

On What Does Mood-Dependent Memory Depend?

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The effects of mood on memory can be viewed in terms of either resource allocation theories of attention or associative network theories of memory. As presently stated, the resource allocation model is ambiguous with respect to both the mechanism by which mood affects memory processing, and the effects of elation as opposed to depression. Associative network theories, on the other hand, anticipate a phenomenon—mood-dependent memory—that apparently cannot be produced reliably. Possible reasons for this failure include the relative weakness of emotional mood states, the distinction between explicit and implicit retrieval cues, encoding variability, and automaticity. The resource allocation and associative network theories are best viewed as complementary rather than competitive views on mood and memory.

Although the cognitive revolution is more than three decades old, only recently has there been any attempt among cognitive scientists to study the interactions among the various components of the “trilogy of mind”—cognition, emotion, and motivation (Hilgard, 1980). Perhaps the most striking example of this activity is the large body of work on mood and memory, as reviewed by Ellis and Ashbrook (1987, 1989; see also Blaney, 1986; Bower, 1981, 1986; Johnson & Magaro, 1987; Kihlstrom & Nasby, 1981; Mayer, 1986; Nasby & Kihlstrom, 1986).

We now have a number of models, some couched in terms of a generic associative network theory and others couched in terms of attentional processes, that detail how memory processes are sensitive to the emotional valence of stored episodic and semantic knowledge, or of the environment in which it is encoded and retrieved. Despite their own theoretical leanings, Ellis and Ashbrook have provided a balanced summary of the available literature. In this paper, I wish to comment on some ambiguities

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in their resource-allocation approach, as well on the persisting problem of mood-dependent memory.

Mood Effects on Resource Allocation

In the instant paper and elsewhere, Ellis and Ashbrook depart from associative network approaches to focus on the effects of mood on attentional capacity—that is, the subject's ability or inclination to deploy cognitive resources to the task at hand. Moods regulate the allocation of processing resources; specifically, depression consumes attentional capacity, leaving correspondingly less capacity available to be devoted to other tasks. Depression does not interfere with automatized activities, which do not themselves consume attentional resources; its effects are visible only when the processing task requires some attentional effort. Ellis and Ashbrook (1987; see also Miller, 1975) cite a wealth of experimental evidence supporting their hypothesis. Their idea has the extra advantage that it is not inconsistent with associative network models. That is, it is one thing for mood to figure as a feature of a memory representation, and quite another for mood to affect the deployment of attention. The two effects are not mutually exclusive, and may even be independent of each other.

With their model, Ellis and Ashbrook have done us a service by drawing attention to aspects of mood and memory that must be ignored or considered nuisances by associative network theories. For example, associative network theory predicts that mood-dependent and mood-congruent memory effects should be symmetrical—that is, the shifting from happiness to sadness should have the same effect as shifting from sadness to happiness; and the effects of sadness on negative material should be the same as the effects of happiness on positive material. But most experiments reveal a clear asymmetry in the effects of mood on memory: in particular, sadness and depression appear to interfere with memory processing. This asymmetry cannot be explained by associative network theory alone, and offers the best reason for taking resource allocation seriously as a supplement or complement to it. Nevertheless, it seems that the resource allocation theory—at least, as it is currently formulated—has its own problems. Chief among these is an ambiguity concerning the mechanism by which mood affects memory processing; related to this are ambiguities concerning the effects of positive mood states.

Mechanisms of the resource-allocation effect. In their detailed account of the resource allocation model, Ellis and Ashbrook (1987) hypothesize that depression and sadness tie up attentional resources, leaving less cognitive capacity available to be allocated to ongoing cognitive activities. Two mechanisms are specifically proposed for this

effect: (1) depressed individuals allocate more resources to processing stimulus features that are irrelevant to their manifest task; alternatively, (2) depressed individuals think about their moods, and this extra-task processing effectively reduces the cognitive resources available to be devoted to the manifest task. In either case, the diminution of attentional capacity caused by depression consequently impairs the individual's performance on attention-demanding tasks. Performance of more automatized activities, however, which do not consume attentional resources, is spared the effects of depression.

There is a third possibility, though. It may be that depression merely reduces people's interest in their surroundings, and consequently their motivation to pay attention to them and to other ongoing activities. More than 20 years ago, Talland (1965) made a similar proposal concerning memory deficits in patients with the amnesic syndrome caused by brain damage. In terms that seem to presage the resource allocation view of memory adopted by Ellis and Ashbrook (1987, 1989), Talland suggested that learning and remembering take cognitive effort, and that amnesic patients (who, Talland argued, show motivational deficits in other domains as well) experience a "premature closure of activation" that precludes effective encoding or retrieval. Because depressed individuals are so obviously lacking in motivation to do almost anything, what might be called the "Talland model" might provide a parsimonious account of a wide variety of psychological deficits in depression (Miller, 1975), including but going beyond the effects of depression on memory.

