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18 Cognitive consequences of emotional arousal

Stephen G. Gilligan and Gordon H. Bower

Does the cheerful person really view the world through rose-colored glasses? Does the depressed person act and think in ways that sustain his misery? Does the pessimist describe as "half empty" the same beer bottle that the optimist calls "half full"? These familiar emotional stereotypes crystallize several important assumptions, specifically, that our perceptions, thoughts, and actions are strongly biased by our emotional feelings.

We have been interested in experimentally testing these assumptions and have thus examined how emotional mood states might influence such cognitive processes as learning, memory, perception, and judgments. The following discussion of our research in this area is divided into four sections. First, we describe our general procedure of using hypnosis to induce and sustain emotional states in experimental subjects. We then summarize our experiments according to four major results: (1) mood selectively biases the recall of affectively toned material; (2) mood enhances the learning of mood-congruent material; (3) the intensity of a mood affects learning differently, depending on the particular mood and the type of materials used; and (4) emotional states can bias many cognitive processes, such as interpretations, fantasies, projections, free associations, personal forecasts, and social judgments.

The second section marshals arguments against a "compliance with demand" explanation of the obtained findings. The third section then explains the results in terms of a semantic network theory of affect. This theory conceptualizes memory for an event in terms of an associative network of descriptive propositions and concepts. As central units in a network, emotions are proposed that have strong associative linkages to other aspects of the network – for example, to autonomic response patterns, expressive behaviors, beliefs, events, and themes. These associative connections are used to explain how activation of a mood influences cognitive processes in multiple ways.

The final section addresses some problems with the network model and offers speculations about how the theory might be extended to deal with various affect-related phenomena. Among the topics addressed are the interaction of

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cognition, behavior, and emotion; the development of affective structures; and the use of control processes to regulate emotional responses.

Empirical investigations

The general procedure

The experiments were conducted by the authors and a few colleagues over a five-year period. The general procedure shared by most of the experiments involved recruiting highly hypnotizable subjects, defined by their high scores (top 15% of population) on the Stanford Hypnotic Susceptibility Scale, Form C (Weitzenhoffer & Hilgard, 1962) or the Harvard Group Scale of Hypnotic Susceptibility, Form A (Shor & Orne, 1962). Approximately 60% to 70% of the subjects were Stanford undergraduate students; the rest were mental-health professionals who had attended hypnosis workshops given by the first author. Most subjects were run in groups of 1 to 4.

To experimentally induce the desired mood state, subjects were first hypnotized via a 10–15-minute general eye-closure induction (Weitzenhoffer & Hilgard, 1962). They were then asked to begin to develop a specific mood (e.g., happiness or sadness) by remembering and revivifying a personal experience in which that mood was prominent. Thus, a subject who was asked to feel happy would often recall an enjoyable vacation or an exuberant success; subjects who were requested to feel sad would remember funerals or crushing disappointments. When, as instructed, a subject signaled that an emotional incident had been accessed and replayed in imagination – usually within a minute or two – instructions were given to forget about the specific content of the revivified memory and instead simply concentrate on intensifying the accessed emotional state. These instructions were repeated for about 5 minutes until subjects were totally immersed in the suggested mood. They were told to maintain the mood until the experimenter asked them to do otherwise and then given further instructions regarding the specific tasks of the experiment. (Amnesia suggestions for the mood induction were usually also given to decrease possible compliance effects.) Following the experimental tasks, the experimenter would rehypnotize subjects, shift them back to a neutral mood, remove all other suggestions (e.g., posthypnotic cues), and then reorient them to their waking states. Subjects would then be thoroughly questioned and debriefed, usually paid or given credit for their participation, and then dismissed after ascertaining that they were suffering no ill effects from the mood induction.

The issue of demand compliance will be addressed later; here, however, preliminary comments about the use of hypnosis are in order. The sensational folklore and myths surrounding hypnosis have led many lay people to overestimate its value, with the result that skeptical academicians have reacted by rejecting its authenticity outright. We would emphasize that the scientific validity of hypnosis has been established by many reputable investigators (e.g., Hilgard, 1965; Hull, 1933; Orne, 1959). We have used it as a methodological tool because we have found it to be a highly reliable and effective way to experimentally induce and maintain mood states. The hypnotic alteration of physiological states is well documented (e.g., Crasilneck & Hall, 1959; Gottlieb, Gleser, & Gottschalk, 1967; Sarbin, 1956), as is the hypnotic production of emotional states (Blum, 1967; Damaser, Shor, & Orne, 1963; Gidro-Frank & Bull, 1950; Hepps & Brady, 1967; Zimbardo, Maslach, & Marshall, 1972). These findings are consistent with our general understanding of hypnosis as a naturalistic state in which the suggested development of relaxation enables complete absorption in suggested images to the extent that actual physiological changes may result (cf. Hilgard, 1965; Zimbardo et al., 1972). We therefore expected that our highly hypnotizable subjects would easily develop the suggested moods, and their success was confirmed by experimenter observations, subject reports, mood checklists, and experimental results.

The remainder of this section describes how the induced moods were used to test four general hypotheses: the *state-dependent recall hypothesis*, which postulates that superior memory occurs when the recall "state" (e.g., mood) matches the learning state; the *mood-congruity hypothesis*, which states that material agreeing in emotional tone with the subject's mood is learned best; the *mood-intensity hypothesis*, which predicts that learning is positively correlated with the intensity of a mood; and the *thought-congruity hypothesis*, which states generally that subjects' thoughts – free associations, fantasies, interpretations, and judgments – will be thematically congruent with their mood state.

State-dependent recall

General theories of memory proposed by Anderson and Bower (1973) and Tulving and Thomson (1973) share the premise that memory retrieval is positively correlated with the overlap of cues available during retrieval and those present at the time of learning; in other words, the more "learning context" cues present at recall, the better the memory. Because the "learning context" includes many variables – other items on a list, testing room, the subject's posture, his mood – there have been many tests relevant to this claim. In an early study by Abernathy (1940), for example, students taking a final exam in a room different from the regular classroom remembered less and performed worse than students tested in the regular room. More recently, Godden and Baddeley (1975) had deep-sea divers learn word lists while either on a boat or 20 feet underwater. When later tested in either the same or the different environment, subjects recalling in the same environment remembered significantly more words. Similarly, Smith, Glenberg, and Bjork (1978) had subjects learn a word list one day in one environment (a windowless, clean room with

a well-groomed experimenter) and then another list the next day in a different environment (a sloppy basement room with a "hippie-type" experimenter). When on the third day subjects recalled *both* lists in either the first or second learning environment, they recalled more words (59% vs. 46%) that were learned in the same environment. State-dependent effects have also been found when subjects' internal states were manipulated. An early experiment by Nagge (1935) showed that interference caused by learning multiple word lists could be reduced by having subjects learn one list in a waking state and another while hypnotized. Eich and his colleagues (1975, 1980) independently varied whether a subject was drugged ("stoned") with marijuana or nondrugged when learning and later recalling a word list; the best memory prevailed when the recall state matched the learning state. Parker, Birnbaum, and Noble (1976) obtained a similar effect using alcohol.

Mood/state-dependency with multiple lists. These and other findings of state-dependent recall suggested to us that mood might also be a powerful context in this regard. In an initial study (Bower, Monteiro, & Gilligan, 1978), we first tried the straightforward approach of having subjects learn a word list composed of half happy words and half sad words (abstract nouns) while in a hypnotically induced happy or sad mood and then recall them in either the same or opposite mood. We were somewhat surprised and discouraged that the groups did not differ in recall during either learning or retention testing. Noting Nagge's (1935) results suggesting the list-differentiating properties of internal states, we modified the experimental design to include two word lists. Subjects first learned a list while happy or sad, learned another list while happy or sad, then recalled the first list twenty minutes later while happy or sad. Thus, mood was induced three times in each subject, with the type of mood (happy or sad) independently varied each time.

This design yields three relevant conditions. Subjects in a control condition learned and recalled both lists in the same mood, thereby providing base-line data against which to compare the other groups. Subjects in a facilitation condition learned the first list in one mood, switched moods to learn the second list, then shifted back to the original mood to recall the first list. Our prediction was that this group would show the best memory for the first list because (1) interference would be decreased because the second list had been isolated by having been learned under a different mood and (2) the matching mood at first-list recall would enhance its retrieval. Subjects in an interference condition learned the first list in one mood, then the second list in the opposite mood, then recalled the first list in that (opposite) mood. We expected this condition to have the poorest recall because (1) interference would arise from the second list, which had been learned in the retrieval mood and (2) retrieval problems would arise because the recall state differed from the learning mood of the first list.

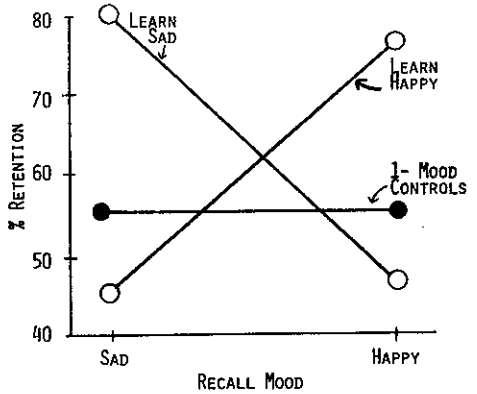

Figure 18.1. Percentage retention scores depending on the match between learning mood and recall mood. The sloping lines refer to subjects who learned the two lists under different moods. (From G. H. Bower, "Mood & Memory," *American Psychologist*, 1981, *36*(2), 129–148. Copyright 1981 by the American Psychological Association. Reprinted by permission.)

The results were scored in terms of the percentage of items recalled during an original learning phase and those that were recalled on the (later) critical test. Although mood had no influence on the type of word learned or recalled within a list, it did affect overall recall of a list (Figure 18.1). The flat line in Figure 18.1 indicates that recall percentages for the two control groups were about the same (56% for the always-sad subjects vs. 53% for the always-happy group). However, subjects in the other conditions performed remarkably differently. As shown by the crossing lines, recall was far better in the facilitation groups than in the interference groups (70% and 63% vs. 43% and 48%, respectively). In short, memory for a list was best when (1) its recall mood matched its learning mood and (2) the interfering list was isolated by being learned under a different mood. Memory was poorest when the opposite conditions held.

