffective coping has also been implicated in the aetiology of depression. Rohde, Lewinsohn, Tilson and Seely (1990) ran a 2-year study of 742 older adults, which showed that coping through "ineffective escapism" correlated with both present depression and change in depression over time, particularly in individuals subject to life stressors. They also found some indications that active "self-control" predicted less future depression, regardless of life stress. These results are interpreted as being consistent with a cycle in which maladaptive coping generates depression, which in turn maintains maladaptive coping. Nezu and D'Zurilla (1989) review several cross-sectional studies and one longitudinal one which show that stressful events are more strongly related to depressive symptoms in people with poor interpersonal problem-solving skills. They argue that competence in problem-focused coping buffers against stress. Unfortunately, there is generally too little research on the causal role of these non-attributional cognitive factors to assess the reliability of causal effects, though Barnett and Gotlib (1988) review several studies which provide only weak evidence for a causal effect of Beck's (1967) dysfunctional attitudes.

Alloy, Abramson, Metalsky and Hartlage (1988) have responded to some of the criticisms of the attributional style hypothesis by claiming that the studies conducted to test it (including their own!) were inadequate for that purpose. They state that the hypothesis is concerned with a specific type of depression, "hopelessness depression", which must be distinguished from other variants of depression. Also, it is the "expectation of hopelessness" rather than attributional style which is the primary cause of depression, so that under certain conditions attributions may not be predictive of depression. Various methodological difficulties with existing research are also discussed, such as a failure to test adequately for an interaction between attributional style and life events. It may be that future research along the lines suggested by Alloy et al. (1988) will vindicate the basic diathesis-stressor approach of Abramson et al. (1978). One recent study (Metalsky & Joiner, 1992) used a longitudinal design to show that depression was predicted by the interaction of life stress and three cognitive diatheses: generality of attributions, perceived likelihood of negative events leading to negative consequences, and elicitation of negative inferences about the self following negative events. However, hopelessness did not seem to play the central role hypothesised by Alloy et al. (1988): it only partially mediated two out of the three interaction effects.

Longitudinal studies of depression: Conclusions

Methodological issues

Alternative explanations for the weakness of causal effects of attributional style and other cognitive variables in depression concern methodological issues. Robins (1988) suggests that the statistical power of designs used to test cognitive theories is often inadequate. Costello (1992) identifies a number of general conceptual problems with cognitive research, such as difficulties in defining and distinguishing concepts. There are also difficulties in measuring the schemas or other types of knowledge which may cause depression. Self-report measures may be invalid because thought content is affected by factors other than the schema, such as cues provided by the assessment itself (Spielman & Bargh, 1990).

Kuiper, Olinger and Martin (1990) point out that longitudinal studies of cognitive theories often adopt rather simplistic hypotheses which do not adequately test the cognitive model to be evaluated. As an example, they take Beck and Epstein's (1982) distinction between vulnerability cognitions related to thoughts of hopelessness, and state-dependent cognitions associated with automatic negative thoughts. Rholes, Riskind and Neville (1985) found that, as the Beck and Epstein (1982) model predicts, hopelessness predicted future depression in a longitudinal study but automatic negative thoughts did not. Studies which fail to distinguish between different kinds of negative belief are unlikely to identify causal agents. Kuiper et al. (1988) make further distinctions between different negative cognitions in their own work. They suggest that vulnerability to depression is associated with dysfunctional self-worth contingencies, which are beliefs that unrealistic goals must be attained to maintain self-worth, such as being liked by everyone. More general negative beliefs are associated with a negative self schema, which develops as a concomitant of depression. These hypotheses do not seem to have been tested against longitudinal data, however. Another reason for the inconsistency of the data may be the role of negative mood. Individuals vulnerable to depression show an increased incidence of dysfunctional beliefs only when in an induced or naturally occurring depressed mood (Miranda, Persons, & Byers, 1990). Miranda et al. (1990) suggest that this effect may explain the poor record of measures of dysfunctional attitudes as predictors of future depression. More generally, maladaptive cognitions may be latent until activated by negative affect, so that measures of premorbid cognition may not index validly the person's cognitive response to unpleasant events. It is also unfortunate that the studies reviewed have generally failed to measure personality dispositions such as neuroticism, which may affect both cognition and affective disorder.

The longitudinal studies reviewed are generally suggestive of a causal role for at least some types of cognition, but details of the picture are obscure. Studies of attributional style provide a mixture of positive and negative results, so that it is uncertain whether attributional style is, at best, one of several factors predisposing to depression, or, at worst, either a mere symptom or correlate of other cognitive processes which are the true causal agents. There is evidence to show that certain attributions are associated with self-focused attention, and so it may be this process rather than attributions which contribute to depression (see Chapter 9). For example, self-focus is associated with attributions of greater personal responsibility for events (Duval & Wicklund, 1973). The effect of self-focus on attributions has been explained in terms of the availability of the self-schema in processing information. More specifically, self-focus may increase this availability (Carver & Scheier, 1981) and thus self-referent cognitions may be more easily brought to mind.

Studies of other aspects of cognition provide a number of findings of causal influence, but the constructs investigated are so heterogeneous that it is impossible to pick out any particular cognitive abnormality as being of primary importance. It seems that it is not just general optimism/pessimism which is the causal agent (Marshall & Lang, 1990), or negative self-beliefs (Kuiper et al., 1988). It is imperative that future research tests the predictive power of different cognitive measures against each other if the impasse is to be overcome.

Longitudinal studies of anxiety

Given the central role assigned to cognitive processes in the aetiology of anxiety (e.g. Beck et al., 1985), there are surprisingly few longitudinal studies of cognitive influences on clinical anxiety. The most thorough studies are concerned with post-traumatic stress disorder (PTSD), though none measured functioning prior to the traumatic event, which limits the causal conclusions which may be drawn. Creamer, Burgess and Pattison (1992) surveyed cognitions and symptoms of PTSD on three occasions over a 14-month period in a sample of 158 office workers who were in an office building at the time of a multiple shooting. Structural modelling of the data suggested that intrusive cognitions predicted future levels of symptoms. Creamer et al. suggest that intrusions are generated by the formation of a fear-related network at the time of the trauma. Their operational measure of network formation, a single rating of fear at the time of the incident, seems very crude, though it did predict subsequent intrusions. A measure of avoidance coping was positively related to symptoms at 4 months post-trauma, but not at 14 months, implying that this strategy may be ineffective in the short term, but not in the long term. Two studies of Israeli soldiers traumatised in the 1982 Lebanon conflict (Mikulincer & Solomon, 1988; Solomon, Mikulincer, & Flum, 1988) indicate a number of influences on changes in post-trauma symptoms following an initial diagnosis of combat stress reaction or PTSD. Future pathology was predicted by use of more emotion-focused and less problem-focused coping. Individuals experiencing negative life events were particularly adversely affected by the use of emotion-focused coping, and also by the use of distraction strategies (Solomon et al., 1988). Mikulincer and Solomon (1988) found that PTSD symptoms were intensified by attribution of bad events to external, stable and uncontrollable causes. This pattern of attribution is different from that associated with depression, in which patients tend to make internal attributions for negative events. It seems that PTSD sufferers may not blame themselves for misfortunes as depressives do. However, in some types of trauma such as sexual assault, clinical experience suggests that some victims do have self-blaming appraisals. Perhaps under such circumstances the individual is more likely to develop depression as a component of PTSD. The role of attributions in other anxiety disorders may be different: Ganellan (1988) found that the "depressive" attributional style was related as strongly to anxious as to depressive symptomatology. However, Metalsky and Joiner (1992) found that interactions between life stress and generality of attribution affected depression but not trait or state anxiety.

Ehlers (1993) provides a brief report on a study which showed that greater awareness of heart rate in patients with a history of panic disorder (who had not experienced panic for at least 6 months) is positively related to the risk of subsequent panics over a 12-month period. On the other hand, Pauli et al. (1991) monitored ECGs, cardiac perceptions and anxiety over a 24-hour period, and found that panic attack patients were characterised by anxious reactions to cardiac perceptions, rather than frequency of cardiac perceptions. However, as Ehlers (1933) argues, it may be difficult to detect differences in heart-rate perception in some experimental paradigms due to the level of competing external stimulation, such as that involved with body posture or concurrent task demands (e.g. motor tracking of heart beat). Ehlers and Breuer (1992, study 2) used a mental tracking task to assess objectively the accuracy of cardiac perceptions in 65 patients with panic disorder (45 were currently panicking and 20 were in remission), 50 subjects with infrequent panics, 27 patients with simple phobias and 46 normal controls. The subjects were asked to count silently their heartbeats during signalled intervals of 25, 35 and 45 sec. The panic patients showed significantly better heart-rate perception than all other groups. Interestingly, the panic patients in remission did not differ from current panickers in their perception. In a third study, Ehlers and Breuer (1992) found that patients with panic disorder and patients with generalised anxiety disorder had better heart-rate perception than depressed patients. These results imply that heightened cardiac awareness is a feature of panic and generalised anxiety, which, at least in the case of panic, may represent a cognitive vulnerability factor.

Studies comparing trait and state effects

Performance studies

Most of the studies explicitly comparing state and trait effects have used anxiety measures. In Chapter 7, we saw that state anxiety was a stronger predictor of efficiency of memory and attention than trait anxiety, but detrimental effects of anxiety seem to be associated with worry rather than emotionality. Unfortunately, few studies have attempted to distinguish the effects of the four distinct variables potentially involved—trait and state worry, and trait and state emotionality—although several studies show that state worry is a better predictor of reduced performance than state emotionality under conditions of evaluative stress (e.g. Deffenbacher, 1980; Tryon, 1980). On the basis of anxiety data, we may tentatively conclude that state-anxiety effects on processing efficiency are associated with the effects on attention of immediate cognitive processing state, rather than with stable cognitive structures, or with the somatic component of emotion.

The picture is different for anxiety effects on attentional bias, which are most strongly predicted by the person's stable condition of emotional disorder, and are not reliably predicted by state anxiety alone. This observation implies that bias is not directly caused by anxious emotion. Furthermore, the bias may itself generate emotion. MacLeod and Hagen (1992) administered the emotional Stroop task to a sample of women awaiting gynaecological examination for cervical pathology. An index of attentional bias was a stronger predictor of emotional distress 8 weeks later in response to a pathological diagnosis than either trait or state anxiety. To complicate matters, there is some evidence for an interaction between trait and state anxiety in affecting attentional bias, though too few studies have tested for this interaction, so strong conclusions cannot be drawn. As described in Chapter 4, MacLeod and Mathews (1988) showed that enhancement of attention to specific threat stimuli associated with an examination depended on an interaction between state and trait anxiety: only subjects anxious in both respects showed a bias towards specific threatening material. However, bias towards generally threatening stimuli was primarily associated with trait anxiety. In general, the primacy of trait-anxiety and clinical disorder effects implies that enduring cognitive structures are more important than transient emotional states in generating attentional bias. Since state anxiety has both emotionality and cognitive components, the implications of the interaction between state and trait anxiety are unclear, even if they do prove to be reliable. Enduring cognitive structures associated with anxiety may be latent until activated by state anxiety (MacLeod, 1991b), but it could be either worry or anxious emotion which serves to activate processing bias.

It is more difficult to distinguish between trait and state depression effects. Most of the effects of clinical depression on cognitive bias and processing efficiency appear to be at least partially replicable in mood manipulation studies, though less reliably. For example, Sutton, Teasdale and Broadbent (1988) used a musical mood induction with normal subjects to reproduce Derry and Kuiper's (1981) finding of enhanced recall for self-referenced depressive content words in depression. Williams and Nulty (1986) investigated Stroop effects in depressed subjects. They tested a stable depressed group who had high Beck depression scores on two occasions one year apart, a stable non-depressed group, and a group of subjects for whom depression had improved over this period. The highest Stroop interference was found in the stable depressed group and the smallest in the stable non-depressed group. An important finding in terms of the state–trait distinction was that the degree of interference was best predicted by initial depression score rather than concurrent depression score. This suggests that at least under some conditions, Stroop interference reflects the residual effect of previous depression or is indicative of underlying predisposing factors (traits) and it does not merely reflect current mood state. In addition, mood change on its own appears to be insufficient to evoke some of the characteristics of depressive cognitive content, such as attributional style (Mukherji, Abramson, & Martin, 1982) and dysfunctional attitudes (Miranda et al., 1990).

Studies of neuroticism and stress vulnerability

Other work suggests that attentional bias is only one of a cluster of cognitive symptoms associated with traits of "negative affectivity" (Watson & Clark, 1984), such as trait anxiety and neuroticism. As Eysenck (1992) points out, although patients suffering from affective disorder are characterised by high neuroticism, no large-scale prospective studies have been run to test the hypothesis that this trait actually predisposes the person to subsequent clinical disorder. Successful psychotherapy tends to lead to decreased neuroticism (Barnett & Gotlib, 1988; Hallam, 1976), implying that changes in trait scores may be a symptom rather than a cause of disorder. Barnett and Gotlib (1988) argue that social introversion may be a stronger risk factor. However, the symptom hypothesis may not fully explain the association between neuroticism and depression. Hirschfeld, Klerman, Clayton and Keller (1983) found that recovered patients were significantly more neurotic than never-depressed controls, and Paykel, Klerman and Prusoff (1976) showed that level of neuroticism after recovery predicted prior symptoms during the depressed episode

Table 11.1 shows correlations between neuroticism and extraversion, and psychiatric symptoms measured 10 years later, in a sample of 1324 middle-aged and elderly adults (Levenson, Aidwin, Bosse, & Spiro, 1988). Neuroticism and, to a lesser extent, introversion predict a range of psychopathology including anxiety and depression. The symptoms were not assessed on the first occasion of testing, so strong inferences cannot be drawn, but the data are impressive testimony to the long-term predictive power of simple personality measures. In the field of stress research, Ormel and Wohlfarth (1991) have shown from a 7-year longitudinal study that neuroticism has a direct effect on later psychological distress. In their study, the influence of neuroticism on subsequent stress was considerably stronger than influences of unpleasant life events and change in

TABLE 11.1 Correlations between personality and psychiatric symptoms ten years later (Levenson et al., 1988)

	Neuroticism	*Extraversion*
Somatisation	0.34	−0.15
Depression	0.39	−0.22
Phobia	0.26	−0.15
Obsessive-compulsive	0.41	−0.23
Anxiety	0.42	−0.19
Paranoid ideation	0.29	−0.13
Interpersonal sensitivity	0.40	−0.24
Hostility	0.37	−0.14
Psychoticism	0.34	−0.19
Global Severity Index	0.46	−0.23

Note: All coefficients significant at $P < 0.01$.

quality of life. In addition, decline in quality of life had stronger effects on subsequent distress in the more neurotic subjects. These data provide striking evidence for a causal effect of neuroticism on stress symptoms, and add to the plausibility of a causal effect on affective disorder. Bolger and Schilling (1991) point out that there is some evidence that neurotic subjects have more frequent exposure to stressors (consistent with the view that neuroticism is in part a stress symptom). Their own longitudinal diary study distinguished exposure effects from emotional stress reactions. Neurotic subjects showed significantly greater exposure to arguments with others but not to other minor stressors. However, neuroticism was correlated with emotional reactions to stressors in which there was no significant exposure difference, such as overload at work. Statistically, reactivity to stressors was twice as important as exposure to stressors in explaining the greater distress of neurotic subjects, although a substantial part of the neuroticism–distress association was unrelated to the stressors measured.

In contrast, Watson and Pennebaker (1989) reviewed studies of neuroticism ("negative affectivity") and health, and concluded that neuroticism is neither a cause nor symptom of physical ill-health. Instead, higher neuroticism subjects tend to exaggerate physical symptoms, generating somewhat artifactual correlations between neuroticism and health. They suggest symptom magnification may be caused by a self-focused, introspective attentional style associated with neuroticism. Symptom perception effects may not be the whole story; for example, neuroticism and trait anxiety appear to predict speed of recovery from surgery (Auerbach, 1989; Mathews & Ridgeway, 1981). However, it seems that neuroticism has a stronger causal effect on mental than on physical malfunctioning.

It is conceivable that neuroticism effects are mediated by some simple, non-cognitive neural system, such as over-sensitivity to arousal of the visceral brain as proposed by Eysenck (1967), although psychophysiological evidence is not encouraging for this hypothesis (Zuckerman, 1991). However, as discussed in Chapter 8, there is increasing evidence that neuroticism is associated with a variety of cognitive stress processes such as use of passive, emotion-focused coping strategies. McCrae and Costa (1986) found that coping strategies used by neurotic subjects were typically rated as being ineffective in dealing with the source of stress. These authors also argue for a causal effect of neuroticism on coping, on the basis of the greater temporal stability of this trait, but admit that it is unclear whether individual differences in coping have a direct effect on emotional well-being. Other studies have investigated this issue. Bolger (1990) used structural modelling of longitudinal data to show that neuroticism measured 35 days prior to an examination predicted anxiety increase a week before the exam. The effect was statistically mediated by the neurotics' greater use of wishful thinking and self-blame coping strategies. There was no direct effect of neuroticism on anxiety change when coping was statistically controlled, although the sample size of 50 may have been insufficient to establish the absence of the direct effect. Holohan and Moos (1990) reported that a rather *ad hoc* measure of easy-going, confident personality, presumably related to low neuroticism, was related to stress resistance, within a large-scale (n=405) one-year longitudinal study. Unfortunately, personality effects were not clearly distinguished in the analysis from other influences, such as family conflict. There were indications that they were partially mediated by the use of active, approach coping strategies, however.

As described in Chapter 8, Mohamed and Matthews (unpublished) found that neuroticism in a sample of 140 postgraduate students was associated with higher levels of primary appraisals of threat and loss, and lower perceived control (secondary appraisal). More neurotic students also reported less use of problem-focused coping and more use of self-criticism as a coping strategy. However, multiple-regression showed that neuroticism still predicted chronic stress symptoms even when appraisal and coping were statistically controlled. For example, with score on the General Health Questionnaire as the dependent measure, sets of variables were entered into the regression equation in the order suggested by the transactional model of stress. Each successive variable added significantly to the variance explained: primary appraisal contributed 25% of the variance, secondary appraisal an extra 7%, coping strategies a further 11%, and neuroticism, the final variable, an additional 8%. Either the study failed to measure all the relevant cognitive variables, or neuroticism is associated with enhanced affective and somatic reactions to negative appraisals. In another unpublished study, Matthews and Thomson obtained similar results with mood measured by the UMACL (Matthews et al., 1990c) as the dependent variable. The subjects were 77 first-year undergraduates who were asked to rate their appraisals of being away from home. Predictors were entered into the regression equation in the same order as before. With tension as the dependent variable, significant contributions to the equation were made by primary appraisal (26% of the variance), coping strategies (16%) and neuroticism (13%). Neuroticism also contributed significantly (4%) to the prediction of depressed mood. In general, although the evidence is somewhat indirect, neuroticism may be associated with cognitive responses to stress which make the person vulnerable to emotional disorders such as depression (Martin, 1985).

Studies of recovered patients

Anxiety patients

Studies of patients who have recovered from emotional disorders generally show that their attentional performance is similar to that of normal controls. The main exception to this finding was reported by Mathews et al. (1990). Using a visual selective attention task, they found that recovered generalised anxiety disorder (GAD) patients showed a similar bias towards threat words as currently anxious patients, although the latter had significantly higher state anxiety levels. This study implies that attentional bias is a stable attribute of individuals prone to anxiety. This attribute may be a necessary but not sufficient cause of the disorder. However, Eysenck (1992) describes an unpublished longitudinal study in which cognitive bias to threat words on the Mathews et al. (1990) task was apparent during clinical anxiety but not after recovery. Other studies have failed to show any difference between recovered patients and controls on the MacLeod et al. (1986) visual attention task (Mogg et al. 1992), on interpretation of ambiguous sentences (Eysenck et al., 1991) and on implicit memory for threat words (Mathews et al., 1989a). Mogg et al. (1992) failed to demonstrate significant differences in attentional responses between recovered GAD patients, and either currently anxious GADs or normal controls using MacLeod and co-workers' (1986) probe detection task. The recovered group of subjects used in this study had received treatment for GAD at least 6 months prior to the experiment. Unfortunately, the nature of this treatment was not specified. It is important to know how patients in these types of studies are treated, and to ensure that groups of recovered patients have been treated in the same way, as some treatments may modify cognitive-attentional characteristics of the patient to a greater or lesser degree.

Two studies of other anxiety conditions have also explored treatment effects on attentional bias. The effects of behavioural exposure treatments have been investigated in spider phobics with the Stroop task (Watts, 1986) and in obsessionals with dichotic listening (Foa & McNally, 1986). In both instances, treatment was shown to reduce attentional bias. In contrast, Stoler and McNally (1991) showed that both symptomatic and recovered agoraphobics produced more threatening completions of incomplete ambiguous sentences than controls, although it appeared that recovered agoraphobics' completions made more references to active coping than those of current patients. We have also seen that recovered depressed patients show reduced Stroop interference (Williams & Nulty, 1986).

With the exception of the Mathews et al. (1990) study, the studies reviewed imply that attentional bias may simply be a symptom of the clinical condition, since bias is reduced as the person's condition improves. However, there are several problems with this inference (Eysenck, 1992). First, recovery from anxiety may involve structural cognitive and attentional change, which itself may underlie both a reduction in attentional bias and the intensity of anxiety. In other words, it may be changes in attentional bias during treatment or spontaneous recovery which are responsible for the improvement in the patient's condition. One way to overcome this problem would be to compare treatments, where one treatment has a greater impact on the emotionality component rather than the cognitive component of anxiety and the other treatment has the reverse impact. Ideally, future treatment studies of attentional functioning could use groups of subjects treated with attentionally based therapy and compare the effects of this with treatment without this component. Second, the cognitive vulnerability factor may be latent rather than manifest: exposure of recovered patients to stress might elicit the bias. The weakness of this argument, however, is that it cannot explain instances of bias in the absence of state anxiety, such as MacLeod. and Mathews' (1988) finding that bias to general threat material is dependent on trait anxiety only. Third, recovered patients may be motivated to try and perform like normals. At present, our limited understanding of the causal processes responsible for recovery from affective disorder makes it difficult to draw any strong conclusions from comparisons between current and recovered patients.

