CHAPTER 1

Cognition/Emotion Interactions

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OVERVIEW

Recent years have witnessed a revival of research interest in the interplay between cognition and emotion—a subject that stimulated much debate and discussion among psychologists in the nineteenth century, but was shunned throughout most of the twentieth. As other writers have remarked (Izard, Kagan, & Zajonc 1984; Kitayama & Niedenthal, 1994; LeDoux, 1996; Watts, 1987), the reasons for this renaissance are several and varied. In the first place, emotion theorists have come to recognize the pivotal role that appraisal, expectations, and other cognitive constructs play in the experience of emotion and to rely on basic cognitive concepts and methods for insight in creating new models of affective space. Also, the successful application of cognitive therapies to the affective disorders has prompted clinical psychologists to work toward a clearer understanding of the connections between cognitive processes and emotional problems. Social psychologists, for their part, have shown how moods influence people's perceptions of both themselves and others. And whereas most cognitive revolutionaries of the 1960s regarded emotions with suspicion, viewing them as nagging sources of ''hot'' noise in an otherwise coolly rational and computerlike system of information processing, cognitive researchers of the 1990s regard emotions with respect, owing to their potent and predictable effects on tasks as diverse as episodic recall, word recognition, and risk assessment. These intersecting lines of interest have made cognition and emotion one of the most active and rapidly developing areas within psychological science. This same convergence makes *Cognition and Emotion* a prime candidate for inclusion in the *Counterpoints* series of texts published by Oxford University Press.

ORGANIZATION

The bulk of this book consists of three chapters written by several leading figures in the study of cognition/emotion interactions. In chapter 2, John Kihlstrom extends his well-known work on the cognitive unconscious (Kihlstrom, 1987) into the realm of emotions. Specifically, he and his colleagues—Shelagh Mulvaney, Betsy Tobias, and Irene Tobis—examine evidence from several sources (including clinical psychology, hypnosis research, and both cognitive and affective neuroscience) that emotional responses can function as implicit expressions of perception and memory. They also explore theoretical and empirical considerations that point to the provocative conclusion that emotional states themselves can be unconscious.

Chapter 3 is an ambitious attempt by Gordon Bower and Joseph Forgas to accomplish two ends: first, provide a systematic review of the burgeoning literature on emotional influences in social judgments—a literature to which Bower has long been a leading contributor; second, offer a coherent account of the relevant findings based on the Affect Infusion Model, an influential theory recently advanced by Forgas. A contribution from either Professor Bower or Professor Forgas would have benefited this book; undoubtedly, it is a real bonus to have them combine their efforts and expertise.

In chapter 4, Paula Niedenthal and her long-time collaborator, Jamin Halberstadt, take a fresh look at a problem familiar to mainstream cognitive psychologists: how do people categorize their perceptual experience, so that they ''know''—confidently yet effortlessly—whether one object goes with another? The traditional solution to this problem is that people group objects together to form categories on the basis of (a) the structural or perceptual similarity of the objects, (b) their common use in facilitating a goal, or (c) their conformity to a common theory of mental representation. Although not denying the value of these strictly cognitive accounts, Niedenthal and Halberstadt develop the intriguing idea that perceptual objects may also cohere as categories because they tend to evoke the same emotional reaction in a perceiver. In addition, their chapter summarizes several recent studies designed to test the proposal of ''emotional categorization.''

One of the objectives of *Counterpoints* is to encourage contributors to express and exchange ideas on issues of current concern (Marschark, 1996). To this end, Professors Bower, Forgas, Kihlstrom, and Niedenthal have been asked to respond to a series of questions posed by the project editor (Eric Eich); their answers appear in chapter 5. Whereas some of their responses relate to specific points raised in earlier parts of the book, others reflect their outlook on matters of broader significance, such as where the field of cognition/emotion research is—or should be—heading.

CURRENT CONCERNS AND CONTINUING CONTROVERSIES

Taken together, the three chapters (2–4) that comprise the core of this book cover a lot of ground. For instance, consideration is given to cognitive tasks that range from the simple and quick (e.g., deciding whether a string of letters forms a word) to the complex and deliberate (e.g., deciding who is to blame for serious marital strife). Also, whereas some of the issues discussed are relatively recent in origin (e.g., whether attitudes, like memories, are expressible both explicitly and implicitly), others relate to long-standing controversies (e.g., whether moods influence ''low level'' perceptions as well as ''higher order'' cognitions).

Nonetheless, no single text can cover *all* of the issues that motivate modern research on cognition/emotion interactions: the field has become too big for that. Indeed, this book does not deal with such salient subjects as the role of affect in economic decision making or the cognitive consequences of clinical anxiety and major depression (for recent reviews of these issues, see Mellers, Schwartz, Ho, & Ritov, 1997; Watts, 1995). To fill in some of the many remaining blanks, we devote the rest of this chapter to discussion of two important topics covered only briefly in other parts of the book: mood dependent memory (MDM) and remembering emotional events.

MOOD DEPENDENT MEMORY

Are events encoded in a certain state of affect or mood more retrievable in the same state than in a different one? Stated more simply, is memory mood dependent?

In principle, the answer is plainly ''yes'' on two accounts. First, the cognitive literature is replete with theories that suggest that memory *should* be mood dependent; examples include such classic contributions as McGeogh's (1942) interference theory of forgetting and Miller's (1950) drive-as-stimulus hypothesis, as well as such contemporary innovations as Bower's (1981) network theory of emotions and Tulving's (1983) encoding specificity principle. Similarly, the clinical literature contains numerous conjectures implicating MDM as a causal factor in the memory deficits displayed by patients with alcoholic blackout, chronic depression, multiple personality, traumatic amnesia, and other psychiatric disorders (see Goodwin, 1974; Ludwig, 1984; Reus, Weingartner, & Post, 1979; Schacter & Kihlstrom, 1989).

