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INVITED ESSAY

COMMENTARY ON MOOD AND MEMORY

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In 1981, I reported my research on cognitive consequences of emotional arousal and mood states in an article entitled 'Mood and memory', henceforth M&M. In that paper, I attempted to place the construct of emotion within the current framework of cognitive psychology. Since I was primarily concerned with the influence of different emotional states upon associative processes such as memory, thinking, daydreaming, and social inferences, I postulated the existence of distinct emotion nodes (corresponding to primary emotions such as happiness, sadness, anger and fear) that would be placed in the midst of a person's network of associations among ideas, concepts, themes, and memories of events. This cryptic statement requires elaboration.

A semantic network is a medium for representing a person's knowledge and beliefs about concepts and events (see, e.g. Anderson and Bower, 1973; Collins and Loftus, 1975). Concepts (or ideas) are characterized by their configurations of associations to other ideas. Facts or beliefs, such as 'Oswald killed John F. Kennedy', are represented in terms of propositions relating two or more ideas. New events are recorded into such as semantic network by establishing new associations between concepts that describe the event. Thus, an event like 'Mary kissed me' would be recorded into memory by associations connecting the concepts of me, Mary, and kissing. The semantics of such representations is explicated in terms of set theory: the statement says I am a member of the set of 'kissers of Mary'. By concatenation of properties and relationships, one can build up arbitrarily large configurations of embedded propositions (e.g. 'A man who was very tall brutally kissed defenseless Mary on her red cheeks'). Retrieval in such systems is assumed to occur by following associations out from some stimulus cues. This association-tracing process is presumed to arise by the spreading of activation along associative pathways radiating from the cues. Thus, if we asked 'What did Mary do to me?', activation from the Mary unit and from the 'self' unit will converge onto this event so that memory can retrieve the relation, viz. 'She kissed me'. To greatly simplify, we may conceive of the spreading activation by analogy to the flow of electrical current in a circuit network, and ideas are like light-bulb terminals that 'light up' and become conscious when they accumulate enough activation.

Let us presume that people have developed a complex set of pattern-recognition procedures for identifying situations which evoke (or cause us to 'turn on') appropriate emotions such as joy, anger, fear, sadness, and so on. In M&M, I proposed that events which evoke emotional reactions can become associated to those emotions by causal belongingness. Thus, if 'Mary kissing me' causes me to feel joy, then an association will form between the kissing event and my 'joy' emotion. Similarly, if I feel sad while attending the funeral of a friend, then the internal description of events of that funeral which I store in memory will also be stored in association with sadness. Thus, later, while mentally reviewing the scenes of that funeral in vivid imagery, I am likely to reactivate and hence 'relive' a weakened version of the sadness I felt at the original event.

The basic idea underlying this approach is to treat emotions as unique, special-purpose units (or 'nodes') embedded in each person's associative network which encodes concepts, actions, and events. Any node, including these special-purpose emotion nodes, is characterized in the network

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by what it is connected to, by its inputs and its outputs. The inputs for an emotion node (say, for anger) are the outputs from sets of pattern-recognition rules which identify situations where that emotion is appropriate for this person. These pattern-recognition rules are more complex than ones we use for object recognition (e.g. to identify cars, birds, infidelity, etc.) because they often rely upon attributions of social intentions to others. For example, we modulate our anger at someone who has injured us by deciding whether he intended harm or whether it was an unintended accident. I will say no more here about such pattern-recognition rules for emotion, but rather will dwell more on the consequences of emotions once they are aroused.

Emotion nodes have output connections to our facial expressions, to bodily posture, to our autonomic nervous system and viscera, to word labels for the emotion, to concepts which describe the emotion and its pattern, to themes that caused us to feel this way, and finally the memories of events when that emotion was strongly aroused and hence associated to the emotion. This means that perceptual descriptions of events that originally produced emotions will be encoded into memory, and re-thinking of those events (by activating them) can reactivate the emotions by the spreading of activation to the emotion. Importantly, the links are two-way, so that the influences work in the reverse direction as well, viz. when aroused by whatever means, an emotion will tend to activate selectively those memories, themes, perceptual categories, and thoughts that have been associated with that emotion in the past. Similarly, when one configures his face into a particular pattern (a smile or a frown), shrivels up his bodily postures, or attends to a racing, pounding heart, those elements can feed back activation to the emotion node and arouse some of the corresponding feelings and influences on other response systems.

In M&M, I illustrated how this network theory of emotion could account for several influences of emotions on cognition. These effects fall into three large categories. First was mood-dependent retrieval, wherein people better retrieve memories that were learned when the person was in the same emotional state as when retrieval is tested. Thus, when happy or sad, people should better retrieve memories of events that happened earlier when they were happy or sad, respectively. Second was mood-congruity, which means that stimuli whose affective significance matches the person's emotional state will provoke greater attention, faster perception, and more elaborate processing, with the result that those stimuli will be learned better than neutral or mood-incongruent materials. It is as if *S*s are biased to attend to stimuli that justify and maintain their emotional state. Third was a collection of top-down influences of emotional priming upon free associative thinking, daydreaming, forecasts of future positive or negative events, snap judgments of others, social impressions, self-observation, self-image, and self-efficacy judgments [see, e.g. Bower and Cohen (1982), Forgas, Bower and Krantz (1984) and Kavanagh and Bower (1985)]. The basic idea is that arousal of an emotion by whatever means primes into readiness concepts and categories that are congruent with how one is feeling. These primed categories are then used to describe the somewhat ambiguous social events that go on around us—whether someone's action is interpreted as assertive or hostile, whether reckless or courageous, whether sarcastic or joking, etc. And we know that such weakly primed categories can influence the inferences and attributions people draw from ambiguous social encounters (e.g. Higgins, Rholes and Jones, 1977; Wyer and Srull, 1984).