This state-dependent finding was replicated and extended in an undergraduate honors thesis carried out by Brett Thompson under Bower's direction (see Bower, 1981). Briefly stated, Thompson and Bower wondered if different degrees of mood/state-dependency could be produced. Using Plutchik's (1980) analysis of basic emotions, they selected the emotions of joy, sadness, anger, and fear. In Plutchik's scheme, the first two emotions are diametrically opposed to each other, as are the latter two. The main prediction was that a recall mood similar to the learning mood would result in a better memory. To test this, subjects were asked to learn a different word list in each of the four basic mood states and then to recall each list while either in the same mood (in which it was learned), a different but not opposite mood, or the opposite mood. The major finding was that emotional proximity affected recall: when learning

and recall moods matched, recall averaged 85%; when moods were different but not opposite, 70% of the words on a list were remembered; but with opposite moods, recall averaged only 54%.

These generalization scores, predicted by Plutchik's theory, could also be interpreted in terms of the differential emotions theory of Izard (1972). That theory would claim that the nominal "emotional states" in this experiment are patterns or mixtures of elements from several primary emotions, for example, that sad situations may also evoke some elements of anger and/or fear. This theory would further claim that the coefficients of overlap in emotional elements among our experimental conditions follow the gradients predicted by Plutchik's model. These claims could be tested simply by asking subjects to fill out Izard's (1972) Differential Emotions Scale while in our four different emotional states and then checking for the overlap coefficients in the patterns of emotions checked off.

State-dependent recall of autobiographical events. To determine whether these results would obtain for more naturalistic situations involving the retrieval of autobiographical memories, we modified a methodology developed by Holmes (1970). Diaries were given to 26 highly hypnotizable subjects (Bower & Gilligan, 1980), in which they were to record the time, place, and gist of each emotionally laden event, along with a rating of its intensity on a 10-point scale, for a week. Thus, entries might read: "Monday 7:30 p.m.: just got angry at my mother on the phone; a −8 rating" or "Wednesday noon . . . got word that my vacation request has been granted . . . +6."

A week later, most subjects returned at their scheduled times. Not surprisingly, a number of them had been remiss in maintaining accurate diary recordings. Using the criterion of 15 or more adequately recorded incidents, only 14 of the 26 diaries were judged usable. The 14 subjects were asked to return a week later for some hypnotic experiments, ostensibly unrelated to the diaries. Upon their return they were hypnotized (in groups of 1–4), induced into a pleasant or unpleasant state (7 subjects in each condition), and then asked to recall as many incidents recorded in the diary as they could. Subjects later rated each recalled incident according to its *present* intensity value.

The major results, in terms of the average number of pleasant and unpleasant incidents as recorded in the diary and the corresponding numbers recalled (Table 18.1), indicate that more pleasant than unpleasant experiences were recorded by subjects, replicating a finding by Holmes (1970) and Matlin and Stang (1979). This may be due to a variety of factors, including a reporting bias, a greater frequency of happy events, or different forgetting rates for happy and sad events. Accordingly, more pleasant experiences were recalled by most subjects. The major data of interest, however, are the relative percentages of pleasant and unpleasant incidents recalled by subjects in the different moods. As indicated in the right column, the expected interaction occurred

Table 18.1. *Average number of pleasant and unpleasant incidents recorded in diary and later recalled by subjects in pleasant or unpleasant emotional state*

Recall mood	Pleasant incidents recorded	Pleasant incidents recalled	Unpleasant incidents recorded	Unpleasant incidents recalled
Pleasant	20.8	6.43 (31)	11.3	2.57 (23)
Unpleasant	20.0	6.57 (33)	14.1	5.29 (38)

Note: Figures in parentheses indicate percentages.

between mood state and type of incident recalled: subjects in a pleasant mood recalled more pleasant than unpleasant experiences (31% vs. 23%), whereas subjects in an unpleasant mood showed the reverse pattern (33% vs. 38%).

Another finding was that the original intensity ratings given to incidents were somewhat predictive of recall. Dividing each subject's ratings at the median, the more intense experiences were later recalled better than the less intense ones (37% vs. 25%). The second round of ratings, made at the time of recall, were largely influenced by the experimentally induced mood: happy subjects tended to rate happy incidents as more pleasant and unhappy events as less unpleasant than before, whereas sad subjects showed the opposite tendency. Thus, the current mood seemed to shift the evaluation scale for memories.

To ensure that the selective recall effect was not a design artifact, Monteiro and Bower (see Bower & Gilligan, 1980) ran a similar experiment in which hypnotized subjects made happy or sad were asked to recall for 10 minutes a succession of unrelated childhood incidents. They were also instructed to write down the gist, time, and place of each remembered event (e.g., "my party in fifth grade; we went to the fun house"). When subjects returned the next day for a different experiment, they rated (while in a neutral mood) each recalled event as being either pleasant, unpleasant, or neutral. The ratings indicated that 92% of the memories recalled by "happy" subjects were happy, whereas only 45% retrieved by "sad" subjects were happy and slightly more than 50% were sad. Thus, the overall bias toward recalling happy memories was again found, as was the more important effect of mood/state-dependent recall.

Supporting evidence. These experiments show that mood can bias recall, a finding consistent with those reported by others. For example, Isen and her associates (1978) found that positive moods induced by winning a game enhanced recall of positively toned experimental materials. Bartlett and Santrock (1979) used a design similar to the two-list state-dependency experiment described

earlier (see Figure 18.1) – except that no hypnosis was used – and found that kindergarten children showed a similar state-dependent memory. Henry, Weingartner, and Murphy (1973) found that word associations learned by manic-depressives were remembered best when patients learned and recalled in the same mood (mania or depression). Similarly, both Teasdale and Fogarty (1979) and Lloyd and Lishman (1975) reported that a mood quickened access to mood-congruent memories. Given the differences in mood inductions, designs, and subject populations across these studies, it appears that our state-dependency results were not due simply to demand characteristics or design artifacts.

Recognition memory uninfluenced by mood. An interesting aspect of these experiments – including ours – is that none examined the possible effects of mood on recognition memory. Our intuition was that little if any mood effects would obtain under such testing conditions. This was based partly on Eich's (1980) report that drug/state-dependency did not occur with recognition memory tests and partly on our explanation of our recall results in terms of an associative network theory. A central assumption of this theory, to be described later, is that a learning mood constitutes a contextual cue that becomes encoded in an associative network representation of the event. Because of its associative links to other parts of the memory representation, reactivating the learning mood could boost recall by enhancing access to the rest of the memory. In this view, however, a recognition test would not be much influenced by mood mismatching, because the direct access that recognition provides to the memory minimizes such retrieval cues.

Despite these negative expectations, Gellerman and Bower (see Bower & Gilligan, 1980) decided to run an experiment involving recognition memory, partly because positive results would suggest the serious consideration of alternative explanations of our results. Pictures of human faces were chosen as the experimental stimuli, as they might be subject to emotional biases at encoding (e.g., Schiffenbauer, 1974). Slides of pictures from high-school yearbooks of Caucasian male high-school seniors with average physical features were made. Subjects studied some slides while in a hypnotically induced angry or happy state and then studied different slides in the opposite mood. Following an interval, they took one recognition test in one mood and a second test in the alternate mood. Each recognition test contained some distractor items not previously presented, some pictures that had been presented during the "angry" learning state, and some that had been presented during the "happy" learning state. This counterbalanced 2-×-2 design ensured that subjects saw half the "old" slides while in the same mood and half in the opposite mood, thus testing for state-dependent effects.

The results showed absolutely no differences in recognition memory stemming from input mood or test mood. More important, no interaction (state-dependent) effects were obtained. Old faces were recognized about 60% of the time in all input-by-output conditions, and about 84% of the distractor faces were correctly

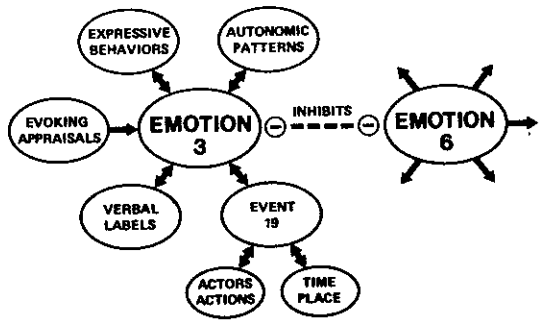

Figure 18.2. Small fragment of the connections surrounding a specific emotion node or unit. Bidirectional arrows refer to mutual exchange of activation between nodes. An inhibitory pathway from Emotion 3 to Emotion 6 is also shown. (From G. H. Bower, "Mood & Memory," *American Psychologist*, 1981, *36*(2), 129–148. Copyright 1981 by the American Psychological Association. Reprinted by permission.)

rejected. These results indicate that subjects could clearly discriminate old from new faces but were not affected in any way by their mood states. Thus, the generalization that state-dependent effects are minimized with recognition tests appears to pertain to mood states as well as to drug states.

Summary. To summarize, our experiments yielded several interesting findings. Mood biased memory when multiple word lists or autobiographical events were the recall targets. It did not affect memory for mood-related words within a list or when only a single list was used; nor did it influence recognition memory in any way. Other findings included that (1) mood shaded the subjective evaluation of a past event (in the diary experiment); (2) mood intensity correlated with the memorability of an event (in the diary experiment); and (3) pleasant experiences tended to be recalled more than unpleasant ones, an interesting finding but of no special relevance to our concerns.