Depressed patients

The majority of studies have shown that recovered depressives do not differ from matched controls in cognitive measures such as attributional style and dysfunctional attitudes (Barnett & Gotlib, 1988; Persons & Miranda, 1992). As in longitudinal studies, null findings may not provide a true indication of the causal status of cognitive processes, because of the use of non-causal cognitive measures, a failure to derive predictions from theory adequately, and a failure to allow for the state-dependence of cognitions. For example, Miranda et al. (1990) found that recovered depressives showed elevated scores on measures of dysfunctional attitudes only if they were in a negative mood state at the time of assessment: mood did not affect attitudes in subjects with no history of depression. A few studies do show a persistence of maladaptive cognitions in recovered patients, such as self-criticism, which is as high in remitted depressives as it is in current patients (Franche & Dobson, 1992). Franche and Dobson (1992) also found elevated levels of interpersonal dependency in recovered patients, which they take as an indication of a maladaptive schema for interpersonal interaction.

In a study of recovery from depression, Billings and Moos (1985) showed that depressed patients were initially characterised by the use of more emotional discharge and less problem-solving strategies. After recovery, the remitted patients differed from controls only in emotional discharge, suggesting that this may be a vulnerability factor, although emotional discharge decreased in the patient group.

Teasdale (1983; 1988) has advanced a depression vulnerability model which distinguishes between vulnerability in terms of factors which exist in the non-depressed state and also those that are activated (e.g. type of thinking) in the depressed state. The extent to which negative cognitive processes or structures become activated in depressed mood is considered important in determining whether initial depression remains mild and transient or becomes severe and persistent. This "differential activation" model predicts that subjects who have suffered from depression but have recovered—in other words, they are cognitively predisposed—should differ from never-depressed subjects in terms of the degree of activation of negative cognitive structures under depressed mood. Teasdale and Dent (1987) tested this hypothesis along with the hypothesis that there are persistent individual differences in cognitive processing, marked by neuroticism, which predispose to depression. Martin (1985) proposed that neuroticism acts as a cognitive predisposition to depression. In the Teasdale and Dent (1987) study, recovered depressives and never-depressed subjects were compared on the incidental recall of positive (e.g. capable, confident) and depressive (e.g. deficient, failure) self-referred trait word under normal mood conditions and after experimental induction of depressed mood. The subjects were initially required to rate the words in accordance with whether or not they described their personalities (self-referential encoding task), and were then asked to write down immediately as many of the trait words as they could remember in 3 min. They then received a musical mood induction procedure, a similar rating task with the words presented in a different order and a second incidental recall task. Recovered depressives showed significantly poorer recall of positive words than never-depressed subjects, but similar recall for negative words under normal mood. Under depressed mood, the recovered depressives recalled more depressive words than never-depressed subjects. Those subjects with high neuroticism scores endorsed more depressive words as self-descriptive and recalled fewer positive words under neutral and depressed mood conditions. These results are consistent with the hypothesis that persistent individual differences in cognitive processing, for which neuroticism may be a marker, underlie proneness to depression. In addition, depressives appear to differ from non-depressives in the ease with which negative cognitive processing is activated.

Conclusions

In summary, the evidence that has been reviewed here suggests that the attention–emotion relationship is bidirectional. Moreover, the experimental, and in particular the longitudinal, studies reviewed provide empirical support for the view that attentional processes have an aetiological role on several levels in the development of emotional dysfunction and stress reactions. These levels are: (1) the initiation of emotional problems; (2) intensification of existing emotional reactions; and (3) the maintenance of emotional problems. Clinical studies provide only patchy and inconsistent support for an aetiological role for cognitive processes. This may be because the measures typically used, such as attributional style, are only indirectly related to the attentional processes shown to be important in the experimental studies, and for various methodological reasons. Studies of trait anxiety and neuroticism suggest that these dispositional variables have causal effects on stress vulnerability, although neuroticism seems to be reciprocally elevated by clinical states of distress.

Although the data reviewed support the proposition that attentional disorder can have a causal significance in the development of emotional dysfunction, and is likely to constitute a cognitive risk factor, the mechanisms or effects underlying this risk are not fully understood. In Chapter 12, we advance a theoretical model which offers an integrative framework for understanding the mechanisms and processes underlying the risk associated with attentional disorder.

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PART III

New theoretical model and clinical implications

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12
THEORETICAL INTEGRATION

In this chapter, we present a theoretical model of attentional processes involved in the self-regulation of emotion. The model is intended to account for the attentional phenomena discussed in previous chapters and offers an integrative account of cognitive-attentional processes involved in the development and maintenance of emotional disorders. First, we offer a brief overview of the link between self-focused attention and emotional distress and then we present a detailed information-processing model of the cognitive-attentional syndrome underlying this association. Then we consider the application of the model to explaining the aetiology of negative emotion, the roles of distraction and attention training in therapy, and the explanation of experimentally observed biases in processing emotional stimuli.

Self-attention and emotional distress

In previous work, Wells (1991) has accounted for the non-specific association between self-focus and emotional distress in terms of the effects of self-attention on the perception of internal responses and on attentional capacity. More specifically, he proposed that self-focus intensifies internal responses and reduces general spare processing capacity. Self-focus is considered to be an important process moderating the appraisal of internal responses and initiating self-regulatory responses in light of perceived discrepancies between perceived self-state and the ideal state on the salient dimension affected. Although self-focus in its typical form is not pathological, since it promotes self-regulation, intense or inflexible states of self-focus can have deleterious effects on self-regulation. Such states intensify the experience of internal (emotional, somatic, cognitive) events and lead to cognitive resource limitations. Individuals high in self-focus may initially be motivated to make greater efforts to manage internal events, but intensification and capacity-limiting effects reduce the likelihood that active "coping" (including emotional repair) strategies can be implemented. These individuals more readily encounter situations which tax or exceed their resources for dealing with them and they are therefore more likely to use avoidance and withdrawal forms of coping. This choice of coping can reinforce negative beliefs about self-control and maintain self-discrepancies leading to perseveration of self-focus or an increased likelihood that self-focus will be initiated in similar encounters in the future. Self-focus is "switched off" when a discrepancy is eliminated or when attention is directed away from the self. In this model, the nature of the emotion accompanying self-focus is determined by the content of beliefs which are activated during appraisal of the self-discrepancy. If the beliefs concern personal danger, then anxious affect predominates; if the beliefs concern personal loss and hopelessness, then depression is foremost.

Building on this theoretical account, we propose that individual differences in dispositional self-focus (private self-consciousness) are a marker for the likelihood that individuals will develop a certain cognitive-attentional syndrome under stress (Wells & Matthews, 1994). The cognitive attentional syndrome increases vulnerability to emotional dysfunction.

The cognitive-attentional syndrome

The cognitive-attentional syndrome consists of the phenomena previously discussed in connection with self-focus (intensified processing of internal events, capacity limitations) plus reduced efficiency of cognitive functioning, activation of self-beliefs and appraisal, attentional bias, and intensified self-monitoring. The syndrome is generated by an interaction between upper-level controlled processing and lower-level automatic processing functions. The interaction of primary concern in understanding emotional distress is that which is associated with the appraisal of self-relevant information. This interaction is conceptually operationalised by a process we have termed the Self-Regulatory Executive Function (SREF), which allows upper self-knowledge and lower processing levels to interact with the aim of reacting to perceived self-discrepancies, and "repairing" distressing emotions through behavioural and cognitive self-regulation.

An integrative attentional model of emotional distress

In the remainder of this chapter, we present an integrative model of cognitive-attentional processing which predisposes to emotional distress. A schematic representation of the basic model is presented in Fig. 12.1. Three levels of cognition are differentiated in the SREF model. These levels consist of automatic low-level processing, controlled processing corresponding to conscious appraisal and regulation of action, and a store of self-knowledge comprised of items of acquired knowledge about the self and strategies for self-regulation, held in long-term memory.

We see the lower level as comprising a network of activation-driven elementary processing units of the kind described by Norman and Shallice (1985). There may be some modularity associated with different kinds of units as in connectionist accounts of attention (e.g. Phaf et al., 1990), and there may be local mechanisms for sequencing processing operations of the kind discussed by Norman and Shallice. Processing is automatic in that it may be triggered by specific stimulus inputs, although it often operates in conjunction with partial top-down regulation by the controlling executive. Some lower-level processes may only run if activated by top-down attentional processing, as well as by lower-level inputs (Cohen et al., 1990). Resource requirements are relatively low, but probably not zero. It is possible that multiple domain-specific resources of the kind

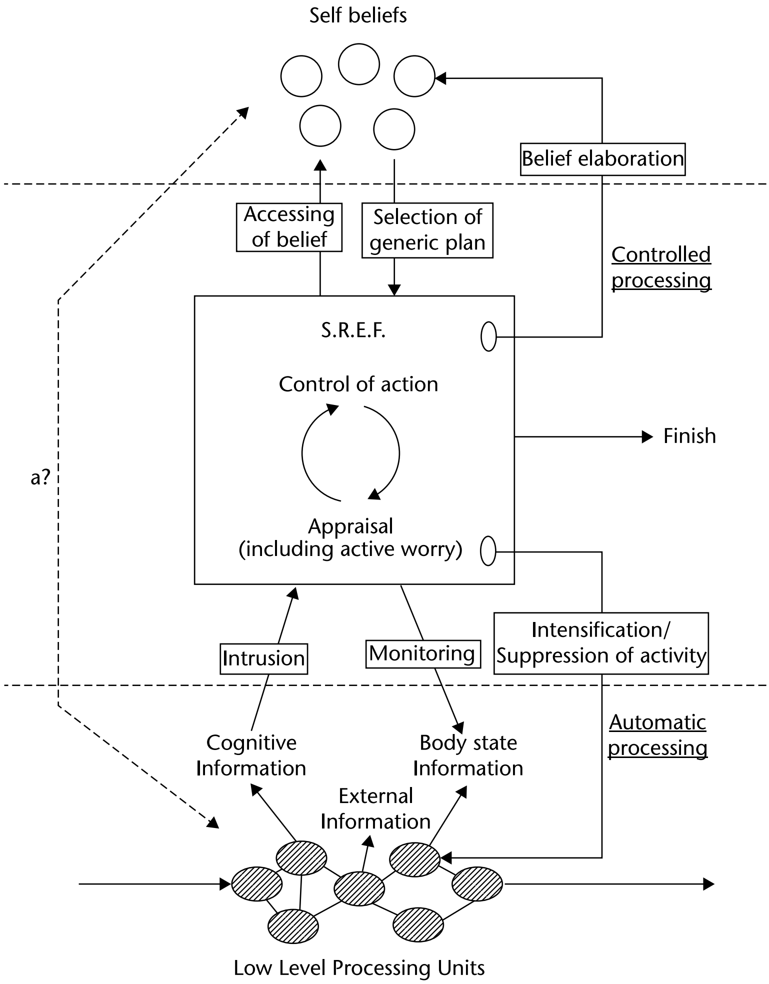

FIGURE 12.1 Schematic representation of the Self-Regulatory Executive Function (SREF) model of emotional dysfunction.

posited by Wickens (1984) are required, rather than the general-purpose resources used by executive processing. Processing is typically unconscious, although when units become highly activated, intrusion of information into awareness accompanies a call to the executive for controlled processing. Three types of information can be represented initially at the lower level: (1) external stimulus information; (2) cognitive state information (e.g. errors in cognition, discrete thoughts); and (3) body state information (e.g. heart rate, temperature, pain). For highly learned stimulus–response patterns or continuously mapped stimulus-response patterns, lower-level processing units are strongly linked, so that certain stimuli can undergo quite complex processing without upper-level input. This may be important in understanding some of the phenomenology of emotional disorders. We return to this point in the next chapter.

We have already introduced the concept of the SREF. It is proposed that the SREF serves as a meta-cognitive process involved in cognitive, affective and behavioural self-regulation. More specifically, it performs the appraisal of lower-level outputs and initiates and regulates action aimed at reducing self-discrepancies and perceived threats to the self. SREF processing is influenced by the content of self-beliefs, which not only affect the content of SREF appraisals but also affect SREF strategies. In particular, some beliefs may enhance the monitoring of certain outputs from lower-level processes.

The SREF can be engaged by conscious strategic commands and also by lower-level intrusions into consciousness. Some arrays of lower-level activation produce a call for SREF activity when activated, and this is apparent as the intrusion of thoughts and sensations into consciousness. Following intrusion of material, the SREF serves to appraise the significance of this material. Part of this appraisal consists of comparing perceived self-state with an acquired referent standard for self-regulation. These standards are represented in self-relevant knowledge; for example, if an individual believes that he or she is "a bad person" or "seriously ill", this may be linked to plans for being good or becoming well. A reference standard for achieving the desired self-state determines termination or maintenance of plan-driven responses. If a discrepancy is perceived between the reference standard and the self-state, external or internal responses are initiated to reduce the discrepancy. Expectancies concerning the ability to reduce a discrepancy are influenced by situational appraisals and self-beliefs, and influence the selection of action.

Effects of SREF processing on attention and self-knowledge

The SREF influences both the immediate focus of attention, and longer-term changes in knowledge structures. Attention to lower-level information will vary with the specific strategy adopted. A common component of the strategies associated with the SREF is *monitoring*, which refers to increased vigilance for self-relevant products of lower-level processing. Monitoring may be voluntarily initiated by activation of self-relevant knowledge. For example, the belief of an obsessional patient that certain internal cognitions are bad, and must be controlled, might initiate a search for the patterns of activation within the lower-level network corresponding to such events. Alternatively, monitoring might be initiated by a lower-level intrusion such as a thought or physical sensation which activates the monitoring plan. This strategy may be prone to generate a vicious circle of appraising lower-level information as threatening, enhancing monitoring as a result, leading to increased threat appraisal, and so forth. Under other circumstances, when the person is reviewing coping options for example, awareness of intrusions from lower-level processing is likely to be reduced, because the capacity demands of executive processing divert attention away from lower-level monitoring. The danger here is that of excessive rumination and increased detachment from external and internal lower-level inputs.

A central function of SREF processing which is important in conceptualising recovery from emotional problems, or, conversely, the maintenance of such problems, concerns its effects on self-knowledge and on the modification of lower-level processing. SREF processing can lead to an elaboration of beliefs and the accommodation of new information in self-knowledge structures. The operations of the SREF also contribute to confirmatory and disconfirmatory learning. Its plans may be geared either to assimilating appraisal of events to existing knowledge, or in using appraisals to modify self-knowledge: we assume that once a plan has been modified, its generic elements may be "saved" in memory in modified form.

In addition, we propose that the SREF also assists in the temporary and long-term suppression or intensification of sequences of lower-level processing. There are at least four ways in which this may occur. First, negative appraisals may have an effect on the level of autonomic arousal, which then amplifies or deactivates the representations of body-state and cognitive-state information processed at the lower level. Second, the individual may voluntarily employ self-regulatory behaviours which reduce the intensity of internal information, such as relaxation practices. Third, lower-level processing may sometimes be disrupted by focusing attention on over-learned action sequences, generating what Reason (1990) terms errors of "over-attention". Fourth, lower-level processing may be modified in the longer term by repeatedly introducing different strategically controlled actions at decision points in the lower-level network (see Schneider, 1985, for a detailed theoretical account of learning of this type). That is, SREF activity modifies not only self-relevant knowledge, but also action sequences not intrinsically related to the self. For example, a rape victim might learn karate under general SREF control as a means of self-defence, as a matter of personal urgency. After the trauma has subsided, the same skills might then be used in a leisure or recreational context, without much SREF involvement. From the procedural perspective, the person slowly refines and reshapes existing self-relevant procedures in response to successive stressful or otherwise motivationally significant encounters. The inherent changeability and complexity of the majority of significant threats to the person, such as difficulties with social relationships or one-off life events, generally serve to prevent full automatisation of learning. In summary, SREF activity serves not only for appraisal and for the initiation of action, but it also modifies the status of the cognitive system at the self-knowledge and stimulus-driven processing network levels.

Factors affecting choice and control of action

Several factors in the present model bias the choice and control of action in response to appraisals: the content of self-knowledge, capacity limitations, degree of intrusiveness of lower-level activity, social cues, individual differences in attentional style, preference for certain coping strategies, etc.

Self-knowledge

Important elements of self-knowledge are generalised plans or procedures for coping with actually or potentially harmful situations. We see these as analogues to scripts or Memory Organisation Packets (Schank, 1982), which specify in general terms how types of encounter should be managed. The implementation of a specific strategy requires executive processing of the procedure to tailor it to the particular demands of the immediate situation. SREF processing is always driven by a strategy derived from a procedure in long-term memory (LTM). As discussed previously, there is little direct evidence on the nature of representations of self-relevant knowledge in LTM, so we do not specify this part of the SREF in detail. Conceivably, either a network or schema approach could be used. It may also be the case that self-relevant knowledge is fully procedural. In this case, declarative beliefs about the self, such as "I am weak", may only be the outputs from procedures for self-evaluation. Affective disorder may be associated with self-evaluative procedures which incorporate negative beliefs as a result of prior learning (see Anderson, 1982). The idea of a fully procedural knowledge base for the SREF is attractive because theoretical accounts of executive functioning emphasise the role of discrete high-level programmes (e.g. Shallice, 1988). In some of the following sections, however, we find it convenient to assume that the negative self-beliefs in anxiety and depression are directly represented, although it may actually be the case that each instance of such cognitions is procedurally generated. In any case, we assume that self-relevant knowledge has the following general characteristics:

1. It is the primary influence on the processing operations of the SREF. The SREF is concerned with applying self-relevant knowledge to the current situation. Specific strategies result from on-line modification of existing knowledge.
2. Self-relevant knowledge is tightly coupled to SREF activity, in that SREF processing implies accessing of knowledge, and vice versa. It is possible that self-relevant knowledge may be directly activated by stimulus input

(illustrated by arrow "a?" in Fig. 12.1), but such activation only influences other processing by initiating SREF activity. Once the SREF is activated, further self-relevant knowledge is likely to be activated, and so forth, prolonging self-relevant processing over time.

3. Self-relevant knowledge is relevant to the person's well-being. Minor factual and trivial knowledge about the self (e.g. "I had eggs for breakfast this morning", or "I'm 5′8″ tall") is likely to be stored elsewhere.
4. Clinical data suggest that items of self-relevant knowledge tend to be associatively or structurally linked, although, as critics of schema theory point out (Segal, 1988), experimental evidence on this point is lacking. We assume some tendency for mutual co-activation of disparate knowledge items, which serves to maintain activation and accessibility of self-relevant knowledge as in conceptions of loss- or fear-related networks (Foa & Kozak, 1986; Ingram, 1984). However, the mechanism may not be one of direct structural links. An alternative possibility is that specific negative beliefs are co-activated through being called by the same high-level procedure, or through mutual recursive linking of procedures. A simplistic example would be that of a depressive patient with the following two procedures:
   - If I am a weak person THEN I cannot face the future;
   - If I cannot face the future THEN I must be a weak person.

Capacity limits

Since SREF functioning is executed within the limited-capacity processing system, its operation and concurrent controlled processing activities exert reciprocal influences on each other. Perseverative SREF appraisal, namely active worry, is particularly attentionally demanding, and reduces the overall capacity of the SREF system available for other functions. If worry is intense and perseverative, for example, there may be insufficient resources for processing automatically generated intrusions non-congruent with worry. In addition, capacity-demanding coping responses may also be adversely affected. Capacity limits within the SREF may predispose some individuals to adopt certain "preferred" coping strategies which reduce capacity demands. As we saw in Chapter 7, worry has been conceptualised as a form of cognitive-emotional avoidance in some individuals (Borkovec & Inz, 1990; Borkovec et al., 1991). In the SREF system, some active worry strategies may avoid arousal associated with the appraisal of certain more threatening events by diverting attention to other, relatively minor concerns. Although worry may be a conceptual coping response, which pre-empts SREF capacity, other SREF functions also use attention. Monitoring is one of them. Rather than reducing awareness and the processing of certain lower-level events, monitoring is intended to increase the sensitivity of the SREF in detecting certain events. This may make processing of non-event data less likely and contribute to the maintenance of negative appraisal. Finally, the control of action by the SREF is also sensitive to attentional capacity, because some actions are more attentionally demanding than others. Demanding coping strategies like cognitive reappraisal may be difficult to execute if there are high concurrent SREF processing demands.

