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# 9 Cognition, Emotion, and Memory: Some Applications and Issues

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This chapter describes some ways in which the psychology of cognition, emotion, and memory can or might be applied in several practical settings. Recent years have seen a rapid growth in research on cognition and emotion and this research has been summarized in a variety of sources (e.g., Ellis & Ashbrook, 1988, 1989; Ellis, Varner, & Becker, in press; Fiedler & Forgas, 1988; Isen, 1984; Kuiken, 1989; Williams, Watts, MacLeod, & Mathews, 1988). Moreover, a new journal appeared in 1987, *Cognition and Emotion*, which is entirely devoted to relations among emotional states and the full range of cognitive processes typically studied by psychologists. Ellis and Ashbrook (1989) noted that although this research area has a much earlier history of activity, it lay relatively dormant until the mid-1970s. However, its growth has accelerated rapidly until it has now become an important and active area of research and theoretical development.

We believe that a discussion of the application of this area is now timely, and it is profitable to consider how the domain of cognition, emotion and memory is either currently or potentially applicable. In this chapter we have not attempted to be comprehensive in detailing a number of applications; rather, we have selectively focused on four arenas of application either in progress or having potential application. These include the maintenance and repair of disturbed moods, cognition and emotion in health behaviors, emotion and eyewitness testimony, and emotional states in human performance.

## MAINTENANCE AND REPAIR OF DISTURBED MOODS

Most of us occasionally experience episodes of disturbed affect from which we wish to escape. For some such disturbance qualifies as a depressive or anxiety-related disorder, whereas others are affected on a more transient or less profound basis. Regardless of the severity of the disturbance, it appears to be characterized by identifiable patterns of cognitive phenomena and concomitant complaints. One important direction for the application of research on cognition and emotion, then, is provided by its implications for mood maintenance and subsequent repair. Moods are maintained by ongoing cognitive functions. Mood disturbances are repaired by changes in these functions or in their focus.

We identify two categories of ways in which negative mood states—*anxiety* and *depression*, in particular—might be maintained and repaired through the involvement of cognitive procedures. The first category concerns the *direct* involvement of cognitive procedures in maintenance and repair. In this category, we briefly outline the literature on mood congruency, or the focus of mental processes on episodes and materials that are meaningfully related to the mood state. We also describe research concerning the nature of impairments experienced when depressed and anxious people encounter the relatively neutral materials of their educational and occupational endeavors.

The second type of cognitive involvement in the maintenance and repair of disturbed affect is *indirect*. Disturbed moods are indirectly maintained by failures to perform well in cognitive tasks. Test-anxious students, for example, become increasingly anxious with each failure. Depressed people perhaps remain depressed as long as they fail to achieve in ways that provide social approbation or increase self-esteem. Improving cognitive performance indirectly assists in mood repair by helping mood-impaired people to experience self-efficacy and to achieve important goals (see Hertel, in press). In these ways cognitive procedures are indirectly implicated, because the disturbed moods are maintained or repaired by the outcomes of cognitive tasks. Yet, it is important to keep in mind that disturbed moods are centrally associated with the tendency to perform poorly in the first place (see Ellis & Ashbrook, 1988). In each of the following sections on the maintenance and repair of disturbed moods, we address both the direct and the indirect nature of emotional and cognitive interactions.

### Mood Maintenance

Disturbed moods are maintained by selective attention to mood-congruent aspects of current and past experience (Isen, 1984; Williams, Watts, MacLeod, & Mathews, 1988). Attention to mood-congruent elements of an event appears to be a relatively automatic process and, moreover, one that diverts attention away from more task-appropriate processing. Such selectivity maintains the disturbed

mood directly by bringing congruent information to mind and indirectly by impeding performance on the task at hand. Mood maintenance can also result from selective remembering of past events, and if the mood-impaired person actively rehearses these negatively valenced memories the moods are further maintained. We next describe a few examples to illustrate the evidence for mood-congruent attention and remembering and to suggest their involvement in the maintenance of disturbed moods.