Explaining mood/state-dependent recall

Our results are explained in the third section in terms of a theory of affect. A part of the theory will be introduced here to explain the state-dependent results. Network theories (e.g., Anderson & Bower, 1973; Collins & Loftus, 1975; Collins & Quillian, 1969) conceptualize memory as an associative network of nodes representing, among other things, numerous concepts, schemata, and events. Bower (1981) proposed that emotions might be considered as units in such a network, with each emotion "node" having strong associative links to other units in the network (Figure 18.2). An event becomes encoded in the network as a cluster of propositions with strong associative links to concepts and other units (e.g., emotions) and schemata to which they are related. These propositions might refer to individual words learned on a word list, actions in

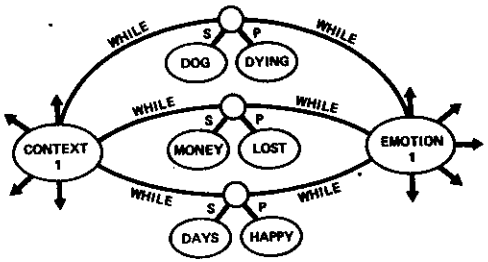

Figure 18.3. The crucial connections for explaining mood/state-dependent retrieval. The subject has studied many adjective-noun phrases (dying dog, lost money, happy days, etc.) in Context 1 while feeling Emotion 1. The associations indicated (and many others) are weakly formed. (From G. H. Bower, "Mood & Memory," *American Psychologist*, 1981, *36*(2), 129–148. Copyright 1981 by the American Psychological Association. Reprinted by permission.)

a story, autobiographical experiences, and so on. The propositions constitute the basic units of thought, and the activation of them or their related concepts is the basic process of thought. Activation can occur directly or indirectly. Direct activation occurs by presentation of a corresponding stimulus pattern: for example, stimulation of an emotion would activate the corresponding emotion node; presentation of a word on a recognition test would access its network representative. Indirect activation occurs when "energy" spreads from associated nodes that are activated, for example, the mood could be "turned on" via activation spreading to it from associated concepts or propositions.

The state-dependent results can be explained straightforwardly by this model. Figure 18.3 illustrates in a highly simplified fashion how two-word phrases like "happy days" or "dying dog" learned under different moods in one of our multiple-list experiments would be represented in a memory network. Each memory is represented as a subject-predicate (S-P) proposition, which was experienced and learned while (note the name on the association) the subject was in Mood 1 and List Context 1. At recall, reinstating the learning mood for, say, List 1 would reactivate that mood unit (Emotion 1) and spread activation down its associative links, thereby priming List 1 words. At the same time, asking the subject to recall the first list would activate the List 1 node, which would also spread activation. Thus, the target items (i.e., the List 1 words) would receive the summation of activation emanating from the two activated sources, thereby making them more highly accessible than alternative contents. Intersection of activation from the List 1 node helps to discriminate the target items from the many other associations to Emotion 1; it also provides the additional energy needed to push activation of target items over threshold, thereby bringing them into consciousness. Conversely, mismatching learning and recall moods would depress accessibility, because the recall mood not only would fail to activate the target items but would also

activate interfering associations. As discussed in the third section, this interference is especially pronounced when the recall mood is diametrically opposed to the learning mood.

The mood-congruity effect

The character identification experiment. In addition to the question of how mood biases memory, we have also been interested in whether mood might cause selective learning of affective material (see Bower, Gilligan, & Monteiro, 1981). Our first experiment in this area developed from an earlier interest in the role of character identification in the reading and recall of narratives (Bower, 1978). The basic question was whether a subject made happy or sad would identify more with, and thus learn and recall more about, a story character expressing the same mood. To test this idea, we composed a short third-person narrative about two students playing tennis on a Saturday afternoon. One character, André, is very happy – he sings, jokes, enjoys the sunshine, wins the game, and so on. The other character, Jack, is just the opposite – he is morose, worries about exams, feels scorched by the sun, loses the game, and so on. The number of (mostly happy) statements about André equaled the number of (mostly sad) statements about Jack.

Subjects were induced into a happy or a sad mood via a posthypnotic cue (see Bower et al., 1981) and then asked to read the narrative. Afterward, they filled out questionnaires regarding which character they identified with and attended to more. A written free-recall test of the story was given the next day while subjects were in a neutral mood. Of the facts recalled by "happy" readers, 55% were about Happy André, whereas of the propositions recalled by "sad" readers, 80% were about Sad Jack. In addition, all subjects reported identifying more with the character whose mood matched theirs at the time of reading. This is not a state-dependent effect, as a neutral mood prevailed at the time of recall; rather, the results suggest selective learning.

The single character experiment. The hypothesis attributing the recall differences to "character identification" was not uniquely tested in the André-Jack experiment because that story confounded the type of fact with the character. That is, all happy facts involved Happy André and all sad facts pertained to Sad Jack. Thus, the observed effect may have reflected selective learning of mood-congruent materials, unmediated by character identification. To test this possibility, we constructed a short narrative about a single character, a psychiatric patient, recounting a mixture of happy and sad memories uncovered during hypnotherapeutic age regressions. As before, subjects read the story while in hypnotically induced happy or sad moods. This time, though, they were also in an induced mood while recalling the story some 20 minutes later. By independently manipulating learning and recall moods, we could isolate possible

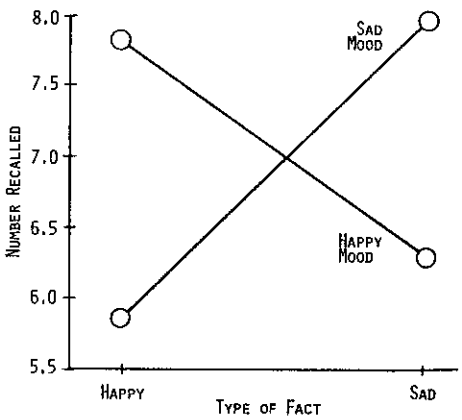

Figure 18.4. Number of happy versus sad story incidents recalled by readers who were happy or sad. (One character in the story described both types of personal incidents.) (From G. H. Bower, "Mood & Memory," *American Psychologist*, 1981, *36*(2), 129–148. Copyright 1981 by the American Psychological Association. Reprinted by permission.)

learning, recall, and state-dependent (interaction) effects. The results indicate that learning mood does affect the type of facts recalled, with happy learners later recalling more happy incidents and sad learners more sad ones (Figure 18.4). However, there was no reliable state-dependent effect, that is, overall recall by subjects whose learning and recall moods matched was not significantly greater than that of subjects in different moods. Also, recall mood did not influence which type of material – happy or sad – was remembered.

The absence of a mood-matching effect here is consistent with our earlier failings using single lists. Remember, we had to use two interfering lists before the facilitation provided by mood-matching was shown clearly. The important result here is that mood during learning influenced selective learning, whereas mood during recall of a single list had little or no selective influence on recall.

The absence of a simple effect of recall mood surprised us, so we conducted two experiments that varied mood only at recall following neutral-mood learning. Subjects read either the two-character (André and Jack) or the single-character (the psychiatric patient) story while in a neutral mood, then returned six hours later to recall the story twice, first while happy or sad and then in the opposite mood. Results showed that recall mood had no selective influence on memory for pleasant versus unpleasant events in either story, thus replicating the null effects of the earlier experiment.

Character identification versus mood-episode congruity. The major positive finding, then, was that subjects' moods while reading a narrative caused superior

learning of mood-congruent episodes. Whereas our first experiment assumed that selectivity was caused by mood-mediated character identification, the single-character study suggested that it could have resulted from congruity (agreement) between subjects' moods and the pleasant or unpleasant episodes. These two hypotheses are not mutually exclusive and could both be correct. To compare these hypotheses, a narrative was constructed that opposed the character-identification factor against the mood-congruity factor. The story was about two patients about to leave therapy. Joe was introduced as a happy-go-lucky manic type, and Mike was described as a gloomy depressive. In a final interview with their mutual therapist, the young men alternated in describing some of the key memories uncovered during their therapies, with an equal number of happy and sad incidents recited by each character. (Each incident was described in about two statements.) Thus the mood of the character and the type of episode he related were independently manipulated. Subjects were made to feel happy or sad as they read this narrative.

Subjects recalled the story 20 minutes later while in a neutral mood. The recall data revealed that readers learned more mood-congruent than mood-incongruent incidents but did not learn more incidents related by the mood-congruent character. (That characters were actually perceived as being happy or sad was confirmed by questionnaire data and by the fact that all subjects recalled more happy facts about Happy Joe and more sad facts about Sad Mike.) These results suggest that the mood-congruity of the episode outweighed the character-mood factor in determining the moody reader's selection of material for greater learning.

Explaining the mood-congruity effect. Four possible explanations of the mood-congruity effect might be briefly noted here. Three of the explanations assume generally that mood-congruent material receives *greater elaboration* and is thus better learned (see Anderson, 1976; Anderson & Reder, 1979). The first specifies a *greater ease of elaboration* for mood-congruent items. That is, the reader's mood primes affectively congruent cognitions and associations that facilitate various types of elaborations on mood-similar episodes, for example, thinking about their antecedents and consequents or imaging the character or one's self involved in the described actions. This hypothesis is supported by experiments reported later showing that associative thinking – interpretations, judgments, free associations – is biased toward the subject's mood.

A second hypothesis – one that is really a special case of the first – is *selective reminding*. This hypothesis suggests that subjects are more likely to access related memories while reading about a mood-congruent episode than a mood-incongruent episode. For example, a storybook character who fails an exam might more often remind a sad (than a happy) reader of a similar depressing incident; in contrast, a fantastic victory for that character would be more likely to trigger related memories in a happy (than a sad) reader. This state-dependent

reminding, strongly suggested by subject reports and by other experiments (e.g., Lloyd & Lishman, 1975; Teasdale & Fogarty, 1979), would result in more elaboration on mood-congruent material. And as Bower and Gilligan (1979) have found in other work, memory is enhanced substantially by associating personal memories to the to-be-learned material. Thus selective reminding as a plausible explanation of the mood-congruity effect merits further investigation.

A third hypothesis is *selective attention* to mood-congruent material. A good case for this can be made via attribution theory. Specifically, our subjects were typically given amnesia for the mood suggestions and thus may have wondered why they were feeling so intensely happy or sad while reading the story. If so, they could have attributed their feelings to the story material; then, to justify their attribution, they might have spent more time attending to mood-congruent items.