In practice, however, the answer is a much more guarded ''maybe.'' Over the past 25 years, many studies have sought to demonstrate MDM using a variety of memory materials, encoding tasks, retrieval measures, retention intervals, and mood-modification techniques (for reviews, see Bower, 1992; Eich,

1995b; Kenealy, 1997). The fact that these studies have failed about as often as they have succeeded raises a new question: even if mood dependence is not the powerful and prevalent effect many cognitivists and clinicians once thought it was, might MDM nevertheless emerge clearly and consistently under certain limited conditions? To help answer this question, attention now turns to two sets of factors that appear fundamental to the occurrence of mood dependence: one concerned with characteristics of the subjects' encoding and retrieval tasks, a second with attributes of the moods they experience while performing these tasks.

Task Factors

Intuitively, one might reasonably suppose that how strongly memory is mood dependent will depend on how the to-be-remembered or target events are encoded. To clarify, consider two hypothetical cases described by Eich, Macaulay, and Ryan (1994). In Scenario 1:

> Two individuals—one happy, one sad—are shown, say, a *rose* and are asked to identify and describe what they see. Both individuals are apt to say much the same thing and to encode the *rose* event in much the same manner. After all, and with all due respect to Gertrude Stein, a rose is a rose is a rose, regardless of whether it is seen through a happy or sad eye. The implication, then, is that the manner in which the perceivers encode the *rose* event will be largely, if not entirely, unrelated to their mood. If true, then when retrieval of the event is later assessed via nominally noncued or "spontaneous" recall, it should make little if any difference whether or not the subjects are in the same mood they had experienced earlier. In short, memory for the *rose* event will probably not appear to be mood dependent under these circumstances.
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> Now imagine a different situation [scenario 2]. Instead of identifying and describing the rose, the subjects are asked to recall an episode, from any time in their personal past, that the object calls to mind. Rather than involving the relatively automatic or data-driven perception of an external stimulus, the task now requires the subjects to engage in internal mental processes such as reasoning, reflection, and cotemporal thought, "the sort of elaborative and associative processes that augment, bridge, or embellish ongoing perceptual experience but that are not necessarily part of the veridical representation of perceptual experience" (Johnson & Raye, 1981, p. 70). Furthermore, even though the stimulus object is itself affectively neutral, the autobiographical memories it triggers are apt to be strongly influenced by the subjects' mood. Thus, for example, whereas the happy subject may recollect receiving a dozen roses from a secret admirer, the sad subject may remember the flowers that adorned his father's coffin. In effect, then, the *rose* event becomes closely associated with or deeply colored by the subject's mood, thereby making mood a potentially potent cue for retrieving the event. Thus, when later asked to spontaneously recall the gist of the episode they had recounted earlier, the subjects should be more likely to remember having related a vignette involving roses if they are in the same mood they had experienced earlier. In this situation, then, memory for the *rose* event should appear to be mood dependent. (pp. 213–214)

These armchair conjectures concur with the results of actual research. Many of the earliest experiments on MDM used a simple list-learning paradigm—analogous to the situation sketched in scenario 1—in which subjects memorized unrelated words while they were in a particular mood, typically either happiness or sadness, induced via hypnotic suggestions, guided imagery, mood-appropriate music, or some other means. As Bower (1992; chapter 3 here) has observed, the assumption was that the words would become associated, through temporal contiguity, to the subjects' current mood as well as to the list-context; hence, reinstatement of the same mood should enhance performance on a later test of retention. Though a few list-learning experiments found MDM, several others did not (see Blaney, 1986; Bower, 1987). Worse, attempts to replicate positive results seldom prevailed, even when undertaken by the same investigator using similar materials, tasks, and mood-modification techniques (see Bower & Mayer, 1989).

Unlike list-learning experiments, studies involving autobiographical memory—including those modeled after scenario 2—have revealed robust and reliable evidence of MDM (see Bower, 1992; Eich, 1995b). An example is experiment 2 reported by Eich et al. (1994). During the encoding session of this study, university undergraduates completed a task of *autobiographical event generation* while they were feeling either happy (H) or sad (S)—affects that had been instilled through a combination of mood-appropriate music and thought. The task required the students to recollect or generate a specific event, from any time in their personal past, that was called to mind by a probe word such as *rose*; every subject generated as many as 16 different events, each elicited by a different probe. Subjects described each event in detail and rated it along several dimensions, including its original emotional valence—that is, whether the event seemed positive, neutral, or negative when it occurred.

During the retrieval session, held two days after encoding, subjects were asked to recall—in any order, and without benefit of any observable reminders or cues—the gist of as many of their previously generated events as possible, preferably by recalling their precise corresponding probes. Subjects undertook this test of *autobiographical event recall* either in the same mood in which they had generated the events or in the alternative affective state, thus creating two conditions in which encoding and retrieval moods matched (H/H and S/S) and two in which they mismatched (H/S and S/H).

Results of the encoding session revealed that, in comparison with their sad-mood counterparts, happy subjects generated more positive events (means = 11.1 vs. 6.7), fewer negative events (3.3 vs. 6.8), and a similar number of neutral

events (1.2 vs. 2.0). This pattern replicates earlier experiments (e.g., Clark & Teasdale, 1982; Snyder & White, 1982), and it provides evidence of mood *congruent* memory—the "enhanced encoding and/or retrieval of material the affective valence of which is congruent with ongoing mood" (Blaney, 1986, p. 229).

Results of the retrieval session provided evidence of mood *dependent* memory. In comparison to their mismatched-mood peers, subjects whose encoding and retrieval moods matched freely recalled a greater percentage of their previously generated positive events (means = 37% vs. 26%), negative events (37% vs. 27%), and neutral events (32% vs. 17%).