Some explication of the exact relationship between SREF and other controlled processing is necessary at this point. The parsimonious view is that there is a single executive processing system capable of running both self-relevant and other plans, rather than separate executive systems. Consistent with Ingram's (1990) view that there is a continuum of attentional states varying in the proportions of self-focused and externally- focused attention, we assume that the executive is capable of time-sharing the two types of plan. To some extent, this is simply a question of serial interleaving of the procedures called by the plans. We assume also that some parallel processing is also possible, at least to the extent of simultaneously maintaining a limited set of self-relevant and non-self-relevant goals in working memory. We suppose also that when the need for self-regulatory processing is appraised as urgent, as when a self-discrepancy is large, or when self-relevant executive processing is particularly complex, SREF processing will take over executive functioning in general, to the exclusion of other activities. Under these circumstances, the SREF will operate as though it were a discrete system whose operation suppresses other executive operations. The converse will apply when problem-solving functions detached from self-relevance require the full capacity of the executive. For example, a chess player, after an opponent's move, may initially engage SREF processing due to perception of personal threat ("I'm about to lose an important piece"), and then suppress SREF activity by running a purely chess-oriented plan when formulating the next move. Conflict of SREF processing with other executive processing is not just a function of capacity limitation, but also of the difficulty of maintaining simultaneous goals (cf. Allport, 1980). From a skill theory perspective (Anderson, 1982), firing of high-level procedures requires goals to be held in working memory, which limits the ability of the system to time-share multiple activities with different goals. In affective disorder, cascades of interlinked procedures may generate so many goals and sub-goals that the executive is unable to function objectively, and subjectively the person feels completely overwhelmed by his or her problems.

This hypothesis explains why worry can itself be displaced by parallel processing activity, as discussed in Chapter 10. When a person is asked to perform a distracting activity, a goal conflict between goals associated with the distraction and with worry is generated. Anderson (1982) discusses several instances of principles for resolving conflict, including specificity and strength. Strong procedures and procedures triggered by highly specific input conditions take precedence over weak procedures and procedures triggered by a wider set of input conditions. So, instructions to produce a simple, and so easily over-learned, response to a specific stimulus may resolve the conflict in favour of the distractor, and suppress the more general worry-related procedure, which also suppresses further self-regulatory procedures called by it. Executive functioning is no longer dominated by self-referent processing, and sufficient working memory space may be freed for other executive processes to be time-shared with the distracting activity. For example, task-focusing instructions have been used effectively to distract from negative self-preoccupation in test-anxious subjects, and thus reduce anxiety and improve performance (e.g. Wise & Haynes, 1983). The system will remain vulnerable to reverting to SREF control. For example, committing an error in task performance may generate an intrusion which calls the SREF, or ceasing to process the distractor stimulus allows the goals associated with worry renewed access to working memory. In some individuals, worry may serve as a default activity in the absence of any more pressing and immediate goals.

Event intrusiveness

The intensity of lower-level intrusions is likely to influence the control of action in the SREF. Highly intrusive events may capture attention and thus be more capable of interrupting ongoing SREF activity. Highly intrusive material may orient the SREF system towards processing and responding to intrusion-related information. Event intrusiveness is determined both by strategic priorities such as those involved in monitoring, and also by low-level analysis of stimulus significance of the kind discussed in Chapter 3. The information processing associated with the psychophysiological orienting, defence and startle reactions may also generate autonomic activity which calls the SREF. If ongoing SREF activity is to be maintained and intrusions excluded from focal attention at a particular time, the SREF system must suppress the capture of attention by intrusions. These processing priorities will be governed by the momentary availability of resources and beliefs concerning the salience of the intrusion in terms of personal well-being. The extent to which the intrusion must be processed prior to rejection depends on both its strength and the expectancies encoded within the SREF plan. We saw in Chapter 2 that the normally attention-capturing properties of rapid visual onsets can be overridden voluntarily (Yantis & Jonides, 1990).

Social cues

Social stimuli appear to be particularly effective in influencing stress and psychopathology, as discussed in Chapter 8. We follow Higgins (1990) in supposing that social cues are prone to activate self-discrepancies in LTM, which in turn activate the SREF. Under these circumstances, the person is likely to be in a state of public rather than private self-focus of attention, such that attention to social cues is particularly enhanced. If we accept that social interaction is generally beneficial (Cohen & Wills, 1985), it may also be the case that positive social interaction activates positive information about the self, which reduces the salience of self discrepancies and tends to terminate SREF activity. We partially agree with Bargh (1984) and Higgins (1990) that social knowledge may be activated involuntarily and unconsciously, in that the evidence for automatic priming effects is suggestive, if not conclusive (see Chapter 3). It may be the case, however, as suggested by Logan (1988), that automatic activation of knowledge is post-attentive and follows conscious stimulus identification. The SREF model emphasises that activation of negative self-relevant social knowledge is accompanied by SREF processing. Hence, the emotional and behavioural consequences of knowledge activation are more likely to depend on controlled processing than on automatic activation, as the person uses the activated knowledge as the basis for subsequent primary and secondary appraisal. The role of appraisal can, in general, explain some of the inconsistencies in the effects of social variables on stress discussed in Chapter 8: social integration may not always be appraised as positive, for example. The hypothesised role of knowledge activation is supported by direct evidence that perception of social support is related to self-beliefs such as dysfunctional attitudes (Lakey & Cassady, 1990). Hence, we do not ascribe the special significance to social factors for which some authors have argued (e.g. Oatley, 1988), but we acknowledge that negative self-relevant information often concerns social beliefs, such as perceived self-efficacy in social situations, and internalised social judgements of the self. We also accept that the SREF model is not intended to predict social behaviour in threatening situations. To do this, we would have to expand the model to accommodate the dynamic social processes operating when one or more individuals in whom the SREF is activated interact.

Individual differences

Several personality traits appear to be correlated with aspects of SREF function. Self-focus of attention serves as a marker for the likelihood of SREF activity. Such individuals have lower thresholds for the activation of self-relevant knowledge, or, in Anderson's (1982) terminology, stronger self-regulatory productions. Dispositional self-focus will not necessarily determine the extent of SREF activity in a given situation, as this will also depend on other factors, as evidenced by the relatively modest correlation between trait and state measures of private self-focus discussed in Chapter 9. The distinction between dispositional private and public self-focus relates to whether the type of self-knowledge prone to activation is personal or social. Self-focus is a general vulnerability factor to many kinds of mental disorder (Ingram, 1990) because frequent SREF activity is likely to activate negative information such as discrepancies, which in turn may generate the vicious circle linking SREF activity to activation of negative self-knowledge. As discussed previously (see Chapter 9), public self-consciousness is particularly strongly related to indicators of stress, perhaps because attention to social cues is especially effective in activating self-discrepancies. However, any causal link is of moderate strength at most, because dispositional self-attention does not necessarily lead to dysfunctional self-monitoring. For example, the person's self-knowledge may be predominantly positive, or the person may be capable of efficient coping strategies for preventing excessive worry. Under such circumstances, self-focus might even be associated with positive emotions. However, dispositional self-focus may also act to maintain emotional disorder once disorder is initiated through maintaining attention on negative beliefs, and hindering modification of dysfunctional self-knowledge.

We see neuroticism as being more directly related to predominantly negative self-knowledge. As discussed in Chapter 4, neuroticism/trait anxiety relates to a variety of negative biases in evaluation and judgement, selective attention and some aspects of memory, such as autobiographical memory. These effects do not seem to be simply the result of increased state anxiety, although state anxiety may enhance them. Likewise, stress research (see Chapter 8) shows associations between neuroticism and negative appraisals and coping strategies suggestive of negative bias, such as self-criticism. Neuroticism is at least a marker for accessibility of negative cognitions of various kinds. More detailed causal hypotheses are harder to formulate. On the one hand, there is evidence for a causal effect of neuroticism on subsequent emotional distress (Ormel & Wohlfarth, 1991), but on the other, neuroticism often seems to decline as symptoms respond to treatment (Barnett & Gotlib, 1988), implying that it is not a stable vulnerability factor. These observations can be reconciled if we suppose that the cognitive substrate for neuroticism is a causal but flexible influence reciprocally related to symptoms of emotional distress. For example, if neuroticism relates to the general negativity of self-relevant knowledge, it should lead to a raised probability of dysfunctional SREF activity and pathology, which may in turn feed back into increased negative self-beliefs. However, successful treatment may influence the content of self-beliefs, leading to a reduction in neuroticism and vulnerability to negative emotional states.

It is possible that neuroticism is more directly related to some psychobiological sensitivity to signals of punishment, which in turn generates negative cognitions (see Gray, 1982). We saw in Chapter 8 that the link between neuroticism and unpleasant mood is not always statistically mediated by cognitive appraisal and coping (Matthews et al., 1994). We assume that the negative cognitions correlated with neuroticism will have causal effects on attention and behaviour mediated by the SREF in any case, but we cannot exclude the possibility that neuroticism effects are ultimately reducible to subcortical neural mechanisms. However, if this is the case, we must suppose that the neural mechanisms are influenced by therapies which reduce neuroticism. The psychobiological hypothesis also has difficulties explaining the specific association between neuroticism and evaluative and social threats (Hodges, 1968). King and Endler (1990) present evidence for multiple anxiety traits, each linked to a particular domain of threat, such as social threat, physical danger and so forth. These data fit better with a cognitive approach, with each type of threat corresponding to a particular area of self-knowledge, than to the generalised sensitivity to threat signals posited by Gray (1982). We consider the integration of cognitive and psychobiological theory in more detail in the concluding chapter. Finally, it should be noted that other traits may also be important, such as extraversion-introversion, which appears to be a good predictor of future depression (Barnett & Gotlib, 1988). It is possible that introversion is associated with negative beliefs about the self in social encounters.

Emotional distress

Next, we consider the relationship between the SREF and the aetiology of negative emotions. Our theoretical approach fits well with Oatley and Johnson-Laird's (1987) hypothesis that emotions are generated by the actual or anticipated success or failure of the current plan for action. Since the SREF is explicitly plan-driven, we see emotion as derived primarily from evaluation of the status of the plan with respect to its goals, which, as Oatley and Johnson-Laird (1987) propose, may take place mainly at plan junctures. This view is also broadly consistent with the hypothesis from stress research that negative mood is associated with secondary appraisal of lack of competence to cope with external demands (Cox, 1978). Specifically, Oatley and Johnson-Laird (1987) relate sadness to a major plan failure, and anxiety to a self-preservation goal. This hypothesis contrasts to some extent with other appraisal-related views of emotion, that depression and anxiety are linked to loss/harm and threat appraisals, respectively (see Lazarus & Folkman, 1984), or to actual-ideal and actual–ought self-discrepancies (Higgins, 1990). Our view is that these distinctions are probably too highly correlated to decide from the evidence which is the most direct causal influence on emotion. For example, it is unclear whether the SREF maintains some internal representation of the status of the self-regulative plans which can be read off directly, or whether emotion is generated by some more complex and indirect appraisal process. One modification to existing hypotheses suggested by the model is that the appraisal of plan status will influence emotion mainly when the SREF is active. According to the model, losing a casual game of chess or cards, for example, does not necessarily activate the SREF at all, even though plan failure has occurred. The person simply notes defeat in a detached fashion, and subsequent cognitive activity might concern a reappraisal of game strategy or other matters entirely. There are two routes whereby SREF activation may take place. First, losing the game might elicit lower-level processing which generates an intruding negative belief which activates the SREF. In this case, the SREF might either rapidly appraise the intrusion as trivial, in which case its impact on processing is minimal, or appraise the intrusion as personally significant, leading to continued SREF activity associated with, for example, appraisal of the self as a loser or failure. Second, the outcome of the game may be perceived as personally important from the outset, in which case game-oriented plans will be time-shared with self-regulative plans (to the likely detriment of performance). Losing may then trigger a more protracted episode of SREF activity.

We suppose also that there is some reciprocal influence between negative emotion and persistence of SREF activity, as the experimental evidence on self-focus and mood suggests (see Chapter 9). In general, we suggest that dysfunctional states of SREF perseveration are in part maintained because the negative emotion generated tends to maintain SREF processing. Again, the causal role of appraisal is somewhat unclear here. Oatley and Johnson-Laird (1987) propose that emotions are part of a primitive internal and social signalling system, which biases choice of plans without the need for propositional or symbolic processing. It may be that negative emotions also generally bias SREF activity regardless of the specific content of appraisals. Conversely, as the transactional theory of stress (Lazarus & Folkman, 1984) would tend to suggest, appraisal of emotion may be the key causal influence. Negative emotions may generate mood-congruent appraisals which increase accessibility of dysfunctional beliefs, which in turn maintain the negative mood state.

Although on-line appraisal of plan status is the primary determinant of emotional state, there may be other influences also. In some cases, it appears that emotion can be altered without voluntary or conscious processing, as in Kemp-Wheeler and Hill's (1987) demonstration of increased state anxiety following subliminal presentation of emotionally unpleasant words. We argued in Chapter 3 that there is quite good evidence for pre-attentive and possibly unconscious processing of emotional stimuli, and it may be that the lower-level processing network is not only capable of extracting emotional information, but also of generating the corresponding subjective emotion. We discuss this interesting but somewhat speculative possibility at more length in the next chapter. An alternative possibility is that emotional stimuli contribute to the activation of self-relevant plans, partially automatically. It is plausible that the generic plans which we see as an important part of self-relevant knowledge encode the likely goal status of the plan. So if a person has failed a succession of exams, his or her plan for dealing with the exam situation includes the information that the plan will probably fail. When the plan is initially activated, on arrival at the exam hall perhaps, this stored plan status information generates the appropriate emotion without the need for extended appraisal. If subliminal stimuli are capable of activating plans, the person may be aware of this emotion without being aware of its source.

The effect of distraction in treatment: A new perspective

In this section, we describe how the model accounts for the mixed effects of distraction on affect and processing in emotional disorders. We saw in Chapter 10 that the use of distraction during certain treatment procedures can either have a facilitatory or inhibitory effect on outcome. The SREF model can easily accommodate these findings and explain the circumstances under which the different effects are likely to be found. We also saw in Chapter 10 that distraction can displace negative automatic thoughts in depressed affect. Since on-line SREF worry and appraisals are considered to be resource-demanding and require maintenance of goals in working memory, the intensity of this type of processing will be sensitive to concurrent controlled processing demands. The processing of distracting material will divert attention away from SREF negative perseverative activity and thus attenuate active worry. However, it is likely that the efficacy of such distraction will partly depend on the degree of intrusiveness of lower-level activity, which has the potential to activate renewed SREF activity. We propose that SREF activity can usually only be temporarily suspended by distraction, and that this activity will ultimately resume once distraction ceases. Resumed SREF activity will be a consequence of incompletely executed plans, and will be motivated by the discrepancy between the current self-status and the goal which may be stored with the plan in long-term memory. The plan and plan status are likely to be reactivated by particular stimuli, thereby producing a similar pattern of SREF activity and affect. The ameliorative effect of distraction on negative cognitions and mood appears to be limited only to mildly depressed individuals (Fennel & Teasdale, 1984). This specificity may be due to a general motivational deficit associated with more severe depression or because the self-relevant goal is always more strongly activated than other goals. For such individuals, it is easier to allow SREF active worry to perseverate than to redirect attention away from this activity. Moreover, some depressed patients may perceive themselves as helpless and not attempt distraction-based activities. The observed improvement in primary task performance of depressives following the addition of a secondary task is also consistent with the view that other controlled processing activities can divert attention away from SREF processing and its disruptive effects. The literature on distraction effects is somewhat equivocal (e.g. Doleys, 1976), but there remains, however, the issue of why distraction does not impair performance in the same way as SREF activity. One possibility suggested by the present model is that distraction does not normally require large amounts of resources, as does active appraisal and the execution of complex plans.

We also saw in Chapter 10 that distraction may interact with exposure treatment of anxiety, moderating the effect of exposure. In addition, distraction procedures have been employed in composite treatment approaches such as anxiety management training. The data from these studies offer a rather mixed picture of distraction effects. The use of distraction following exposure to a phobic object has been linked to an increase in return of fear compared with thinking about the object following exposure (Sartory et al., 1982). Distraction during exposure reduces the amount of within-session heart-rate habituation in compulsives exposed to feared contaminants (Grayson et al., 1986). We propose that under exposure conditions, distraction causes disengagement of the SREF so that it is less likely that corrective information is processed and used to modify dysfunctional self-knowledge. Distraction may be deleterious for long-term change for two primary reasons. First, under exposure conditions, distraction causes resource starvation of the SREF so that disconfirmatory information is less likely to be processed. This will impede the modification of dysfunctional self-knowledge. Second, distraction may actually prevent exposure to ideal disconfirmatory experiences. For example, a person who fears losing control of his or her mind in phobic situations, may use distraction, since he or she believes it helps to maintain control. Disconfirmation of the unrealistic fear that loss of control will occur can only be achieved if the person tests out whether or not loss of control is possible. In order to do this, self-control strategies like distraction should not be used during exposure to the phobic situation. When control strategies are used, the non-occurrence of catastrophies can be attributed to the use of the strategy and the person fails to discover that the catastrophe will not occur, and that the fear is based on faulty knowledge.

In contrast to the notion that distraction only has positive effects in the short term, there is preliminary evidence that more sophisticated attention-modification techniques (Wells, 1990) may have a relatively enduring positive impact on anxiety and panic. Attentional training (Wells, 1990) consists of the patient developing externally directed, auditory-focused, selective and divided attention capabilities (see Chapter 10). The simplest explanation for the effects of attention training is that the procedure offers a more efficient form of distraction than other more simple distraction procedures. However, the procedure has not been used as a distractor under panic conditions but has been implemented at other times. Therefore, an explanation of its effects must go beyond viewing the effect in terms of simple diversion of attention from anxiety. In terms of the present model, attentional training can be conceptualised as "turning off" SREF processing by developing demanding and flexible non-self-referent executive functions. We propose that the mechanism underlying its effect is an increase in the meta-cognitive control of attention allocation, which facilitates the implementation and elaboration of alternative plans for appraisal and action. In other words, attention becomes more flexible and less bound to particular types of dysfunctional knowledge. Improved executive control of attention allows the person to modify dysfunctional knowledge and process potentially threatening stimuli without triggering the full-blown cognitive-attentional syndrome of self-focused perseverative active worry. In accounting for attention training effects, we should also consider the impact of the rationale which accompanies the procedure. The rationale links the maintenance of panic to excessive attention to bodily events, and this may contribute to therapeutic effects because it decatastrophises the meaning of such events and thus modifies dysfunctional knowledge. It is unlikely, however, that this accounts for a large proportion of the therapeutic gains observed, since clinical experience suggests that reassurance alone has little impact on panic. We cannot rule out the possibility at the present time that non-specific treatment factors account for the effects observed. Nevertheless, there is no reason to suppose that the effect of such factors cannot be explained by the SREF model.

Emotional processing

In this section, we consider the concept of emotional processing as it relates to the SREF model. Emotional processing, described by Foa and Kozak (1986), involves the accessing of fear structures and the assimilation of corrective information in them. This process is a subset of SREF activity. However, the present model offers a detailed account of the cognitive architecture and attentional processes involved not only in "emotional processing" but also in the regulation or disregulation of personal well-being. We view SREF processing as pervasive across all types of distress and not only involved in fear reduction in anxiety disorders. Within the present model, so-called "failures of emotional processing" would occur when plans direct information processing and behaviour in a way which prevents the encoding of information that can disconfirm dysfunctional knowledge. Such plans may lead to the choice of cognitive and behavioural avoidance strategies, and such strategies may also be linked to hypervigilance for threat, in the form of increased monitoring or active search for threat.

Intrusive thoughts have been viewed as phenomena that result from failures at emotional processing (Rachman, 1980). Within the present model, such intrusions may be the result of increased top-down motivated monitoring of activation at the lower level, or the result of indirect activation of lower-level representations by SREF activity. Such intrusions are probably adaptive in their normal form, since they interrupt ongoing SREF activity and stimulate selection and modification of upper-level knowledge and plans for dealing with threat. However, they become problematic when they are themselves appraised negatively based on dysfunctional meta-cognitive knowledge, and when this appraisal is combined with the execution of plans involving the control and avoidance of such intrusions.

Obsessions

Intrusions not only result from traumatic events or failures to process emotionally. The research on normal obsessions reveals that cognitive intrusions are common among 79–88% of individuals (Rachman & de Silva, 1978; Salkovskis & Harrison, 1984). We consider such intrusions to occur both as an epiphenomenon of parallel processing at the lower level, and as a result of facilitation of lower-level activation by top-down influences. Moreover, these top-down influences are responsible for transforming normal obsessions into highly distressing pathological intrusions because they lead to negative appraisal of the intrusion, and also strategically activate lower-level representations of these unwanted internal cognitive events. In other words, some monitoring plans may act as self-fulfilling prophecies. A low level of evidence for a negative cognition is accepted by the plan, which tends to generate the negative appraisal-monitoring vicious circle which increases the frequency of occurrence of the intrusive cognition. Hence, the SREF model is consistent with Salkovskis' (1985; 1989) cognitive-behavioural formulation of obsessions, in which it is appraisals of intrusions, and subsequent attempts to neutralise them, which are primarily responsible for their recurrence and persistence. Salkovskis also emphasises the role of self-knowledge: appraising oneself as personally responsible for the content of the intrusion serves to maintain it. However, the present model suggests that dysfunctional meta-cognitive knowledge may underlie responsibility appraisals and other obsessive-compulsive features (see Chapters 13, 14).

Explanations for attentional phenomena

In this section, we show how the model can be used to explain the observed data on affective disorder and the performance of attentional tasks. With respect to the attentional theory reviewed in Chapters 2 and 3, we see the SREF as performing two main functions. The first is to regulate the top-down control of selective attention, according to a plan or strategy, as in instances of "schema-driven" attention. This might be achieved by top-down activation of lower-level processing units associated with particular feature maps of the visual field (Cave & Wolfe, 1990) or of "templates" for objects of interest (Duncan & Humphreys, 1989). The second function of the SREF is to process intrusions of information from the lower-level network in order to either reject intrusions as irrelevant to its ongoing activities, or to interrupt its current plan and initiate a new plan. The processing of intrusions must itself be plan-driven, since the SREF is not an homunculus capable of autonomous decisions. It may be that the ongoing plan states what action is to be taken in response to specified intrusions. For example, a vehicle driving plan would specify braking in response to the perception of a child in the road ahead. We see plan execution and intrusion processing as being governed by a common set of processing mechanisms.