Extensions of the basic theory

The M&M paper did not elaborate many aspects of the network theory: first, it was based on a speech to the American Psychological Association, so florid details were omitted; second, the data presented in M&M required no more than the minimal theory for explanation. In other places, my associates and I have elaborated slightly upon the basic associative network theory. First, in Gilligan and Bower (1984), we showed how a network could be constructed so as to produce differential reactions to different degrees of activation to a basic emotion node. This would enable the person to label the intensity of his emotional arousal as low ('annoyance'), moderate ('anger'), or intense ('rage'). Second, in Bower and Cohen (1982), we outlined the important distinction between the emotion's word (e.g. the word 'fear'), the concept of the emotion (e.g. what it means, its relationships to behaviors and other emotions), and the referent feeling itself (e.g. the brain structures that turn on when one actually feels fear). Every semantic network makes similar distinctions between words (names), concepts, and referents, especially for sensory concepts (such

as 'red', 'smooth') and motoric concepts (such as 'kick', 'stroke', 'pinch'). Thus, just as this separation of nodes in the network enable us to talk about kicking without actually kicking anything, so does it permit us to discourse about anxiety without feeling anxious. However, some connections must be preserved, because we use words partly to point to situations and memories which can re-arouse the emotion. So just as I can ask you to activate a memory image of your mother's face, so can I ask you to get sad by remembering a sad scene (like a funeral) at which you were sad. I can also get you sad by having you imagine yourself in a small drama which places you in an imaginary situation which triggers off a sad reaction.

A third development in the theory was to show how it could be refined so as to give different emotional reactions to different features of a complex scene. The example given in Bower and Cohen (1982) was of watching a big bully beating up on our small child: we would feel anger at the bully, sympathy and concern for our child, and perhaps distress at the overall episode.

In the Bower and Cohen paper, we also provided a beginning framework within which to model the complexities of recognizing emotional situations and the interactions between emotions. Prototypic examples of the former are, say, modelling the anxiety reaction of a former rape victim alone at night in her creaking house trying to decide whether an intruder is downstairs; or modelling the victim of panic-attacks who is vigilantly monitoring his physiology for the slightest sign that another panic-attack is about to begin. Social examples include trying to decide whether you have been insulted and should be angry, whether you are being genuinely congratulated or pitied, and so on. For these purposes, we assumed that people have learned a set of emotional interpretation rules (like pattern-action productions) which propose hypotheses in the person's working memory, and that these hypotheses are quickly evaluated and modified in the light of other sources of evidence. Thus, the initial disappointment a man feels upon being turned down in a request for a date may be mitigated if the woman tells him that she has another engagement that evening.

As noted, Cohen and I also illustrated how two different emotions would interact, considering especially cases where one reduced another, such as anxiety reducing erotic desire. The state of the person was characterized as a vector of the momentary amplitudes of $7 \pm$ basic emotions, and emotion interaction rules were proposed which modified a particular emotion (say, erotic arousal) depending on the external instigation (a nude partner) and a modulating emotion (anxiety).

Although the basic framework for theorizing about those issues was laid out in Bower and Cohen, it must be admitted that very little of substance was added to fill in the bones of this outline. That was left for future thought and research.

The following paper describes some of the research on the earlier theory. The paper began as some remarks delivered at a symposium on 'Affect and Cognition' organized by Andrew Mathews and Frazier Watts and presented at the Autumn 1985 meetings of the British Psychological Association. I was pleased to see so much interest in affect and cognition as attested by the symposium and its audience. The topics have fascinated me for some time but also lured me down some frustrating blind alleys. In this paper, I will provide a selective review and up-dating of some of the research results that have appeared since the Mood and Memory (M&M) paper.

Perceptual effects of induced moods

First, I will consider the research concerning the effects of mood on perception. The spreading activation theory in M&M predicts a perceptual effect, that a pleasant mood would prime and lower the threshold for pleasant words—or at least, increase the response bias in their favor—and unpleasant moods should facilitate identification of unpleasant words. Postman and Brown (1952) had reported effects which I interpreted in M&M as supportive of those predictions. But in four subsequent experiments my group failed to find any effects on perception of induced moods. Gerrig and Bower (1982) reported no effect of hypnotically induced happiness or anger on tachistoscopic thresholds for identifying pleasant vs unpleasant words. In unpublished research, Jerry Clore and I could find no consistent mood-congruent interference in a Stroop task when subjects induced to feel happy or sad named the ink colour of happy or sad phrases. In other unpublished work, Colleen Kelly and I found no mood-congruent allure of happy vs sad messages to distract happy vs sad subjects, respectively, from a dichotic shadowing task. That is, *S*s made no more shadowing errors when the irrelevant message on the to-be-ignored ear agreed rather than disagreed with their mood of the moment. As is customary, we did not publish these failures: I have never found journal

editors at all receptive to such offerings. As another illustration of the absence of mood-effects on low-level processing, Clark, Teasdale, Broadbent and Martin (1983) reported a failure to find any effect of induced depression on lexical decisions regarding sad vs neutral words.