Distinguishing among the alternatives. One way to test the third hypothesis against the others might be to examine the effects of elation and happiness on memory—a topic that has been largely ignored in the effort to make research on mood and memory relevant to clinical syndromes of depression. Although they do not discuss positive moods in any detail, there is the suggestion in their model that euphoria and dysphoria should have parallel effects. For example, there is no reason to think that depressed individuals are more likely to think about their mood states than happy ones are. Thus, both positive and negative moods alike should induce extra-task processing, reduce attentional capacity, and impair performance on effortful cognitive tasks. On the other hand, the motivational hypothesis seems to suggest that these effects should be specific to depression and sadness. Unfortunately, there seems to be little systematic empirical literature comparing positive and negative moods. Perhaps this is an inadvertent consequence of pragmatic clinical concerns. In any event, it seems that symmetry is an important issue in research on mood and memory (Isen, 1984), and I hope that Ellis and Ashbrook will address it explicitly as they continue to develop their model.

As a related matter, I hope that Ellis and Ashbrook (and other investigators as well) will address the role of arousal in mediating the effects of mood on cognition. Relying on the Yerkes-Dodson Law, Easterbrook (1959) suggested that increases in emotional arousal restricted the deployment of attention, and thus reduced the amount of information processed (for reviews, see Anderson, 1987; Mandler, 1975, 1984). This "cue-utilization hypothesis", seems to make the same sorts of predictions as the resource-allocation hypothesis, and again the predictions seem to be symmetrical with respect to mood-state valence. Thus, both dysphoria and euphoria should impair performance on effortful cognitive tasks. The emotional implications of Easterbrook's hypothesis have usually been studied in the context of anxiety, and perhaps it is time to consider its relation to depression and euphoria as well.

The Puzzle of Mood-Dependent Memory

A final problem with the resource-allocation hypothesis is that it seems to have little to say about the two phenomena that have received most attention in theoretical and empirical analyses of mood and memory—phenomena that are easily accommodated, at least in principle, by generic associative network theory. The general idea behind the associative network models is that aspects of organismic context, including emotional mood state, are encoded as features of episodic memory traces, and can serve as effective cues for the retrieval of trace information on a subsequent occasion. Perhaps the best experimental evidence underlying these theoretical developments comes from studies of mood-congruent memory. That is, the accessibility of a trace in memory depends on the congruence between the emotional state of the person at the time of encoding or retrieval, and the emotional connotations of the material itself. Unfortunately, the more dramatic mood-memory interaction—mood-dependent retrieval—has proved to have the qualities of a will-o'-the-wisp. It has been very difficult to demonstrate that the accessibility of a memory depends on the degree of congruence between the emotional state in which it was encoded, and that in which it is retrieved. To take an example not cited by Ellis and Ashbrook: Nasby and Yando (1980, 1982) found clear evidence for mood-congruence effects on both encoding and retrieval, but not even a hint of a mood-dependent effect. The paradox here is that the same theoretical point of view that predicts mood-congruency also predicts mood dependent retention. In particular, the implication of the encoding-specificity principle (Tulving & Thomson, 1973) is that if we get the former effect, we should also get the latter—particularly if, as in Nasby's experiments, the emotional valence of the material itself is taken into account.

The notion of mood-dependent retrieval is based on an analogy with state-dependent memory produced by pharmacological substances that act directly on the central nervous system (Overton, 1964; for reviews see Eich, 1980, 1987). In state-dependent memory, information acquired under the influence of a particular drug is accessible only in that same state, or a closely related one. In fact, Eich and Birnbaum (1987) have suggested that the state-dependent memory effects produced by psychoactive drugs are mediated by their affective properties. Conceptually similar environment-dependent memory effects have been observed in experiments where study and test phases take place under water or on land (Godden & Baddeley, 1975) or in differently furnished rooms (Smith, Glenberg, & Bjork, 1978). In all these cases, the memorability of an event is controlled by the degree of congruence between the context in which a memory is encoded and that in which retrieval is attempted. "Context" is defined broadly to include features of both the organism's external and internal environment.

In whatever form it occurs, such context dependency in memory is predicted by the encoding specificity principle (Tulving & Thomson, 1973), which states that the accessibility of a memory is determined by the degree of similarity between the information encoded at the time an event occurred and that supplied at the time of retrieval. The environmental and organismic contexts apparently supply some of this information. Experiments on mood-dependent memory, therefore, are highly relevant to the general problem of context and its representation in memory (Baddeley, 1982; Davies & Thomson, 1987). In this regard, the failure to obtain reliable mood dependent memory effects takes on enhanced performance, because it suggests that mood does not form part of the context in which events are encoded and retrieved.