To explain performance effects, we must think in terms of mechanisms rather than functions. We can dissociate two elements of the self-regulatory system for special attention: the on-line processing machinery of the SREF and the library of self-relevant knowledge and plans in long-term memory on which it may draw. Emotional disorder is associated both with plans which incorporate negative self-relevant beliefs, and with an excessive tendency for the SREF to engage in active, perseverative self-focused processing. These characteristics may be responsible for differing effects on performance. We suggest that the long-term knowledge base is responsible for shaping the meanings derived from negative information, which in turn may affect knowledge in long-term memory and complex judgements. Emotionally disordered people tend to access plans which function to increase the salience of certain negative information. We have seen that mood-state-dependent effects of depression on memory increase with personal involvement, self-relevant stimuli and strong moods (Ucros, 1989). These are all factors which increase the likelihood of involvement of the SREF in processing, which, according to the model, is necessary to obtain the bias effects. Effects are sometimes found with material which does not immediately appear to be self-referent because the person may spontaneously judge it to be self-referent. Self-relevant plans also contribute to selective attention effects, operating post-attentively. As in Eysenck's (1992) hypervigilance theory, we suppose that anxious subjects are more likely to access plans for monitoring the environment which specify active search for threats, and maintenance of focused attention on threatening stimuli which intrude into consciousness. The results of Stroop test studies suggest that plans of this kind are also more accessible in patients suffering from other affective disorders (though there may be differences in detail between different disorders). Plans associated with self-referent processing may also specify explicit monitoring of the person's cognitions or somatic processes, enhancing sensitivity to activations of this information at the lower level.

The other mechanism influencing performance is self-referent processing itself. The primary effect is to withdraw attentional resources from other activities, causing general decrements in performance on demanding tasks, particularly when self-referent processing is perseverative. In addition, self-referent processing contributes to the biasing of attention over and above the effects of the plan. First, running a self-referent plan may indirectly increase attention to congruent intrusions from lower-level processing. Since controlled processing operates indirectly, perhaps by biasing activation levels of lower-level processing units (Norman & Shallice, 1986), self-referent processing of negative information will tend to activate lower-level processing units, which in turn activate associated units through a process of spreading activation. In other words, an incidental by-product of SREF activity is the activation of lower-level units associated with the content of the upper-level plan. If so, these residual activations will summate with those generated by negative external stimuli to increase the probability of their controlling automatic responses and/or intruding into the SREF. This effect may contribute to bias on the Stroop test. If the person is voluntarily thinking negative thoughts, associated lower-level units may become activated, even if there is no explicit intention to direct attention towards negative external stimuli. Residual activation is likely to decay rapidly, so continuous activity of the SREF is necessary to maintain it. For example, people's inability to suppress certain thoughts when instructed to do so in experimental studies, such as thoughts of "white bears" (Wegner et al., 1987), may occur because running the suppression plan automatically activates the lower-level units for the thought. Second, the person's ability to comply with task requirements is likely to be impaired through draining of resources, particularly when effort is required to follow the instructions. This process may contribute to effects on emotion-related bias on Stroop test performance. We have seen that negative stimuli appear to have intrinsic attention-grabbing properties (Pratto & John, 1991). In the emotional Stroop test, the subject is forced, in effect, to attend to both colour and negative word content, since colour can only be selected as part of the perceptual object which includes both stimulus attributes. Word content must be selectively ignored at a relatively late stage of processing, which requires effort and resources, and may be harder to perform if resources have been diverted to self-referent processing. SREF processing may generally impair disengagement of attention from motivationally salient attributes of stimuli within the focus of attention.

In general, we see the effects of emotional disorder on attention as being mainly post-attentive, operating through the direct effects of plans executed by the self-regulatory executive and through the indirect effects on other processes of prolonged SREF activity. The studies reviewed in Chapter 3 suggested that affective stimuli, particularly those of negative content, appear to influence pre-attentive processing. However, subject anxiety and depression effects on simple encoding tasks are weak or absent. That is, pre-attentive processing seems primarily sensitive to motivationally salient properties of the environment, rather than to characteristics of the person, such as anxiety. The SREF model attributes bias to the top-down influence of the system on lower-level processing. Strongly data-limited tasks should not be sensitive to bias, and the failure to find consistent affective bias on primarily perceptual tasks is as predicted. Weak effects on perception and encoding, mainly reported in studies of depression (e.g. Small & Robins, 1988), are consistent with either a weak bias at the lower level, or a weak top-down influence. Cohen et al. (1990), in the context of connectionist models of attention, describe how network units may show a continuum of sensitivities to activation by top-down attentional units, depending on the relative strengths of bottom-up and top-down associative paths. Units associated with early perception and encoding might be strongly activated by input stimuli, but only weakly activated by attentional units, generating weak top-down bias effects. Hence, the model explains the restriction of bias to relatively complex and demanding tasks, in outline at least. Next we consider in more detail the extent to which bias is automatised, and explain the key empirical findings reviewed in Chapters 4 and 5.

Automatisation

In this section, we discuss how affective bias in SREF function relates to the three principal criteria distinguishing automatic and controlled processing: consciousness, voluntary control and capacity demands.

We assume that much of the activity of the SREF is accessible to consciousness, typically in the form of worries, appraisals and so forth. However, there are a number of respects in which consciousness is limited. First, people do not have direct access to the state of the lower-level processing network. Hence, when information intrudes into the upper level, the SREF must construct its own hypothesis as to its origin. In the case of intrusions primed by the effect of the SREF on lower-level units, the person may attach false attributions to intrusions. For example, a panic patient may be thinking about heart attacks and so primes lower-level units associated with heart-rate perception. A perception of speeded heart rate will be more likely to intrude into consciousness and may be misinterpreted as a heart attack if the individual has dysfunctional upper-level beliefs about his or her heart activity. More generally, people have limited and sometimes inaccurate knowledge about the workings of their cognitive and physiological system.

Parts of the operation of the SREF are likely to be unconscious. Schneider and Shiffrin (1977) describe some of the simpler, mechanical elements of controlled processing as "veiled", occurring outside of awareness. Thus within Duncan and Humphreys' (1989) model, constructing a template to guide selective attention may well be unconscious, though the person may be aware of the general aim of the attentional plan. Third, we assume that much of the content of the self-relevant knowledge in long-term memory is procedural rather than declarative in nature. When a plan is run, the person is aware of some aspects of its functioning but does not have detailed introspective access to its structure.

SREF activity is also voluntary, in that it is directed towards a goal specified by the plan (see Toates, 1986). We assume that it is normally associated with awareness of voluntary control. However, in some depressed and anxiety disorder patients, there is an underestimation of the degree of control, even though control exists. For example, a compulsive patient might believe he or she lacks control over compulsive behaviour, although at the information-processing level the behaviour remains under top-down control. Suppose the compulsion takes the form of hand-washing under a running tap. If the water supply is cut off, the patient is likely to develop alternative means of meeting the goal of, say, freedom from germs, by washing in disinfectant or making a journey to another source of water, showing the flexibility of goal-directed behaviour. Involuntary behaviour is more closely tied to a stimulus or class of stimuli which initiate it—taps or water, perhaps, in the example. However, there may be an element of involuntary control in selection of plans. Skill theory (e.g. Anderson, 1987) suggests that with practice high-level skills are increasingly elicited by environmental cues rather than by voluntary intent, in some cases becoming fully automatic. Full automatisation is possible only with a consistent S-R mapping (Ackerman, 1988). It is unlikely that the plans typically associated with affective disorder, which concern complex and changeable situations like reactions to a social threat, ever become strongly automatised. There may be a limited degree of unconscious priming of plans, as suggested by Higgins (1990) for example, so that control is only partly voluntary. In other words, plan initiation is sometimes partly involuntary, but plan execution is always voluntary, in the sense that the person may react flexibly and adapt to meet the goal of the plan. One aspect of affective disorder may be an excessive degree of automatisation of activation of plans for appraisal and coping, such that the person involuntarily tends to assume neutral stimuli are threatening, or adopt a maladaptive withdrawal coping strategy, although partial control remains.

Finally, we propose that SREF operation is resource-demanding, and active, prolonged worry is likely to be particularly so. Like Norman and Shallice (1985), we propose that it is primarily executive operations which require resources, and much processing may function without resource allocation, or be energised by more task-specific reservoirs of resources, as proposed by Wickens (1984). As argued in Chapter 2, we also see resource-limitation as a convenient macro-level metaphor for describing the load-sensitivity of the system, but more precise micro-level descriptions may eventually be possible (see Cohen et al., 1990). Resource demands of the SREF will vary with its mode of functioning. For example, some plans require more resources to run than others, depending on their complexity, demands on working memory and the extent to which the plan requires on-line modification.

In summary, SREF activity is primarily controlled, in the sense of being voluntary and resource-limited, and, to a lesser degree, accessible to conscious awareness. By definition, it is never fully automatic, but its functioning may be sensitive to involuntary priming of plans, and its demands for resources will be highly task-dependent.

Explaining performance data: Consequences of biasing of plans

We now consider in detail how the SREF model explains the empirical data on affect and bias reviewed in Chapter 4. We consider both effects which appear to generalise across a range of disorders, and biases specific to either generalised anxiety or depression. In the next section, we consider effects on performance of the draining of resources associated with the characteristic self-focused SREF operation typical of affective disorder. Our review of the data and their theoretical implications (Chapters 4 and 5) suggests the following central findings to be explained by the model:

1. At least some attentional bias effects generalise across a range of affective disorders. Increased Stroop interference with stimuli congruent with the disorder provides the most reliable marker for this effect. Negative bias in judgement and evaluation, and enhanced memory for self-relevant negative events, also appear to be common to all or most affective disorders.
2. Some bias effects, such as anxiety-related biases in visuo-spatial attention and lexical encoding, may be specific to particular affective disorders, although evidence of this kind is no more than suggestive.
3. Emotional states are relatively weak influences on bias. Bias is stronger when there is an underlying clinical pathology, and when self-relevant stimulus material is used.
4. There is no conclusive evidence that bias is generated either by "automatic" processes or by pre-attentive processing. There are several indications that bias is influenced by post-attentive controlled processing, such as the strengthening of bias effects at longer time delays in short-term priming (e.g. Segal & Vella, 1990) and the effects of blocked presentation and exposure to the task on magnitude of bias (Broadbent & Broadbent, 1988; Richards et al., 1992).

We attribute Stroop interference effects primarily to a plan which specifies monitoring of negative stimuli which intrude into awareness, although, as stated above, incidental effects of SREF activity may also contribute to it. The action specified need be no more than maintaining attention on the stimulus so as to detect any change in its characteristics, such as an increase in its threat value, and so does not necessarily imply enhanced elaboration or recall of the stimulus material. This process might be effected either by maintenance of prioritising the attended stimulus channel within an early selection model, or by construction of a template guiding attention to threat in a late selection mode. As Richards and French (in press) state, anxious patients seem prone to "lock onto" negative stimuli. The review of Chapter 4 suggests this process generalises to depression (Gotlib & Cane, 1987), and other anxiety conditions such as panic (McNally et al., 1990b) and post-traumatic stress disorder (McNally et al., 1990a). The main prediction of the model is that Stroop effects are contingent upon the voluntary execution of the threat-monitoring plan, which may be initiated in a variety of ways. Thus, the monitoring plan hypothesis explains why blocked presentation is more efficient than mixed-trial presentation in inducing anxiety bias (Richards et al., 1992), because the plan is more likely to be run if negative stimuli are expected. A similar explanation applies to Bargh's (1992) finding of depression-related interference only in subjects primed by prior completion of the BDI. Priming of the threat-monitoring plan by state anxiety accounts for trait × state interaction (see Richards et al., 1992). The lack of such priming explains why recovered anxiety patients do not show reliable bias (see Chapter 11). The greater consistency of anxiety effects in clinical patients relative to matched trait-anxious controls (Martin et al., 1991) is explained by greater accessibility of the monitoring plan in long-term memory. Patients, as part of their pathology, apply the plan to a greater range of situations, and may have poor access to plans which would allow more flexible or situation-specific responses. In addition, the plan may be more susceptible to involuntary activation in patients, although there is no direct evidence on this point. The exact nature of the types of threat to be monitored may vary across different clinical conditions, accounting for evidence for specificity of bias, to physical threat words in panic patients, for example (Ehlers et al., 1988b). As discussed in Chapter 4, the evidence for specificity of attentional bias (i.e. bias only occurring for material matching patients' main concerns) is somewhat inconsistent (e.g. Martin et al., 1991). We do not therefore exclude the possibility that the monitoring plan may direct attention to threatening or emotional stimuli in general. It may be that the specificity of bias varies somewhat with the type of disorder. Greenberg and Beck (1989), for example, argue that bias in depressives is specific to depression-related stimuli, but bias in anxiety is more general. We would also expect plans associated with phobias to be highly stimulus-specific (see, e.g. Watts et al., 1986a; 1986b).

It might be supposed that studies interpreted as showing unconscious bias in anxiety patients (e.g. MacLeod & Rutherford, 1992; Mathews & MacLeod, 1986) are problematic for the model. As discussed in Chapter 5, these studies are far from conclusive, and the possibility of momentary awareness of threatening stimuli is very real. Nevertheless, it may actually be the case that the anxiety bias was operating outside awareness, and we must ask whether such a phenomenon would threaten the model proposed here. In fact, such a result would not present any difficulty, because of the weakness of consciousness as an index of level of control of processing. We have seen that running a plan to be vigilant to threats is likely to enhance the sensitivity of certain ("post-perceptual") lower-level processing units to threat. It is possible that all subjects, anxious and non-anxious, encode the presence of threat when stimuli are presented between Cheesman and Merikle's (1986) objective and subjective thresholds. Later processing units, perhaps those governing the interruption of current activities or response production, are then automatically activated. In anxious subjects, these units also receive some activation as the direct or indirect result of the activities of the SREF, and this increases their potency and causes the interference effects observed. It is the top-down rather than bottom-up activation which is sensitive to anxiety. As discussed in Chapter 5, Dagenbach et al. (1989) demonstrated that the strategy used to try to perceive near-threshold stimuli influences lower-level processing even when the strategy fails and the stimulus remains inaccessible to awareness. Hence, the subject's threat-monitoring strategy may affect processing of Stroop stimuli even if they are not consciously perceived. The likelihood of such a strategic process is enhanced by the designs of the studies concerned, in which threat stimuli are also presented above threshold, and may initiate SREF activity in anxious subjects. Indeed, the anxious patient's casual thoughts about the words consciously perceived, and their personal significance, may be sufficient to prime the lower level.

The influence of affect on stimulus evaluation and on memory may be similarly explained. In tasks requiring judgement and decision, subjects use simplifying strategies called heuristics, which make use of information in LTM (Tversky & Kahneman, 1974). For example, in using the "availability heuristic", people base their judgement of the likelihood of an event, such as having a heart attack, on the number of instances of such events which they can recall having happened to people they know, or on how easy it is to imagine such an event. These heuristics may be represented as plans which are run by the SREF. Patients with emotional disorders are more likely to use plans which incorporate negative biases in processing. Anxious or depressed subjects may tend to retrieve negative information, either because they have more negative instances available, or because their plan for making judgements specifies that negative instances should be strongly weighted. The role of self-referent plans, rather than some automatic bias to negative information, explains evidence that depression and anxiety are associated with negative evaluations of the self (Greenberg & Alloy, 1989), because an automatic bias would influence self-referent and non-self-referent processing equally. Negative affect appears to be associated with bias in the plans used for this purpose, specifically in elaborating negative information. The role of strategy explains why bias is stronger for intentional learning, and for tasks in which the subject is personally involved (Ucros, 1989). Incidental learning tasks do not engage strategies directed towards elaboration of memory, and, if the subject is not personally involved, SREF processing will not influence choice of strategy. The "threat-monitoring" plan will contribute to evaluation and memory bias, through enhancing selective encoding of negative stimuli. However, evidence for self-referent memory bias in the absence of encoding bias (Derry & Kuiper, 1981) implies that additional evaluation and elaboration plans are involved. We suspect that in those cases where bias in implicit memory in anxious subjects has been demonstrated, it is due to plan activation during encoding or retrieval, as in Richards and French's (1991) study in which bias was found only when subjects had previously generated self-referenced images for words used. Two biasing effects which may be specific to anxiety are:

- bias in visuo-spatial attention to threat in anxiety;
- bias in lexical encoding in anxiety.

We have seen that the evidence for preferential attention to spatially distributed threat words is stronger for anxiety than depression (MacLeod et al., 1986). This conclusion is tentative because of the shortage of studies using depressed patients, and because there is some evidence for happiness biasing attention to positive words (Gotlib et al., 1988). It is also possible that these results are explained by bias in the threat-monitoring plan already discussed. We saw in Chapter 5 that in the studies of MacLeod et al. (1986), task-anxious patients reliably show enhanced attention to threat presented at the upper, initially attended position, but not to threat presented at the lower position. As discussed in Chapter 5, the data are consistent with anxious patients adopting a strategy of maintaining focused attention on locations associated with threat.

The critical empirical question is whether threat words presented in an unattended spatial location lead to breakdown of spatial filtering and, as discussed in Chapter 5, the evidence on this point is equivocal. If so, the attentional bias may be explained by Eysenck's (1992) hypervigilance theory, which proposes that anxious individuals are prone to scan the visual field for threat. In terms of our model, anxiety patients are characterised by the operation of a threat search as well as a threat monitoring plan: search requires active scanning of the visual field, whereas monitoring refers to an analysis of threat stimuli attended for other reasons. This interpretation of the evidence is consistent with Broadbent and Broadbent's (1988) view that bias in the MacLeod et al. (1986) paradigm is post-attentive. Evidence for a trait–state interaction obtained by the Broadbents implies that state anxiety primes initiation of the threat search plan.

We saw in Chapter 4 that there may also be anxiety-specific bias in tasks requiring encoding of threat words. Anxiety effects on spelling of ambiguous homophones (Mathews et al., 1989b) and homograph priming (Richards & French, in press) appear to be reliable. Again, there is a lack of evidence from studies of other disorders, and the data on other related tasks, such as unprimed lexical decisions, are confusing. Richards and French's (in press) priming data are consistent with the post-attentive effect predicted by the SREF model in that bias increased with time lag (SOA) between prime and target, which provides a strong indication of a controlled processing mechanism (see Neely, 1991). We have argued that priming may also influence the homophone spelling task. It may well be that priming is biased by the operation of the threat-monitoring or elaboration strategies already discussed. As French and Richards suggest, anxious patients may lock onto threatening interpretations, or they may actively elaborate them. However, there may also be a plan specific to anxiety operating in verbal processing. One possibility is that the threat search plan associated with hypervigilance directs attention preferentially towards threatening meanings of homophones, again post-attentively. Such a plan might influence the checking processes which operate after lexical access when stimuli are mutually confusable (see Neely, 1991).

Consequences of resource limitation

Because the SREF draws on the same pool of resources as other executive processes, its activity is likely to interfere with performance of tasks requiring controlled processing. The syndrome of prolonged self-focused worry and appraisal we have related to emotional disorder is particularly draining of resources, because of the intrinsic complexity of much of the processing involved. Also, the persistent activity of the system will make it difficult for the system to relinquish control of information processing to lower-level systems when necessary for successful performance—flexible switching between levels of control will be impaired. Hence, the executive processing of other activities is likely to be impaired, and there will be fewer resources available for allocation to those partially automated processes which require an input from the upper level to function efficiently. The main prediction that worry and active self-focused appraisal will interfere with concurrent performance of demanding tasks is hardly novel (see e.g. Wine, 1971). However, the model does account for some additional features of the data. First, we saw in Chapter 6 that attempts to identify anxiety effects with specific information-processing constructs, such as working memory (Eysenck, 1982) or sustained information transfer resources (Humphreys & Revelle, 1984), have had only limited success. For example, neither hypothesis readily explains anxiety effects on fine motor control (Calvo & Alamo, 1987). The SREF model proposes that the primary anxiety deficit is in executive control, which may affect any task of sufficient difficulty, complexity or novelty, irrespective of its exact information-processing requirements. One aspect of deficit in executive control is failure to effect strategic control of lower-level processing efficiently, which may lead to the semblance of more specific decrements. For example, if the use of the articulatory loop in working memory on a particular task requires initiation by the executive, this component may show greater decrements than other aspects of performance. However, the effect may not generalise to other tasks, controlled by different executive plans, and it may be modified by the subject's strategy. Second, the model explains the trend in the data towards a dissociation between trait and state anxiety effects (see Chapter 4). Trait anxiety appears to be stronger as a predictor of bias, whereas state anxiety (particularly worry) is the stronger determinant of performance efficiency on demanding tasks. We attribute the trait effect to the plans in LTM, and the state effect to the immediate consequences of SREF activity. It is unclear whether this dissociation holds up for trait and state depression. As noted above, SREF activity may have some indirect effects on bias, although we attribute bias primarily to plans. Third, the model explains the context specificity of anxiety effects. For example, test-anxious subjects do not show attentional decrements when given reassuring instructions (e.g. Geen, 1985). Under these circumstances, the SREF may not be strongly activated, so there is no source of interference with attention. As the test anxiety literature discussed in Chapter 6 shows, interactive effects of anxiety and instruction are also found in the subject's conscious cognitions, so that reassurance reduces self-reports of intrusive thoughts (Sarason et al., 1990).