This effect does not appear to be a fluke: the same advantage appeared in two other studies using moods instilled via music and thought (Eich et al., 1994, experiments 1 and 3), as well as in three separate studies in which the subjects' affective states were altered through a change in their physical surroundings (Eich, 1995a). Moreover, similar results were obtained in a recent investigation of patients who cycled rapidly——and spontaneously—between states of mania or hypomania and depression (Eich, Macaulay, & Lam, 1997). Thus, it seems that autobiographical event generation, when combined with event free recall, constitutes a useful tool for exploring mood dependent effects under both laboratory and clinical conditions, and that these effects emerge in conjunction with either exogenous (experimentally engendered) or endogenous (naturally occurring) shifts in affective state.

Recall that this discussion of task factors began with some simple intuitions about the circumstances under which MDM would or would not be expected to occur. Though the results reviewed thus far fit these intuitions, the former are by no means "explained" by the latter. We can, however, point to two recent theoretical developments that provide a clearer and more complete understanding of why mood dependence sometimes comes, sometimes goes.

One of these developments relates to Bower's (1981; Bower & Cohen, 1982) *network model of emotions*, which has been revised to reflect recent MDM research (Bower, 1992; chapter 3 here). A key aspect of the new model is the idea, derived from Thorndike (1932), that in order for subjects to associate a target event with their current mood, contiguity alone between the mood and the event may not be sufficient. Rather, it may be necessary for subjects to perceive the event as enabling or causing their mood, for only then will a change in mood cause that event to be forgotten.

To elaborate, we alluded earlier to the conventional list-learning paradigm. According to Bower and Forgas (this volume), this paradigm is ill-suited to demonstrating mood dependence, because it

> arranges only contiguity, not causal belonging, between presentation of the to-be-learned material and emotional arousal. Typically, the mood is induced minutes before presentation of the learning material, and the mood serves only as the prevailing background; hence, the temporal relations are not synchronized to persuade subjects to attribute their emotional feelings to the material they are studying. Thus, contiguity, without causal belonging, produces only weak associations at best. (p. 97)

In contrast, the new model permits strong mood dependent effects to emerge in studies of autobiographical memory, such as those reported by Eich et al. (1994). Exactly how this is accomplished is described in detail in Bower and Forgas's chapter, but as a brief illustration, suppose a person is presented with *rose* and other list items as probes for recollecting or generating specific incidents from his or her past. Theoretically, the concept of *rose* is represented in long-term memory as a node within a complex associative network that includes, among many other things, connections between *rose* and various autobiographical events: some positive in emotional tone (e.g., receiving a surprise bouquet), others negative (e.g., seeing flowers at a funeral). The theory also holds that, through causal belongingness, the bouquet event had been associated to that node in the network that corresponds to feeling happy and that the funeral event had been associated to the sadness emotion it caused. Thus, if the subject is feeling happy when probed with *rose*, he or she is more likely to generate the bouquet event than the funeral event, because the former receives activation from two separate sources (the probe and the happy emotion node), whereas the latter receives activation from only one source (*rose*). Assuming this happens, the subject will also associate the list-context to the bouquet event and to the word *rose* that evoked it. These newly formed list associations originate because the subject attributes causal belonging of the word-and-event to the experimenter's presentation of the probe *rose* within the list.

These contextual associations are called on later when the subject is asked to freely recall the probes (or the autobiographical recollections they triggered) when induced into the same mood or a different one. If the subject is happy at the time of recall testing, then the bouquet memory would benefit because it would receive the summation of activation from the happy-mood node and the list context, raising it above the threshold required for recall. However, if the subject's mood at recall were shifted to sadness, that node has no connection to the bouquet event activated during list input, so the recall of *rose* in this case would rely exclusively on the association to *rose* in the list-context node. In this manner, the revised network model provides a plausible explanation for not only the specific results obtained by Eich et al. (1994) but also the more general observation that studies involving autobiographical memory often succeed in showing MDM, whereas those using the more traditional list-learning paradigm frequently fail.

Moreover, the revised network model accommodates an important qualification: mood dependence is more apt to occur when retention is tested in the

absence rather than in the presence of specific, tangible reminders or cues (see Bower, 1981, 1992; Eich, 1980, 1989). Thus, free recall is a much more sensitive measure of mood dependence than either cued recall or recognition memory. According to the network model, recognition memory for whether the word *rose* appeared in the list of probes for autobiographical event generation simply requires activation of the *rose*-to-list association, and this is no less likely to occur when there is a mismatch between encoding and retrieval moods than when there is a match.

A more complete account of the revised network model can be found in Bower and Forgas's chapter. Conveniently, their chapter also contains the second theoretical development of current concern: namely, the *affect infusion model,* or AIM, which Forgas (1995) has advanced as a comprehensive account of the role of mood states in social judgments. Affect infusion may be defined as "the process whereby affectively loaded information exerts an influence on and becomes incorporated into the judgmental process, entering into the judge's deliberations and eventually coloring the judgmental outcome" (Forgas, 1995, p. 39). For our purposes, the crucial feature of AIM is the following claim:

> Affect infusion is most likely to occur in the course of constructive processing that involves the substantial transformation rather than the mere reproduction of existing cognitive representations; such processing requires a relatively open information search strategy and a significant degree of generative elaboration of the available stimulus details. This definition seems broadly consistent with the weight of recent evidence suggesting that affect "will influence cognitive processes to the extent that the cognitive task involves the active generation of new information as opposed to the passive conservation of information given" (Fiedler, 1990, pp. 2–3). (Forgas, 1995, pp. 39–40)

Though AIM is chiefly concerned with mood *congruence*, it seems relevant to mood *dependence* as well. Compared to the rote memorization of unrelated words, the task of recollecting and recounting real-life events would seem to place a greater premium on active, substantive processing, and thereby promotes a higher degree of affect infusion. Thus, the AIM, like the revised network model, agrees with the fact that list-learning experiments often fail to find mood dependence, whereas studies involving autobiographical memory usually succeed. Also like the revised network model, the AIM can be readily reconciled with the typical finding of mood *in*dependent recognition if one assumes that recognition memory entails *direct access thinking,* Forgas's (1995) term for cognitive processing that is simpler, more automatic, and less emotionally suffused than that required for free recall.