However, this attribution hypothesis was not supported by further experiments, which showed that the mood-congruity effect obtained even when no amnesia was given for subjects' moods, so that subjects knew that their mood stemmed from the suggestion. Of course, a case could be made for selective attention independent of attribution processes; for example, more time might be spent on mood-congruent items because of ease of elaboration or selective reminding processes. This could be tested by controlling reading times for congruent versus incongruent items and checking whether the mood-congruity effect still obtained. Another possibility would be to let the mood-induced subjects pace their reading of the stories line by line, with reading time recorded for each line. Subjects should spend more time on the mood-congruent statements.

A fourth explanation of mood-congruent learning involves *mood intensity*. This explanation assumes that (1) the intensity of subjects' mood states increases while reading mood-congruent episodes but decreases while reading mood-incongruent episodes and (2) an episode's memorability increases with the intensity of the subject's emotional reaction to it at the time of learning. The first assumption was suggested by subjects' frequent postexperimental mentioning of mood fluctuations in response to happy or sad episodes in the story they were reading. Specifically, "sad" subjects often reported that their sadness intensified when reading sad events but lessened when reading about happy events; similarly, "happy" subjects noted that their emotional intensity was augmented by happy events but dampened by sad ones. That this intensity difference could have produced the mood-congruity effect is suggested by a number of sources, including (1) our finding in the "mood diary" experiment (described earlier) that emotional intensity ratings of events correlated with their recall, and (2) Kanungo and Dutta's (1966; Dutta & Kanungo, 1975) findings that emotionally provocative material was remembered better than neutral material.

Mood intensity and learning

The experiments just cited, showing results supportive of the mood-intensity hypothesis, systematically confound the nature of the material with the normal emotional reaction to it. Theoretical inferences would be simpler if we could disentangle the influence of emotional intensity per se from the stimulus materials. To rectify this, we conducted experiments in which mood intensity was manipulated hypnotically, with the materials presented at each intensity level randomized for each subject. We used a procedure adapted from Blum (1967) in which highly hypnotizable subjects were first trained to experience various intensity levels of a mood and then given various learning tasks at each intensity level.

Experiment 1. In the first experiment, subjects were trained to experience three intensity levels of happiness: low (calm and content), medium (joy), and high (ecstatic bliss). Once subjects could reliably shift (on cue from the hypnotist-experimenter) among the three intensity levels, they received an experimental learning task in which both mood-relevant and mood-irrelevant episodes were presented at the different intensity levels. Specifically, subjects were hypnotized, shifted to a randomly determined mood-intensity level, and asked to imagine themselves personally involved in twelve short episodes (vignettes) that were read to them. They were also asked after each reading to rate on a scale of 1 to 7 how imaginatively absorbed or involved they had become in that vignette. Following this, subjects were shifted to a different intensity level and asked to repeat the procedure with twelve additional vignettes. They were then shifted to the third intensity level and presented with more vignettes.

Half the vignettes presented at each intensity level were affectively neutral (e.g., "reading a newspaper and passing the time while doing your laundry"); the other half described happy incidents ("walking along the street and finding a five-dollar bill"). Aside from this constraint, presentation of the materials was randomized across subjects. Recall occurred in a neutral state following a 20-minute retention interval.

Both mood-congruent and mood-irrelevant vignettes were included because an earlier pilot study had shown that, contrary to the simple intensity hypothesis, increasing the intensity of a happy mood significantly *decreased* learning rates for neutral words (e.g., names of American cities, kitchen utensils). Extensive subject interviews suggested that the ease of relating the learning material to the mood might be critical in determining how intensity level influenced learning. Subjects commonly reported being unwilling or unable to attend to "kitchen utensils" and the like while feeling intense euphoria. The present experiment was designed in part to test this possible interaction between materials and intensity level.

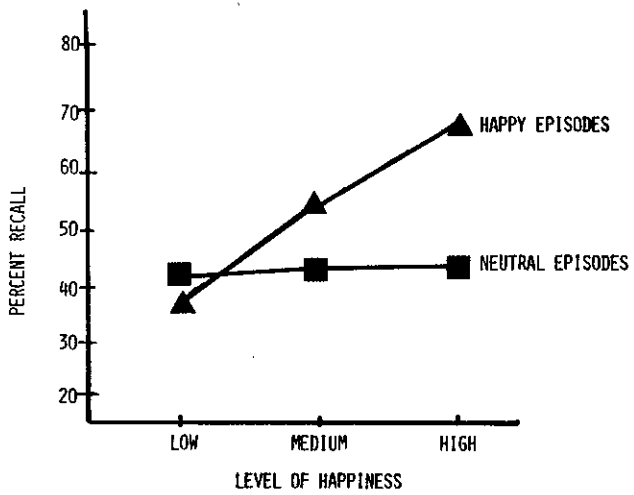

Figure 18.5. Free recall of happy and neutral episodes experienced when the subject was feeling mildly, moderately, or extremely happy.

We predicted that increasing intensity would enhance learning of mood-related materials but not of mood-irrelevant materials. The recall results generally confirm this prediction (Figure 18.5). As indicated by the sloping line, learning of happy incidents increased with intensity level. As illustrated by the relatively flat line, however, learning of affectively neutral incidents was not influenced significantly by mood intensity (recall percentages were 40%, 43%, and 47%). The imagery ratings were also interesting. While ratings were higher for happy than for neutral vignettes (4.99 vs. 4.08), ratings for both types of vignettes increased with intensity level (lower: 4.27; medium: 4.52; high: 4.83). Thus, overall imagery ratings are somewhat predictive of recallability.

The results suggest an interesting interaction between mood intensity and the type of materials. When the material was irrelevant to the happy mood, intensifying the mood had relatively little impact on learning; but when the material was relatable to the subject's happiness, increasing intensity enhanced learning. This pattern is quite consistent with Easterbrook's (1959) hypothesis that increasing arousal narrows attention so that "relevant" stimuli become more salient and attended. This hypothesis has been supported by several other investigations (Bahrick, Fitts, & Rankin, 1952; Bursill, 1958; Callaway & Stone, 1960; Cornsweet, 1969; McNamara & Fisch, 1964).

Experiment 2. The preceding experiment used only happy moods, and thus permitted no conclusions about learning and emotional intensity in general.

To see if the results would generalize to other moods, we conducted a second experiment in which the between-subjects factor of type of mood (happy or sad) was added to the within-subject factors of mood intensity (high or low) and type of materials (happy, sad, or neutral vignettes). Subjects were randomly assigned to the "happy" or "sad" group, and then trained as before to experience two intensity levels of the mood. In the experimental session subjects were shifted back and forth (twice) between these intensity levels. At each intensity level (two high and two low), they imagined themselves in 12 different vignettes (4 happy, 4 sad, and 4 neutral) that were read to them. They also gave a "degree of absorption" rating after imagining each vignette. Free recall of the 48 vignettes occurred in a neutral-mood waking state after a 20-minute retention interval.

Figure 18.6 shows an intriguing pattern of results for the happy and sad subjects for the happy and sad items. (Neutral items were recalled equally by both groups and thus for ease of understanding are not represented in the figure.)First, the sloping lines indicate the expected mood-congruity effect, with happy subjects learning happy vignettes better than sad ones, and sad subjects learning sad vignettes better than happy ones. Second, the highly intense happy state (Figure 18.6 top) produced better learning than the mild happy state (overall recall percentages were 43% vs. 29%); rather surprisingly, however, the exact opposite occurred for sad subjects (Figure 18.6 bottom), with vignettes learned in the mildly sad state being recalled better than those learned in the profoundly sad mood (overall scores of 44% vs. 26%). It thus appears that extreme sadness produces low motivation for learning or demanding tasks. Later, we will offer an explanation of this finding.

Interestingly, subjects' absorption and imagery ratings conformed to this general pattern of findings. Happy subjects gave higher ratings to happy vignettes than to sad ones (5.60 vs. 4.15), and sad subjects gave higher ratings for sad than for happy vignettes (4.19 vs. 3.85); this pattern is exactly as expected by the mood-congruity hypothesis. In addition, happy subjects gave higher imaginal absorption ratings when intensely happy than when mildly happy (5.09 vs. 4.52), whereas sad subjects showed more imaginal absorption in the vignettes when mildly sad than when intensely sad (4.72 vs. 3.76). These absorption ratings were completely consistent with the recall interaction between mood intensity and mood type. Thus, the recallability of an item could have been mediated by the degree to which the subject could become imaginally absorbed in it.

Summary and general explanation. The results of these several experiments on mood intensity suggest a state of affairs more complicated than predicted by our original hypothesis. Intensifying a happy state had little influence on learning of mood-irrelevant items, whereas it improved the learning of happy

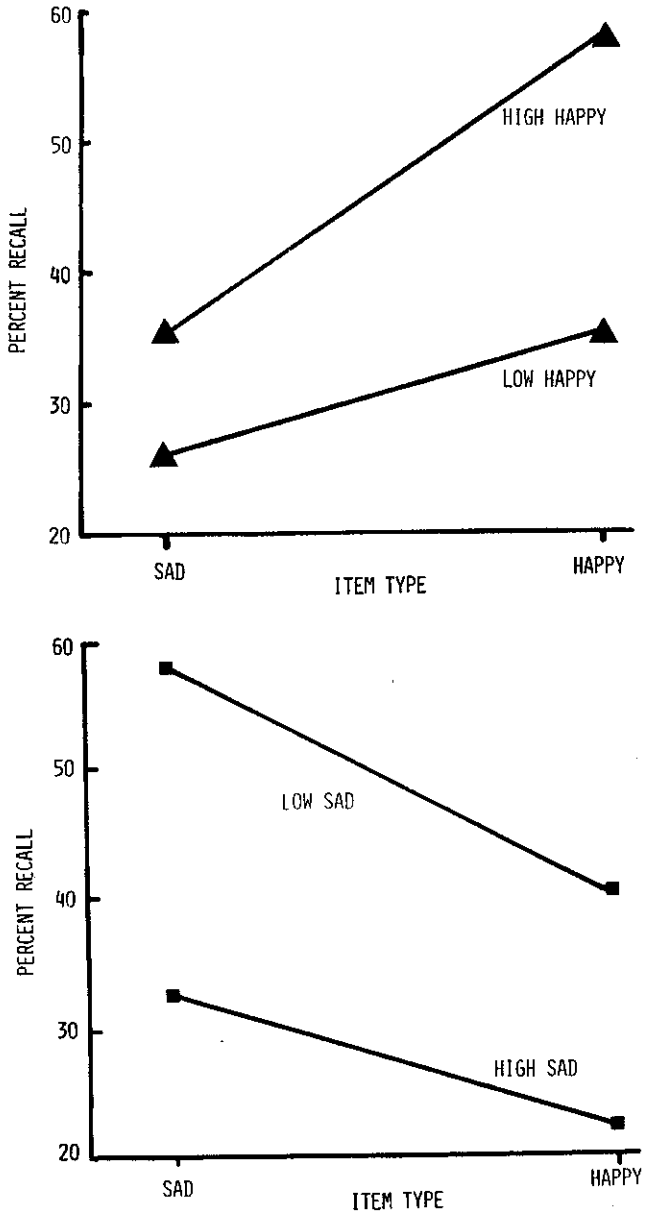

Figure 18.6(top) Recall by happy subjects under low and high mood intensities.
Figure 18.6(bottom) Recall by sad subjects under low and high mood intensities.

vignettes; intensifying a sad mood hampered the learning of even mood-relevant vignettes. Thus, both the mood and the relatedness of the learning materials are important variables in determining the effect of mood intensity on learning. Further experiments are currently under way to determine if these results can be replicated and generalized.