An important but difficult question is the generality of resource-driven effects across different forms of pathology, particularly anxiety and depression. An issue which is yet to be resolved is the role of motivation, effort and task strategy in SREF-mediated effects on performance. The difficulty arises from the possibility that some or all of the performance decrements associated with these conditions may arise from the use of certain strategies rather than from a lack of resources *per se*. It is claimed that anxiety and depression states are associated with reduced resource availability (e.g. Ellis & Ashbrook, 1987; Eysenck, 1992), and, particularly in the case of anxiety, there are a number of studies where the resource interpretation is strongly supported (see Eysenck, 1992). However, both conditions have also been linked to the use of less demanding strategies, which may give the superficial appearance of a resource deficit (Griffin et al., 1986; Mueller, 1978). Eysenck (1992) has argued that anxious subjects increase effort to compensate for resource deficits, but the effect is not evident in studies of strategy such as those of Mueller (1978). We saw, too, in Chapter 6 that there are similar questions concerning the respective roles of lack of resources and strategy choice arising from studies of obsessive-compulsive disorder and performance.

The dearth of studies investigating strategy use and resource allocation in detail make any conclusions drawn from the data very tentative. However, strategy effects are a direct indication of a plan-based mechanism, and the data provide some pointers to the roles of plans in mediating anxiety and depression effects. The simplest mechanism is that adoption of an undemanding strategy is a secondary reaction to SREF activity, a generally rational coping strategy for dealing with interference by worry and appraisal. We would expect that most individuals' meta-cognitions would bias use of a simple task strategy when efficiency of attention and thought is appraised as impaired. An alternative mechanism is that strategy choice is influenced by the content of plans accessed from LTM. For example, it may be that motivation is controlled by plans which specify the input conditions under which effort is increased or decreased, and, in clinical disorders, self-referent processing accesses plans biased towards reluctance to increase effort (since increased task effort might compromise the efficiency of self-referent processing). Depressed patients' improvements in performance when distracted (Foulds, 1952), an effect quite opposite to expectation from resource theory, may reflect the replacement of self-monitoring plans by more task-oriented plans for coping with the distracting stimuli.

The content of plans relating to task effort may be a fruitful area for identifying differences between anxiety and depression. As discussed in Chapter 6, depressives appear to have a more global motivational deficit than anxiety patients. Depressives may have a special impairment, either in appraising input conditions as unsuitable for enhanced effort, or in having plans which fail to increase effort in circumstances where non-depressives would do so. An hypothesis of this kind might also help to integrate data on learned helplessness and causal attributions within the model. However, there is currently insufficient evidence from studies of attentional performance to do so. Another task for future research is to determine the role in depression of subjective fatigue, which is associated with decrements in visual resource availability (Matthews et al., 1990b).

Summary of the model

In this chapter, we have presented a detailed model of cognitive processing as it relates to emotional disorder. It is proposed that a certain cognitive-attentional syndrome underlies individual vulnerability to emotional dysfunction. This syndrome consists of heightened self-focused processing, capacity limitations, reduced efficiency of cognitive functioning, activation of self-relevant knowledge, and attentional bias. In particular, the use of a self-relevant, ruminative and perseverative style of appraisal (active worry) is a pernicious component of this syndrome.

We have modelled the processing characteristics of emotional disorder on a cognitive architecture comprised of three interacting levels. The levels comprise (1) a low-level network of elementary processing units reflexively activated by incoming stimuli, (2) controlled processing of self-relevant information, which is voluntarily initiated and requires attentional resources, and (3) a library of items of self-knowledge held in long-term memory. Interactions between processing at these different levels supports the SREF, which controls selective attention and response to self-relevant stimuli. The SREF may be activated either by a voluntarily implemented strategy or by intrusions of self-relevant information from lower-level processing which activate discrepancies between perceived actual and ideal states of the self. Social cues are particularly prone to elicit SREF activity. There are also pronounced individual differences in the ease with which the SREF is engaged, related to personality traits such as dispositional self-focus and neuroticism. Activation of the SREF is reciprocally linked to the accessing of self-relevant knowledge in the form of generic plans for self-regulatory processing, which are adapted to the needs of the immediate situation by "on-line" controlled processing. Plans represented as procedural knowledge may be at least as important as declarative beliefs in generating pathology. Some plans are "meta-cognitive" in nature, in that they are driven by the person's beliefs about their internal processing, and direct attention towards feedback from such processing.

SREF activation has both direct and indirect consequences. The plans run by the SREF directly influence processing strategies, such as monitoring the output of lower-level processing for particular types of intrusion, maintaining focused attention on sources of threatening stimuli, and attempts at mood repair. Plans for controlling attentional selection may be responsible for the effects of negative emotion on attentional bias reviewed in previous chapters. In addition, the attentional resource demands of SREF processing may interfere with the efficiency of some processing operations. Demanding task-related processing and the modification of dysfunctional self-knowledge may be particularly vulnerable to impairment of this type.

In the SREF model, emotional reactions result from an anticipated failure (anxiety) or an actual failure (sadness) to meet the self-regulatory goals specified by self-knowledge. The status of the plan for regulation will only influence emotion when the SREF is active. Emotion is associated with the maintenance of SREF processing as the individual attempts to meet goal requirements and thus escape from unpleasant affective experience. Information concerning the success or failure of the plan may be stored together with the plan in the self-referent knowledge base, so that emotion is generated without extended appraisal the next time the plan is accessed by the SREF.

In this chapter, we have seen how the model can be used to explain a wide range of clinical and experimental findings in emotional disorder. In the next chapter, we discuss some of the important treatment implications of the model.

13

CLINICAL IMPLICATIONS

In this chapter, we consider in detail the implications of the present model for the treatment of emotional disorders. In the first section, we offer an account of the efficacy of existing treatments in terms of the new model, because the mechanisms of change specified by the current model are different from the mechanisms postulated by other theories. In the second section, new implications for treatment are discussed, with an emphasis on the augmentation of existing schema-based cognitive therapy. While many of the treatment implications are consistent with existing cognitive therapy, several new possibilities are implied by the present model. In particular, existing cognitive theories offer no more than a basic principle for therapy: namely, modifying patients' belief in dysfunctional appraisals and assumptions and generating replacement knowledge. This approach tends to focus on modifying the content of cognition (declarative knowledge), but it is likely that procedural knowledge is at least as important in dysfunction. The theories fail to specify in detail the different aspects of the cognitive architecture which may contribute to emotional problems. An analysis of this type is possible with the SREF model and it leads to new predictions concerning what should be done in treatment. In addition, this model, unlike other cognitive models, offers guidelines concerned with *how* cognitive change may be best achieved.

Behavioural and cognitive therapies

A wide range of therapeutic approaches has been developed for, and applied to, depression and anxiety disorders. It is beyond the scope of this book to present a detailed analysis of these approaches. In this section, we discuss popular exposure-based behavioural and cognitive (Beckian) treatments and consider how their effects may be interpreted in terms of the present SREF model.

Behavioural approaches

Behavioural approaches to emotional disorders, particularly anxiety states, have used variations of exposure-based techniques. One of the most common fear-reduction techniques, systematic desensitisation (Wolpe, 1958) is historically based on the principle of reciprocal inhibition. That is, a learned fear response can be inhibited by substituting an antagonistic activity for it. The antagonistic activity is typically some form of relaxation. Desensitisation involves learning a relaxation response and applying this during gradual exposure to the feared situation in imagination and/or in real-life circumstances. In a review of treatment studies, Jansson and Ost (1982) concluded that imaginal flooding and real-life exposure consistently produced improvement in agoraphobic patients, whereas systematic desensitisation did not. Michelson and Marchione (1991) conclude that contemporary findings indicate that therapist-assisted, prolonged, graduated real-life exposure appears most effective in the treatment of panic disorder with agoraphobia. However, the exposure technique still appears inadequate for many patients. After reviewing the meta-analyses of existing studies, they suggest that while exposure is a relatively beneficial treatment for this problem, a significant proportion of patients seem not to benefit (60–75% show a clinically significant response, although the figure is closer to 50% if drop-outs and non-responders are included). Moreover, residual symptomatology such as mild avoidance is common.

Relaxation has been used in addition to exposure treatment, or as a treatment in its own right in clinical outcome studies. Generally, studies in which relaxation and exposure have been combined show that the combined treatment is no more effective than exposure alone (Michelson, Mavissakalian, & Marchione, 1988; Ost, Jerremalm, & Jansson, 1984). However, several studies of panic show that relaxation alone, in particular applied relaxation (Ost, 1987)—which involves the learning of relaxation skills to short-circuit panic—plus programmed practice, is as effective as therapist-assisted, real-life exposure (see Michelson & Marchione, 1991, for a review). Applied relaxation training (Ost, 1987) consists of six main stages, and homework practice is an important part of the treatment. At the outset, patients are presented with a rationale emphasising that relaxation is a skill that can be learned and applied to breaking the "vicious circle" of panic. Patients are required to keep a record of early signs of anxiety so that they may increase their ability to recognise such signs. The first stage of relaxation proper is *progressive relaxation*, which involves the systematic production and release of tension in a series of muscle groups. Stage two is *release only* relaxation, which is aimed at reducing the length of time needed to relax, and uses only the release phase learned previously. Following this stage, *cue-controlled relaxation* is taught. This is quicker still (2–3 min) and focuses on slow breathing and forming an association between the self-suggestion "relax" and feelings of relaxation. Stage four, *differential relaxation*, involves relaxing using cue-controlled relaxation followed by instructions in body movement and subsequently relaxation during particular activities such as walking. This stage of relaxation training is followed by *rapid relaxation*, which is aimed at reducing the time needed to relax to 20–30 sec. It consists of practising cue-controlled relaxation many times a day in response to seeing an agreed cue which is introduced at different locations in the person's natural environment (e.g. a red dot placed on the telephone, wrist-watch, television, etc.). The final stage of applied relaxation is *application training*, in which patients are instructed to practise relaxation in anxiety- provoking situations. This often involves practice during exposure to a wide range of anxiety-provoking situations.

Exposure has also been used in the treatment of obsessive-compulsive disorder. The behavioural model of this disorder proposes that ritualistic behaviour maintains obsessions by reducing the amount of exposure to them, thereby preventing habituation (Rachman & Hodgson, 1980). Exposure has been combined with response prevention to provide one of the most effective treatments for obsessive-compulsive disorder. In this approach, the patient is encouraged not to use overt or covert ritualising responses during exposure to feared stimuli. The results of studies employing exposure and response prevention are consistent, with approximately 65–70% of patients showing improvement which is maintained at follow-up (Foa, Steketee, & Ozarow, 1985; see Rachman & Hodgson, 1980, for a review).

Cognitive approaches

There are several cognitive therapies which have been used in the treatment of emotional problems (e.g. Beck, 1976; Beck et al., 1979; Ellis, 1962; Meichenbaum, 1977). Beck's approach to treatment is geared towards the collaborative modification of "dysfunctional" thinking through verbal and behavioural re-attribution techniques. Detailed accounts of this treatment are available elsewhere (e.g. Beck et al., 1979; 1985; Wells, 1992). Generally, the treatment consists of sharing a cognitive formulation of the problem with the patient, and this is followed by the use of behavioural strategies designed to elevate mood in cases of depression. Treatment also focuses on the identification and questioning of negative automatic thoughts, and the modification of behaviour in a way which provides information important for socialising the patient in the cognitive model and invalidating dysfunctional thoughts, and validating more functional ones. These behavioural "experiments" often involve exposure to feared situations set out to test danger-related cognitions in anxiety or to reverse avoidance and self-defeating behaviours in depression. Exposure experiments are presented as an opportunity for patients to test their belief in negative thoughts. Thus the rationale for exposure is explicitly related to the cognitive formulation of the problem and exposure is not used in a pure behavioural sense. Later in treatment, usually following symptomatic improvement, verbal and behavioural re-attribution techniques are applied to the modification of patients' more stable beliefs and assumptions conceptualised as underlying their stress vulnerability. Several studies have shown that this approach is effective in the treatment of depression (e.g. Blackburn et al., 1981; Kovacs, Rush, Beck, & Hollon, 1981; Rush, Beck, Kovacs, & Hollon, 1977). However, there still appears to be a lot of scope for improving outcome, especially in the case of depression where relapse rates in outcome studies are between 20 and 33% after 12 months follow-up (see Clark, 1990, for a review). In these instances, relapse is defined as return to treatment or a BDI score of 16 or more. In a study by Evans et al. (submitted), only 30% of patients who were offered cognitive therapy found the treatment acceptable, responded to it in 3 months, and remained well over the next 2 years.

Cognitive therapy and closely allied treatments have been used in the treatment of panic (e.g. Clark et al., 1990; Salkovskis, Clark, & Hackmann, 1991; Sokol et al., 1989; see also Michelson & Marchione, 1991). The therapy outcome in panic appears superior to that in depression. For example, Clark et al. (1990) compared cognitive therapy with imipramine, applied relaxation and a no-treatment condition. All treated groups were superior to the control group on most measures. At post-treatment, 90% of patients who had received cognitive therapy were panic-free (i.e. no panics within the preceding 2 weeks), compared with 50% of patients in the applied relaxation group and 55% in the imipramine group (only 7% of the control group patients were panic-free at the equivalent time period). At 12-month follow-up, 85% of cognitive therapy patients were still panic-free, compared with 47% of the relaxation group and 60% of the imipramine-treated patients. At 6–12-month follow-up, 5% of cognitive therapy patients relapsed (required further treatment), compared with 11% of the relaxation group and 40% of imipramine-treated patients.

In general clinical practice, cognitive-behaviour therapists employ combinations of cognitive and behavioural techniques. The combination is probably shaped by what they have found effective through experience as well as by what is derived from a particular model. With more eclectic approaches, it is particularly difficult to explore the relative efficacy of the more and less cognitive components. However, Beck's cognitive therapy has been compared with behaviour therapy in the treatment of generalised anxiety by Durham and Turvey (1987) and Butler, Fennell, Robson and Gelder (1991). Both these studies suggest a slight superiority for the cognitive approach, but the Durham and Turvey study was uncontrolled and strong conclusions require other controlled comparisons.

Accounting for existing therapy effects in the SREF model

In this section, we consider how the SREF model can account for the apparent efficacy of theoretically diverse and procedurally different treatment approaches like those reviewed in the previous section. It is likely that the success of all therapies depends to some extent on non-specific treatment factors, such as supportive therapist contact, the provision of a credible treatment rationale and so on. The role of these non-specific factors can be accounted for by the present model. For example, these factors may simply facilitate active encoding and processing of new information, which leads to a restructuring of dysfunctional self-knowledge. It is generally accepted, however, that these factors alone are insufficient for clinical improvement in most cases. The treatment perspectives reviewed share other features which are particularly important for therapeutic gain as specified by the present model. First, they typically involve some form of exposure to feared stimuli in anxiety disorders. This is important because it facilitates encounters with information capable of disconfirming dysfunctional self-knowledge. Second, the controlled execution of exposure-related responses will override procedural knowledge which normally specifies behavioural avoidance, and this should augment the development of new procedures and increase executive control over choice of activities. This is also likely to be the case in exposure and response prevention in the treatment of obsessive-compulsive problems. Exposure and response prevention can be conceptualised in terms of disconfirmatory learning: patients experience exposure to the feared stimulus (e.g. thought or contaminant) without engaging in behaviours which are believed to thwart the appraised disaster associated with exposure. In this way, they can learn at an unconscious procedural level that the stimulus or situation is harmless. Exposure and response prevention instructions also require behaviour change which depends on demanding executive control over processing and, following extensive practice, leads to the development of new procedural knowledge for the regulation of appraisal and behaviour during exposure to stimuli.

The SREF model suggests that exposure would not be effective if the patient is engaging in perseverative SREF activity which drains resources. Thus, perseveration should be reduced before, during and immediately following exposure, to facilitate processing and encoding of new information.

The SREF model predicts that effective treatment requires the modification of the content of dysfunctional self-knowledge and provision of effective control over on-line SREF processing with a view to replacing dysfunctional procedural knowledge governing information processing and behaviour. Exposure is effective when it facilitates modification of dysfunctional self-knowledge, increases control over processing in threatening situations, and leads to the formation of alternative procedural knowledge, capable of activation by previously distressing stimuli. However, the model also implies that traditional exposure may not produce optimal change in these dimensions, primarily because it does not provide a cognitive set which facilitates optimal and enduring belief change, and it does not prevent the operation of other dysfunctional processing specified by procedural knowledge, such as SREF perseveration, selective attention and monitoring, which can contribute to anxiety maintenance. We discuss this point in more detail in the next section.

The SREF model implies that the provision of control strategies such as relaxation in the treatment of anxiety is likely to be most effective when they modify self-knowledge. Furthermore, if successful anxiety reduction is achieved in anxiety-provoking situations, it is likely to increase beliefs about self-control and potentially decatastrophise the significance of anxiety. However, if the control of anxiety is a particular goal specified by the patient's procedural knowledge because, for example, he or she believes that experiencing anxiety is harmful to the physical or social self, this knowledge may remain unchanged if control strategies are used, and could maintain vulnerability over a longer time-course.

Some varieties of relaxation increase self-referent processing of body-state information. Activation of the SREF in this way prompts the accessing of self-knowledge associated with heightened body-awareness. When this knowledge is dysfunctional, as for example when it implies threat associated with somatic perception, paradoxical anxiety enhancement is likely to occur. This is the phenomenon of relaxation-induced anxiety reported in the literature (e.g. Heide & Borkovec, 1983; 1984). Continued relaxation practice under such circumstances could potentially decatastrophise the meaning of body-state information to the extent that it offers an alternative "safe" appraisal of sensations, which may be encoded within the activated knowledge system.

The present model also predicts that exposure and relaxation will be most effective when they exert an effect on meta-cognition; that is, when they increase patients' perceived control over on-line processing. When these techniques specify the use of non-perseverative self-control appraisals and behaviours, this is more likely to result in increased control over SREF activity under stressful conditions. This control is necessary for efficient processing of belief-incongruent information.

Some treatments use more direct cognitive modification strategies. These approaches can be seen as directly changing on-line SREF processing by using procedures such as distraction, challenging negative automatic thoughts, and rational responding. These techniques have been employed in eclectic treatments such as anxiety management where there may be varying degrees of emphasis on modifying other levels of information processing such as the content of self-knowledge. Beck's cognitive therapy, in contrast, is explicitly directed at modifying the content of cognition at SREF *and* self-knowledge levels, and also certain cognitive processes typified by thinking errors (e.g. selective abstraction, mental filtering, jumping to conclusions, etc.). We presume that these errors are plan-driven. Cognition is modified at both levels through verbal and behavioural techniques. Verbal techniques include identifying and questioning thoughts, reviewing evidence and counter-evidence for them, generating alternative appraisals, and refocusing attention on information which disconfirms negative cognition. Behavioural techniques are typically presented as experiments to gain new information and invalidate, through experience, certain negative thoughts and beliefs. Both the SREF and the schema models predict that treatments which successfully modify dysfunctional self-knowledge rather than just on-line activity, both of which are directly targeted in cognitive therapy, should have superior long-term benefits compared with treatments which do not do this. It is conceivable that symptom-focused approaches like relaxation and pharmacological interventions are less efficient at self-knowlege modification. For example, anxiolytic drugs seem not to modify attentional bias in anxious patients (Golombok, Stavrou, & Bonn, 1991). They are likely to modify on-line SREF activity or the activity of lower-level processes rather than more stable self-knowledge. However, drugs could be used to reduce state anxiety and free-up resources which the therapist can then direct towards modification of self-knowledge. For example, SREF perseveration and energetic effects in depression may be so severe that cognitive modification can only be accomplished if these effects are initially moderated with drugs. However, drugs with sedative effects may generally degrade processing, and so may reduce the availability of dysfunctional self-knowledge and plans, rendering modification difficult. Improvements in depression with anti-depressant drug treatment are associated with changes in depressive thinking similar to that achieved in cognitive therapy (e.g. Simons, Garfield, & Murphy, 1984). It may be that the release of attentional resources accounts for the effects of anti-depressants. The therapeutic effects of anti-depressants may be contingent on the belief that the drug will be effective, so that the patient is motivated to use extra resources for modifying self-knowledge.

While there may be a common set of mechanisms which account for the effectiveness of a diverse range of treatment approaches, these approaches may not be equally effective in modifying relevant dimensions of processing. The pure behavioural approach pays little attention to the patient developing meta-cognitive skills of increased awareness of dysfunctional cognition and the ability to question that cognitive content. In terms of the present model, the cognitive approach would be favoured over pure behavioural treatments (although present cognitive approaches are not optimal) for emotional disorder because it directly modifies on-line SREF activity in order to disrupt perseverative processing, and in a way which facilitates the modification of dysfunctional self-knowledge. A prerequisite for this type of corrective processing is increased awareness of SREF activity and manoeuvres which increase control over the processing driven by dysfunctional plans. In summary, the present model can account for the treatment effects of a range of approaches, in cognitive-attentional terms. However, it implies that particular approaches might be more effective than others. Generally, the treatments which combine the interruption of perseverative SREF appraisals with increases in meta-cognitive control and modification of self-knowledge at the declarative and procedural level are most likely to produce beneficial long-term effects. In addition, the model presented here offers several more specific implications for the conduct of cognitive therapy, which may increase the efficacy of treatment in the long term. These are considered in the next section.