After those failures using word identification, I thought that a mood effect might be shown if the *S* were required to retrieve the affective significance of the word, not just to recognize it as a word. I carried out an experiment on this issue assisted by Maureen Holt. We induced *S*s to feel happy or sad by using music plus guided fantasies. Then we had them quickly judge whether the affective quality or pleasantness of two words agreed or disagreed with one another. The words could both be pleasant or both unpleasant, in which case the *S* should say 'Agree', or one word could be pleasant and one unpleasant, in which case the *S* should say 'Disagree'.

If there were a mood-congruity effect on retrieving the affective value of words, then when feeling happy, *S*s should answer 'Agree' faster to pleasant–pleasant pairs of words. On the other hand, when feeling sad, subjects should decide 'Agree' faster for unpleasant–unpleasant pairs. That is, the mood-congruity hypotheses expects an interaction between the *S*'s mood and the evaluation of pleasant vs unpleasant words.

Table 1 shows the results divided according to the two kinds of agreement. For the group as a whole shown at the top, there was no interaction between the *S*'s mood and the pleasantness of the words. The bottom of Table 1 shows the results for just those *S*s who showed a large mood swing between the happy and sad states—over seven points on a -10 to $+10$ scale of well-being.

This bottom table suggests an interaction between mood and word type. It is just barely significant at the 10% level, and one can either ignore it or consider it sympathetically as suggesting an effect of laboratory-induced moods on retrieval from memory of the affective value of words. For the moment, however, I have tentatively decided to ignore and discount this result.

Perceptual effects in patients with mood disorders

Our failures to find influences of induced moods on word perception may be contrasted with the very positive perceptual effects found when testing patients with clinical mood disorders. The main methods used in these studies have been the dichotic listening task and the Stroop test. A first positive result was reported by Burgess, Jones, Robertson, Radcliffe and Emerson (1981) who had agarophobic and social phobic patients shadow one of two prose passages presented to each ear, and to behaviorally detect occasional presentations of a target word in the attended (shadowed) or unattended (nonshadowed) ear. The target word was either neutral or a threat word relevant to the patient's phobia. They found that patients were better at detecting the fear word on the unattended channel (where baseline performance was poor) but there was no difference in detecting the two types of targets in the attended ear (where performance was near-ceiling). Similar results were reported by Foa and McNally (1986) with obsessive–compulsive patients. Target words relevant to the patients' contamination phobias (e.g. cancer, feces, rabies) were detected more readily than control words in the unattended but not in the attended channel.

This greater sensitivity to fear words by phobics may be contrasted to the earlier failure by Colleen Kelly and me to find any influence of induced happiness or sadness upon a dichotic listening task. The methodologies of the studies differ considerably. In Kelly's experiment, we were interested in the power of a mood-congruent message (the Velten statements) on the nonshadowed ear to disrupt the *S*s' shadowing, thus leading to errors (in fact, *S*s made very few errors); in the

Table 1. Latencies for same judgments according to mood and valence of the words

	Mood	
All *S*s	Happy	Sad
Pleasant–Pleasant	1.70	1.85
Unpleasant–Unpleasant	2.02	2.12
Difference	0.32	0.27
Intense-Mood *S*s		
Pleasant–Pleasant	1.51	1.82
Unpleasant–Unpleasant	1.92	2.03
Difference	0.41	0.21

Burgess *et al.* and Foa and McNally studies, the *S* is looking out for the target word, and so can lower his criterion for hearing it. Possibly the latter procedure, to detect the feared word, is more sensitive than Kelly's, to reject the affectively attractive words. However, MacLeod, Mathews and Tata (1986, Exp. 2) did find in anxiety patients greater distraction due to threat words given in the unattended channel during a shadowing task similar to Kelly's. In light of these contrasting results, it would be prudent to repeat the Burgess *et al.* dichotic listening task with *S*s in temporary emotional states induced in the laboratory.

The other class of studies with positive results have examined the Stroop task, wherein the *S* names the ink color in which threat or neutral words are printed. The basic idea is that if these threat words have a special charge of emotion attached to and priming them, then they should be more prepotent as responses, thus blocking and interfering more with the naming of the ink-color of the word. MacLeod *et al.* (1986) reported that anxiety patients are slowed in color-naming threat words in the Stroop test. In a similar vein, Watts, McKenna, Sharrock and Trezise (1986) found that spider phobics were slowed in colour-naming words related to their phobia; and Gotlib and McCann (1984) reported that depressed patients were slowed in colour-naming depressing words. On the other hand, Gotlib and McCann (1984), and Jerry Clore and I (unpublished), found that Stroop interference was not produced in normal *S*s who had been made sad by a laboratory mood induction.