*Selective Attention.* To what extent do mood-congruent materials capture the attention of mood-impaired people? The evidence suggests that anxiety in particular is associated with such selective attention (see Williams et al., 1988). For example, in a study by Eysenck, MacLeod, and Mathews (1987) trait-anxious subjects more often than nonanxious subjects spelled homophones (such as *die/dye*) to coincide with the more threatening concept. Much earlier, Postman and Brown (1952) demonstrated similarly that depressed subjects detected failure-related words at very brief exposures more frequently than did non-depressed people and more frequently than other words. Symptoms of depression and anxiety are highly correlated, so we cannot address the specificity of the selectivity to a particular type of disturbance, but we can conclude that disturbed moods are associated with attention to mood congruent information.

Consider the implications of such evidence for performance in typical cognitive tasks. The kinds of tasks that anxious and depressed people typically encounter in educational and occupational settings are usually neutral, in that the materials are not particularly related to the nature of their moods. Yet the tasks clearly provide potential sources of threat and failure if one's ongoing performance of them is evaluated self-referentially. In this manner, disturbed moods encourage the allocation of attention to inappropriate aspects of the self or the situation and distract attention away from task-appropriate processing (see Ellis & Ashbrook, 1988; Ingram, 1990). By making the assumption that attentional resources are limited, we can understand how mood-impaired people might not perform well on what are thought to be neutral tasks. Thus, selective attention to mood-congruent aspects of current processing episodes directly maintains the disturbance by bringing such information to mind and indirectly maintains the disturbance by hampering performance on everyday cognitive tasks.

*Selective Remembering.* Disturbed moods also guide the recruitment of mood-related memories. Mood-congruent retrieval can occur on a relatively automatic basis (i.e., when people are not consciously attempting to remember events from the past, but make use of them in the performance of some other task), or they can occur in more controlled episodes of remembering.

As an illustration of possible automatic effects of mood-congruent retrieval, consider a study by Mathews, Mogg, May, and Eysenck (1989). In the first phase of the experiment, anxious and nonanxious subjects imagined scenes for threat-

ening and nonthreatening words and judged their pleasantness. This phase was followed by two tests. In one test, subjects were given three-letter stems for old and new words and instructed to complete them with the first word that came to mind. The anxious subjects completed the stems of old threatening words more often than other types of words, but nonanxious subjects did not show this bias in recruiting threatening materials from the first phase. In the other test, the subjects were asked to use the three-letter stems as cues for conscious recall of the Phase-I words; here, their recall of threatening material was not reliably correlated with anxiety (also see Mathews & MacLeod, 1985). Furthermore, sometimes anxiety is associated with reduced recall of threatening materials (see Mogg, Mathews, & Weinman, 1987).

Others (see Mueller, 1980) have shown anxiety-congruent effects, so the story regarding intentional recall by anxious subjects is not a simple one (see Ingram & Kendall, 1987). But the evidence regarding depression is much clearer: Depressed people tend to recall negatively valenced events from the past (see reviews by Blaney, 1986; Bower, 1981; Johnson & Magaro, 1987). Williams et al. (1988, chap. 10) believed that the picture regarding depressive versus anxious recall can be clarified by considering the different momentary goals of depressed and anxious people.

Williams and colleagues proposed that depression and anxiety involve different types of biased processing of mood-related events. Quick detection of potential threat is a central concern of the fearful person, thus automatic processes involved in the allocation of attention are sensitive to anxious moods. Then, depending on whether subsequent avoidance of continued exposure to the threat is an important goal, controlled processes might divert attention from its source. In this manner, anxious subjects would not elaborately process threatening materials on initial exposure and therefore would not have cues available for subsequent intentional recall. The effects of depression are in some ways opposite to the effects of anxiety, according to Williams and colleagues. The depressed person actively processes negative information at the time of initial exposure by attempting to reconcile that information in the context of goals for overcoming depression.

In short, the differing goals of depressed and anxious people have corresponding implications for the processes involved in mood maintenance and repair. The answer to the question of whether mood-congruent retrieval serves to maintain disturbed moods depends importantly on subsequent processing of the retrieved episode. If that subsequent processing does not achieve a change in mood state, the ongoing mood is maintained or enhanced by attention to mood-related aspects of experience.

### Mood Repair

Clark and Isen (1982) were among the first to point out that disturbed moods are repaired by controlled processing of mood-related information (cf. Blaney,

1986). Active avoidance of mood-related materials can (at least temporarily) inhibit the feeling state; active rehearsal of mood-related materials can reconcile their meaning in the service of achieving self-control (Rehm, 1982). These are examples of direct actions of cognitive procedures in the repair of disturbed moods. These direct effects are illuminated by considering cognitive/behavioral approaches to treatments of anxiety and depression.

