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Emotion, Mood, and Memory

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typically involves six to twelve treatments given over a period of two to four weeks, the ability to learn new material is reduced and access to some memories that were formed prior to ECT is lost. *Anterograde amnesia* refers to the difficulty that patients have in remembering events that occur after treatment begins. This difficulty persists for many weeks after treatment, gradually resolving as the capacity for new learning recovers. *Retrograde amnesia*, the loss of memories acquired prior to treatment, can initially involve memories acquired many years earlier. Access to these memories gradually recovers as time passes after treatment.

It should be emphasized that memory for the time period surrounding the treatment period itself does not recover after ECT. For example, when patients were asked three years after treatment to identify what past time periods they had difficulty remembering, the average patient reported difficulty remembering the time during ECT, the two months after treatment, and the six months prior to treatment. Thus, except for this lacuna around the time of ECT, formal memory testing suggests that patients eventually recover their capacity for learning and memory. At the same time, absence of evidence for a lasting memory problem is not the same as proving that no such problem exists. It is possible that more sensitive tests could be developed that would detect persisting impairment. It is always difficult to prove that something does not exist. However, memory tests sensitive enough to show differences between the memory abilities of healthy forty-year-olds and healthy fifty-year-olds (some decline in memory ability does occur with normal aging) do not detect lasting memory problems in patients who have received ECT.

In contrast with the findings from memory tests, it is noteworthy that some patients do report, even long after ECT, that their memory is not as good as it used to be. Although it is possible that the patients have a degree of sensitivity about their own memory problems beyond what can be detected by memory tests, there are a number of other possibilities. One possibility is that, having recovered gradually from a period of rather severe and easily documented memory impairment, it is difficult for a person to know when memory abilities have recovered to what they should be. People who lead active lives use their memories many times each day to recall past events and previously acquired knowledge. It is commonplace for recall

to be incomplete or inaccurate, especially for information that lies at the fringes of our stored knowledge, such as information that was encountered only once or material that was not fully attended to when it was first encountered. Sometimes memory fails altogether. If someone has had ECT, how can he or she know whether any particular failure of memory is normal or whether it might be due to ECT? To the extent that ECT does lead many patients to doubt the integrity of their own memories, it is possible that this effect of treatment could be attenuated or eliminated by sympathetic and informed counseling during the period immediately following ECT.

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Larry R. Squire

EMOTION, MOOD, AND MEMORY

The ways in which we attend, learn, and remember are related to our transitory moods and to our enduring emotional states. This assertion is based on research performed by experimental and clinical psychologists who use a variety of methods. In some studies, psychologists measure differences in emotional states and determine whether those differences are associated with differences in the ways that the participants perform cognitive tasks. These studies usually focus on unpleasant emotions

and moods, such as depression and anxiety. In other studies, psychologists attempt to induce either unpleasant or pleasant moods in the participants (perhaps by having them listen to different types of music) and then examine how performance is affected by these manipulations. Both types of research have tried to answer three major questions about the interaction of mood and memory: (a) Do depressed and anxious moods hinder performance on cognitive tasks? (b) Do people remember events that are emotionally consistent with their moods better than other events? (c) Is performance improved if the same mood exists on the occasions of the original experience and the attempt to remember it? The ensuing summary suggests answers to the questions in the context of theoretical frameworks for understanding the relationships between mood and memory.

Mood-Related Impairments in Learning and Memory

Cognitive tasks vary according to the degree to which they require our attention. Some tasks require little attentional control for successful performance; many of the cognitive processes involved in these tasks are relatively automatic, which means that they are well practiced and can occur simultaneously with other cognitive processes. Other tasks require a more effortful and deliberate focus of attention if good performance is to be achieved. The degree to which focused attention is required for good performance is a characteristic of tasks that are performed during initial exposure or learning and tasks that reveal memory for past events. Reading a long list of unrelated words for the first time, for example, requires little attentional control by fluent readers, but organizing them in ways that will be useful during later attempts to remember them clearly requires more effortful and deliberate focus. Similarly, tests of memory for those words vary in the degree of focused attention that they require. Rereading the same words is one index of memory (in that the old words can be read faster than new words) that involves processes which are relatively automatic. In contrast, trying to recall the words on the list is a deliberate task that can benefit from a great deal of attention and the use of special strategies. (See also ATTENTION AND MEMORY.)