An ingenious experiment by MacLeod *et al.* (1986) provides a different perspective on the issues. They tested anxious and nonanxious patients on their speed of detecting a visual dot (probe) presented sporadically as they were reading the top word of a pair of words presented on a CRT. Some of the words were anxiety-related ('threat') words. MacLeod and Mathews found that anxious patients see the probe dot sooner if it follows in the location where a threat-word had just appeared. Such results can be explained by the hypothesis that people continue to pay more attention to places where they have just detected a high-priority stimulus. In the case of anxious patients, words denoting threats would be among their high-priority stimuli. Presumably one could obtain similar results by instructing nonanxious *S*s to read the top word of presented word pairs and include the *S*'s name amongst the word pairs, and have the probe dot follow in the same or a different location from the person's name. Presuming one's name is a high-priority stimulus, that experiment should yield parallel results, although there is no threat or anxiety involved in such a task.

Is it emotion or frequency?

We may generalize these several results and conjecture that laboratory-induced temporary emotions in normal *S*s have no impact on perceptual processes, whereas long-standing conditions of trait anxiety or depression, enhance processing of congruent words. But this latter effect might be correlated with a high frequency of using or hearing anxiety-related or depression-related words, perhaps when these people describe their problems or listen to others describing them. This higher frequency of use will leave activation on the logogens or memory units for those affect-related words; and therefore, the person will show a lower threshold and greater sensitivity to such words. Such word-frequency effects are quite familiar in perceptual identification tasks.

This frequency hypothesis would explain the greater Stroop interference caused by illness-related words in both anxiety and depression patients. The frequency hypothesis has the advantage of not expecting a perceptual effect due to transient emotions induced in normal *S*s; and, as I noted earlier, we have found none. The frequency hypothesis would also predict the greater distraction due to illness-related words given during the shadowing task, which is the result found in the second experiment reported by MacLeod *et al.* (1986).

A simple test of the frequency vs transient emotion hypotheses would be to test anxiety patients after their anxiety has been relieved by psychotherapy. A strict emotion hypothesis would predict that such recovered patients would show no greater perceptual sensitivity for threat words. On the other hand, one version of the frequency theory says that a long history of frequent usage would continue to produce a perceptual advantage for threat-related words, even after recovery.

At the time I made these remarks at the British symposium, I knew of no such studies. Since then, however, two studies have appeared testing the indicated contrast. In one by Foa and McNally (1986), the greater detection of threat (vs control) words on the unattended ear was

reduced to insignificance by a flooding procedure which extinguished the patients' contamination phobias. Although the treatment reduced the detection advantage for threat words, it did not completely eliminate it. Thus, one could argue for both emotion and frequency contributing to the original difference in perceptual sensitivity.

In a second study, by Watts *et al.* (1986; exp. 2), the Stroop interference of spider-phobias in naming the ink-color of phobia-relevant words was significantly reduced by desensitization treatment to reduce the phobia; however, the effect was qualified to some extent by the fact that the spider interference effect was also reduced for phobic controls who were tested a second-time without having received desensitization treatments between the two Stroop tests. The average spider interference scores went from 18.9 to 2.9 for treated patients, and from 20.4 to 7.9 s for untreated phobic controls. In a covariance analysis taking account of initial interference scores, the drop for the treated patients was significantly larger ($P < 0.05$), but the differences in change scores (16.0 vs 12.5 s) are not as impressive as one might hope.

The upshot of these two experiments is a qualified vote in favor of the 'affect' hypothesis: words related to a patient's intense fears produce greater interference than control words, and the magnitude of this difference is reduced by treatments which reduce the patient's fear. Perhaps we may draw the larger implication from these studies that the affective priming of emotionally relevant words (expected by the M&M theory) shows forth in perceptual tasks conducted with patients with chronic mood-disorders. On the other hand, inductions of weak, temporary nonspecific moods of happiness and sadness in the laboratory have not primed perceptual processing of the general class of pleasant and unpleasant words, respectively. Conceivably, to obtain a positive effect, the priming may have to be pointed to a more specific set of words and emotional themes, e.g. guilt over an illicit sexual affair. Such conjectures remain to be tested.

Emotional influences on social and personal judgments

In M&M, I discussed several implications of the emotional priming theory for the way in which people describe themselves, describe their acquaintances, and form impressions of new people they meet. A person's association surrounding another person such as his or her parents, teachers, boss, or casual acquaintances comprise a mass of demographic facts, opinions, feelings, generalizations, and specific encounters with them. Some of these are positive in affective tone, some are negative, and most are probably neutral. We may suppose that when a person is asked to give an opinion about a person or topic, to the extent that he does not retrieve a rigidly, pre-formed attitude, he will cast his mind back over the facts, episodes, and generalizations he has collected around that person or topic. In M&M, I proposed that if the people are feeling a positive (or negative) mood, then, according to the principle of mood-dependent memory, he will retrieve primarily the positive (or negative) aspects of this collection of opinions. The high availability of the positive (or negative) information on such occasions biases the person to give a relatively positive (or negative) opinion of the target person or topic. Thus, when asked about their third-grade teacher, people who are happy give relatively charitable, friendly descriptions of her, people who are angry give relatively negative, unforgiving descriptions (see Bower, 1981). Although we did not demonstrate it, we could probably get different opinions about some target from the same person if he or she were tested in different moods several days apart.