In terms of overall explanatory power, however, the AIM *may* have an edge over the revised network model on two accounts. (We emphasize "may" for the simple reason that to our knowledge, no empirical evidence has yet been reported that clearly favors any one model over the other as a comprehensive theoretical account of mood dependent memory.) First, though several studies have sought, without success, to demonstrate mood dependent recognition, most have used simple, concrete, and easily codable stimuli (such as common words or pictures of ordinary objects) as the target items. However, the elusive effect was revealed in a recent study (Eich, Macaulay, & Lam, 1997) in which bipolar patients were tested for their ability to recognize abstract, Rorschach-like inkblots—the sort of complex and unusual stimuli that the AIM suggests should be highly infused with affect (a point made clearer in Bower and Forgas's chapter).

Second, although the network model speaks to *explicit* measures of MDM (e.g., free recall versus recognition memory), it is silent on whether *implicit* indices of retention should show mood dependence. However, AIM suggests that implicit tests may indeed be sensitive to MDM, provided that the tests call on substantive, open-ended thinking and admit a wide range of possible responses (i.e., conceptually driven tests, such as free association and category-instance generation, as opposed to data-driven tests, such as perceptual identification and word-fragment completion; see Roediger, 1990; Roediger & McDermott, 1993). To date, only a handful of studies of implicit mood dependence have been reported, but their results are generally consistent with this reasoning (see Eich, Macaulay, Loewenstein, & Dihle, 1997; Kihlstrom, Eich, Sandbrand, & Tobias, 2000; Macaulay, Ryan, & Eich, 1993; Nissen, Ross, Willingham, MacKenzie, & Schacter, 1988; Tobias, Kihlstrom, & Schacter, 1992).

Though the AIM shows promise as a way of understanding the results (both positive and negative) of prior studies of MDM, its real potential may lie in the possibilities it suggests for future MDM research. For example, suppose that happy and sad subjects read about and form impressions of named individuals, some of whom appear quite normal and some who seem rather strange. As described in the Bower and Forgas chapter, AIM predicts that atypical, unusual, or complex targets should selectively recruit longer and more substantive processing strategies, and correspondingly greater affect infusion effects. Accordingly, strange people should be evaluated more positively by happy than by sad subjects, whereas normal individuals should be perceived similarly, a deduction verified in several studies (see Forgas, 1992).

Now suppose that the subjects are later asked to freely recall, by name, all of the people they can and that testing takes place either in the same mood they had experienced earlier or in the alternative affect. The prediction is that, relative to their mismatched mood counterparts, subjects tested under matched mood conditions will recall more of the strange people, but an equivalent number of the normal individuals. More generally, it is conceivable that mood dependence, like mood congruence, is magnified by the encoding and retrieval of atypical

targets, for the reasons given by AIM. Similarly, judgments about the self, in contrast to others, may be more conducive to demonstrating MDM, as people tend to process self-relevant information more extensively and elaborately (see Forgas, 1995; Sedikides, 1995). Just how real or remote these possibilities are remains to be seen.

To close this discussion of task factors, we wish to return to the question posed earlier: even if MDM is not, as was once commonly believed, a powerful and prevalent effect, might it nevertheless emerge clearly and consistently under certain limited conditions? Though certain that the answer is "yes," we are not altogether sure why. One conjecture is that the higher the level of affect infusion achieved at encoding *and* at retrieval, the higher the likelihood of detecting mood dependence. Though admittedly simplistic, this idea accords well with current knowledge about mood dependence, and—more important—it has numerous testable implications (including those identified earlier) that seem well worth pursuing.

Mood Factors

Up to now, the focus of discussion has been on factors that determine the sensitivity of an encoding or a retrieval task to the detection of mood dependence. However, no matter how sensitive these tasks may be, their odds of demonstrating MDM are slim in the absence of an effective manipulation of mood. So what makes a mood manipulation effective?

One factor is mood strength. By definition, mood dependence demands a statistically significant loss of memory when target events are encoded in one mood and retrieved in another. It is doubtful that anything less than a substantial shift in mood, between the occasions of event encoding and event retrieval, could produce such an impairment. The same point has been made by Bower (1992; chapter 3 here), who maintains that MDM reflects a failure of information acquired in one mood to generalize to a different mood; the more dissimilar the two moods, the more likely generalization will fail. Indeed, the results of an MDM meta-analysis by Ucros (1989) revealed that the greater the difference in moods—depression versus elation, for example, as opposed to depression versus a neutral affect—the greater the mood dependent effect.

No less important than the strength of the moods is their stability over time and across tasks. In terms of demonstrating MDM, it does no good to engender a mood that evaporates as soon as the subject is given something to do, such as memorize a list of words or recall a previously studied story. Some studies probably failed to find MDM simply because they relied on moods that were potent initially but paled rapidly (see Eich & Metcalfe, 1989).

One practical means of inducing a mood—either happy or sad—that is stable as well as strong is the *continuous music technique* (CMT), alluded to earlier.

Subjects are asked to contemplate elating or depressing thoughts while they listen to various selections of sprightly or somber classical music. The music plays softly in the background all throughout testing—hence the term *continuous* music technique. (A variant of this technique has been used with success in some of the studies summarized in chapter 4.)

Periodically, subjects mark a copy of the *affect grid*: a single-item scale that assesses current levels of pleasure/displeasure and arousal/sleepiness—the two bipolar dimensions underlying the circumplex model of mood (see Russell, 1980; Russell, Weiss, & Mendelsohn, 1989). Subjects are not allowed to advance to cognitive testing until they have attained a critical level of mood: typically either *very* or *extremely pleasant* in the case of H-mood induction; *very* or *extremely unpleasant* in the case of S-mood induction. In principle, subjects can satisfy the pleasure criterion regardless of their concurrent level of arousal. In practice, however, ratings of pleasure are correlated (approximate $r = .50$) with those of arousal, meaning that H-mood subjects usually feel more active or alert than do their S-mood counterparts.