New implications for cognitive therapy

Schema theory is predominantly concerned with the content of declarative self-knowledge (e.g. "I'm weak"; "I'm bad") and associated propositions or assumptions at the level of stable stored representations. The SREF model specifies the role of procedural domains of self-knowledge additional to the declarative. We are not certain that declarative knowledge is actually stored as a discrete entity in memory, since it may be the situational output of running a particular plan. Thus the plan is the stable entity, whereas the declarative concept may not be. This would account for the variability in self-beliefs observed within many patients across different conditions. If this is the case, it may not be particularly useful in the long term to challenge the declarative beliefs articulated by patients during therapy, although some of the manoeuvres used to do this may be more generally beneficial because they also lead to modification of the plan. Challenging of the declarative belief may lead the patient to concede that they logically know that the belief is wrong but it still "feels as if it is right". In other words, the plan is still functioning in response to particular stimuli, and continues to activate the majority of the pattern of cognitive, affective and behavioural processes which are consistent with the belief. In addition, the indicator of the status of the plan, which may generate emotion, will not be influenced by changing the specific belief. We suggest that if the procedure remains unmodified, it is likely to override the intellectual reappraisal of the belief. For example, a generalised anxious patient may report the belief "I'm vulnerable", which may be associated with plans directing hypervigilance for threat, self-focused attention, active worry, and also behaviours such as avoidance and heightened dependency. If the plan is not modified, it will prevent exposure to disconfirmatory information, and it is also likely to produce patterns of processing which increase feelings of vulnerability.

As there is little direct empirical data on the organisation of self-knowledge (see Segal, 1988), we do not wish to overstate the role of plans in producing declarative self-beliefs. Even if these types of knowledge co-exist in stable form, it would be necessary to modify both types of knowledge for the reasons we have just outlined.

Cognitive-behavioural treatments have tended to emphasise the control of symptoms by relaxation and the interrogation of thoughts within the SREF by the SREF. Challenging negative appraisals and generating rational responses requires considerable SREF resources and does not necessarily modify dysfunctional self-knowledge or facilitate optimal control over SREF function. Rather than using the SREF to interrogate thoughts, which could contribute to rumination tendencies in some patients, the present model suggests that attempts should be made to promote a meta-cognitive detachment from thoughts while maintaining objective awareness of them. We may view this as a type of "disconnected mindfulness", which does not have full ego-involvement and therefore does not trigger the full dysfunctional SREF syndrome. This should also encompass a *passive* "letting go" of rumination combined with the observation of thought but without active control. These procedures could facilitate: (1) the development of meta-cognitive awareness; (2) control over the selection of different SREF strategies for appraisal; (3) the development of new strategies (plans) for regulating SREF activity; (4) the freeing-up of resources for disconfirmatory processing and modification of beliefs.

This type of training is an important initial step in the endeavour to modify self-knowledge. The model predicts that efficient modification of self-knowledge can be achieved by activating the belief and examining it without triggering the full-blown dysfunctional SREF syndrome (perseveration, high self-focus, attentional bias, etc.). The initial aim of treatment based on the SREF model is the development by the patient of a higher meta-cognitive awareness at which level the individual is encouraged to "reside", rather than residing at the level of negative SREF appraisals themselves. This type of detached processing may be useful in preventing full SREF activation and may be developed as an adaptive coping strategy which facilitates cognitive control and disconfirmatory processing. Consistent with this, Roger et al. (1993) demonstrated that detached processing, which involves not taking things personally, feeling clear-headed about situations, deciding it's useless to get upset and just getting on with things, etc., represents an empirically distinct mode of coping which may be more adaptive than emotional coping and avoidance strategies. They have developed the Cognitive Styles Questionnaire in which detached coping is an independent subscale.

The present model differs from current cognitive approaches in another fundamental way. It implies that we should look at a person's knowledge in a *dynamic* rather than a static way. Current cognitive approaches focus on disconfirming patients' thoughts and use questions such as: "What's your evidence for thinking that?" "Is there any counterevidence?" "What's the thinking error?" The SREF approach advocates the use of questions which explore and modify the patient's strategies for processing operations such as selective attention, evaluation and memory search. Questions might include: "How do you form judgements?" "What sort of evidence do you look for?" "What are you paying most attention to in the situation?" "What is most salient?" "Are you focusing on your thoughts or the situation?" "What memories are activated?" "Does the situation/stimulus directly tell you this (interpretation)—if not, *where* does your data come from?" Such questions are also crucial in exploring the dynamics of processing. Dynamic factors can be elucidated by setting up exercises in which patients are instructed to observe what they do in problematic situations. This should go beyond merely observing negative automatic thoughts (the contents of the SREF), and include a self-analysis of cognitive processes using the types of questions presented above. This technique can be used to build a profile of the patient's dysfunctional processing routine, which is specified by his or her plan. Once the profile has been established, it can be systematically modified so that: (1) maintenance and construction of dysfunctional self-knowledge can be averted; (2) new routines can be developed and practised in a way that leads to the construction and maintenance of new knowledge; (3) simple elements may be added or changed in existing routines which have a profound effect on the implicational output and/ or have an inhibiting effect on dysfunctional processing by producing response competition.

The use of procedures like those presented here requires that patients become aware of when a maladaptive plan is operating. Once again, the development of detached mindfulness is likely to be a necessary prerequisite, and when combined these techniques can be aimed at teaching control over the selection of generic plans for processing. In the next section, we discuss other meta-cognitive considerations in the clinical formulation of patients' problems and in treatment.

A neglected dimension of self-knowledge: Meta-cognitive beliefs

Cognitive approaches to emotional disorders have focused primarily on the role of beliefs about the self as a social object or beliefs about physical well-being. The SREF model proposes that a third dimension of belief and cognitive processing, which has been largely neglected by previous theories, is also important in psychopathology. This dimension consists of beliefs and procedures concerned with the regulation and interpretation of one's own cognitive processes, which appear to be impaired in patients (Slife & Weaver, 1992).

The SREF system serves to promote self-regulation, which includes regulation of the cognitive environment as well as affective, physical and psychosocial status. It is essential, for example, that an individual can reliably discriminate "reality" from internal fantasy (see pp. 333–336 for a theoretical discussion of how this may relate to obsessional checking). In order for this type of discrimination to occur, the individual must possess knowledge about the significance and meaning of his or her own cognitive events. We saw in Chapter 7 that some patients with emotional disorders have particular meta-cognitive beliefs concerning danger or safety associated with certain forms of cognition. For example, an obsessional patient may believe that having bad thoughts is likely to make bad things happen. Moreover, this belief may be accompanied by the activation of lower-level processing units for detecting such events, so that intrusions become more frequent or intense. We propose that dysfunction at the meta-cognitive level is of primary significance in obsessive-compulsive disorder and in disorders involving subjectively uncontrollable perseverative worry. However, dysfunctional meta-cognitive appraisals also occur in some panic patients who, for example, believe that their spontaneously occurring images of loss of behavioural control (e.g. images of rushing out of a crowded shop or going crazy) mean that they will actually lose control. We infer that this type of appraisal is based on dysfunctional meta-cognitive knowledge. For example: "Having images about loss of control means it is more likely to happen"; "My images of disaster predict the future"; "If I think I've lost control then I probably have lost control".

Meta-cognitive beliefs and procedures are likely to be part of general-purpose self-regulatory processes and plans and "weak-method procedures" in Anderson's (1987) terminology. If they include faulty knowledge, it will be necessary to modify them as well as modifying other more specific knowledge about the physical and social self. The modification of general meta-cognitive knowledge may be an important addition to the modification of more specific knowledge, because this knowledge may determine the types of behavioural and cognitive strategies employed as new plans develop. For example, a hypochondriacal patient who believes that worrying about health will keep him or her safe may not respond optimally to procedures designed to reduce the frequency, or challenge the content, of worry unless the procedures also challenge the meta-cognitive belief. Similarly, attempts to modify the content of disturbing intrusive images of catastrophe of some patients may reduce the immediate distress accompanying the image, but if the patient believes that such images indicate that the catastrophe is highly likely, he or she will remain vulnerable to distress from subsequent intrusions. Other forms of meta-cognitive knowledge are also relevant in influencing a person's situational appraisals and choice of coping response. Knowledge about the efficacy and controllability of one's cognitive system (e.g. Wells, 1994a,b) may be important for general-purpose knowledge involved in the formation of more specific procedural knowledge. While not all emotional disorders will involve dysfunctional beliefs about cognition, we propose that they do all involve dysfunctional meta-cognitive plans, which specify, for example, perseverative worry, attentional bias, monitoring and so on.

Apart from the content of meta-cognitive beliefs and associated appraisals which may be involved in psychopathology, other dimensions of processing which we may also term meta-cognitive could play a role in the maintenance of emotional problems. Cognitive processes and also behaviours specified by meta-cognitive plans may reduce the subjective controllability of unintended thought. For example, certain thought regulatory responses such as suppression might be counterproductive. It is likely that other attempts at thought control such as neutralising may have similar deleterious consequences because they increase the range of stimuli which become associated with the unwanted thought, thus increasing the range of potential triggers. Furthermore, attempts at control are likely to increase preoccupation with lower-level cognitive products.

Meta-cognitive plans may specify certain types of SREF activity when activated. For example, a social phobic when asked to give a formal presentation may engage in SREF perseverative activity consisting of rehearsal of the situation in a worrisome (negative) way. Even if the patient has received psychological treatment and no longer experiences the conscious belief that he or she will act foolishly in the situation, the patient could still find that he or she engages in worry and becomes unnecessarily apprehensive because the plan for SREF activity is not yet overridden.

In conclusion, cognitive therapy should focus on eliciting and modifying dysfunctional meta-cognitive knowledge in addition to other varieties of self-knowledge. Modification of dysfunctional meta-cognitive knowledge may involve the reversal of attentional and behavioural responses which block natural disconfirmation of declarative knowledge, and also encourage use of procedures like those outlined which lead to the learning of new plans which facilitate efficacious cognitive control.

Secondary "emotion"

Since the SREF system is concerned with the processing of self-relevant information and with self-regulation, it is also the source of appraisal of emotion. We saw in Chapter 6 that it is possible to distinguish worry about worry from other dimensions of worry (Wells, 1994a), and some models of anxiety such as panic propose a central role of fear of fear (e.g. Goldstein & Chambless, 1978). Similarly in depression the problem may be compounded by depression about depression (e.g. Teasdale, 1985). The SREF model underlines the importance of this type of secondary emotion as a consequence of not meeting emotional self-regulatory goals, and adds impetus for the modification of goals and plans which give rise to secondary emotion. More specifically, therapy should aim to provide patients with a degree of acceptance of their emotional reactions, decatastrophise the meaning of emotion and increase perceived control of adverse consequences, so preventing secondary emotion.

Stimulus considerations in treatment

Stimulus considerations are of central importance in cognitive therapy derived from the SREF model. It is not possible to erase directly an existing item of self-knowledge, but it is possible for a patient to learn new knowledge which is stronger than the initial knowledge and is called by the same stimulus input. It is important, therefore, to conduct therapy so that it resembles as closely as possible real stimulus configurations which activate the patient's problem. If the configuration does not match that which normally leads to distress, the patient will not be able to learn new declarative and procedural knowledge which is spontaneously activated in distressing situations. The sometimes high specificity of stimulus configurations required to activate dysfunctional processing and negative affect could account for the variable nature of some emotional problems. For example, an agoraphobic patient who finds that on some occasions a phobic situation does not elicit anxiety, is likely to be responding to micro-variations in the external and internal environment (e.g. intensity of certain body sensations and the number of other people in the situation), which determine whether or not dysfunctional knowledge will be called. In treatment, it will be necessary to expose the patient to all combinations of stimulus characteristics which normally elicit distress in changing declarative and procedural self-knowledge.

Modifying on-line SREF activity

Processing of the SREF is initiated by plans derived from self-knowledge or by intrusions from lower-level processes. However, it is also involved in the modification of these aspects of functioning. Changes in the self-regulatory system can only be achieved in psychological therapy via modification of processing at the SREF level. The efficacy of treatment will be moderated by the extent to which SREF processing can be manipulated, so that it activates the appropriate dysfunctional self-knowledge and concurrently processes disconfirmatory information, and consequently modifies self-knowledge in long-term memory. Perseverative SREF activity may prevent the processing of new information and the development of new plans because it reduces attentional resources, and it may also lead to stimulus generalisation for subsequent activation of dysfunctional knowledge. In such cases, it will be important to block SREF perseveration early in treatment, perhaps using attention-modification techniques and/or the provision of discrete controlled worry periods (e.g. Borkovec, Wilkinson, Folensbee, & Lerman, 1983).

The development of new plans for processing also has to be accomplished through repeated controlled SREF activity. This may consist of instructing the patient in the redeployment of attention during normal and negative affective states. The aim here is the facilitation of increased perception of cognitive control and the processing of information which is incongruent with dysfunctional self-knowledge. The practise of control over SREF activity will also strengthen general-purpose meta-cognitive plans. The aim of treatment should not merely reflect attempts at modifying the content of SREF appraisals, but also emphasise the development of new procedures for evaluating the significance of lower-level outputs.

Procedures and goals

Self-relevant procedural knowledge consists of specifications for processing or action sequences aimed at fulfilling personally relevant goals for self-regulation. In the present model, failure to meet important goals results in negative affect. Such failures may be caused by the use of inappropriate processing and behavioural responses, negatively biased evaluation of the success of plans, and attentional deficits. They may also be the result of unrealistic goals which are unobtainable. Thus, the modification of procedural knowledge should encompass the identification and changing of unrealistic goals for self-regulation. These goals are likely to be tied to particular beliefs about the costs of not achieving the goal, but may remain active even if the belief is modified. For example, a social phobic's goal may be to gain acceptance from everyone: this may be operationalised by never showing signs of negative emotion around others and always putting others' needs before one's own. The goal of acceptance from everyone they know is unrealistic, and may continue to shape behaviour even when they no longer see a great personal cost of not achieving this goal. However, pursuit of the goal has negative implications for emotional well-being because it will lead to frequent failures to meet the goal (discrepancies) and may also produce unhealthy interpersonal encounters in which one's own needs in other areas are not met.

Conclusions: A summary of specific treatment implications

Several treatment innovations are suggested by the present model. The general therapeutic rationale should be to create *replacement* self-knowledge which guides the SREF in response to stress, rather than just *challenging* negative automatic thoughts and beliefs. The principal therapeutic implications are summarised below:

1. Emotional disorders should be conceptualised in terms of an interaction between levels of cognition.
2. Cognitive processes as well as content should be modified as part of a dynamic conceptualisation of self-knowledge.
3. Patients should be encouraged to develop a higher meta-cognitive awareness and learn to process information in a way that does not trigger full-blown dysfunctional SREF activity. This may be achieved by training in self-observation and attentional control which promotes "detached mindfulness".
4. Dysfunctional plans for directing processing can be inferred from observation of attentional, memory and ideational processes during problematic situations. This *meta-cognitive profiling* can be used to identify problematic processing routines, which can then be modified to facilitate disconfirmation and replacement of knowledge. It is important to modify these routines (plans for processing) as well as the content of knowledge. We envisage four stages to the development of new routines: (i) detached objectivity and development of meta-cognitive skills; (ii) examination of situational processing routines; (iii) modification of old routines and their implementation; (iv) repeated practice at situational selection and execution of these new routines.
5. Treatment should involve a micro-analysis of stimulus configurations which trigger self-knowledge. Effective therapeutic configurations are those which closely match real-life configurations, so that newly acquired plans can be developed which are spontaneously activated by real-life triggers and which override dysfunctional plans.
6. Procedural knowledge specifies plans for both processing and behavioural responses. Cognitive and also behavioural responses which maintain dysfunctional processing and prevent disconfirmation of faulty knowledge must be identified and reversed.
7. Modification of self-knowledge and lower-level processing activities is achieved through manipulating on-line SREF activity. Due to capacity limits, perseveration of such activity has to be blocked early in treatment in order to increase subjective control over processing, and facilitate both activation of dysfunctional plans and the efficient processing of disconfirmatory information. This will require a detailed analysis of the problem and a high level of therapeutic skill, because the blocking of perseveration must not be achieved at the expense of removing the trigger conditions which produce distress.
8. The locus of dysfunctional processing in some disorders may be predominantly meta-cognitive. This suggests that a more specific clinical conceptualisation of disorders such as obsessive-compulsive disorder may be developed.
9. Formulation of clinical problems based on the present model should communicate to patients that: (a) the maintenance of dysfunctional processing is subject to voluntary modification; (b) conscious control is, however, not necessary for the maintenance of self-regulation in most circumstances (i.e.

patients may be applying controlled processing to relatively automatic activities and this is unnecessary); (c) faulty knowledge about the social, physical and/or cognitive self is responsible for maintaining the emotional problem; (d) this knowledge is maintained by particular plans of action associated with the knowledge (e.g. behavioural avoidance, body-focused attention, ruminative processing, etc.); (e) it is necessary to modify beliefs about the self and also plans for thinking and behaving.

10. Plan goals should be specified so that unrealistic and counterproductive goals can be altered, and the implications of not meeting goals can be decatastrophised.
11. Exposure to a wide range of emotional triggers (situations) with concomitant execution of new plans is necessary in order for new plans to override dysfunctional ones (i.e. to achieve stimulus generalisation of knowledge activation).
12. A patient may be able to recognise intellectually the faulty nature of declarative cognitions, but still "feels" as if the cognition is correct. In such circumstances, it is likely that therapy has failed to modify the dysfunctional cognitive and behavioural plan which continues to operate in a discrepancy-reducing way. This phenomenon may also result from the development in treatment of a general-purpose meta-cognitive plan which enables the patient to intellectualise other dysfunctional knowledge, although there is not yet a replacement plan for this dysfunctional knowledge.
13. Since perseverative SREF appraisal, which is normally verbal, can affect the content of self-knowledge and the activity of lower-level networks in a deleterious way, this type of processing should be prevented following exposure to emotional triggers. That is, patients should be encouraged to allow stressful stimulation to decay "in its own way" and not actively recycle events in the SREF. This may require a general strategy shift for dealing with emotional issues.
14. A general marker for the efficacy of treatment in modifying the dysfunctional SREF syndrome is the extent to which treatment reduces self-focused processing tendencies.

14

CONCLUSIONS

Overview of theoretical issues

In the first two parts of this book, we reviewed a variety of different theories relating to attention and emotion. In the course of constructing the novel theory presented in Chapter 12, we adopted or modified some existing theoretical propositions, and rejected others. The aim of this section is to summarise the principal theoretical issues with which our theory is concerned, to acknowledge our debts to existing theory, and to identify the principal areas of difference between our theory and others. In subsequent sections, we consider future experimental work on the SREF model, the relationship between the SREF theory and psychobiological approaches to emotion, and the implications of the model for future clinically oriented research.

Choice of information-processing framework

All frameworks, such as network and schema theories, are metaphors, not to be taken too literally. With sufficient effort in theory development and ramification, the available data on emotion and bias could probably be fitted to most of the frameworks in current use. We propose that contemporary theories of attention and skill (e.g. Ackerman, 1988; Norman & Shallice, 1985), which accommodate the roles of resources and strategies, and which differentiate automatic, controlled and executive processes, are particularly well-suited to explaining emotional bias effects. The adoption of skill theory allows us to deal with the fact that affective pathology in everyday life is most typically expressed in complex social encounters, such as initiating or maintaining an intimate relationship. Under these conditions, past experience is only a general guide to action, and behaviour requires reconfiguration of learned techniques for evaluation and reaction in the light of current circumstances. The theory of skilled behaviour at cognitive and autonomous stages of learning, depending on the degree of proceduralisation of skill (Anderson, 1982), provides insight into how maladaptive "skills for living" may be developed and preserved. Excessive self-focused processing leads to (1) inefficient skill development, modification and execution at the cognitive stage, (2) long-term storage of maladaptive procedures and self-knowledge, and (3) difficulties in modifying pre-existing maladaptive procedures. Maladaptive procedures both use up attentional capacity otherwise allocatable to other activities, and initiate strategies which cause attentional bias. That emotion influences rule-based production systems has been recognised (e.g. Forgas, 1989), but previous work has not tackled the role of attentional processes and demands in modifying the operation of productions.

From this perspective, other frameworks have the following disadvantages. Network theory tends to lead to an excessive emphasis on lower-level processing and spreading activation. Although control processes may be accommodated within network theory (Ingram, 1984), it is difficult for such theories to explain how negative bias can become an integral part of the person's strategies and executive routines, even in the absence of activation of specific lower-level processing units associated with negative constructs. We assert that there is a sense in which the processing of the clinical patient is always primed to be guided by negative beliefs even when stimulus input is not overtly negative. The kind of attentional theory proposed by Williams et al. (1988) seems too rigid in its allocation of bias effects to specific attentional stages. As discussed in Chapters 4 and 5, the evidence for this degree of specificity of biasing is equivocal. However, it may do as an approximation; possibly the characteristic generic plans of anxious patients have a broad tendency to be directed towards specific processing stages. In addition, this framework is not well-suited for accommodating learning-based effects, such as differences in the degree of proceduralisation of specific plans. The schema theory of anxiety (e.g. Beck et al., 1985) in many ways offers an overview of the nature of affective disorder as derived from the self-relevant knowledge base similar to the present approach. Its weakness is that it does not specify how that knowledge interacts with attentional processing. Hence, it cannot explain the task-specificity of bias effects as the current approach can.

Causes of attentional bias in anxiety

We have argued that attention is biased by the content of generic plans for controlling selection of information, appraising information and choosing coping strategies. However, the nature of bias is unstable to the extent it depends on on-line modification of the generic plan, dynamic interaction between the execution of the plan and intruding information from lower-level processing, and direct and indirect effects of capacity limitation. This view differs from network theory (Bower, 1981; 1987) and from Williams and co-workers' (1988) attentional theory in emphasising the role of high-level, self-relevant information in LTM in exerting top-down influence on attention. The hypothesis is not unlike the transactional theory of stress, which proposes that appraisal is influenced by the knowledge base (Lazarus & Smith, 1988), though without specifying processing mechanisms in detail. We consider that Ingram's (1984) view of depression as resulting from an interaction between involuntary lower-level processing and faulty cognitive control strategies generalises to anxiety and other affective disorders. However, we see individual differences in anxiety symptoms as caused primarily by the content of self-relevant knowledge, including the procedural knowledge generating cycles of self-referent processing. We also emphasise the role of strategic post-attentional processing in both anxiety and depression. Our interpretation of the evidence (see Chapter 5) is that lower-level and pre-attentive processing appears to be influenced mainly by relatively objective, external properties of stimuli, such as its threat value (Pratto & John, 1991), rather than by individual differences in threat sensitivity. Other authors (e.g. MacLeod & Rutherford, 1992) see the evidence differently, and further fine-grained analysis of bias in experimental studies of selective attention is necessary.