Just as one's mood can alter his or her description of someone else, so can the mood bias a person's self-description. When happy, people describe themselves and their traits as relatively more competent, self-assured, outgoing, and highly esteemed with bright prospects; when sad, the same people will describe themselves in more negative terms, as less capable, less successful, with less self-esteem and poorer prospects. Moreover, their judgment of their personal capabilities or self-efficacy (Bandura, 1986) for most performances increases or decreases according to their temporary mood (see Kavanagh and Bower, 1985). And just as mood affects people's self-efficacy judgments, so does it also affect their persistence in working on some difficult or threatening task.

These effects are explicable on the assumption that mood-dependent memory causes a bias in which affectively loaded memories are temporarily more available in short-term memory, thus to bias the summary judgment. A second class of experimental findings is relevant to a second influence of mood, namely, that a mood primes into readiness for use a collection of congruent categories, themes, and inference rules which people use to interpret and judge objects and

situations. These 'top-down' influences of mood on interpretations should be especially prominent for somewhat ambiguous stimuli. For example, people will judge an ambiguous facial expression as more happy or more sad accordingly as they are happy or sad.

Similar mood effects occur in social inferences. Social actions and conversations are often ambiguous because we must infer the intentions that lay behind those actions. Does his action mean that he is being aggressive or assertive? Is he being reckless or courageous? Is he trying to help me or is he pitying or condescending? We must read the intentions behind the actions. And in that reading our emotions prime and promote certain categories as available interpreters. Thus, angry people 'see' others as aggressive, reckless, obstreperous, and condescending. Happy subjects 'see' or interpret just the reverse side of others' behaviors.

A recent demonstration of mood's influence on impression formation occurred in an experiment by Forgas and Bower (1987). In that experiment, *S*s received bogus positive or negative feedback about their personality and social adjustment, presumably evoking either self-satisfied contentment or mild distress and worry. They then read about a person about whom they were to form an impression. The behavioral descriptions were half about positive, socially desirable traits, and half about negative, unfavorable traits. Subjects presented each behavior description to themselves on a CRT by pushing a button to bring up the next description. One result of this experiment was that *S*s spent more time reading and thinking about the mood-congruent descriptions of the target person rather than the incongruent attributes. A second result is that person's overall evaluation of the described person was distinctly positive or negative according to whether they felt positive or negative, respectively, when they read about him. A third result was that *S*s later recalled more behavioral descriptions that agreed with their inferred mood. That is, following positive feedback about themselves, people later recalled more about the target person's positive attributes; after receiving negative feedback, they recalled more about the target's negative attributes.

Just as your mood influences the categories you use to interpret the behavior of others, so does it also influence the way in which you observe and interpret your own behavior. For example, depressed patients are notorious for the way in which they castigate themselves for their behaviors which we may evaluate in a positive way. The impact of a negative mood upon observations of one's behavior was demonstrated in an experiment by Forgas, Krantz and Bower (1984). Subjects were videotaped during a 20-min interview on a variety of topics with their knowledge and consent. The next day they returned to the lab, received an induction to make them feel happy or sad about themselves, and then scored their own videotape for the occurrence every 5 s of either neutral, prosocial, or antisocial behaviors. Subjects who were feeling happy 'saw' themselves as competent, confident, socially skilled, and giving off many prosocial acts. Subjects who were feeling sad 'saw' themselves in an opposite light, as incompetent, diffident, clumsy, unskilled, and giving off many antisocial acts. These differences were 'all in the eye of the beholder', since objective judges rated the two interviews as showing equivalent social skills.

The result shows how a temporary mood can alter the moment-by-moment interpretation of behavior, even the interpretation of one's recent behavior. Such results are consistent with the hypothesis that an emotional state can prime the use of congruent categories which are then used in top-down fashion to interpret surrounding events.

Mood-congruent learning

Another main result in M&M was that people who have been induced to feel happy or sad will, when shown a mixed list of pleasant and unpleasant items, learn more about the mood-congruent materials. My research group has now replicated this basic result 5 times in the course of other experiments, usually with lists of pleasant vs unpleasant words (e.g. Bower and Mayer, 1985, in press). The continuing issue is how to interpret these findings.

A persistent confounding factor in these demonstrations has been experimenter demand. When *S*s are induced to feel happy or sad by an autosuggestion technique (using either hypnosis or guided fantasy or the Velten method), they may believe that to maintain that mood throughout the subsequent learning task they should attend more to mood-sustaining material; as a consequence they learn it better. Perhaps the most direct assessment of this hypothesis is to ask *S*s after the learning task to describe the techniques they used to maintain their mood state during the task. When Mayer, Gayle, Meehan and Haarman (1987; Exps 2 and 3) so questioned their *S*s in a

mood-congruity experiment, few *S*s mentioned using the congruent learning items to maintain their mood; and those few *S*s who used learned items to maintain their mood showed no more mood-congruent learning than those who did not use such strategies.