*Direct Effects in Therapeutic Intervention.* Cognitive/behavioral therapies are effective approaches to the treatment of depression (e.g., Teasdale, Fennell, Hibbert, & Amies, 1984) and anxiety (e.g., Wine, 1980). Often, they employ techniques of “cognitive restructuring” of depressive or worrisome thoughts into more realistic appraisals (Teasdale, 1983). How would research on basic cognitive processes inform our understanding of how cognitive restructuring and other therapeutic techniques repair disturbed moods?

According to the analysis by Williams and colleagues (1988), remediation is achieved in several ways. First, by encouraging the client to recall positive or neutral aspects of their experience, the therapist directs attentional resources away from mood-maintaining episodes. However, attention is redirected in the *context* of the client’s retrieval of negative-valenced ideations, such that the rehearsal of realistic thoughts increase the probability that they will be selected on future occasions of the same type (Beck, Rush, Shaw, & Emery, 1979). Second, by maintaining attention to negatively valenced events, the therapist can use extinction or counterconditioning procedures to alter the valence of a particular memory. This potential is particularly rich in the case of anxiety, in which avoidance-motivated controlled procedures operate. By hampering the tendency to avoid threat, its impact can be challenged (Foa & Kozak, 1986).

Therapeutic interventions provide good examples of the direct involvement of cognitive procedures in mood repair. We turn our attention next to the topic of their indirect involvement through attempts to improve performance of mood-impaired people on typically neutral cognitive tasks.

*Indirect Involvement of Cognitive Procedures in Mood Repair.* Improving cognitive performance by depressed and anxious people can help them to achieve the goals that might eventually assist in mood repair (Hertel, in press). Memory complaints, for example, are common diagnostic indices of depression. We speculate that depressed (and usually anxious) people do not worry about their memory foibles simply because they dislike forgetting, but also because they are concerned about their performances at school and in the workplace. A major characteristic of depression, in particular, is the downward spiral produced by decreasing achievements. We therefore question whether such failures are inevitable concomitants of depression or if achievement can be attained without mood-related interventions.

Deficits in the allocation of attention to task-appropriate procedures are associated with anxiety (Eysenck, 1982; Wine, 1980) and depressive moods and

disorders (see Ellis, Thomas, McFarland, & Lane, 1985; Ellis, Thomas, & Rodriguez, 1984; Hasher & Zacks, 1979; Roy-Byrne, Weingartner, Bierer, Thompson, & Post, 1981). To some extent, these deficits might be biochemically endemic to the disorders, through reduced production of neurotransmitters; pharmacological agents that slow their re-uptake seem to improve performance on some types of mental activities (see Weingartner & Herrmann, in press). However, we do know that the attentional resources that are available to depressed and anxious people are sometimes allocated inappropriately to task-irrelevant thoughts. Therefore, any procedure that directs allocation to task-appropriate processes has the potential to improve the cognitive performance of mood-impaired people.

Consider the results of an experiment conducted by Hertel and Rude (1991a) that compared the performance of clinically depressed (and often anxious) outpatients to the performance of recovered outpatients and nonpsychiatric controls. The task consisted of a learning phase, in which subjects made decisions about the semantic fit of words in sentence frames, and a remembering phase, in which recall of the targeted words was unexpectedly requested. In one condition of the learning phase, subjects were required to pay attention to each target in the context of the sentence frame for the duration of the trial. In the other condition (with the same trial duration), subjects' attention was unconstrained. Compared to both control groups, depressed subjects in this latter condition recalled fewer targets on the subsequent test, but mood-related differences were not produced by subjects who were required to pay attention. Depressive deficits in recall can be eliminated by guiding the procedures that are appropriate to the situation (see Ellis, 1990; Hertel & Rude, 1991b).