Automaticity

In Chapter 5, we claimed that the evidence for automaticity of bias has been exaggerated, with respect to the three criteria of voluntary control, capacity usage and consciousness. This view sets apart our approach from that of Williams et al. (1988) and Bower (1981), though less so from some of Bower's subsequent theorising (e.g. Bower & Cohen, 1982). We agree with Eysenck (1992) that a full understanding of anxiety effects requires an analysis of selection of strategies, such as those which may underlie hypervigilance phenomena. We agree with practically everyone in identifying reduced attentional capacity as an important element of anxiety states, but particularly with Sarason et al. (1990) in their identification of self-preoccupying thoughts as the main source of cognitive interference. We have also suggested that anxiety deficits may often be motivational, in the sense that the person has difficulty maintaining concurrent goals for self-referent and task-referent processing, as well as directly mediated by lack of capacity. SREF theory states also that the immediate cause of self-preoccupation is controlled processing generated by the initiation of a specific self-regulatory plan. However, automatic activation may contribute to the choice of generic plan from which the specific plan is derived, in a manner somewhat analogous to knowledge activation theory (Higgins, 1990), although we concur with Bargh (1992) that automaticity is probably only partial in this respect. Connectionist theories of attention (e.g. Cohen et al., 1992) offer a suitable framework for conceptualising partially automatic processes as activated both by lower-level associative links and by higher-level "attention units". Logan's (1990) view that information in LTM may be activated automatically as a result of attentional stimulus processing may provide further insight into knowledge activation processes.

Role of self-focus of attention

We support Ingram's (1990) contention that self-focus is a central feature of affective disorder, and Carver and Scheier's (1981) hypothesis that self-focused processing is essentially regulatory in nature. However, we would place more emphasis on variation in the reciprocal interaction between self-focus and the knowledge base. The particular generic plan activated will influence the behavioural consequences of self-focus, in determining whether attention is directed towards external self-referent stimuli or towards internal rumination and appraisal, for example. Conversely, the plan may lead to the restructuring of self-relevant information and procedures in LTM, or it may generate perseverative cognitions which block restructuring. We also emphasise the importance of self-referent processing of social cues, activation of discrepancies between self-knowledge and socially derived self-guides (Higgins, 1990) and public self-consciousness in generating affective disorder. In non-clinical samples, public self-consciousness appears to have a more general association with emotional stress than private self-consciousness, whose effects on well-being may vary with factors such as demands for attentional capacity and secondary appraisal.

Dynamic factors

We take from the transactional theory of stress (Folkman & Lazarus, 1984) the importance of the changing, unfolding nature of the encounters which generate negative affect. Laboratory experiments on anxiety and attention probably tend to overlook systemic change and the processing of feedback from task performance. Self-knowledge influences selective attention, but, over time, selection strategy feeds back to reshape the knowledge base. We have identified three instances of "vicious circles" which may promote pathology. The first is the cycle of mutually reinforcing negative cognitions and physical sensations generated by the lower level of processing evident in panic attack (Clark, 1986). Sensations intrude into consciousness, activating self-focused processing and negative evaluation procedures, which in turn amplify the intrusions. The second is the tendency of self-focus to generate prolonged ruminative cognition, which interferes with the adaptive coping response and alteration of maladaptive beliefs (e.g. Nolen-Hoeksma, 1991). We have characterised appraisal processes of this type as supported by a set of self-referent procedures which form a "network" to the extent that they tend to call each other repeatedly, so that the high-level goals of self-regulation are difficult to achieve. The third is the cycle of degenerating social interaction, which may be associated with depression (McCann, 1990). Negative self-beliefs tend to impair social skills and generate unattractive styles of reaction to others, and raise the person's sensitivity to negative feedback. These characteristics tend to elicit negative reactions from the person interacting with the depressive, which in turn strengthens the negative beliefs. The importance of dynamic effects such as the recycling of negative information (Ingram, 1984) has been recognised before, but we consider the SREF theory makes their nature particularly explicit, and distinguishes qualitatively different cyclic effects. We have refrained from any reference to formal systems theory, because too often in psychology it simply provides an excuse for proposing a mish-mash of complex and untestable interrelationships between variables, but dynamic processes require further attention.

Differences and similarities of specific disorders

We differ sharply from Williams et al. (1988) in supposing that different types of affective disorder are associated with entirely separate information-processing mechanisms. We would agree with Ingram (1990) and Beck et al. (1985) in supposing that the various disorders share qualitatively similar features, such as excessive self-focus and guidance of attention by maladaptive knowledge structures, evidenced most clearly by the generality of Stroop test effects. The overlap of the cognitive consequences of anxiety and depression maps onto overlap of their clinical diagnostic features. Tentatively, we identify the common elements of attentional bias in the emotional disorders with Clark and Watson's (1991) diagnostic category of general affective distress. Further work is necessary on the relationship of disorders such as obsessional-compulsive neurosis, panic and phobias to general affective distress. There may well be some degree of specificity of bias in cognition associated with specific disorders, such as the specific anxiety and depression syndromes identified by Clark and Watson (1991). We suggest that future research on attentional bias should attempt to "partial out" general affective distress, before testing for specific cognitive features of specific disorders.

The present model implies that emotional disorders of anxiety, depression and obsessionality, and possibly other disorders also, are associated with a general core dysfunctional attentional syndrome. Specific features of particular disorders are superimposed on this general syndrome, as determined by the nature of self-knowledge, and the resulting content of SREF appraisals, strategies and goal states. In depression, appraisals concern themes of loss and failure, strategies are emotion-focused and effort-avoidant, and there is a persistent failure to meet goal requirements. In anxiety, appraisals concern future threat and danger, strategies may include active search for threat as well as emotion-focused coping, and the goal discrepancy concerns anticipated failure to meet self-preserving goals. Appraisals in obsession are those of personal responsibility for future harm to self and others (see Salkovskis, 1985), strategies are primarily meta-cognitive, and goals may be characterised by both present and anticipated failure. Nevertheless, despite these important differences, all these disorders partake of the common characteristics of the SREF syndrome.

Individual differences

Our approach to personality and individual differences is in line with contemporary interactionist approaches, which emphasise the joint influence of personality and situational factors (Deary & Matthews, 1993). The strength of personality effects will tend to vary with the scope for individual differences in appraisal and coping. To some extent, the SREF model differentiates the cognitive bases of different aspects of personality. We have identified dispositional self-focus essentially with the accessibility of processing routines which activate both the SREF and self-relevant knowledge, and neuroticism with the accessibility of specifically negative self-relevant knowledge and procedures for appraisal and coping. We also identify traits mainly with the knowledge base, and states with the immediate extent and character of SREF processing. Traits and states will interact, however, such that maladaptive aspects of personality are enhanced by high levels of SREF activity. Our approach avoids the pitfalls of over-simplistic psychobiological approaches to personality while maintaining the causal importance of the cognitive structures and processes associated with personality. We also avoid over-reliance on a central trait of "negative affectivity" (Watson & Clark, 1984) influencing cognition and emotion in a uniform fashion regardless of context.

Further experimental research

In this section, we outline some of the principal areas of theoretical uncertainty, and the kind of work necessary to integrate research in these areas with the attentional theory of emotional disorder.

Development of skill theory

Any theoretical statement in psychology must trade off flexibility of application against scientific rigour. It might be argued that schema and network theories are over-flexible, in that it is too easy to modify them to accommodate results discrepant with expectation. Our view of the processing stage theory of Williams et al. (1988) is that it errs in the opposite direction. It is easy to falsify, but it cannot readily explain those effects of anxiety and depression on attention which we have attributed to variation in strategy use. The use of skill theory as a framework for explaining attentional bias may come closer to the optimal balance between rigour and flexibility given the current state of the empirical evidence. However, there are some pitfalls to be avoided. The major danger is that of circularity, in that it is too easy to attribute any specific bias to whatever hypothetical plan seems to fit the data at hand. Our analysis of experimental research aimed to avoid this problem by proposing that a variety of anxiety and depression effects can parsimoniously be explained by the hypothesis that threat, once attended, activates a generic plan for monitoring the threat stimulus or location. That is, the input and output of the plan is specified in detail. The identification of plans which may be specific to generalised anxiety, depression and other affective disorders was more difficult, which indicates one task for future research. The success of the present approach depends on identifying a relatively small number of plans, which affect a reasonably wide range of tasks.

It is important also to investigate the role of proceduralisation of self-relevant knowledge. The characteristics of the attentional plans we have identified appear to be those typical of the autonomous stage of skill learning (Anderson, 1982). Procedural and declarative knowledge co-exist, initiation of skill is partly voluntary and partly automatic, and performance remains limited by attentional capacity or working memory. Matthews et al. (1992) have argued that individual differences in performance may actually be most sensitive to capacity limitation at the autonomous stage. The capacity demands of individual processes may be maximal at the cognitive stage, but resource limitations tend to be swamped by strategy variation as the main influence on performance. What is thus required is greater attention to the cognitive factors which cause maladaptive proceduralisation. The simplest hypothesis is the one we have proposed, that excessive self-focus interferes with attention-dependent learning, but there are other possibilities. Anderson (1987) describes initial skill learning as being under the control of "weak-method problem-solving procedures", which are applied to declarative knowledge, such as defining sub-goals or working backwards from the solution. One element of affective disorder may be maladaptation of these general procedures, which might in turn lead to maladaptation of specific procedures. It may indeed be the weak-method procedure which initiates self-focus, perhaps specifying careful scrutiny of self-beliefs, motives and emotions rather than problem-solving techniques. The kind of experiment required is that of exposing anxious subjects to some novel, relatively complex and potentially threatening situation, and obtaining verbal protocols to track their learning within it. An alternative approach would be to investigate the role of meta-cognition in affective disorder, which may be related to weak-method procedures. Detailed research is necessary to determine whether meta-cognitive deficit (Slife & Weaver, 1992) and "worry about worry" (Wells, 1994a,b) are directly implicated in maladaptive learning.

Research on lower-level processes

There is a paucity of research on how emotional information processing at the lower level should be characterised, and how it is influenced. On the basis of the experimental evidence on attentional bias (see Chapter 5), the present model focuses on dysfunction at the level of self-knowledge and SREF activity, but we do not rule out the possibility of dysfunction in the lower-level network. According to theories of automatic processing (e.g. Norman & Shallice, 1985; Schneider et al., 1984), repeated consistent S-R mapping may cause strong interconnections among lower-level processing units, allowing quite complex processing with minimal attentional input and conscious awareness. Speculatively, some individuals may have acquired relatively complex arrays of strongly interconnected units which process emotional stimuli "intelligently" but maladaptively, and generate dysfunctional emotions prior to SREF activation. In emotional disorders, intelligent lower-level networks may react to noxious S-R associations learned through repeated exposure early in life prior to the development of more complex upper-level knowledge. These configurations would shape the development of upper-level knowledge, and could still operate dysfunctionally even if the upper level was modified.

We have suggested previously that the lower level is primarily tuned to external stimuli rather than to individual differences in interpretation of significant stimuli. Hence, lower-level maladaptation is most likely when the person is exposed to an unusual environment, particularly over a long period of time. The lower level may also be more sensitive to innate fear stimuli (Gray, 1987) than to the complex and ambiguous social stimuli which often generate anxiety and depression. Such stimuli are unlikely to be associated with fixed S-R associations, and hence are unlikely to activate complex lower-level associative processing. The conditions for lower-level maladaptation are most likely to be met in exposure to trauma. Veteran soldiers, for example, are confronted by serious physical threats requiring immediate action, on a number of occasions. Military training is partly geared towards the development of "automatic" safety-seeking or aggressive reactions in response to threat cues, so that unusual S-R pathways are already present. It may be that some of the symptoms of PTSD, such as inappropriate aggressive or fear behaviour, are generated by the "accidental" triggering of lower-level processing, which might be most successfully treated by behaviourally oriented therapies that treat the maladaptive pathways directly. However, dysfunction of the lower level is likely to generate intrusions and other feedback to the upper level which tends to activate the SREF. A veteran soldier who has just attacked another person irrationally will experience cognitions of self-blame, loss of control, fears of future episodes and of social disapprobation, etc., as in other affective disorders. Hence, lower-level maladjustment is likely to be inter-meshed with SREF dysfunction. It may even be SREF dysfunction which prevents maladaptive lower-level pathways from decaying as the lower-level network "retunes" to the more normal environment.

In discussing the role of possible lower-level maladjustment, we are in part responding to concerns raised by Teasdale (1993), that cognitive theories expressed in terms of distinct propositions, such as schema theory, have had only limited success clinically. Barnard and Teasdale (1991) suggest that propositional codes should be distinguished from "implicational" codes representing generic, holistic levels of meaning. Emotion is directly linked to implicational but not propositional codes, so that emotional disorder may be associated with abnormality in forming implicational codes. However, our theoretical approach differs from that of Barnard and Teasdale (1991) in emphasising levels of control rather than type of code. We see processing of propositions as being possible at both the lower and upper levels, although lower-level processing is probably limited to regenerating familiar, over-learned propositions. What is at issue is whether automatic processing can generate emotional states directly, in addition to generating specific propositions, such as those associated with intrusions. Barnard and Teasdale (1991) may be falsely attributing an implicational code to specific meaning-based processing which is inaccessible to consciousness. Alternatively, the implicational code may correspond not to lower-level processing but to the cybernetic plan status of the SREF, which similarly expresses the person's general motivational state rather than specific information.

Developmental issues

There is little doubt that emotional problems in adulthood are correlated to some extent with difficulties in childhood and adolescence, particularly when family disruption is prolonged (Coyne & Downey, 1991). Childhood trauma, particularly abuse, is associated with adult depression, although the effects of trauma are mitigated by social support in both the childhood and adult years (Coyne & Downey, 1991; Holmes & Robins, 1988). Personality traits associated with neuroticism such as guilt-proneness and defensiveness are moderately stable over time, at least from the teenage years (Block, 1971; Holmlund, 1991). There are some sex differences in which aspects of personality show stability. Teachers' ratings of timidity at age 13 predict anxiety and nervous tension 14 years later in males, but do not predict later negative emotionality in females (Af Klinteberg, Schalling, & Magnusson, 1990). Conversely, dependency and passivity appear to be more stable in females than males (Kagan & Moss, 1962). These sex differences may be related to age-changes in the social roles and expectations of the two sexes. Pulkkinen (1992) suggests that childhood coping style may influence adult adjustment: her longitudinal data showed that constructiveness of coping at age 8 was negatively related to neuroticism at age 26.

In older children, at least, cognitive stress processes seem to function roughly as they do in adulthood. Goodyer, Kolvin and Gatzanis (1985) found from prospective data that life events occurring in the prior 12 months were potentially causal factors in 60% of children attending psychiatric clinics as new cases. Exit events such as parental separation appeared to be particularly important for severe anxious and depressive disorders in this sample. It appears that factors important in adults such as social support and coping abilities moderate the impact of stressors (Goodyer, 1988). Younger children in particular necessarily have a more limited repertoire of coping skills; for example, lack of insight into internal cognitive processes (Harris, Olthof, & Meerum Terwogt, 1981) is likely to limit the scope for emotion-focused coping. Nolen-Hoeksma (1991) suggests that children may develop potentially maladaptive, ruminative coping styles because of poor parental instruction in active coping. There has been considerable interest in the ways in which the care-giving styles of clinically depressed parents put their children at risk for depression, and generate a poor quality of family interaction which exacerbates the symptoms of the parents (Downey & Coyne, 1990).

From the current perspective, the key question is the extent to which enduring self-relevant knowledge structures are developed in childhood which may influence later pathology. According to Higgins (1987), adult vulnerability to emotional distress is associated with believing that it is essential to meet the guides set by parents. A more detailed theoretical account (Higgins, 1989) suggests that strong self-guides are generated by care-giving characteristics such as a high level of parental involvement and responsiveness, causing high self-regulation and more pro-social behaviour in adulthood, as well as more negative self-appraisals and emotional problems. That is, there is a trade-off between degree of socialisation and emotional satisfaction. However, there seems to be relatively little evidence, particularly from longitudinal studies, to support detailed hypotheses.

With respect to skill theory, the primary need for research seems to be in investigating the specificity of learning in response to potential threat. Procedures developed to deal with threats specific to childhood such as bullying in the playground may never be engaged in adulthood because the input conditions are never met, and presumably will gradually decay in strength. It is possible that children vulnerable to later affective disorder are those who build up a repertoire of negative beliefs about the self, and/or maladaptive general social problem-solving routines, which are maintained in adulthood in procedural form of sufficient generality to be triggered by adult problems. It appears that stable self-schemas are present in quite young children, although schema content tends to change with level of cognitive development (Markus & Cross, 1990). There is also evidence that self-regulatory skills in childhood are important for later adjustment. Pre-school children who are able to delay gratification to obtain a later reward are more highly rated by their parents 13 years later for resistance to stress, attentional control, planfulness, self-esteem and social competence (Mischel, 1984). Future research should be directed towards identifying the cognitive structures which maintain continuities of adjustment through childhood into adulthood.

The role of psychobiological processes

Throughout this book, we have emphasised that cognitive constructs provide the most suitable level of description for explaining anxiety symptoms and processes. Psychobiological processes have contributed mainly in the form of non-specific arousal and its somatic manifestations. Subjective energy, which may index an underlying central arousal system (Thayer, 1989), is directly related to availability of attentional resources for high-priority task components (Matthews, 1992a). A lack of energy may contribute especially to cognitive deficit in depressives. We have seen also that perceptions of specific physiological responses related to autonomic arousal are represented at the lower level of processing, and may generate intrusions which activate or maintain SREF function. However, neither of these processes relates directly to cognitive bias towards non-somatic threatening information, and in this section we consider whether psychobiological and cognitive approaches to anxiety can be successfully integrated. Space does not permit us to describe the physiology involved in detail, so the reader not conversant with models of this kind may wish to skip this section.

Psychophysiological preparation and mobilisation

As discussed in Chapter 3, there is extensive research on psychophysiological responses such as the OR which appear to be associated with early attentional processes. There is even evidence for emotional biasing of the magnitude of the startle response (Lang et al., 1990). Processes of this kind may well be related to the pre-attentive prioritisation of emotional stimuli under some circumstances (e.g. Kitayama, 1990), but we have argued that pre-attentive stimulus emotion effects are insensitive to subject mood. Moreover, individuals who are prone to transient autonomic response, as assessed by spontaneous rate of phasic skin conductance responses (so-called "labiles"), appear to be better at sustaining attention than those who do not (Davies & Parasuraman, 1982). A tendency towards high rates of orienting appears to be more associated with beneficial arousal than with deficit-inducing anxiety. In general, trait and state anxiety are not associated with stronger phasic electrodermal responses, and the connection between anxiety and orienting is tenuous (Zuckerman, 1991).

There may be more scope for relating panic to physiological mobilisation: Barlow (1988) and Fowles (1992) argue that panic is associated with a primitive fight/flight reaction which tends to become conditioned to associated internal cues, rather as phobias may be related to conditioning to external stimuli. However, as Barlow (1988) points out, panic is more likely to develop in individuals prone to anxious apprehension, which is related to cognitive as well as to physiological processes. Similarly, purely physiological explanations of phobias appear to be incomplete, at best. Ohman (1986) has argued that reactions to phobic stimuli may elicit both automatic and controlled processing, with automaticity predominating when the nature of the threat requires rapid activation of the fight/flight system.

Gray's animal model for generalised anxiety

A potentially promising approach to generalised anxiety derives from animal models of central mechanisms in anxiety. Gray (1982) has proposed a detailed theory of anxiety which has excited the interest of cognitive psychologists because it describes the neural basis of specific information-processing functions in some detail. Anxiety is related to a behavioural inhibition system (BIS) comprising a number of anatomical structures, notably the septum and hippocampus. Among the system's functions is checking for discrepancy between actual and expected events, by comparing the actual state of sensory input with a prediction. The prediction is generated from information about past environmental regularities, the organism's plan for response, in addition to current sensory input. Detection of discrepancy activates the outputs of the BIS: enhanced attention to the discrepant stimulus, inhibition of current motor activity and increased arousal. The system is sensitive not only to novelty, but also to innate fear stimuli and signals of punishment and non-reward. Trait and state anxiety may be straightforwardly linked to the sensitivity of the system, and to its current level of activity, respectively. Phobia relates to sensitivity to innate fear stimuli, and obsessive-compulsive disorder to excessive checking of inputs. The behavioural consequences of BIS activation seem superficially comparable to anxiety effects in humans, such as enhanced selective attention to threat and disruption of processing of neutral stimuli.