An interesting variation on the typical mood-congruity experiment was introduced by Perrig and Perrig (in press). Before their *S*s studied a mixed list of pleasant and unpleasant words, the Perrigs asked them to try to simulate happiness (or sadness) and to learn the words they believed a happy (or sad) person might. The same instructions applied at recall. Such simulation *S*s showed 'mood congruent' selective recall; the selective-recall effect was especially strong for *S*s who said (in interviews) that they believed the mood-congruity hypothesis; but it was virtually absent for *S*s who did not state that hypothesis. The Perrigs' point is that selective encoding and recall of valenced items can be promoted by instructions for subjects to 'act as if' they were happy or sad, and that a real mood is not necessary to produce the effect. Instructions alone can induce a *S* to identify the appropriately valenced words, to attend more to them, and elaborate more associations around them, to the detriment of the other words in the list. They suggest that the standard mood-congruity effect observed following laboratory mood-inductions may be more related to the induction creating 'as if' role-playing than to it creating an actual mood component. Clearly, sorting out these two components will be a task on the research agenda. In this regard, more crucial studies may be those which manipulate the *S*s' moods by either subtly unobtrusive means or by naturalistic affective events.

In this regard, I am aware of several experiments in which such role playing and experimenter-demand was precluded, yet mood-congruent learning was still observed. One was a study by Laird, Wagener, Halal and Szegda (1982) in which a mood was subtly induced by having *S* configure their facial muscles in a smile or frown or pout, under the guise of a cover story. Presented with mixed lists of happy, angry and sad phrases, *S*s later remembered more phrases affectively congruent with the emotion appropriate to their facial expression. Thus, this selective learning arose even though the mood was not salient and *S*s were not aware of any experimenter demand.

Another example of mood-congruent learning while avoiding demand arose in the experiment by Forgas and Bower (1987) mentioned in the previous section. As noted, in that experiment, *S*s received bogus positive or negative feedback about their personality and social adjustment, presumably evoking either self-satisfied contentment or mild distress and worry. After reading a mixture of positive and negative facts about a target person, they then performed some ratings of him, then tried to recall what was said about him. That experiment found mood-congruent recall: happy *S*s recalled more positive facts, sad *S*s recalled more negative facts about the target person. The experiment avoided differential demand since the bogus feedback was seen as authentic and as part of a completely different experiment than the following experiment on impression formation. Subjects' interviews revealed no hypotheses about the connections between the mood induction and the impression-forming task.

Two important limitations on mood-congruent learning have been noted in the literature. First, McDowall (1984) found that better learning of depressing material appeared in psychiatrically depressed patients but only when they studied a mixed list of pleasant and unpleasant words, and not when independent groups studied pure lists of all pleasant words or all unpleasant words. All of the positive demonstrations heretofore have used mixed lists of pleasant and unpleasant materials. The suggestion is that congruent learning arises in the mixed-list case because the *S* selectively attends more to the affectivity congruent items (for any of a variety of suggested reasons) so that incongruent items receive less processing either nominally or functionally. This view is quite consistent with that proposed in M&M.

Another limitation on mood-congruent learning is that it seems not to occur with college students with mild subclinical depression (Hasher, Rose, Zacks, Sanft and Doren, 1985). College students selected for relatively high scores on the Beck Depression Inventory were comparable in their learning scores with those with average or normal scores. This finding conflicts with the literature showing poorer overall learning as well as preferential learning of unpleasant items by both psychiatrically depressed patients (e.g. Breslow, Kocsis and Belkin, 1981) and by normal *S*s induced to feel temporarily sad (e.g. Clark and Teasdale, 1985; Bower, Gilligan and Monteiro, 1981; Ellis, Thomas and Rodriguez, 1984). The exact interpretation of these conflicting findings is in dispute. Mayer and Bower (1985) have argued, for example, that the Beck Depression

Inventory may be more of a trait than a state measure, that high-scoring *S*s may not be in a sufficiently sad state to produce mood-congruent learning, and that the experimental methods in the Hasher *et al.* studies may have diluted an expected effect. In turn, these claims have been counter-argued and the original results reinterpreted in a spirited rebuttal by Hasher, Zacks, Rose and Doren (1985). Such scientific disputes are normal, healthy and useful in clarifying the conditions under which different results are obtained, and in understanding the significance of the results.

Mood-State Dependent Retrieval

Memory is said to be mood-state dependent if people remember best when their retrieval mood matches the mood they were in during original learning. For example, if people are sad, they should do better at remembering material they learned earlier when they were sad. M&M reported mood-state-dependent memory in an experiment done in 1978 by Stephen Gilligan, a student working with me. Hypnotic *S*s learned two lists, one after being made happy, another after being made sad. They later recalled both lists when they were happy or sad, with the result that they better recalled the list when they were in a matching mood. M&M reviewed that experiment plus several supporting ones (one in my lab by Bret Thompson), and since then a few confirmatory results have appeared (e.g. Bartlett, Burleson and Santrock, 1982; Schare, Lisman and Spear, 1984).

A few years ago, I heard a few rumblings about problems some others were having in replicating parts of that state-dependency result. So I began with Jack Mayer a full replication of the study. The only minor change was our replacing a third of the words in Gilligan's learning lists because they seemed of too low a frequency for our *S*s. In that direct replication attempt, Mayer and I failed to get a mood-dependent retrieval effect (Bower and Mayer, 1985). Moreover, this same null result occurred in two further experiments, which altered details of the procedure. These experiments are described in Bower and Mayer (in press). Wetzler (1985) reported a failure to find mood-dependent retrieval whereas Mecklenbrauker and Hager (1984) reported a successful demonstration. I have been unable to figure out anything systematic that causes these conflicting results, although I confess to not having carefully inspected all the varying procedures of the 'successes' and 'failures'. In light of the conflicting results using what appear to be similar experimental procedures, I have regretfully concluded that mood-state-dependent retrieval under the conditions originally reported in Bower, Monteiro and Gilligan (1978) is probably a small, unreliable effect. The effect seems a will-of-the-wisp that appears or not in different experiments in capricious ways that I do not understand.