An examination of evidence for depressive deficits in a variety of cognitive tasks suggests that depressed subjects typically suffer deficits in cognitive initiative (Hertel & Hardin, 1990). That is, they do not spontaneously employ cognitive procedures and strategies that characterize the performance of non-depressed subjects. For example, experimental inductions of depressed moods by Leight and Ellis (1981) produced poor detection of the optimal learning strategy, but did not significantly hamper its use if it had been detected in a nondepressed state. Similarly, depressed subjects in concept learning and problem-solving tasks have difficulty producing hypotheses, but seem unimpaired in their ability to test hypotheses provided by the experimenters (see Abramson, Alloy, & Rosoff, 1981; Silberman, Weingartner, & Post, 1983). In these types of tasks, the mind seems to "go blank" when a strategy is needed (Watts, MacLeod, & Morris, 1988). Thus, depressive disorders may involve metacognitive impairments, such as in the ability or tendency to monitor cognitive performance (Slife & Weaver, in press). Clinical researchers have focused on the phenomenon of impaired initiative in broader contexts of depression (see Coyne & Gotlib, 1983), contexts that likely involve the need to plan, monitor, and concoct strategies.

In short, depressed people need help in determining what to do if they are to

perform well in cognitive tasks. Although less is known about the metacognitive functions of purely anxious people (e.g., nondepressed students with high levels of test anxiety), their high degree of distractibility suggests that procedural instruction would also benefit their performance. Hertel (in press) outlined general guidelines to be used in attempts to improve the cognitive performance of depressed and anxious people. However, the practical advice that cognitive research currently can provide is somewhat limited. In this regard, Watkins (1990) seemed to be right in calling for the development of a taxonomy of procedures involved in typical cognitive tasks.

The larger arena of our concern with improving performance is mood repair. If depressed and anxious people get the kind of help they need, their sense of efficacy would no doubt improve. Bandura's (1977) work on self-efficacy has been extended to the domain of cognitive tasks by Hertzog (in press). When feeling efficacious, mood-impaired people—like other people—attempt more difficult cognitive tasks and are more persistent in their execution. The implications are clear: If we assist mood-impaired people in the selection of strategies for performing some cognitive tasks, experiences of success on those tasks might generalize to new situations. The hope is that such small successes would ultimately contribute to mood repair and future research on mood-related cognition will point the way to achieving these goals.

## COGNITION AND EMOTION IN HEALTH BEHAVIORS

The area of health psychology has emerged in the past 25 years as an important focus both for research and for practical applications in professional settings (Kaplan, 1990). Much of health psychology in its early days was seen as part of or related to behavioral medicine and was therefore viewed as an area in which changes in the behavioral (unhealthy) activities of patients were brought about principally by behavioral strategies and techniques. Seen in this light, unhealthy, risky, or damaging behaviors were to be reduced or eliminated and substituted by new, healthy appropriate behaviors. Accordingly, considerable emphasis was placed on behavior modification procedures and activities derived from operant conditioning procedures.

The role of cognitive processes in health has received substantial recognition in recent years. The contribution of cognitive styles and activities to a diverse number of health problems such as arthritis, hypertension, cancer, elevated blood cholesterol, and heart disease has been widely discussed and is beyond the scope of this chapter. Reviews of this extensive literature can be seen in many sources (e.g., Rodin & Salovey, 1989). The importance of cognitive processes in health has been recently highlighted by Seeman (1989), who stated that the cognitive subsystem is "a domain that is so powerful in its impact on health that it would



be difficult to overstate its centrality. In this domain, theory and research converge to explain many facets of health behavior" (p. 1105). Examples of this connection between cognition and health can be seen in Hamilton's (1982) model of cognition as a way of explaining a person's appraisal and response to stress situations, Lazarus and Folkman's (1984) model of stress, which is based on cognitive processes including a person's interpretation of situations, Ellis and Ashbrook's (1988) model of depression and memory, and Ottaviani and Becks' (1988) cognitive theory of depression.