Moderators of mood-dependent memory. Perhaps, though, not too much should be made of our failure to obtain reliable, robust mood-dependent effects, simply because context-dependent retrieval in general is typically weak and unreliable in human subjects (for reviews see Eich, 1980, 1987; Swanson & Kinsbourne, 1978, 1979). Drug state-dependent retrieval effects have been induced in humans by means of psychoactive drugs such as alcohol, barbiturates, amphetamines, and marijuana (for reviews, see Eich, 1977, 1980, 1987; Swanson & Kinsbourne, 1978, 1979); and conceptually similar effects have been produced by varying the environmental context in which encoding and retrieval take place (e.g., Godden & Baddeley, 1975; Smith, Glenberg, & Bjork, 1978; but see Fernandez & Glenberg, 1985). In all three classes of experiments, the effects obtained have been weak at best, and could be fairly described as unreliable. Therefore, no special onus should be attached to the mood and

memory literature, simply because it cannot produce reliable mood-dependent retrieval. Such effects have proved difficult to observe in humans under any circumstances.

It is also worth remembering that the complete dissociations between drug and no-drug conditions in Overton's (1964) original animal studies were with barely sublethal doses of barbiturate—his rats were in such a stupor that they could hardly traverse the runways. Nothing remotely resembling these doses is given in human research on context-dependent retrieval, except in the case of general anesthesia (Bennett, 1987; but see Eich, Reeves, & Katz, 1985). It is difficult to assess the "doses" of mood involved in the typical mood-dependence experiment, but they must be considered relatively mild compared to 25 mg/kg of pentobarbital. Perhaps, then, what is needed is a technique for inducing powerful mood states. Some of us thought we had it in hypnosis, and indeed our experience indicates that appropriate suggestion can induce powerful mood states in hypnotizable subjects, but apparently hypnosis is not the entire solution. The occurrence of mood-dependency will also vary as a function of the particular memory task set for the subjects. Eich (1980), summarizing the drug literature, concluded that state-dependent memory effects are strongest when retrieval cues are relatively weak. They are most frequently observed in free recall, and rarely under conditions of cued recall or recognition. Other investigators have obtained them only when the memory task is quite difficult for the subjects. Cued-recall and recognition, of course, generally make the retrieval task easier. A generalization begins to emerge here: organismic state, whether manipulated by drugs, or mood, or context, is relatively weak compared to other cue information that may be available. When rich, informative cues are provided by the retrieval environment, or can be easily generated by the subject, the effects of contextual or state cues will be relatively weak. Alternatively, when the retrieval task is easy the influence of state cues are obscured by ceiling effects.

Explicit and implicit cues. One reason why state and context cues are relatively weak is that they are fairly implicit—that is, they are not expressly contained in the list presented to the subject at the time of encoding, nor in the cues provided by the experimenter at the time of retrieval (Kihlstrom, Breneman, Pistole, & Shor, 1985). When category labels are presented along with list items, especially in a manner that makes them relevant to the task at hand, it seems likely that subjects will pick up and encode this information at the time that they study the list. Similarly, if the experimenter's query expressly contains list or copy cues, the subjects' attention will naturally be drawn to them. However, this may not be the case with state cues, which by virtue of being implicit may be subject

to a great deal of encoding variability (Bower, 1972; Estes, 1959). Only if mood state is noticed, deemed relevant to the task at hand, and actively encoded by the subject, will it be encoded as part of an episodic memory trace and able to serve as an effective retrieval cue.

This proposition is of some theoretical interest, because the subject's mood is part of the context in which list items are encoded, and a variety of memory theories have been concerned with the question of how all sorts of contextual features are represented in episodic memory, and how these components of trace information are encoded and retrieved. For example, Kihlstrom (1984, 1985) has proposed that episodic memory traces link propositions representing factual descriptions of specific events to other propositions representing the self as the agent or experiencer of those events, and the spatiotemporal context in which they occurred. The literature on mood-memory interactions suggests that our conceptualization of context should be expanded to include mood state as well as other features of the *intraorganismic* environment. Some investigators have argued that the extraorganismic context is encoded automatically (Hasher & Zacks, 1979; Hirst & Volpe, 1984). Automatic encodings, however, should not require attentional effort, and should be invariant across task conditions; but if they were not effortful and variable, then mood-dependent effects should be more reliable than they are. The difficulty we encounter in obtaining mood-dependent effects, then, raises wider questions about how emotions and other contextual features are encoded, represented, and retrieved.

Conclusions

Although resource allocation and associative networks represent two different emphases in the study of mood and memory, they are best construed as complementary rather than competitive theoretical approaches. Notions of resource allocation do not predict either mood congruent or mood dependent memory, but they do help us understand the circumstances under which they might occur. Associative network theories do not discuss the deployment of attention, but they do have something to say about how emotion is represented in memory. After a first wave of successful demonstration experiments and a second wave of complete or partial attempts to replicate, we now face a blooming, buzzing confusion of results. In resolving this situation, and in moving toward a coherent account of the effects of mood on memory, Ellis and Ashbrook are correct in their implication that a little theoretical pluralism will take us a long way.

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