Understandably, subjects are not told in advance about the pleasure criteria, and as one might expect, the length of time it takes them to reach the critical levels of mood varies widely. Thus, the CMT does not arbitrarily limit the amount of time allocated to mood induction—the common practice in prior research on MDM, and one that virtually guarantees substantial differences in subjects' postinduction levels of mood. Rather, the CMT takes an idiographic approach to mood induction, permitting each individual to achieve a predetermined degree of pleasure or displeasure at his or her own pace. Though the CMT can be quite time consuming (taking up to an hour in some studies), it instills moods that start out strong and stay that way over time and across tasks (see Eich et al., 1994, tables 1 and 2 for supporting data).

In our most recent studies of MDM, we have asked subjects to candidly assess (postexperimentally) whether the CMT created an authentic change in their mood. Nearly 90% of the participants in these studies rate the technique as at least moderately effective (i.e., a rating of 5 or higher on a 0–10 mood genuineness scale), indicating a high degree of affective realism. Moreover, those who feel most genuinely "moved" tend to show the strongest mood dependent effects (Eich, 1995b). Thus, it seems that the odds of demonstrating MDM are improved by instilling affective states that have three important properties: strength, stability, and sincerity.

Yet a fourth influential feature relates to the fact, noted earlier, that most studies using the CMT have found a reliable correlation between ratings of pleasure and those of arousal, meaning that H-mood subjects *usually* feel more active or alert than do their S-mood counterparts. We stress "usually" because the strength of the correlation between pleasure and arousal ratings seems to have a profound impact on memory performance. To amplify, suppose that a

person generates autobiographical events while in a state akin to sadness—that is, a state characterized by low pleasure combined with low arousal. Correlational evidence from several sources (see Eich et al., 1994; Eich & Metcalfe, 1989) suggests that the person will freely recall more of these events when later tested while feeling happy as a clam (high pleasure plus low arousal) as opposed to feeling happy as a lark (high pleasure plus high arousal). In short, a shift along both the pleasure and arousal dimensions of mood apparently impairs memory more than a shift along either dimension alone.

Summary

The preceding sections reviewed recent attempts to uncover key factors in the occurrence of MDM. What conclusions can be drawn from this line of research?

The broadest conclusion is that the problem of unreliability that has long beset research on mood dependence may not be as serious or stubborn as is commonly supposed. More to the point, it now appears that robust and reliable evidence of MDM can be realized under conditions in which subjects (a) are induced to experience strong, stable, and sincere moods; (b) encode the target events in a way that promotes high affect infusion; and (c) engage in similarly high affect infusion processes or strategies during event retrieval. Moreover, correlational data indicate that alterations in affective state that involve both the pleasure and arousal dimensions of mood lead to larger losses of memory than do shifts along either dimension alone.

Taken together, these observations make a start toward demystifying mood dependence, but only a start. To date, only a few factors have been examined for their role in MDM; odds are that other factors of equal or even greater weight exist, awaiting discovery. For instance, it is conceivable that mood dependent effects become stronger, not weaker, as the interval separating event encoding and retrieval grows longer (see Smith, 1988) and that such effects may emerge even when retention is assessed implicitly, or in the absence of conscious awareness (see Macaulay et al., 1993; Tobias et al., 1992). By exploring these and other possibilities in a rigorous and programmatic manner, it may be possible to reduce much of the uncertainty that still surrounds the reality of mood dependent memory.

REMEMBERING EMOTIONAL EVENTS

The impact of emotion on memory for personal events is one of the most controversial issues in all of contemporary cognition/emotion research. Though this issue has been explored in a variety of different contexts–in particular, flashbulb memory eyewitness memory, and traumatic memory–two central questions have

permeated its discussion: (a) does emotion increase or decrease the strength of memory for an event, and (b) are special mechanisms required to account for the effects of emotion on memory. Although both questions have invited strong and often sharply divided opinions, recent analyses have become increasingly intricate. Claims regarding the effects of emotion on memory have evolved from relatively simple characterizations to more nuanced assessments of the distinct factors that mediate the impact of emotion. Discussions of the role of special memory mechanisms have also shifted gradually from polarized debates to a growing appreciation of the manner in which emotion and memory interact.

Effects of Emotion on Event Memory

That emotions exert powerful effects on memory has been recognized for so long, and by so many scholars, that it can safely be regarded as a truism. However, whether the influence of emotion is said to help or hinder memory has depended both on the precise characteristics of the situation and on the active paradigm. In research investigating *flashbulb memories* for salient (often shocking) news events, the hypothesis has been that emotion promotes event recollection. Conversely, in research involving *eyewitness memory*, the predominant view has been that emotion impairs recollection. And in the domain of *traumatic memory*, some have argued that the effect of emotion on recollection can go either way. These conflicting, sometimes paradoxical, claims result because emotional effects on memory differ markedly, depending on the precise conditions of encoding and retrieval.

Flashbulb memory. Emotion has often been alleged to enhance memory for major news events such as the assassination of President John Kennedy. Brown and Kulik (1977) coined the term *flashbulb memories* to characterize the vivid and accurate recollections they believed were associated with such events. Brown and Kulik's primary evidence for the accuracy of flashbulb memories was their participants' vivid and highly detailed recollections of their circumstances at the time of learning of Kennedy's assassination. One limitation of Brown and Kulik's evidence, however, is that they did not verify the accuracy of their subjects' recollections.

To circumvent this verification problem, several subsequent studies have used longitudinal designs to assess the consistency of flashbulb memories over time (consistency being a necessary if not sufficient condition for accuracy). These studies have investigated different news events, including the shooting of Ronald Reagan (Pillemer, 1984), the explosion of the space shuttle *Challenger* (McCloskey, Wible, & Cohen, 1988; Neisser & Harsch, 1992), the death of Belgian King Baudoin (Finkenauer et al., 1998), and the resignation of British Prime Minister Margaret Thatcher (Conway et al., 1994).