Prevailing conceptions of cognition and health have focused on the role of cognitive processes as contributing factors in disease and, alternatively, on the importance of positive cognitive outcomes as the result of various treatments. More recently, the role of cognitive psychology's contribution to health has been raised from another perspective. This third perspective examines what role concepts and principles from cognitive psychology might play in designing programs for the improvement of health. Consider, for example, a few instances of concepts in cognitive psychology such as automatic and effortful processing, the generation effect in memory, organization, elaboration, rehearsal, retrieval, selective attention, implicit memory, distinctiveness, heuristics, imagery, reality monitoring, schemas, spreading activation and network models, state-dependent effects, encoding specificity, the self-referent effect, inferences in comprehension, mnemonic strategies, autobiographical memory, chunking, context effects, rules for categorization, mood congruence, and the like. The majority of these concepts have been extensively studied and have substantial experimental support. We therefore believe that it is appropriate that concepts from both cognition and emotion be considered as useful candidates for application to the solution of health issues. We have in mind a program of application in which these concepts, principles, and experimental findings be examined and evaluated for their potential or actual application to health issues. One way that this issue could be approached is to determine what concrete, practical applications might be made of specific concepts from cognition and emotion. As an example of this enterprise, a recent informal conference (1990) was organized by John Kihlstrom and Rodney Cocking in which experts in the field of cognition, emotion, and motivation met, under National Institute of Mental Health (NIMH) auspices, and began an initial exploration of how such concepts might be applied by acquired immunodeficiency syndrome (AIDS)-specialists who are concerned with the control and reduction of risky behaviors associated with this disease. It is the case that unsafe sexual activity and drug consumption are behaviors that occur under emotional conditions so it is clear that any applications of cognitive concepts must be made in the context of what is known about emotion as well. The conference was a preliminary step toward more planning, so little can be reported at this moment. What this does illustrate, however, is the beginning of an enterprise that we view as very important.

## EMOTION AND EYEWITNESS ESTIMONY

The last 20 years have seen a resurgence of interest in eyewitness testimony both with respect to basic research questions and to the application of knowledge about eyewitness testimony to the courtroom (e.g., Kassin, Ellsworth, & Smith, 1989; E. F. Loftus, 1983, 1986; Wells, 1986). A considerable body of knowledge about many facets of eyewitness research, including factors associated with the unreliability of eyewitness testimony, has grown. These include such topics as the lack of any substantive correlation between eyewitness accuracy and witness confidence, the effects of misleading postevent information and the assumption of memory integration (E. F. Loftus, Miller, & Burns, 1978), weapon focus (E. F. Loftus, G. R. Loftus, & Messo, 1987), knowledge of jurors about eyewitness perception and memory (Deffenbacher & E. F. Loftus, 1982), and cross-racial identification bias (Brigham & Malpass, 1985), which are only a few examples of this large research domain.

Recently Kassin and associates (1989) classified 21 major eyewitness testimony topics ranging from the wording of questions, lineup instructions, stress, event violence to weapon focus and cross-racial identification. Experts in the area were asked to judge each topic with respect to the reliability of the experimental evidence, whether or not the expert would testify, whether the expert had testified, and whether the topic was of common knowledge to potential jurors. Of the 21 topics, 13 were judged to be sufficiently reliable to be presented in court by 70% or more of the experts. Topics such as wording of questions, lineup instructions, and the effects of postevent information were judged to be highly reliable, whereas the topic of gender differences in eyewitness testimony was judged to be low in reliability.

For our purposes the topics of stress or emotional factors, weapon focus, and the role of postevent information in memory integration are most pertinent to our concerns. Knowledge about these topics is of obvious practical importance for any experimental cognitive psychologist who chooses to testify in court and the specific issue in all of these is the role that emotional factors play, if any, in weapon focus and in memory integration. And, more generally, what role do emotional states play in any aspect of eyewitness identification and testimony?

With respect to the issue of weapon focus, E. F. Loftus (1979) initially assumed that this was an expected occurrence when an individual was highly aroused. She assumed that in an obviously frightening situation, with a weapon pointed directly at a person, the person would selectively focus on the weapon to the neglect of other details. Subsequently, critics noted that although the idea was certainly feasible, there was no solid evidence to support it. As a result, Loftus conducted several studies that are summarized in E. F. Loftus and associates (1987), which do demonstrate the viability of weapon focus as an identifiable result of emotional effects on perception and memory of a threatening event.

The issue of memory integration is somewhat more complex. E. F. Loftus and associates (1978) argued that postevent information becomes integrated with the earlier learned information so as to become integrated or blended into a single memory. The extreme of this position is that there is only the integrated memory as distinct from two separate memories. Alternatively, there may be both an integrated memory plus portions of the two separate memories. However, McCloskey and Zaragoza (1985) and Bekerian and Bowers (1983) argued that Loftus' findings do not necessarily reflect an integration process but rather are the result of response bias and/or problems in the integration paradigm and a controversy as to the interpretation of Loftus' original findings continues today. Thus the status of the original memory still remains controversial, and it conceivably may be transformed, lost, or perhaps remains simply inaccessible (e.g., E. F. Loftus, Donders, Hoffman, & Schooler, 1989; Zaragoza & McCloskey, 1989).