My theory of mood and memory in M&M is embarrassed by this failure to find mood-dependent retrieval. Since misery loves company, I looked around, and could find lots of company. Every theorist I have read who discusses effects of context would predict mood dependency. This includes the famous drive stimulus theories of Edwin Guthrie, William Estes and Clark Hull (1943), the ideas of Leo Postman as well as Alan Baddeley (1982) about contextual associations, and Endel Tulving's notions of encoding specificity. The mood dependency failure would seem to embarrass a lot of theories.

More recently, I have taken a different approach, trying to figure out conditions that might produce a positive mood-dependent retrieval effect. One useful hypothesis occurred to me. Let us hypothesize that in order to establish effective associations between the emotion and the event to be remembered, the *S* has to causally attribute his emotional reaction to that event. On this hypothesis, contiguity alone between the emotion and the event would not be sufficient to produce an association; rather, the *S* must perceive the emotion as causally belonging to the event or the materials which give rise to it. This hypothesis has a good historical precedent in Edward Thorndike's studies over 50 yr ago, which demonstrated belonging as a necessary condition for forming an association between two mental contents (Thorndike, 1932).

This hypothesis of Causal Belonging says that one should obtain little or no mood-to-memory associations in the standard two-list experiments described above. The failure arises because the mood was induced externally as a background before the items were presented, and the items were not viewed by the *S*s as linked causally to their mood. Rather, these item presentations were just events that occurred coincidentally, one might even say 'accidentally', while the person was feeling

a mood caused by totally different events. According to this hypothesis, such conditions of mere contiguity are not conducive to revealing mood-dependent retrieval.

How, then, can one create a mood-dependent retrieval effect? The Causal Belonging hypothesis says that we must induce the *S* to believe that the events to be remembered are causing his emotional reactions. If so, then an association between the event and the emotion will be learned, thus leading naturally to mood-dependent retrieval. But the proper way to do the experiment raises a number of logistical problems. In principle, we should have *S*s in a neutral mood, present an event that will make them feel very happy or sad, then return them to a neutral mood: and then repeat that cycle, alternating with a different mood, 20 or 30 times in order to obtain a sufficient sample of items to estimate later recall. But all of that is an impractical order: exprimenters cannot quickly flip *S*s into and out of happy and sad moods many times within a few minutes, since the *S*'s emotional reactions (especially those stimulated by fantasies and autosuggestion) are slow to develop, and they persist for some time after they have been asked to switch them off. So rapid switching between happy, neutral and sad states was ruled out as a procedure.

After some thought, I hit upon a compromise arrangement which I believed might work. It is called the 'blocked staircase' method for presenting the learning material. Beginning in a neutral mood, *S*s hear happy or sad music as a supportive background as they receive suggestions to get happy or sad using the eight episodes they are about to read. They then read either eight happy episodes in a block, or eight sad episodes in a block, with the episodes arranged from lesser to greater emotional intensity within the block. Each episode was described in about two sentences, such as 'You're walking along the street and find a $20.00 bill. You think of something unusual and pleasant to treat yourself to.' or 'Walking through a suburban neighborhood, you see a little girl run out into the street. Then, you watch, as she is hit by a car pulling away from a stopsign.'

Subjects were instructed to imagine themselves reliving each episode as described for about 1 min, experiencing the appropriate emotion in reaction to the event, at an instructed level of 1–10 on a 10-point scale. Subjects were asked to step up the intensity of their emotional reactions to the episodes as they moved from one to the next episode within the block. The episodes were ordered in terms of our estimate of their seriousness, so it was appropriate that the person should have a greater emotional reaction to the later episodes within a block.

After the eighth episode within a block, the *S* was asked to return to a neutral mood for 2 min; and then a blocked staircase of eight episodes for the opposite mood would be presented. Each subject was presented with four such blocks, either in the order happy–sad–happy–sad, or the reverse order. In this way the *S* experienced a total of 16 happy episodes and 16 sad episodes. Following these learning experiences, *S* rested in a neutral mood for 3 mins, and then were placed into another happy or sad mood in order to test retention. To induce this final mood, *S*s listened for 5 min to new happy or sad music as they looked at and thought about events depicted in four photographs of either happy or sad scenes. Then, as the music played on, *S*s were asked to free recall all 32 episodes.

Table 2 shows the results. The left side shows the results for all *S*s. The right side shows results for *S*s selected for large mood swings. We now see a significant mood-dependent retrieval effect: happy recallers retrieve more happy than sad episodes, whereas sad recallers retrieve slightly more sad than happy episodes. The effect appears larger if we consider only those *S*s who rated their mood as intense at the end of each learning block and just before the retention testing (the right side of Table 2). The theory says that mood dependency should be larger the greater the difference between the happy and sad moods. In accord with this theory, the mood-dependent effect, which was 7.5% for all *S*s, was twice as large, at 15%, for those *S*s who experienced extreme shifts in their moods on all appropriate occasions.