Though the respondents' precise levels of memory performance have varied considerably across studies, the research as a whole suggests that most people provide generally consistent retrospective reports, although some produce appreciable inconsistencies. Researchers' interpretation of this pattern has depended on their focus on the accuracies or on the errors: some investigators have used the available data to argue that flashbulb memories are indeed uniquely veridical (e.g., Pillemer, 1984), yet others have interpreted the same data as evidence that so-called flashbulb memories are not especially accurate (e.g., McCloskey et al., 1988).

The main source of this discrepancy is that studies of flashbulb memories seldom make it clear to exactly what such memories should be compared. In a clever attempt at clarification, Conway and his colleagues (Conway et al., 1994; also see Conway, 1995) compared the recollections of two groups of subjects—citizens of the United Kingdom (U.K.) versus individuals who did not live in the U.K. (mostly residents of North America)—concerning the resignation of British Prime Minister Margaret Thatcher. Not surprisingly, the U.K. citizens were more emotional about the experience and perceived it as more important than their North American counterparts. Nevertheless, when tested two weeks after the incident, over 90% of subjects in both groups reported recollections of sufficient detail to be classified as flashbulb memories. However, whereas 86% of the U.K. citizens retained a flashbulb memory 11 months later, only 29% of the North American residents did. Moreover, the U.K. subjects showed markedly greater consistency in their recollections between the two testing intervals than did the others. Thus, by providing an appropriate control group, Conway et al. suggest that the quality of recollection associated with a flashbulb-type of news event is indeed more detailed and accurate than that associated with a less emotional news event.

Eyewitness memory. Though research on flashbulb memories has promoted the view that emotion enhances the accuracy of recollection, much of the original work on eyewitness memory seemed to suggest the opposite conclusion. For example, 70% of the eyewitness-memory experts surveyed by Kassin, Ellsworth, and Smith (1989) endorsed the statement that "very high levels of stress impair the accuracy of eyewitness testimony." Though such a characterization is consistent with several early reports of poor eyewitness memory for highly arousing events (e.g., Clifford & Scott; 1978; Loftus & Burns, 1982), recent research has revealed a more intricate relation between eyewitness memory and emotion. For example, several studies have shown that, although emotion impairs memory for the peripheral details of a complex event, it improves memory for central details (e.g., Christianson, 1992b; Heuer & Reisberg, 1990). Other studies have found that emotional memories can be less accurate than neutral memories when subjects are tested immediately, but more accurate when they are tested following a delay (e.g., Burke, Heurer, & Reisberg, 1992, experiment 2; Christianson, 1984; also see Kleinsmith & Kaplan, 1963, 1964). Though there have been several failures to observe this particular pattern (e.g., Burke et al., 1992, experiment 1; Christianson & Loftus, 1987), Park's (1995) recent meta-analysis suggests that the interaction between retention interval and memory for emotionally charged eyewitness events is a bona fide phenomenon. Thus, rather than simply impairing memory for eyewitness events, the effects of emotion on memory depend critically on both the centrality of the details and the interval at which retention is tested.

Traumatic memory. In no domain are the paradoxical claims regarding the effects of emotion on memory more evident than in the territory of trauma (see Bower & Sivers, 1998; Lindsay & Briere, 1997). On the one hand, victims of trauma often lament that their traumatic experiences are associated with painfully vivid recollections (see Koss, Tromp, & Tharan, 1995). On the other hand, some have claimed that trauma can cause memories to become difficult or even impossible to remember, at least temporarily. Though some research seems to support the latter, more controversial claim, much of this research has methodological problems. For example, numerous studies have given memory questionnaires to alleged victims of sexual abuse (e.g., Briere & Conte, 1993; Gold, Hughes, & Hohnecker, 1994; Loftus, Polonsky, & Fullilove, 1994). Invariably, these studies identify a substantial subset of respondents who report there was a time when they did not remember the trauma. Though consistent with the claim that traumatic experiences are apt to be forgotten, this finding must be viewed with caution because (a) there was no independent corroboration of the alleged trauma and (b) questionnaire studies rely on respondents' ability to recall periods of not remembering.

Many researchers doubt people's ability to accurately assess their prior states of forgetting. A recent case-study analyzed several individuals who reportedly forgot and subsequently remembered their traumas (Schooler, in press; Schooler, Ambadar, & Bendiksen, 1997; Schooler, Bendiksen, & Ambadar, 1997). Specifically, in several cases, individuals were found to have known about their traumatic experiences (i.e., they had told someone else about the events) at a time when they thought they had completely forgotten them. These cases highlight the difficulties of relying on retrospective reports of prior forgetting.

A more compelling demonstration of the forgetting of traumatic experiences comes from prospective studies that identify individuals on the basis of their known trauma histories (alleviating concerns about potential false memories) and that test their current recollections of abuse (alleviating concerns about retrospective assessment of forgetting). In several such studies (e.g., Widom & Morris, 1997; Williams, 1994, 1995), a substantial proportion of individuals who were known to have been abused reported no recollection of the recorded abuse

incident. These studies provide reasonably strong evidence that people forget specific incidents of trauma, although they also have limitations. For example, because most of the participants in these studies were victims of repeated abuse, their failure to recall a particular incident may have been a problem of confusion rather than forgetting. Further, even if we grant that these incidents were in fact forgotten, they may not have been forgotten as a result of their emotional qualities.

In addition to this debate over the degree to which individuals can forget episodes of trauma, a related and even more contentious issue has been the accuracy of traumatic memories that were allegedly forgotten but subsequently remembered. Though typically referred to as *recovered memories*, Schooler, Ambadar, and Bendiksen (1997) have advocated the term *discovered memories*, because it maintains neutrality regarding whether the traumatic experience was truly forgotten or, indeed, whether the discovered event even occurred. In recent years, an alarming number of people have reported discovering long-forgotten memories of abuse, often in the context of intense psychotherapy. There are good reasons to believe that discovered memories can be the byproduct of therapists' overzealous search for an explanation of their clients' symptoms. It is beyond the scope of this chapter to survey the voluminous evidence for such concern, and the reader is directed to the excellent reviews on the topic written by Lindsay and Read (1994), Loftus and Ketcham (1994), Pendergrast (1996), and Schacter (1996).