A preliminary explanation of the findings can be offered here in terms of the network theory of affect. As noted earlier (Figure 18.1), this theory assumes that emotions can be represented by central units in an associative network encoding memories, with each emotion node bearing associative connections to specific autonomic patterns, beliefs, events, response patterns, and interpretation schemata. The development of a mood state activates the corresponding emotion unit in the network; by virtue of spreading activation, its surrounding nodes (e.g., the specific autonomic patterns, event instances) are also brought into play. Roughly speaking, the activated components of the network become the "contents of consciousness."

Emotional intensity can be represented as the degree to which an emotion unit has been activated. Low-intensity emotion results in only minor spreading activation to nearby associative nodes; high-intensity emotion causes a large amount of activation to spread along many associated links as well as to distant parts of the network. The amount of emotional activation affects the contents of consciousness because the theory supposes that only those ideas that receive activation above their threshold will become conscious. Thus a stronger emotion will cause more ideas linked to that emotion to "flood into" short-term memory. This is true for both irrelevant, preexperimental associations and the associations specifically trained in the experiment.

This differential flooding of short-term memory by emotion-related material has several implications. First, the impact of the mood on processes of perceptual interpretation, learning, and memory will generally increase insofar as newly arriving stimuli are interpreted according to currently active categories in short-term memory. Second, the filling of consciousness by emotionally related ideas results in the phenomenon described as the "narrowing of attention" to mood-related material (Easterbrook, 1959). In certain cases, if the internally generated scenario is sufficiently compelling, the emotional flooding of short-term memory can lead to "lack of attention" to external stimuli. This may have happened with our high-sad subjects in the last experiment. In addition, the content of the mood-related ideas and their helpfulness for learning may differ for happy versus extremely sad moods. Thus, the very sad mood may evoke a preexperimental depressional syndrome of withdrawal, ruminating over failure, crying, predicting failures, feeling fatigued, and helplessness. In extreme form, these negative factors could lead to poor learning and poor performance by our very sad subjects. This implication agrees with the claims of differential-emotions theory, as well as the clinical observations of depressed people.

Mood effects on other cognitive processes

Associations, interpretations, and depictions. The multiple effects of mood on learning and memory processes led us and our colleagues to investigate whether other cognitive processes would be similarly affected. In one study, hypnotized subjects were induced into happy, angry, or sad moods and then given a series of tasks, including (1) generating chains of free associations to abstract affectively neutral words like *life*, *mind*, and *future*; (2) composing stories in response to pictures of the Thematic Apperception Test (TAT); and (3) giving "thumbnail personality sketches" of people familiar in their lives (e.g., first-grade teacher, uncle, best friend). Independent judges then blindly rated subjects' productions in terms of their mood content. The results showed that mood dramatically biased thought productions: Judges could reliably determine the mood of the subjects during the task. All subjects gave free associations, composed TAT stories, and retrieved selective sketches of their acquaintances in a manner congruent with their mood at the moment. Such results are consistent with the network theory. For example, in the TAT study, the theory implies that the person's emotional state will evoke a theme congruent with that of the story (e.g., *anger* will evoke themes of conflict of war).

Predicting the future. In another experiment, Wright and Bower (1981) investigated the influence of moods on probability estimates of future events. Two lists were constructed, each specifying 12 possible future events. One list referred to personal events, the other to national or global incidents; half the items on each list were happy, half were depressing and catastrophic. Thus, the 24 items were of four different types: Happy Personal Events (e.g., "You will take a European vacation in the next three years"), Happy National or Global Events (e.g., "There will be a cure for most cancers discovered within ten years"), Catastrophic Personal Events (e.g., "You will be involved in a serious auto accident within the next five years"), and Catastrophic National or Global Events (e.g., "World war will occur within the next ten years"). Subjects were made happy or depressed by hypnosis and asked to use a 1–100 scale to estimate the probability of half the events, then shifted into the opposite mood and requested to estimate the probabilities of the other events. Special emphasis was placed on providing "objective" estimates, and subjects later stated that they felt their estimates were not influenced by their moods.

However, a mood bias was in fact revealed by the estimates (Table 18.2). The happy mood boosted estimates for blessed events and lowered them for tragic events, and the sad mood had the opposite effect. The influences are nearly symmetrical around the neutral-mood estimates.

That a transient mood could exert such a powerful effect was somewhat surprising but is nevertheless quite consistent with Tversky and Kahneman's (1973) heuristic principles of availability and representativeness. Three types

Table 18.2. *Probability of "blessed" and "catastrophic" future events as predicted by happy, neutral, and sad subjects*

Mood	Blessed events	Catastrophic events
Happy	.52	.37
Neutral	.44	.43
Sad	.38	.52

of strategies might have been used by our subjects in judging the likelihood of an event: (1) recalling related autobiographical episodes involving one's self or friends and using a representativeness judgment of the available sample to estimate the likelihood of a similar event in the future; (2) retrieving memories of news reports and using them in a similar way; and (3) constructing a "causal scenario" leading to the event and generating an estimate based on the ease with which such a scenario could be formed. Mood would have biased the first two strategies via state-dependent retrieval processes, that is, the availability of relevant episodes would be either lowered (for mood-incongruent material) or raised (for mood-congruent material) by the estimator's emotional state. Similarly, the third strategy could have been influenced by the mood-mediated "ease of elaboration," as discussed earlier. Further investigations of these possibilities are warranted. For now, we merely note that we have produced in the laboratory the fabled optimism of the happy person and pessimism of the depressed person.

Mood and social judgments

The network theory suggests than an emotional state may influence the interpretation of ambiguous stimuli because the emotion primes into readiness congruent concepts and categories. An especially interesting class of ambiguous stimuli are social behaviors of others directed toward us. Judgments of social actions are heavily tinged with subjectivism, because we must rely upon inferences about the actor's intention; and those inferences may differ, depending on the "emotional premise" from which the perceiver begins. Is someone who continues to disagree with you being admirably persistent or unreasonably stubborn and pigheaded? Is a student who disagrees with a professor's work assignment being assertive or lazy or aggressive? The interpretation will vary with how the perceiver feels in general, and how he feels about the actor in particular. Thus, happy people tend to be friendly, charitable, and merciful in their judgments of others; angry people tend to be the opposite.

Just as our emotional state influences our perceptions of others' social actions, so should it also influence perceptions of our own behaviors. This influence has clinical relevance. For example, depressed people are notoriously disparaging and castigating about their own behavior. Indeed, Roth and Rehm (1980) found that when clinically depressed patients rated videotapes of themselves for socially negative and socially positive behaviors, they "saw" twice as many negative as positive behaviors, even though neutral judges scored equivalent numbers of these behaviors. Forgas, Bower, and Krantz (1983) performed a similar experiment using hypnotically induced moods with undergraduate students. On Day 1 of their two-day experiment, 20-minute interviews with pairs of subjects about personal topics were videotaped (with the subjects' consent). When subjects returned the next day, they were first trained to score interview behaviors as either prosocial and positive (e.g., a friendly smile, a kind remark) or antisocial and negative (e.g., looking away, frowning). Subjects were then hypnotized and asked to develop either a feeling of social well-being and success or a feeling of social failure and rejection. They were told to maintain this feeling while viewing a videotape of their interview from the previous day and to mark down every 10 seconds (on cue) at least one positive or negative behavior displayed by themselves or their partner.

The results were as predicted. Subjects in the pleasant mood "saw" far more socially positive than negative behaviors for both themselves and others. In contrast, subjects who were feeling rejected and downcast "saw" mostly negative behaviors in themselves but a roughly equal number of positive and negative behaviors in their partners. The scoring was clearly subjective, as neutral judges rated the two groups as having roughly the same proportions of negative and positive behaviors. Thus, the results suggest that people who are feeling socially successful will tend to see the good points in themselves and others, whereas people who are feeling like social failures will see themselves as socially inept and ineffectual. These results are as expected by the network theory, because the emotional mood primes and brings into readiness perceptual categories and interpretive schemata that guide what people attend to as well as how they interpret it.

Summary. The experiments reviewed indicate that an emotion can have a surprisingly strong influence on how someone thinks and acts in his social world. In one study, mood was shown to bias free association, thematic storytelling, and personality descriptions of familiar people. In another, subjects seemed to be optimistic or pessimistic about the future – whether it involved personal or national affairs – according to their transient mood state. In a third study, whether a person felt socially successful or rejected biased self-observations of his or her socially positive or negative behaviors. Emotion thus seems to be inextricably related to how we perceive and think, influencing them at every turn. Indeed, results reported throughout this chapter suggest that emotion is often a central component of cognitive processes in general, and thus that a comprehensive theory of cognition should address it. The final sections of this chapter offer several initial steps in this direction.