Separate assessments of learning and memory are not possible; any index of learning involves memory and vice versa. It *is* possible, however, to emphasize variations in one type of task by examining research in which the other type of task is held constant. When that is done, a pattern emerges: The learning and memory tasks that benefit from attentional control are the tasks that present difficulties to depressed and anxious people; they perform less well than people who are not mood-impaired. Weingartner and his colleagues (1981), for example, discovered that clinically depressed patients could learn lists of words organized into simple categories as well as could non-depressed people, but when the same words were unorganized, the depressed patients learned less well. Similarly, college students who are experimentally induced to feel depressed do not learn words presented in the context of more elaborate or distinctive sentences as well as do students in neutral moods, but the two groups perform similarly when the contexts are less elaborate or distinctive (Ellis et al., 1984). Williams and his colleagues (1988) reviewed similar findings in the literature on anxiety and cognition. If people approach these types of learning tasks by providing their own organization (a deliberate strategy) or by focusing attention on elaborations and distinctions, they learn at higher levels. Depressed and anxious people do not seem to attend in these ways.

Similar conclusions can be reached in examining different types of memory tests. Hertel and Hardin (1990), for example, found that depressed college students performed as well as nondepressed students when the test did not involve attentional focus on a past event, but when the test required such focus, depressed students did not spontaneously use strategies for recognition that characterized the performance of the nondepressed students.

Why do mood-impaired people experience attentional difficulties of the type just described? Some theoretical frameworks for understanding depression and anxiety emphasize capacity limitations. Although the capacity to allocate attention is normally limited in human beings, depression and anxiety may impose further limitations. These further limitations may be biochemically induced, or they may be a reflection of mood-impaired people's enduring concern with mood-related aspects of their experience—aspects that are often irrele-

vant to the task at hand. These task-irrelevant thoughts can distract attention when participants are left to their own devices (i.e., when they are told to learn a list of words). Yet when learning or memory tasks are devised in ways that constrain attention to materials or build in appropriate strategies, mood-impaired people may perform as well as others (Hertel and Rude, 1991).

Mood-Congruent Memory

People pay attention to and subsequently remember episodes and materials that are consistent (or congruent) with their moods more often than they attend to and remember other occurrences. Mood-congruent attention characterizes the performance of anxious people in particular. To the extent that anxiety is similar to a more general state of physiological arousal (or alertness), attention to threat-related events can be understood from an evolutionary perspective. Research conducted by Eysenck et al. (1987) illustrates anxiety-congruent attention. In that experiment anxious participants, more often than nonanxious participants, spelled spoken homophones (such as *die/dye*) to coincide with the more threatening concept. The results of another experiment by Mathews et al. (1989) showed similar mood-congruent attention on a test of memory. In this test, the participants were shown the first three letters of words and asked to complete them to form the first word that came to mind. The anxious subjects completed the stems of threat-related words that they had encountered in an earlier task more often than other types of old and new words; nonanxious subjects did not show this bias.

On more traditional tests of memory, such as tests of deliberate recall, anxious people do not always remember anxiety-related episodes better than other episodes (see Williams et al., 1988, for a review and possible explanation). Yet research concerned with other emotional states (including depression, happiness, and anger) shows more consistent evidence of mood-congruent recall. Separate investigations by many researchers have revealed mood-congruent recall of personal events from the participants' past, as well as materials provided in experimental settings. For depressed people, these findings are consistent with explanations of their poor performance on typi-

cally neutral tasks. If the conditions of the task permit it, depressed people focus on aspects of experience that are relevant to their emotional states; if those emotional aspects are tapped by the test, they are well remembered, but if they are not, performance on the mood-incongruent aspects suffers because the latter received less attention.

Some theorists understand mood-congruent recall by constructing models of the mind, or internal representations of experience. Bower's (1981) network model of mood and memory, for example, represents emotional states as nodes that are connected to representations of events experienced in their context. A simple analogy can be achieved by thinking about nodes as hubs of wheels; spokes for one hub connect at the other end to other hubs and form a "Tinkertoy" network of interconnected nodes. When a mood is felt, the corresponding emotion node is activated, and that activation spreads along the preestablished pathways (spokes) to representations of mood-congruent experiences (such as adjectives with similar emotional tone). In this way, mood-congruent information is brought to mind (activated) at the time of a recall test.