A critique of Gray's theory: Eysenck (1992)

Eysenck (1992) puts forward three main arguments against Gray's (1982) account of cognitive processes in anxiety. First, psychophysiological evidence fails to demonstrate the expected relationship between anxiety and arousal. Second, Gray (1982) fails to take into account whether the mismatch is desired or not: events which are less fearful than expected reduce fear, contrary to prediction. Third, the cognitive analysis performed by the comparator is too limited, and particularly neglects secondary appraisal and reappraisal. We agree with Eysenck (1992) that the animal model cannot be transferred to human anxiety wholesale, but it may have more potential than Eysenck (1992) acknowledges. Gray (1982) points out that cortical structures play an important role in the cognitive elements of the model: the prefrontal cortex processes planning and the cingulate cortex is associated with the behavioural inhibition function of the BIS. The prefrontal cortex may also be able to relay to the BIS instructions for control generated by the language systems of the neocortex. Hence, damage to the cingulate and prefrontal cortex tends to reduce neuroticism and symptoms of anxiety and depression. The BIS also receives verbally coded information from the temporal lobe, so it may be sensitive to cognitively appraised threat. Presumably, the neocortex may then support appraisal and reappraisal functions in parallel with BIS operation, and feed the BIS with their outputs. The second element of Gray's (1982) model that Eysenck (1992) neglects is the role of pathways ascending to the BIS, which serve to change the character of its functioning. Gray (1982) proposes that outputs of the BIS especially associated with anxiety, such as motor inhibition, are enhanced by inputs from serotonergic pathways ascending from the raphe nuclei. Other pathways have other effects: arousal as an output of the BIS is associated not with comparator function, but with noradrenergic pathways ascending from the locus coeruleus in the brainstem. In other words, identifying trait anxiety with increased sensitivity in comparator function does not necessarily imply increased arousal. The role of the ascending afferents may also counter Eysenck's (1992) other objection to the theory, concerning the type of mismatch. When an outcome is less threatening than expected, anxious behaviour will be reduced by the reduction in serotonergic activity. In addition, a separate reward system, which is activated by omission of an expected punishment ("relief"), will tend to inhibit the BIS. A degree of BIS activity will be adaptive as enhanced attention to the relieving mismatch event will facilitate the organism's adjustment of its store of expectations in LTM.

Compatibility of Gray's theory with the SREF model

Hence, Gray's (1982) theory is not incompatible with the gross features of human anxiety. Its emphasis on regulative functions and the role of plans for behaviour is broadly consistent with the present theoretical framework. However, there are several difficulties in equating the attentional bias seen in experimental studies of anxiety with the "increased attention" output of the BIS. First, Gray's (1982) assumption that the septo-hippocampal system at the core of the BIS is capable of processing linguistic information seems unwarranted: a hippocampus which speaks English stretches credulity! Gray simply does not address the issue of the coding of the information in the pathways connecting the neocortical cognitive system to the BIS. The animal evidence discussed by Gray suggests that the system analyses sensory attributes of stimuli such as intensity and pitch. It seems likely that the cognitive system sends to the BIS not specific verbal information, but outputs coded in a form processable by the BIS, such as a general indication of threat or importance to be associated with a stimulus defined by sensory attributes. This being so, we cannot expect the BIS to do the work of cognitive-symbolic processing: it is likely that the linguistic processing associated with worry is purely cortical in origin. Second, the exact nature of the attention output of the BIS requires scrutiny. In fact, "attention" is enhanced in two quite separate respects. The running of motor programmes previously associated with BIS activity is checked with particular care. However, this checking is entirely internal to the BIS: the external consequences are not so much attentional as response-oriented. The programme runs more slowly and hesitantly, probably because the BIS tends to interrupt it so it can be checked on a step-by-step basis. The other "attentional" output is an increase in exploratory-investigative behaviour, which appears to be controlled by the modulation of motor programmes. In other words, the BIS tends to affect response rather than any purely attentional function external to itself. As far as we can gather from Gray's (1982) description of the theory, the BIS does not modulate the frontal-thalamic attentional gating system (Stuss & Benson, 1984), which would be the obvious locus for pre-cognitive control of selective attention.

Given these considerations, a speculative integration of the current theoretical proposals and Gray's (1982) model might run as follows. The cognitive information-processing system and the BIS operate in parallel, and to a large extent independently. Cognitive appraisal influences the stimulus-checking activities of the BIS, and the BIS relays interrupts to the cognitive system. The consequences for performance are as follows. Attentional bias is a property of the cognitive system, not the BIS, because the plans which support it, such as extended monitoring and elaboration, do not correspond to the motor response-oriented outputs of the BIS. The association of bias with trait rather than state anxiety (e.g. Broadbent & Broadbent, 1988) also supports the cognitive hypothesis. Direct evidence for purely cognitive mediation of bias effects is provided by Golombok and co-workers' (1991) demonstration that the anxiolytic drug diazepam reduces emotional state anxiety, but does not affect bias on the emotional Stroop task. Evidence that panic patients show bias specifically in attention towards physical threat words on the Stroop test (e.g. Hope et al., 1990) is also inconsistent with BIS-mediation of bias: Gray (1987) attributes panic to a different neural system, the fight/flight system.

If the BIS is not responsible for cognitive biasing, could it explain the role of worry in cognitive interference? The hypothesis has at least superficial appeal: perhaps worry is associated with increased checking of inputs, which need not be associated with autonomic arousal, as just described. Again, it is difficult to suppose that the BIS could perform the linguistic computations necessary to support a chain of worry-related thought. It is also unclear why processing taking place primarily in the hippocampus and associated limbic system structures should interfere with cognitive processing. Conceivably, BIS activity generates interference at the cognitive level by transmitting signals to the cognitive system which affect its cybernetic status, rather than specific information. Cybernetic information could plausibly be encoded in a form transferable between systems using different internal codes. We have argued that self-referent processing requires periodic testing of whether self-regulation has been successful and may be terminated, which in turn requires reading an indicator of the success of the system in attaining the top-level self-regulative goal. Speculatively, the BIS might bias the status of this goal attainment indicator towards non-attainment, so that self-referent processing continues even though cognitive processing has successfully resolved the person's current problem. Subjectively, a person might experience feelings of doubt that he or she really had solved the problem, or that he or she had taken everything into account. In other words, BIS activity does not interfere directly with cognitive processing, but it may raise the probability of the initiation or maintenance of perseverative worry. If so, BIS activity would be particularly prone to disrupt performance of complex skills, since initiation of SREF activity would disrupt the transition from attaining one sub-goal to initiating the next. If the cognitive system relays relatively abstract information about the threat or importance of stimuli, or its current goal status, to the BIS, via prefrontal and cingulate cortex, we have the possibility of positive feedback between the BIS and the cognitive system. In episodes of acute anxiety, communication between the two systems may serve to amplify the checking and control functions of the BIS, and the worrying function of the cognitive system. The hypothesis does seem consistent with anecdotal reports of general disruption of skill under anxiety: Idzikowski and Baddeley (1983) cite a graphic account of a public speaker's difficulties in maintaining fluency. Accounts of performance breakdown under extreme stress include instances of possible motor inhibition, such as the failure of soldiers to fire their weapons (Idzikowski & Baddeley, 1983). However, there is little direct evidence, and empirical testing would require discrimination of the role of the BIS from the purely cognitive influences on worry already discussed.

Identifying BIS functions in humans: Emotion and motor responses

Two functions which may be more directly sensitive to the BIS in humans are felt emotion and motor performance. To the extent that anxious emotional experience is associated with limbic system structures linked to the BIS (Gray, 1987), it may be the case that the BIS mediates experienced anxiety (although emotion is notoriously difficult to localise precisely within the brain). Such a suggestion would be compatible with Oatley and Johnson-Laird's (1987) view of emotion as related to a relatively primitive, non-symbolic internal communication system. The BIS might sometimes initiate an episode of anxiety, with cognitive processing functioning mainly to formulate an attribution for the cause of the anxiety, which may or may not be correct. However, the strong influence of cognition on emotion implies that the BIS acts partly, or even mainly, as an emotional transducer of appraisal signals delivered from the cognitive system. BIS activity may be associated with feelings of tension, which correlate moderately with autonomic arousal (Matthews, 1987; Thayer, 1989), but carry no detailed cognitive content. It is possible that clinical anxiety is in part caused by an overactive BIS, but there seems to be no compelling reason to advance this hypothesis when high-level information processing is of such demonstrable importance. Even if BIS activity is the proximal cause of excessive anxiety, the distal cause is more likely to be the cognitive processes and structures we have discussed. It is also questionable whether trait anxiety/neuroticism is caused by individual differences in BIS sensitivity, given the sensitivity of neuroticism to therapy (Barnett & Gotlib, 1988), and its specific association with sensitivity to evaluation and social threat, rather than to threat in general (Hodges, 1968)

In Gray's (1982) model, the behavioural consequences of BIS control are affected by the modulation of systems associated with motor response. Hence, the BIS may be directly responsible for anxiety effects on motor activity, such as the marked deficit in muscle efficiency found by Weinberg (1978), and general impairment of manual dexterity (Idzikowski & Baddeley, 1983). We have argued that emotionality may be a more direct expression of BIS activity than worry, so it may be worth re-examining the differentiation of emotionality and worry with respect to specifically motor tasks. Sports performance, which of course has a large motor component, does seem relatively sensitive to high levels of somatic anxiety, though somatic anxiety is not necessarily associated with performance deficit (see Hardy & Parfitt, 1991). It might also be supposed that the reluctance of anxious subjects to respond is mediated by the motor inhibition function of the BIS (cf. Geen, 1987). However, Leon and Revelle's (1985) demonstration of a more risky speed-accuracy trade-off in stressed trait-anxious subjects suggests that response criterion effects are cognitively mediated.

Status of Gray's model

Interest in subcortical neural systems derives mainly from the impressive body of animal research reviewed by Gray (1982), and the assumption that such mechanisms presumably play some role in humans. There is little in the experimental and clinical data on humans to suggest that purely cognitive explanations for anxiety effects on attention are inadequate, although we have argued that the data do not in themselves falsify Gray's theory. Hence anxiety effects on bias and performance efficiency appear to be largely cognitive in origin, and decoupled from the parallel operation of the BIS. BIS outputs may mediate the more primitive aspects of anxiety such as emotion and efficiency of motor processes. Additionally, dynamic interaction between the cognitive system and the BIS system may possibly influence performance, although there is no direct evidence. The effects of BIS activity on overt behaviour may only be evident in strong anxiety states, which are difficult to study experimentally. Future progress will require methods for assessing subcortical functioning which do not depend on verbal self-report or performance, so that cognitive and BIS effects may be dissociated. More emphasis on cortical structures and functions may also be required, such as the frontal lobes, which may support planning and control functions (Shallice, 1988) similar to those of the SREF. Primate studies show that an early history of control over the environment reduces stress vulnerability in adulthood (Mineka & Kelly, 1989). A psychobiological theory of the development of control functions might make a major contribution to understanding the aetiology of emotional disorder.

Clinical issues

We have aimed to set out an integrative and comprehensive information-processing model of emotional disorder. We believe that advances in the treatment of emotional problems will evolve from attempts to conceptualise the cognitive-attentional processes involved in psychopathological reactions within an information-processing framework of this kind. To this end, we call for a closer link between the clinical approach of cognitive-behaviour therapists and the endeavours of experimental cognitive psychologists. While we have discussed some of the implications for the treatment of the SREF model in Chapter 13, more detailed specifications of therapy are beyond the scope of this book. It is likely that there are further therapeutic implications of the model to be explored. We conclude by considering some future directions for clinical research suggested by the present model, which we hope will contribute to a better understanding of emotional problems.

The challenge ahead

The challenge for cognitive-clinical theories in the future is the rigorous investigation of the different levels of control of cognitive-attentional functioning in emotional disorders, and of their dynamic interaction. Work of this kind will require a more explicit and theory-based taxonomy of cognitive content and processes than is currently available. Future treatment should aim not only at modifying the content of cognition at the level of declarative "schematic" thought and negative automatic thought, but should also modify attentional processes and plans. We advocate the close examination of the role of specific stimuli in triggering or maintaining emotional problems, an area somewhat neglected by current cognitive approaches. More specifically, therapy should identify the stimulus configurations which elicit the dysfunctional attentional syndrome, and attempt to link them to alternative self-knowledge and plans for controlling attention.

Meta-cognition

In Chapters 7 and 12, we outlined the importance of meta-cognitive processes and plans which are central to self-regulation. Further investigation of meta-cognition and its role in emotional disorders relies on the development of instruments which can assess meta-cognitive content and processes validly and reliably (e.g. Wells, 1994a). We contend that beliefs about one's own cognition and specific cognitive-regulatory processes play a significant role in emotional disorders. Meta-cognition may be of particular importance to disorders typified by uncontrollable thought intrusions such as obsessive-compulsive disorder, and disorders associated with chronic worry. Some types of obsessional conditions might represent the prototypical "meta-cognitive disorder". However, a general meta-cognitive disturbance may predispose the person to a range of dysfunctional syndromes. The belief that certain thoughts are potentially harmful and cannot be controlled, for example, may lead to desperate attempts at control through drug use or self-harming strategies. In contrast, belief in the desirability of certain types of negative thought (e.g. Wells & Hackmann, 1993) may account for the persistence of certain negative beliefs. In summary, a better understanding of meta-cognitive influences on SREF activity and on lower-level processing activity could provide useful insights for conceptualising the core disorder in obsessional and chronic worry states.

A prototypical model of obsessions

The SREF model offers a prototypical formulation of obsessional thoughts based on meta-cognitive beliefs and meta-cognitive plans for cognitive regulation. This formulation integrates features of existing cognitive models (e.g. Salkovskis, 1985) with the attentional control structures of the present model. It will serve to illustrate how future research may use the general SREF framework to accommodate the unique features of particular clinical disorders. In the example shown in Fig. 14.1, an intrusion engages the SREF which accesses related self-knowledge; the probability of an intrusion may be raised by the top-down influence of the current plan, such as monitoring for "bad thoughts". This self-

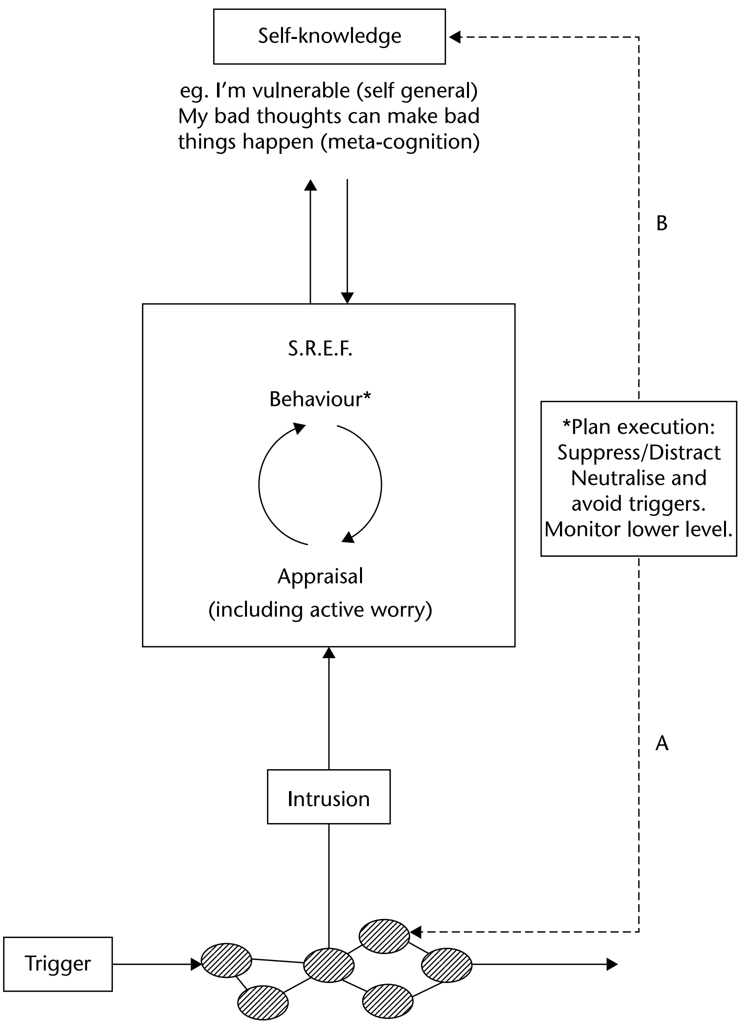

FIGURE 14.1 A prototypical clinical model of obsessions based on the SREF model.

knowledge, and especially general meta-cognitive knowledge, influences appraisal of the intrusion. In the obsessional patient, the generic plan retrieved from self-knowledge is likely to specify control of the internal cognitive environment through coping strategies, such as suppression, avoidance, monitoring and other attempts at mind control such as continued rumination. As discussed previously, attempts to suppress or avoid negative thoughts are likely to be counterproductive, so that all the strategies listed will tend to maintain consciousness of the intruding thought. Two feedback loops associated with the activity of the SREF serve to maintain the problem. Execution of the cognitive control plan leads to (1) continued priming of lower-level units for instances of the intrusion (A), and (2) elaboration and reinforcement of self-knowledge through prevention of disconfirmation, and encoding of distractor and neutralising responses which may serve as future triggers for top-down elicitation of the intrusion (B). In this prototypical model, we may specify the plan goal as permanent elimination of the intrusion or neutralisation of the danger appraised as associated with it. The nature of the meta-cognitive belief is such that a person's strategies for control or neutralising actually prevent disconfirmation of beliefs, and maintain preoccupation with cognitive events. Thus, a negative self-discrepancy persists, leading to dysphoria and anxiety, and an increased likelihood of SREF perseveration and subsequent activation of the dysfunctional cognitive-attentional syndrome.

Generally, the model differs from that of Salkovskis (1989) in (1) emphasising the similarities of obsessionality with other affective disorders, and (2) specifying the role of cognitive-attentional processes in more detail. Specifically, it clarifies the role of active worry in obsessionality as a function of SREF activation, which is differentiated from automatic thoughts generated by spreading activation in the lower-level network. In contrast to Salkovskis' (1985) conception of serial stages of processing, the model also proposes that lower-level automatic thoughts and upper-level worries are generated in parallel by intrusions, and are likely to co-exist and interact during the course of the obsessional episode.

The model is also novel in its emphasis on impairment of meta-cognitive skills in obsessional patients. In Chapter 6, we reviewed evidence suggesting that there is a deficit in memory for actions in sub-clinical obsessional checkers. Rather than a direct failure of encoding or retrieval, this effect may be due to a meta-cognitive failure in distinguishing fantasy from reality. One factor contributing to failures in prospective memory, and forgetting to perform an action, is failure of "reality monitoring". The person may confuse memory for the intention to perform an action with the memory for the action itself (see Cohen & Faulkner, 1989). Obsessional individuals are prone to fantasise about the dire consequences of failing to perform an action, such as locking a door. Hence, they may confuse the memory of the fantasy of action failure with the memory of actually performing the action. Meta-cognitive failure leads to the opposite problem to prospective memory failure, of performing an action already carried out. The negative affect associated with the resulting goal discrepancy may be sufficient to stimulate further checking in an attempt to reduce the discrepancy and lower negative emotion. Obsessional persons may also have a more general tendency to select internally generated percepts in preference to externally generated ones, leading to confusion over whether threatening aspects of a situation were real or imagined.

The effect of treatment on self-focused attention

Since we assume that self-focused attention is a marker for the SREF cognitive-attentional syndrome underlying emotional disorders, future treatment studies should aim to assess self-focused attention as a marker for changes in the syndrome, and as a marker of vulnerability to relapse. Treatments which produce stable decrements in negative self-focus should have better long-term outcome. Clearly, measures of self-focus provide only an approximate measure of the cognitive-attentional syndrome, and other measures are required to provide a more sensitive index. To some extent, measurement can be improved by recourse to the improved taxonomy of cognitive content previously advocated. Since the SREF syndrome is necessarily associated with controlled processing, it should be possible to identify the combinations of conscious beliefs about the self which are most directly related to dysfunctional states. However, for process-oriented research directed towards the explication of the circumstances under which the SREF is switched on and off, and investigation of procedural knowledge, it is unlikely that self-report measures will prove to be adequate. Simple experimental techniques, perhaps based on priming of self-knowledge (see Higgins, 1990), may become an essential tool of the clinician for this purpose.

Modification of attentional control and plans

It is difficult to validate attentional hypotheses on the basis of existing treatment studies, because treatment approaches have combined different cognitive-behavioural modification strategies, and it is also difficult to decouple the modification of cognitive content from change in attentional processes. Attentional hypotheses can be tested with procedures such as attention training (Wells, 1990), which directly and specifically modify the attentional characteristics of the patient. Such techniques are still something of a novelty, so future research must explore in detail the short-and long-term consequences of attentional modification. In particular, it is important to distinguish the respective roles of change in attentional processes and in cognitive content in explaining treatment effects on measures of attentional functioning and memory.

We have conceptualised attentional control plans as one type of plan of special importance. Further research is needed on the covert and overt cognitive and behavioural manifestations of all the important plans run by the SREF. At the least, this research entails an analysis of the behaviours which contribute to the maintenance of dysfunctional self-knowledge, but should also encompass an analysis of the information-processing "style" adopted by the patient in problematic situations. Identification of the content of maladaptive plans, and their stimulus triggers, should point to the specification of new plans which can be developed during treatment.

Diagnosis and treatment of the general syndrome of emotional dysfunction

Empirical clinical work has often focused on elucidating the differences between emotional disorders. Such an approach has stimulated diversity between models of different disorders, but has neglected the common features of dysfunction. The high degree of specificity in models of particular disorders has led to problems in accounting for symptom overlap in emotional disorders, and, perhaps, to difficulties in diagnosing patients with symptoms which fail to conform to the prototypical symptom clusters which specific models aim to explain. Future research efforts may allow us to explain the high correlation between disorders such as anxiety and depression, and explain other forms of co-morbidity. It may be worthwhile to develop a hierarchical system for diagnosis which identifies abnormality in SREF functioning prior to a more specific diagnosis. Appreciation of the role of the general cognitive-attentional syndrome may lead to the development of a core set of treatment strategies which can be legitimately applied to a wide range of disorders with good effect.

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