The "compliance with demand" explanation

The results of our experiments indicate that mood can bias cognition in a wide assortment of ways. Both the learning and recall of mood-congruent memories – whether they be word lists, story events, or autobiographical events – are apparently enhanced by a mood's presence. Similarly, the evaluation of emotionally toned memories can be shaded by emotion, with more memories rated as pleasant under a happy mood and more as unpleasant under a sad mood. The intensity of an emotional reaction has variable effects on learning, depending on the specific mood and the type of learning materials. Specifically, intensifying a happy mood enhanced the learning of mood-related materials, whereas intensifying a sad mood decreased the learning of such materials. The implications of this intriguing finding are still under investigation. Finally, subjects' affective states slanted the emotional tone of their free associations, storytelling, personality descriptions, predictions about the future, and social perceptions of themselves and others.

The network theory supposes that these cognitive influences of emotional states follow "automatically" as a result of activation spreading from the emotion unit to related words, concepts, and themes. However, an alternative interpretation, applying specifically to those results obtained from hypnotic subjects, is that our suggestible subjects figure out what behaviors the experimenter is implicitly demanding by means of his mood-induction instructions. According to this hypothesis, having decided that the experimenter wants them to play the role of, say, a sad person, the subjects comply by behaving in all respects according to their conception of the "sad person" role. Thus, they report sad associations, sad memories, sad fantasies, and give pessimistic estimates of the future. Similarly, subjects told to be happy or angry comply by behaving according to their beliefs about the happy or angry role.

Clearly, if subjects are simply complying with experimental demands, our results are considerably less interesting. So the issue definitely must be confronted.

Ruling out the compliance hypothesis is relatively easy for the memory experiments; in those the explicit "demand" from the experimenter was for subjects to remember everything they could about the target material, regardless of its content. Nonetheless, the mood-matching effect on retrieval came through clearly in free recall. If the compliance hypothesis were to argue that our mood-dependent recall results show that subjects figured out what outcomes were wanted, the hypothesis would be strained beyond reason to explain why

these prescient subjects did not show mood-dependency in memory tests involving recognition. Nor does the hypothesis explain why manipulations of mood only at recall (following neutral input of mixed items) caused no selective recall. The network theory explains both these anomalies, so it is the more parsimonious as well as the more fruitful theory.

In contrast to the memory studies, our results showing the influence of emotion on free associations, fantasies, social judgments, and probability estimates are more vulnerable to the charge of demand compliance. Ruling out the demand hypothesis has proven more challenging for such cases. Nonetheless, we believe several arguments can be marshaled against the demand-compliance hypothesis as a consistent explanation of the results, and we will review four such arguments here.

First, the emotions induced seem real and have little of the phenomenal character of a faked pretense. For example, measures of autonomic arousal such as changes in GSR and heart rate reveal changes during the suggested emotion similar to those during the actual emotional experience (e.g., Gidro-Frank & Bull, 1950; Zimbardo et al., 1972). Furthermore, our subjects looked, sounded, and acted as though they were really in the throes of their emotions: Sad subjects appeared morose, sometimes tearful, and happy subjects beamed, laughed, and exuded a sense of well-being. The authenticity of these moods was confirmed by subjects during postexperimental interviews that urged honest reporting.

Second, similar results have been obtained when the mood manipulation was not hypnotic in nature. We replicated the free-association and TAT results using disguised "mood music" (see Bower, 1981). Laird and his associates (1982) observed a mood-congruity effect in learning in a study where mood was induced by having subjects pose their face into unwitting frowning, smiling, or sorrowful expressions. Isen and her colleagues (1978) have obtained similar results when moods were induced in unobtrusive ways, including having subjects win or lose a computer game, find a dime in a phone booth, or receive a small gift (e.g., nail clippers, cookies). Bartlett and his associates (in press) induced moods in their kindergarten subjects by simply having them revivify and describe an emotional memory. Teasdale and Fogarty (1979) used the Velten procedure, in which subjects read a series of self-referent mood statements to access a particular mood. Thus, our results agree with those obtained when moods were induced by diverse means.

Third, the mood effects on performance often appear as predicted despite running counter to the experimenter's demand. A good example is the experiment by Teasdale and Fogarty (1979) in which happy or sad subjects were instructed to retrieve as fast as possible a stipulated pleasant or unpleasant incident from memory in response to neutral cue words. They found that happy subjects retrieved pleasant memories faster and sad subjects retrieved unpleasant memories faster, despite the experimenter's demand for fast retrieval in all cases.

Fourth, in some studies we have misled subjects about the experimenter's "demand." In one study, subjects wrote free-associations and TAT stories after being told that the experimenter's interest was in whether hypnosis would affect physical properties of handwriting. Whereas post-experimental interviews indicated that subjects believed the handwriting deception, the results showed that mood nonetheless biased the emotional content of subjects' associations and stories. Thus, systematically misleading subjects did not alter the general results.

We will tentatively conclude, therefore, that the mood effects we have observed are "automatic" and not the result of the subjects' compliance with a demanded role. Thus we believe that our use of hypnosis should be recognized as a minor and incidental aspect of our research. Of central importance is that mood can influence cognition in diverse ways. We will now consider an explanatory theory for these findings.

The network theory of affect

Basic assumptions

The results obtained in the preceding experiments can be accounted for by a network theory of affect, which represents memory as a rich associative network of concepts, schemata, and events. We will begin by stating some basic assumptions of the theory. First, emotions will be treated as central units in this network, with multiple associations to related schemata, concepts, and events. How these connections might include autonomic arousal patterns, action patterns, attitudes, beliefs, facial expressions, and interpretative schemata was illustrated in Figure 18.2. The contents of these general aspects of experience may be different for each mood.

To comment briefly on the "emotion node" hypothesis, a node in memory is defined primarily in terms of the other elements to which it is connected. An emotion node like "anger" differs from a concept node in only a few respects. First, at least some emotion nodes are liable to be inborn, with some innate connections to the facial musculature and autonomic nervous system. Second, once activated, emotion nodes receive reverberatory feedback from the autonomic response pattern they initiate, and this feedback cycle causes the activated emotion unit to persist for some time after its arousal. The activation eventually dies out (after removal from the evocative situation) by a natural dampening process. Such persistence of activation is unusual for a simple concept or idea, which typically disappears from working memory as soon as, say, the topic of conversation is changed. Third, the emotion nodes may be distinguished by the absolute amount of excitation that they transmit into the associative network once they pass threshold and are turned on. One might think of nodes in the network as small voltage sources (or signal boosters),

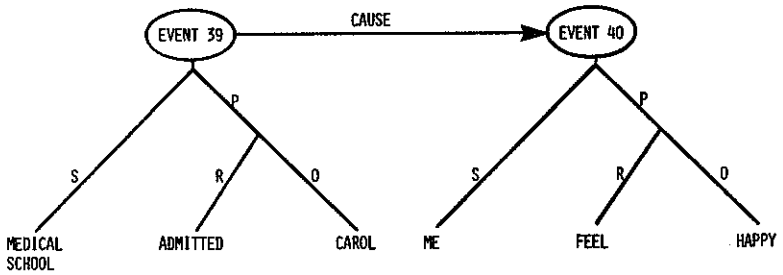

Figure 18.7. A semantic network encoding of a proposition ("medical school admitted Carol") and an emotion it causes. Lower nodes represent preexisting concepts, and lines represent new associations. S = subject; P = predicate; R = relation; and O = object.

and that, once aroused, emotion nodes simply send more "voltage" than concept nodes. This would cause an emotion to gain greater control than a thought over the direction and content of subsequent thoughts. Although we believe that "emotion nodes" in our theory have these unique properties, we should also note that none of these unique properties is needed to explain the results we have presented. We have listed these properties of emotion nodes in response to persistent requests to somehow distinguish emotion nodes from concept nodes within the framework of associative network theory.

Second, to continue our description of the theory, events become encoded within the network in terms of a set of propositions. For example, Figure 18.7 offers a simplified representation of how a person's joy at his friend's acceptance into medical school might be propositionally encoded.

Third, the process of thought is modeled by the activation (or excitation) of specific nodes in this network. Concept nodes that are activated above a threshold become available to consciousness and may issue into a response. Activation can spread among nodes (concepts, emotions, and propositions) according to their associative connections. An analogy is an electrical (or neuronal) network in which terminal junctures represent nodes, wires represent associative connections, a voltage imposed at specific junctures corresponds to activation of a pattern of nodes, and electrical current flowing from a voltage source to a remote juncture corresponds to the spread of activation. Spreading activation has become a standard retrieval theory in cognitive psychology (e.g., Anderson, 1976; Collins & Loftus, 1975); it also is suggestive of an analog for neural nets in the central nervous system.

Fourth, a concept or event can be activated directly by various means, including verbal symbols or physiological stimuli. For example, asking the person how he felt about his friend's medical school acceptance would activate the corresponding nodes in the network; similarly, inducing a mood in a subject (as in our experiments) corresponds to activating that emotion node.

Fifth, activation spreads from an activated node to varying degrees, thus providing a way to indirectly access associated nodes. For instance, activation of the "medical school" node in Figure 18.7 would likely spread to the "happy" node; similarly, activation of an emotion unit might activate neighboring nodes (e.g., mood-related autobiographical experiences).

Sixth, a propositionally encoded event becomes associated with other cognitive elements active at the time of learning. For example, Figure 18.3 illustrated how list words learned in a mood state might develop associative links to the node representing that mood. Finally, the "contents of consciousness" consist of those network nodes whose activation exceeds a threshold at a given time; the flow of activation is supposed to model the *process* of thought.

Explaining the mood-congruity effect. Subjects in the congruity experiments were placed in a happy or sad mood before reading a story consisting of a mixture of happy and sad episodes. According to the network theory, the induction of the mood activates the corresponding emotion node and (some of) its associates, thereby creating a mental context dominated by mood-related themata. Because of hypnotic suggestions to maintain the mood for the duration of the learning task, this mood-biased context is used by the subject to understand and elaborate upon the story materials. Mood-congruent material is easily elaborated because of its similarity to, and consistency with, the context themata, whereas mood-incongruent material is difficult to elaborate because it is inconsistent with such themata. The greater elaboration of mood-congruent material results in a network representation of it which has more interconnections with other memory structures than does mood-incongruent material. This greater number of connections results in better memory for the congruent items, because each link provides a potential retrieval path to the items during recall.