Table 2. Recall percentages of happy or sad episodes by happy and sad recallers. The right-hand table is for those *S*s who had large mood shifts with each induction

All *S*s			Intense *S*s		
	Recall			Recall	
Learning	Happy	Sad		Happy	Sad
Happy	68	55	Happy	69	53
Sad	57	59	Sad	47	60

Here at last is our long-lost mood-dependent retrieval effect. It appears that if *S*s believe in a Causal Belonging between the events to be remembered and their emotional reaction, then they associated the two, and used this association at the time of retrieval.

An especial appeal of the Causal Belonging hypothesis is that it explains the pattern of our successes and failures in obtaining mood-dependent retrieval effects. When mood occurs only as a prevailing background during learning, mood-dependent learning either does not occur or is a small unreliable effect [see also Wetzler (1985)]. Coincidental contiguity of mood with the events is not enough; *S*s have to create causal belonging between the events and the emotion.

The Causal Belonging hypothesis also explains why mood-dependent retrieval is consistently found when *S*s recall autobiographical events in a happy or sad mood. M&M reported two autobiographical studies. In one, we had *S*s keep a daily diary of their emotional events. After 1 week, they submitted their diaries to us. When they returned a week later, we made them happy or sad and then asked them to recall all the events in the diary. Their recall showed mood dependency: happy recallers retrieved a higher percentage of their pleasant dairy events, whereas sad recallers retrieved a higher percentage of their unpleasant daily events.

In the second autobiographical experiment, we induced *S*s to feel happy or sad and then asked them to recall whatever memories from their childhood came to mind. Again, our happy *S*s recalled more happy memories, and sad *S*s more sad memories. Snyder and White (1982) reported similar results in an experiment that controlled for experimenter demand.

According to the Causal Belonging hypothesis, autobiographical memories should show mood-dependent retrieval because these are events that naturally caused the *S* to feel a pleasant or unpleasant emotion. Therefore, a natural association of event-to-emotion occurred, which led to mood-dependent retrieval at the time of testing.

I believe that causal attribution is a sufficient condition to promote associations between the person's mood state and the learning material, which leads to mood-dependent retrieval. While I believe this hypothesis, I have come in recent months to doubt that the 'imaginal blocked staircase' is an appropriate method for testing the attribution idea. Upon closer inspection in a second experiment, several disturbing features of the method came to light. First, untrained *S*s often report that they could not increase the intensity of their emotional arousal on cue in such finely graded steps as suggested by the staircase method. Second, later recall of the episodes does not increase with the instructed intensity of the *S*s' reaction to them, as one might expect were true variations in emotional intensities being created. If anything, *S*s' recall reveals a simple serial-position effect within the block of eight episodes. Third, only a minority of *S*s in this experiment showed mood-dependent retrieval; they sufficed to make the overall results significant, but the absence of the effect in many *S*s is cause for disturbance. Fourth, and most embarrassing, we have failed to obtain the same positive outcome in a replication of this experiment with a new group of *S*s and different experimenters (see Bower and Mayer, exp. 5, in press). That replication of the staircase method experiment yielded no evidence in favor of mood-dependent retrieval, not even a trend in that direction for the most mood-affected *S*s. So, again, I have come to the regretful conclusion that either the staircase method does not work for inducing attributions of causal belonging, or even if it does, mood-dependent retrieval using laboratory-induced moods is an evanescent and unreliable phenomenon. I regret being unable to fathom the causes of our variable outcomes; I should greatly prefer to have a simpler story to tell, that wraps up in a neat conclusion. But, alas, it is time for me to share my puzzlement with others, so that others can become aware of the unreliability of mood-dependent retrieval with material learned in the laboratory. We and others (e.g. Eich, in press) continue to search for conditions that consistently produce mood-dependent retrieval.

Final comments

Looking over the past few years of research since M&M, we see a very mixed pattern of outcomes. In perception, temporary mood inductions seem to have minimal effects, whereas patients selected for mood-disorders show more reliable effects with affectively congruent stimuli. In experiments on social judgments and impression formation, the theory's predictions have fared somewhat better, perhaps because it has been tested less often. In studies of learning, the mood-congruity effect seems robust enough, although it seems to have several causes, and some

are under volitional control. Finally, mood-dependent retrieval is proving to be an unreliable phenomenon with materials learned in the laboratory. One always finds mood-biases in recall of autobiographical memories—a fact consistent with mood-dependent retrieval—but that outcome by itself has other interpretations. The interesting conjecture, that emotion-to-event associations are best forged when the person attributes his emotional reaction to the event, has proven difficult to test in brief laboratory experiments. One proposed method, the imaginal intensifying-staircase, has produced inconsistent results and cannot be counted on to test the causal belongingness hypothesis of when emotions will become associated with events.

Overall, the M&M theory has not fared well: it has had a few successes and several glaring failures, under conditions where it should reasonably have succeeded. Thus, we are left with a theory which is badly in need of repairs—or in need of a replacement theory. But in truth, the theory's failing can be laid at the doorstep of inconsistencies in experimental findings, even in my own laboratory. Such frustrations are part of the 'slings and arrows of outrageous fortune' which all scientists must bear.

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