For our purposes, however, the question is: Do emotional states affect the memory integration process? To our knowledge there is only one piece of evidence on this question and the answer is decidedly positive. Franklin (1985) conducted a study using the E. F. Loftus and associates' (1978) paradigm but introduced a mood induction procedure. As in Loftus' study, subjects were given either misleading information or no information after observing a simulated automobile-pedestrian accident. In addition, Franklin gave subjects either a neutral or depressed mood induction following their observation of the accident. She found that misleading information produced less accurate recognition of the accident in both depressed and neutral mood subjects, and the effects of misleading information were much greater in depressed subjects. It should be noted that, in this case, depression does not disrupt the encoding of the misleading information. If subjects had failed to encode the misleading information, then the depressed subjects would have shown less tendency to have been misled by the questionnaire. In short, Franklin's (1985) study shows clearly that the induction of a depressed mood amplifies the effects of misleading information.

As for emotion and memory in general, there is a substantial body of evidence indicating that emotional states, whether natural or experimentally induced, influence memory in a variety of settings (e.g., Blaney, 1986; Ellis & Ashbrook, 1988, 1989; Johnson & Magaro, 1987; Williams et al., 1988). For example, Ellis showed that the induction of depressed mood states produces poorer recall in a variety of settings including organizational effects (Leight & Ellis, 1981), elaborative encoding, semantic processing, and effortful tasks (Ellis et al., 1984), retrieval effects (Ellis et al., 1985), transfer of strategies (Leight & Ellis, 1981), and thought listing and memory (Ellis, Seibert, & Herbert, 1990; Seibert & Ellis, 1991). It is quite reasonable to assume that these effects could also appear in studies of eyewitness testimony, although comparable conditions have not yet been researched.

Not all experiments have shown recall decrements with depression and it

appears to be the case that depressive deficits are most likely to occur with relatively intense emotional states and with relatively demanding criterion tasks (e.g., Ellis, 1985; Ellis & Ashbrook, 1988; Hertel & Hardin, 1990). Finally, the few studies of memory under extreme emotion appear to yield mixed results. In his review of these effects, Baddeley (1990) noted that not only do prosecution and defense lawyers differ in their opinions about the effects of extreme emotion, but the mixed experimental results do follow a reasonable pattern. Studies using a high level of arousal usually find an impairment of memory, whereas studies employing low levels of arousal report either no effects or small facilitation effects on memory.

There are ways in which eyewitness testimony for events can be improved based on principles of memory. Ellis (1987) described nine general principles, such as elaboration, organization, distinctiveness, and the practice of retrieval, whose application can be used to facilitate memory. Similarly, Fisher and Geiselman (1988) developed what they called the cognitive interview designed to facilitate retrieval of information based on four general principles: (a) mentally reinstating the environment and personal contact that occurred at the time the crime was witnessed; (b) encouraging the reporting of all details; (c) attempting to recall the incident in several different orders, and (d) reporting the incident from several different perspectives. In a test of this interview procedure, Geiselman, Fisher, MacKinnon, and Holland (1985) found approximately a 35% improvement in recall over the standard police interview procedures.

Finally, the role of emotion in the related topic of flashbulb memories is an issue of considerable debate (Neisser & Winograd, 1993). It is not possible to summarize the large literature on flashbulb memories in any simple fashion here. In general, there is a positive relation between degree of emotion and the vividness of the memory. In contrast, the role of affect in memory accuracy seems more complex. We are in agreement with Reisberg and Heuer (1993), who concluded that flashbulb memories are undermined by emotion in some situations by impeding retrieval, whereas emotion may improve memory for some sorts of material as seen, say, in the mood-congruence situation.