This "ease of elaboration" hypothesis may also explain why mood had no learning effect on mood-related items in our word-list experiment. Specifically, the nature of the learning task – a two-second presentation rate of relatively abstract words – did not encourage or permit elaboration of the words. This suggests, of course, that a mood-selective learning effect for single words could be produced if extensive elaboration were encouraged and enabled.

Explaining state-dependent recall. The network theory of affect provides a similar account of our results showing state-dependent recall of autobiographical events. An event becomes propositionally encoded in the network, with connections to its corresponding emotion node and other mood-related concepts (Figures 18.3 and 18.7). The induced mood activates these nodes, thus biasing the subject to initiate from them searches for mood-related memories. This biased search, in addition to the priming of mood-congruent memories via

spreading activation from the excited emotion node, biases recall toward mood-congruent incidents.

This general explanation can be extended to the state-dependent recall study involving word lists. Figure 18.3 depicted the basic explanation of why mood provided a discriminating cue that enhanced or inhibited memory, depending on whether a list's learning and recall moods matched or mismatched. When lists are learned in opposite moods, each list would become associated to a different emotion node. At the time of recall, a mood would activate the corresponding emotion node and spread activation to its associates. Reinstating a target list's learning mood would result in superior recall because of the enhanced accessibility of *only* that list, as the other list would have been associated to a different emotion node. However, recalling while in a different mood – for example, trying to remember List 1 while in Mood 2 – would result in poor memory because the activated emotion node would (1) provide no retrieval paths to the target list and (2) make the alternate list more accessible (and thus augment its interference effect). As noted earlier, this explanation of state-dependent recall in terms of retrieval paths is consistent with the finding that the effect did not obtain when recognition tests were used, as the direct access to target items provided by recognition tests minimizes the need for retrieval cues.

Explaining the mood-intensity results. The network theory of affect explains the "mood-intensity" findings in terms of varying activation levels of an emotion concept. Specifically, intensifying a mood results in increased activation of its corresponding unit in the network and its associates. This causes consciousness to be flooded with mood-congruent associates, which narrows the subject's attention to mood-congruent cues (Easterbrook, 1959). This makes it difficult for the subject to respond to mood-irrelevant tasks or stimuli. The increased activation of a mood also amplifies the influence on behavior of an emotion's associated ideas and roles. As was illustrated in Figure 18.2, the nature of these concepts differs for each basic emotion. For example, "happiness" may be associated with high expectations of successful performances, optimism, confidence, and self-esteem; conversely, "sadness" probably calls forth expectancies of failures, exhaustion, and inwardly directed rumination, resulting in poor motivation for active performances. Each set of associates would have a different impact on a learning task. This may explain why the learning of mood-relevant items increased when a happy mood was intensified but decreased when a sad mood was intensified. Other theories such as Izard's (1972) differential-emotions theory do not derive such implications from first principles but rather simply assume that different emotions differ in their motivational properties.

Explaining the thought and judgment results. The network theory can also be applied to the research showing mood effects on other cognitive processes.

The mood biases in free associations follow by supposing that a person in a specific mood (say, sadness) will associate to a neutral word like *life* those words in the associative hierarchy to *life* that also receive activation from the mood. Thus, sad associations to *life*, such as *death* and *suffering*, will be chosen over more pleasant associations.

The mood bias in TAT stories is explained by supposing that the subject's mood activates and makes available certain themes such as success and romance (for happiness), or conflict and war (for anger), or failure and loss (for sadness). These themes are then elaborated using the characters shown in the TAT pictures.

The mood bias in personality sketches of acquaintances is viewed as a form of state-dependent memory. People probably have a heterogeneous collection of positive and negative opinions, facts, observations, and episodes about anyone they know well. When placed in, say, an angry mood and asked about an acquaintance, the person's memory selectively retrieves the negative (or unflattering) facts and opinions. Since these negative facts are highly available, the subject gives his "snap judgment" of the acquaintance based on them (see Tversky & Kahneman, 1973).

The mood bias in probability estimates of future events is explained as a form of state-dependent retrieval of past relevant events or opinions. For any given future event, whether a blessing or catastrophe, any well-educated person can usually think up some facts (or opinions) that argue for or against the likelihood of that event. The theory supposes that ideas that support positive ("happy") events and discourage negative events will be more available to the happy person, whereas the reverse will be true for the sad person. Introspections of happy and sad subjects during the event-estimation task provided some anecdotal support for this availability hypothesis.

Finally, the mood biasing of social perception of others or of oneself is predicted by the network theory, since social judgments are so heavily determined by the trait categories and schemata used by the observer. If the observer is happy, he tends to look for evidence of "positive" social behaviors in his target; if he is angry, he is biased to look for "negative" antisocial behaviors. Social behavior is sufficiently ambiguous and unconstrained that the perceiver will usually be able to find evidence for whatever trait category or schema he wishes to impose on the behaving target. This top-down determination of social impressions works just as strongly when people judge their own behavior as when they judge that of others.

Summary. The network theory of affect proposes that emotion plays a central role in a unified representation of mind. Basic emotions are viewed as innate elements or units that through experience become connected with various event memories, actions, roles, interpretation schemata, and themes. Activation of a mood is postulated to automatically activate varying numbers of these associates, depending on the intensity of the mood. This basic model provides

an account of how mood affects cognitive processes of memory, learning, free association, interpretation, judgment, and prediction. It also explains how the influence of intensifying a mood can vary depending on the specific mood. The remaining section addresses some of the important questions that have not been discussed.

General comments

The network theory of affect suffices to explain reasonably well our experimental results. However, the theory has several flaws. In this final section we will identify some problems with the theory, and then discuss some issues central to theories of emotion. Because of space limitations, our discussion will be selective; the reader may consult Bower and Cohen (1982) for a fuller discussion of some of these ideas.

Retrieval cue overload. One of our major arguments has been that mood-congruent memories are recalled best because they are associated to the emotion node and are thus primed via spreading activation from that node. In other words, every event in a person's life involving, say, happiness is alleged to become linked to the "happy" emotion node in the network. An obvious problem with this assumption is that, without some means for separating different contexts, an astronomical number of experiences would become linked to each basic emotion node. With this many links, the small amount of activation spreading from that node distributed among its millions of outgoing branches would become extremely dissipated, to the extent that any specific targeted mood-related memory would receive insufficient activation to make its retrieval easier.

We must admit that this objection poses problems for our theory. Briefly stated, our best response is to assert that any retrieval within the network involves searches emanating from at least two cues, with the target items found at intersections of the retrieval paths. Thus the memory search process emanates not just from the happiness node but also from a node corresponding to other stimulus cues (e.g., "my friend" or "List 1" or "third grade"). By restricting the search domain in this manner, the "dissipation of activation" problem is a bit more manageable.

Representation of emotional intensity. Another potential problem is that our network model represents a basic emotion as a single unit that is qualitatively the same across different situations and different intensity levels. We noted earlier that intensity shifts, for example, could be conceived as involving quantitative (and not qualitative) changes in the activation of an emotion, perhaps indexed by autonomic arousal. However, certain problems are encountered in an associative network when different emotional intensities are to be represented by the degree of activation of the same node.

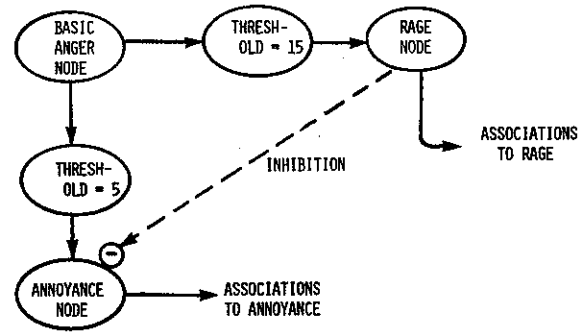

Figure 18.8. A network for activating one node (*annoyance*) when the system experiences a low level of anger and a different node (*rage*) when it experiences a high level of anger. Thresholds are indicated, as is an inhibitory connection (dashed line) from the higher-level to the lower-level node.

An immediate problem is that people (and animals) can learn to make different responses to low versus high intensities of an emotion or drive. For example, we learn to label our mild angers as *annoyances*, moderate angers as *angers*, and extreme angers as *rages*. But to represent this in an associative network requires either special connections or something like an analog-to-digital converter that monitors the activation level of the node. The "special connections" are easily designed in networks using inhibitory links and different threshold elements. Figure 18.8 illustrates a simple network that will activate different nodes (*annoyance* or *rage*), depending on the activation level of the basic emotion node (of *anger*). The lower-intensity node requires a lower threshold for its activation, and the higher-intensity node must have inhibitory connections to all lower-intensity nodes, so that when the high-intensity node fires it shuts off the firing of any lower-intensity nodes connected to that basic emotion node. Whenever the *annoyance* or *rage* node fires, it sends activation to whatever actions and memories have been associated with the firing of that node (such as the label of *annoyance* or *rage*).

A similar complication caused by the assumption of a single unit for primitive emotions is that the theory should differentiate among subtle shadings of a given emotion, depending on its context of arousal and its object. Thus, the feeling of tender love will probably differ greatly between, say, a woman's tender love for her infant, husband, father, kitten, and old flame. Anger at one's failings probably differs from anger at an aggressive stranger or at a governmental policy. The theory handles all such cases by supposing that the anger (or love) node activated is the same in all cases; but that the context or

object of the emotion are two other cognitive elements that, by intersection searches in conjunction with the basic emotion, cause different scripts, roles, and action patterns to be activated and retrieved into short-term memory. The subjective feeling reported is a mixture of the basic emotion together with the script appropriate to the target and the social situation.