Although many discovered memories may be the indirect result of therapist suggestions, others appear to correspond to actual incidents of abuse. Though much more research is needed on this issue, several investigators have successfully documented and independently corroborated cases of discovered memories (Schooler, 1999; Schooler, Ambadar, & Bendiksen, 1997; Schooler, Bendiksen, & Ambadar, 1997; Williams, 1994, 1995). For example, Schooler, Bendiksen, and Ambadar (1997) examined four cases in which discovered memories had been reported; the alleged abuse in these cases ranged from inappropriate fondling to rape. In every case, there was reasonably convincing evidence that the abuse had in fact occurred. These cases also provide some clues concerning the discovery experience. For instance, in each case, the discovery of the memory appeared to be associated with conditions that emulated the original trauma. In addition, individuals' accounts of their initial recollection of the abuse were characterized by great surprise and sudden extreme emotion, illustrating the appropriateness of referring to such experiences as memory "discoveries."

Summary. Though research on the impact of emotion on memory has spanned three rather distinct domains (flashbulb memory, eyewitness memory, and traumatic memory) and invoked all possible relations (improved recollection, impaired recollection, or no effect), several general conclusions can be drawn. First, evidence from all three domains suggests that emotion can make at least the central details of memories more vivid and memorable. At the same time, however, experiencing intense emotion during the encoding of an event does not ensure that the memory will necessarily remain accessible and accurate; indeed, emotional experiences can be misrecalled and sometimes even forgotten entirely. Finally, the conditions under which emotions aid or abate recollection are complex; an understanding of the effects of emotion on memory requires a theoretical account of the mechanisms that underlie these effects.

Mechanisms Underlying Emotional Event Memory

In addition to quarreling over how emotion influences event memory, researchers have also disputed whether the impact of emotion requires the postulation of special memory mechanisms. This issue has been central to debates about flashbulb memory, eyewitness memory, and traumatic memory. Nevertheless, we argue here (and elsewhere, see Schooler & Eich, in press) that the special mechanism issue has led us all away from the more appropriate question of how emotion-related phenomena interact with basic memory processes.

Flashbulb memory. Central to Brown and Kulik's (1977) original characterization of flashbulb memories was the claim that extremely emotional events invoke a special *now print* mechanism that produces a "permanent registration not only of the significant novelty, but of all recent brain events" (p. 76). Critics of this assertion countered that a variety of standard memory mechanisms—such as distinctiveness, rehearsal, and personal relevance—could, in principle, account for the impressive though imperfect accuracy of flashbulb-like recollections. As McCloskey et al. (1988) observed: "To the extent that we accept that ordinary memory mechanism could support reasonably good memory for experiences of learning about shocking events . . . there is no need to postulate a special flashbulb memory mechanism" (p. 180).

More contemporary research implies that flashbulb memories involve standard mechanisms that have been supplemented by the unique influences of emotion. For example, Conway et al. (1994) found that the primary differences between events that either did or did not eventually develop the canonical properties of flashbulb memories were their perceived significance and the intensity of the resulting affective reactions. Recent structural-modeling analyses (Finkenauer et al., 1998) have further highlighted the importance of affective reaction in the formation of flashbulb memories.

Though emotion apparently contributes to the detailed quality of flashbulb memories, they still share great similarity with more standard memories (Anderson & Conway, 1993; Christianson, 1989). Thus, a reasonable answer to the special mechanism question is both "yes" and "no." Emotional processes do

seem to give flashbulb memories unique properties: especially strength, vividness, and detail. However, these processes appear to work in concert with, rather than apart from, more standard memory mechanisms.

Eyewitness memory. A similar reconciliation may be achievable in the case of emotion and eyewitness memory. Within this domain, researchers have argued over the extent to which the emotional intensity of actual crimes elicits processes not observed in the laboratory. For example, drawing on a study detailing the remarkably accurate memory performance of witnesses to an actual robbery and murder, Yuille and Cutshall (1986) concluded that extreme emotional events experienced in real life lead to "qualitatively different memories than innocuous laboratory events" (p. 178). Christianson and his colleagues (Christianson, 1992a; Christianson, Goodman, & Loftus, 1992) have contested this conclusion, noting that, because laboratory studies tend to show comparable albeit not identical memory performance for emotional and nonemotional episodes, the differences between lab-related and real-life emotional events may be more apparent than real.

Studies by Cahill and his associates provide evidence for both positions, suggesting that emotion may qualitatively alter memories, but it can be assessed in the lab. In one experiment (Cahill, Prins, Weber, & McGaugh, 1994), subjects were injected with either propranolol (a beta-adrenergic blocker) or a placebo before they viewed slides depicting an emotionally arousing or a neutral story. Strikingly, propranolol attenuated participants' recognition advantage for emotional elements of the story yet had no effect on their memory for nonemotional elements (the emotional story contained both arousing and neutral parts). This result implies that the normal memory advantage for the central details of emotional scenes results from the unique involvement of adrenergic hormones, which were blocked for participants receiving propranolol.

Other studies suggest a special role of the amygdala in enhancing emotional memory in the eyewitness paradigm. For instance, Cahill, Babinksy, Markowitsch, and McGaugh (1995) found no memorial advantage for emotional compared to nonemotional slides in a patient with bilateral degeneration of the amygdala complex. Moreover, using a PET imaging procedure, Cahill et al. (1996) observed that the degree of amygdala activation during the witnessing of emotional film clips predicted recall performance two weeks later ($r = .92$). They found no reliable relation between amygdala activation during the encoding and subsequent recall for neutral film clips.