The phenomena of mood-congruent memory and their interpretation are qualified by a number of considerations (Blaney, 1986). For example, depressed moods are often associated with a reduction in the recall of positively toned events rather than with increased recall of negative events. Isen (1984) interpreted these findings and other asymmetries to mean that attempts at mood control inhibit the recall of sad events. However, to the extent that mood-congruent memory is observed, it plays an important role in maintaining emotional states (see Teasdale, 1983).

Mood-Dependent Memory

Is there evidence of better memory when one's mood at the time of remembering is the same as one's mood during the original encounter? Initial research on this topic supported this claim for mood-dependent memory. Mood dependency and mood congruency have much in common in theory (as in Bower's network model) and in practice: Remembering mood-congruent events is often a matter of being in the same mood as when those

events were encountered previously. Recent research, however, has frequently failed to produce evidence for mood dependency when mood congruency is not involved—when the materials are not inherently related to the mood. Bower and Mayer (1989) concluded that this type of mood dependency occurs only when other aspects of the context for remembering do not provide strong cues for recalling the material. In other words, a consistent emotional state by itself is a weak basis for retrieving memories of past experience (see Eich and Metcalfe, 1989). Moreover, researchers sometimes ignore possible differences in arousal on the two occasions of learning and remembering (Revelle and Loftus, 1990); because physiological arousal mediates attentional processes, differences in arousal might conceal regularities in mood-dependent memory.

Summary

Individual differences in emotional states and transitory moods correspond to differences in learning and remembering. To date, research findings are consistent with a theoretical framework that emphasizes attentional processes: Attentional deficits or attentional biases toward mood-related aspects of experience are possible sources for difficulties in remembering emotionally irrelevant events.

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Paula Hertel

EPISODIC MEMORY

Episodic memory is the form of memory that allows an individual to recollect happenings from his or her past. It is sometimes referred to as autobiographical memory.

The concept of episodic memory has undergone considerable changes since its introduction by Tulving in 1972, and is now used in different senses by different writers and in different contexts. The two principal meanings are (1) episodic memory as a type of memory task and memory performance, and (2) episodic memory as a distinct neurocognitive system. These two principal senses of the term are discussed here.

Episodic Memory Tasks

Episodic memory in the first sense manifests itself in situations in which a person remembers some information acquired on a particular occasion. Although episodic memory experiments have been concerned with a large variety of different kinds of information—words, names, faces, pictures, facts, sentences, paragraphs, stories, and the like—much of the basic knowledge we have gained about episodic memory comes from various *list learning* experiments in which the to-be-remembered items are familiar words, and in which the acquired information concerns the appearance of particular words in particular lists.

The use of words in episodic memory experiments is a matter of convenience: Words themselves are of no more intrinsic interest to the

students of memory than fruit flies are to the scientists investigating the mechanisms of heredity. Many facts and phenomena of memory that have emerged from research with lists of words also hold for other types of information and materials. Words represent convenient units of to-be-remembered information, because the appearance of each word in a list is an event with well-defined temporal and spatial boundaries. Such an event is readily perceived and can be readily described by the learner. Also helpful is the fact that words have numerous and varied properties, many of which are systematically related to the words' memorability.

A prototypical laboratory experiment on episodic memory consists of (1) an original study experience during which individual items, such as words, are *encoded* and *stored* by the learner, and (2) a subsequent test during which some aspect of the experience is *retrieved*. Tests of different aspects of the original experience define different episodic memory tasks. (These tasks can also be referred to as *explicit* memory tasks.) They include but are not limited to the following (see ALSO MEASUREMENT OF MEMORY):

1. Free recall task—Name the items in the study set or list, regardless of their order.
2. Serial recall, or serial reproduction, task—Name the items in the list in their proper order.
3. Paired-associate task—Name the item that appeared together with Item X.
4. Cued recall task—Name the item in the study list that represented an instance of Category C (or one that rhymes with Word W, or fits into the sentence frame S).
5. Free-choice (or Yes/No) recognition task—Did Item X appear in the study set?
6. Two-alternative forced-choice recognition task—Which of these two items, X or Y, appeared in the study set?
7. (Absolute) Frequency estimation task—How many times did item I occur in the study list?
8. (Relative) Recency judgment task—Which of these two items, X or Y, appeared earlier (or later) in the study list?

Each of these tasks can be described in terms of the subject's earlier personal experience. This is why they are classified as episodic memory tasks.