## EMOTIONAL STATES AND HUMAN PERFORMANCE

This section briefly considers the significance of emotional states for human performance. Newspaper reports of aircraft accidents frequently note that stress was a factor in producing pilot error and, similarly, aircraft controllers have been observed to make errors in judgment when under conditions of stress produced by heavy workloads (cf. Ellis & Hunt, 1993). Newspaper reports, personal experiences, and everyday observations of events all attest to the idea that human performance can be readily influenced by emotional states. As Darke (1988)

observed, the research literature provides strong evidence that emotional states, such as anxiety, produce performance decrements, especially with capacity demanding tasks. Similarly, Ellis and Ashbrook (1988), in their resource allocation model, proposed that induced or natural mood states will have their most pronounced effects on difficult, demanding, poorly structured, or highly effortful tasks. And a large number of experiments support this generalization.

The literature on fear, dangerous environments, and performance has been reviewed by Idzikowski and Baddeley (1983) and points to a wide range of performance decrements associated with fear. Likewise, Sarason (1975) showed test performance decrements due to anxiety in a number of settings and the effects appear to be amplified with more difficult tasks. The effects, however, are not always simple, with anxiety at low levels facilitating performance as the result of arousal, but anxiety at high levels interfering with performance due to increased distraction. Indeed, the process of distraction has been assumed to be important by Ellis and Franklin (1983) in accounting for personality styles on memory performance and by Ellis and colleagues (1990) and by Scibert and Ellis (1991) in accounting for the way in which thinking about irrelevant tasks (distracting thoughts) interferes with memory. Other studies (e.g., Mueller, 1979) have also reported detrimental effects of anticipated danger on memory.

Baddeley (1990) also described the effects of emotion on simulated combat performance. Walker and Burkhardt (1965) looked at error performance in weapons control systems and found that the error rates in operating bomb and missile control systems increased as stress levels increased. This finding is, of course, quite consistent with the predicted interaction between emotional levels and task demands as proposed by the Ellis–Ashbrook (1988) resource allocation model and by Revelle and Loftus' model (1990).

Finally, an important feature of much of the research on emotional effects on performance attempts either to produce the emotional state under highly realistic conditions or to examine performance in work settings (e.g., Walker & Burkhardt, 1965) or both. In an interesting set of experiments, Keinen, Friedland, and Arad (1991) simulated stress in a very convincing manner. In the high stress condition, subjects were trainees in a parachuting course just learning to jump. They were sitting on a runway, harnessed with their parachutes, waiting to board an airplane for their first night parachute jump. Parachute jumping can reasonably be said to be a stressful experience (Keinen, 1986) and it may be further assumed that inexperience and the prospect of parachuting in the night would add to the subjects' stress. In the low stress condition, the subjects carried out the criterion task during a 1-day break in training. The criterion task was a classification procedure in which subjects categorized a list of objects. Interestingly, subjects under high stress categorized the objects more rapidly but employed fewer groups to categorize the objects than did the low stress subjects, suggesting less attention to distinctive features or an overgeneralization process due to stress.

We summarize by noting that the study of emotional states and human performance has considerable practical importance. Many of our everyday tasks are performed under transient or prolonged emotional states and it is therefore important to understand the role of emotion in human performance as well as ways in which individuals might learn to cope with stress and intense emotional states while engaged in demanding tasks. Some suggestions of how the latter might be accomplished were mentioned in the earlier section on the maintenance and repair of disturbed moods.

## CONCLUDING REMARKS

This chapter has examined four areas in which research findings and theory in the domain of cognition and emotion might be applied to practical settings. These include the maintenance and repair of disturbed moods, cognition and emotion in health behaviors, emotion and eyewitness testimony, and the role of emotional states in human performance. Disturbed moods were seen to be maintained by mood congruent aspects of current and past experiences that involve both selective attention and selective remembering. Mood repair can occur by way of direct effects of therapeutic intervention or by the indirect involvement of cognitive procedures in mood repair. The issue of mood repair is the more fundamental of our concerns. Cognition and emotion research is beginning to play an even more important role in designing programs for improving health behaviors. Several models of cognition and emotion have been developed that do have value in organizing health programs. The role of emotion in eyewitness testimony was examined with respect to weapon focus and memory integration. Weapon focus now appears to be a valid phenomenon and depressed mood states do interfere with memory in the Loftus integration paradigm. Finally, emotional states have long been shown to interfere with human performance in a variety of tasks and these effects are greatest with effortful, demanding tasks.

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