The results reported by Cahill and his colleagues suggest some important truths to the claims that emotional memories involve unique processes and that laboratory-based memories are not qualitatively different from more intense real-world ones. The unique role of adrenergic hormones and the amygdala in the encoding of memories with emotional content implies the involvement of brain

processes that may not be associated with nonemotional memories. At the same time, however, the success of Cahill's lab demonstrations of the unique role of emotion in eyewitness memory suggests that the memorial processes observed in the lab may not be qualitatively different from those induced in more extreme, real-life emotional situations.

Traumatic memory. As in the domains of flashbulb and eyewitness memory, the existence of special mechanisms for traumatic memory has been a topic of heated debate. A variety of special mechanisms has been postulated as invoked by trauma—specifically *repression*, *dissociation*, and *pure-sensory processing*. The essence of repression lies in the ego-defensive function of rejecting or keeping something out of consciousness to protect the self from intolerable stress (see Erdelyi & Goldberg, 1979). In contrast, the concept of dissociation suggests that traumatized individuals detach or dissociate themselves from ongoing experience, thereby radically altering the way in which the experience is encoded and later retrieved (see Spiegel & Cardena, 1991). Related to dissociation is the idea that traumatic memories can be recalled in a sensory form only, "without any semantic representation . . . [so that they are] experienced primarily as fragments of the sensory component of the event" (van der Kolk & Fisler, 1995, p. 513). Some have claimed that such memories are especially resistant to change (van der Kolk & van der Hart, 1991) and are elicited automatically in response to certain environmental or experiential cues (see Brewin, 1989; Brewin, Dalgleish, & Joseph, 1996).

Evidence for all three special mechanisms has been mixed. Currently, there is little direct empirical support for repression (see Holmes, 1990; Loftus & Ketcham, 1994); nevertheless, it remains a potentially useful construct and some investigators believe repression is the best explanation for certain cases of forgetting (see Brewin, 1997; Erdelyi, 1990; Freyd, 1996; Ramachandran, 1995; Vaillant, 1992). Evidence for dissociation as a source of memory impairment is also equivocal. Though individuals with extreme dissociative tendencies are known to manifest marked impairments of memory (see Schacter & Kihlstrom, 1989), the contribution of dissociation to the specific case of forgetting and subsequent remembering of traumatic events has yet to be established empirically.

As for the pure-sensory view of traumatic memories, the most persuasive evidence to date has emerged from animal research. LeDoux (1992, 1995) suggested a potentially pivotal role of the amygdala in the formation of such memories and demonstrated that the amygdala is critically involved in the learning of fear responses by rats and other mammals. Nadel and Jacobs (1998) review additional animal studies indicating that stress may disrupt the memory consolidation functions of the hippocampus. These studies suggest that traumatic memories may foster the formation of affectively charged representations in the

amygdala but at the same time impair hippocampal integration and binding processes (see Bower & Sivers, 1998; Krystal, Southwick, & Charney, 1995; Metcalfe & Jacobs, 1998).

Though special mechanisms have been favored by some students of traumatic memory, others have argued that standard mechanisms alone can do the job. For example, Shobe and Kihlstrom (1997) have commented that "nothing about the clinical evidence suggests that traumatic memories are special" (p. 74). Further, Schooler, Ambadar and Bendiksen (1997) noted a number of standard mechanisms that could lead to the discovery of seemingly forgotten recollections of abuse, including directed forgetting, encoding specificity, hypermnesia, and lack of rehearsal. In addition, Schooler and his associates argued that individuals may confuse the reinterpretation of an experience (e.g., realizing that a particular action constituted sexual abuse) with the discovery of the memory itself, thereby evoking a *forgot-it-all-along effect* that could create the illusion that a traumatic event had previously been forgotten.

Though basic memory mechanisms are apt to play important roles in the discovery of traumatic memories, they may be complemented by additional processes initiated by the special circumstances of the experience. For example, in accounting for several—albeit uncorroborated—claims that memories of sexual abuse were precipitously forgotten the morning after they had occurred, Schooler (in press) speculated about the possible involvement of forgetting processes characteristic of nocturnal experiences (e.g., those associated with the forgetting of dreams and brief awakenings). If such processes do in fact contribute to the (alleged) rapid forgetting of nocturnal abuse, they would in a sense be "special" in that they would presumably be limited to specific types of nocturnal experience. Nevertheless, they would also be quite "ordinary" in that they may be drawing on processes that occur every night (see Bonnet, 1983).

Similarly, the suggestion that trauma may reduce the ability of the hippocampus to consolidate the components of emotional memories into a single, coherent narrative does not require the *addition* of any special, new mechanisms. To the contrary, it actually points to the attenuation of standard memory processes—for example, the involvement of the hippocampus in the integration or binding of diverse perceptual experiences into discrete episodes or events (McClelland, McNaughton, & O'Reilly, 1995). Lacking cohesion and integration, such memories could be especially difficult to retrieve deliberately, so they are left at the mercy of situational retrieval cues (see Krystal et al., 1995). Such a state of affairs could resolve one of the most paradoxical aspects of traumatic memories—why they are sometimes remembered excessively but at other times not recalled at all. If traumatic recollections are primarily elicited by external or internal cues, recollections of trauma may be inescapable when such cues are present; however, when the appropriate cues are absent, so too may be the recollections.

Summary. The issue of whether memories of extreme emotional experiences rely on special mechanisms may beg the question of how emotion interacts with basic memory processes. There are good reasons to believe that such fundamental factors as event distinctiveness and rehearsal frequency contribute to the seemingly distinctive qualities of emotional memories. At the same time, however, there are reasons to think that processes more specifically associated with intense emotion, such as increased amygdaloid and decreased hippocampal activity, may be involved in at least some emotional recollections. However, if such processes are in fact involved, they seem likely to work in concert with, rather than in opposition to, more basic memory processes.

NOTES

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