Interaction of emotion, cognition, and behavior. Our research focused mainly on how emotional states influence cognitions. However, reciprocal interactions are to be expected; our cognitions obviously affect our emotions in many ways. Indeed, standard techniques for manipulating moods experimentally require the subject to dwell on certain thoughts or memories. Our hypnotic procedure is clearly of this kind. Another mood-induction method is that devised by Velten (1968), which suggests elation or depression in subjects by having them read a series of self-referential mood statements (e.g., "Things are going badly for me today") and imagine that these describe their feelings. Another procedure, used by Thompson, Cowan, and Rosenhan (1980), induces sadness by having subjects listen to a tape asking them to project themselves into a story about a close friend dying of cancer.

Almost all emotion theorists accord a central role to cognitions in emotional responses. Many theorists relate emotions to cognitive appraisals of actual, imagined, or anticipated transactions in terms of their meaning to the person's goals, self-image, beliefs, and well-being. The well-known "two-factor" theory of Schachter (1966; Schachter & Singer, 1962) suggested that emotion developed from a cognitive interpretation of physiological arousal; Mandler (1975) and Lazarus, Kanner, and Folkman (1980) present similar views about the complex interaction between autonomic arousal, cognitive interpretations, and actions.

The network theory is one representation of these interactions, as the theory conceives of the emotion node as being connected to patterns of autonomic arousal and to expressive behaviors (Figure 18.2). Importantly, these connections are reciprocal and two-way, that is, general autonomic arousal intensifies (amplifies) the activation of whatever emotional unit has already been selected by the cognitive system. This leads to the expectation that a background of excitement from irrelevant stimulation (such as physical exercise or a roller-coaster ride) will intensify any emotion (like anger or romantic love) elicited by a coincident provocation. Zillmann (1978) reviews much positive evidence for this "excitation transfer" hypothesis.

Another reciprocal influence on emotions comes from the face and bodily expressions. Cross-cultural research has shown that each of a limited set of basic emotions is associated with a characteristic facial expression (Ekman, Friesen, & Ellsworth, 1972). Facial expressions similar to those of real emotion occur even when the person simply produces imagery of a certain affective quality (e.g., Schwartz, Brown, & Ahern, 1980; Sirota & Schwartz, 1982). Evidence also suggests that the setting of the facial musculature and bodily

postures will feed back activation to specific emotional units commonly associated with these poses. Laird and his colleagues (1982) found that subjects who configured their facial muscles unwittingly into a specific pose produced some of the corresponding emotional state. One could also expect competition among cognitive and facial determinants of emotion; thus, the time to retrieve and image clearly an anger scene should be slowed by having the subject's face posed in a smile; conversely, the image latency for a happy scene should be slowed by an angry facial pose. Such reciprocal influences are consistent with the network model, which posits two-way linkages.

The development of affective structures

Although the network model is a convenient summary of emotion-cognition interactions, it gives us no clue about how many emotions there are or how they are developed. We feel these issues are outside our area of research and expertise, but as a theory should address these issues, we will hazard a few comments.

An associative (or semantic) network is a kind of formal "language" in which to transcribe theoretical guesses about the internal representation of concepts and events. This is done at the functional level of those elements that are connected to other units. Every language needs a base set of primitive elements in its "vocabulary" to build up higher-level ideas of structures. Thus, semantic-memory theories (such as HAM of Anderson & Bower, 1973, or the conceptual-dependency theory of Schank, 1975) assume that each infant begins with a base set of neural elements that are genetically prespecified to become sensory elements, action elements, and perhaps conceptual elements under appropriate environmental stimulation. For example, given appropriate stimulation, certain neurons along the visual pathways and in the visual cortex would be prespecified to become sensitive, say, to red light. Thus, we would say that "red light" would be a primitive element in the base set of percepts of most infants.

Second, associative theories stipulate a set of relations (among elements) and rules for building up more complex descriptions of objects and events out of relations among primitive elements. For example, a visual square would be characterized by the visual cortex as an object formed by parallel vertical and horizontal lines connected at right angles. From the base set of elements and relations, the brain can then build up arbitrarily complex descriptions of physical or conceptual objects; and it is the internal representations of these structural descriptions that are stored in memory. There is nothing esoteric or mysterious about this: A familiar analogy is that natural languages like English build up an unlimited number of arbitrarily complex words from a vocabulary of 26 letters plus a space and the relation of "successor."

From such logical necessities, the network theory of emotions is led to postulate a beginning set of basic emotions that are genetically prespecified for each human infant. We do not know how to decide how many primitive emotions an infant has or what they are, but other scientists such as Izard (1972; Izard & Buechler, 1980) have come to reasonable conjectures of six to nine primitive emotions. Typical basic emotions are interest-excitement, enjoyment-joy, surprise-startle, distress-anguish, anger-rage, disgust-revulsion, contempt-scorn, fear-terror, and shame-humiliation.

The existence of such innate emotions is suggested by several lines of evidence: (1) the sharing across species of common emotional responses such as distress, startle, interest, revulsion, and aggression (see Strongman, 1978, chap. 7); (2) the cross-cultural similarities of facial expressions in various emotions (Izard, 1971; Ekman, Friesen, & Ellsworth, 1972); and (3) the emotional expressions of very young infants (e.g., Izard, 1971; Izard & Buechler, 1980).

The network theory would suppose that these primitive emotions exist as innate units in the network, each with innate connections to a cortical and autonomic arousal pattern and to its pattern of facial-bodily expression. Also a few innate "productions" (S-R connections) would be needed to recognize stimulus situations in which the indicated emotional unit should be fired. From these rudimentary beginnings, the infant enters into a lifetime of learning through acculturation. The associative network model is capable of representing most of this learning and differentiation.

This cultural learning is extensive and goes on at several different levels. One type of learning involves increasing "stimulus learning and differentiation," with the infant learning to recognize more and more subtle situations that call for a particular emotion. Included would be the infant's learning of specific emotional reactions to specific persons, events, and topics. A second type of learning involves increasing "response learning." Each culture teaches its members certain social "scripts" (see Abelson, 1981; Schank & Abelson, 1977) for conventional displays of specific emotions. These emotional scripts are lengthy action routines, which are modeled for the child repeatedly by his social community. Thus, he learns the accepted cultural scripts for showing romantic love, for grief, shame, loneliness, and so on. These scripts are elaborated around the core of innate behaviors associated with the emotion; thus, the shamed person may put on the same face across cultures, although what he does with his shame – retribution, public breast-beating, or quiet isolation – will vary across cultures. Of course, idiosyncratic variations on these emotional scripts are frequent.

A third form of learning involves increasing differentiations of the primitive emotions. This is accomplished by subcategorizing situations and appropriate behavioral scripts that formerly fell under a given primitive emotion. One subcategorization is according to the intensity of the appropriate emotional reaction. As mentioned earlier (in Figure 18.8), the network model can represent

the experience of different intensities of an emotion by "turning on" different nodes in the network, and these will call forth different response repertoires. Another type of differentiation involves setting up a cognitive unit to represent subtle shadings in subjective feelings attendant upon arousal of different thoughts when a common core emotion is aroused. For example, the core emotion of *interest* will be differentiated and labeled *intellectual curiosity* in one evoking situation, *romantic pursuit* in another, and *thrill-seeking* in still another. Although arousal of the emotion of *interest* is common, these feelings are differentiated not only by their evoking situations and the scripts followed but also by the other emotions and thoughts aroused during prototypical occasions.

This differentiation process is both creative and unbounded, which explains why the English language has nearly 18,000 words referring roughly to shades of emotional feelings or character traits (reported in Allport & Odbert, 1936). Our emotion vocabulary is a motley collection of words that differ in describing the quality of a feeling, its cause, goal, intensity, and its duration; the vocabulary even includes enduring character traits. Such a vocabulary is neither well ordered, logically constructed, nor taught with any precision to language users. Consequently, psychologists cannot hope to discover much about the primitive emotions by factor analyses of adults' judgments about the similarities of emotion words, any more than we learned anything about the physiology of color vision by analyzing our color vocabulary. However, such analyses may tell us something about cultural commonalities in the teaching of emotional terms.

Automatic versus controlled processes in emotion

We have interpreted our results as indicative of automatic (or spontaneous) influences of emotion on cognition rather than as a result of conscious intention to play a role. We may follow Posner and Snyder (1975) in defining *automatic processes* as those that occur without awareness (attention), without intention, and without interfering with other mental processes. Posner and Snyder contrast automatic with *controlled processes*, which require awareness (attentional resources), intention, time and effort to implement, and interfere with other ongoing mental processes.

Following Clark and Isen (1982), we feel that this distinction is useful for emotions, too. Clearly, people have learned diverse methods for controlling their moods and emotional reactions – for prolonging or terminating a mood, for blunting or augmenting an emotional reaction, for even transforming the affective significance of emotional stimuli (e.g., the ecstasy of the religious martyr).

The control strategies for moods involve some purposive manipulation of either our physical state, our environment, or our thoughts, images, and memories. People learn to alter their physical state through the use of psychoactive

drugs, muscle relaxation (with or without biofeedback), deep-breathing exercises, and physical exercise. People try to control their mood by environmental alterations, as when they go to parties, amusement parks, vacation resorts, entertainments (dramas, plays, movies, music), or when they call a friend or engage in absorbing activities to distract themselves from dwelling on their mood.

People also control their emotions by their cognitions about the event in question, by the way they categorize the event initially, by the evaluation and significance they assign to it, and by the persistent rehearsal of self-talk associated with the event. Thus, if someone publicly says that your hairstyle looks silly, you are likely to interpret that as a belittling insult that arouses anger. If you recycle the insult in short-term memory and repeat self-sentences about the event and the target ("What right does he have to embarrass me?"), such repeated thoughts will sustain the anger. Conversely, the anger could be circumvented by interpreting the remark differently in the first place. For example, you might regard it as simple information, or as reflecting good intentions of the observer, or as involving an unimportant issue for you. Alternatively, you can stop the angry self-sentences by counting to ten or by filling consciousness with well-rehearsed distracting or anger-coping thoughts such as "Don't lose your temper. Keep calm." The learning of such emotional self-control procedures is of major concern in psychotherapy with neurotic patients, especially in cognitive behavior therapy (e.g., Meichenbaum, 1977). In such therapy, patients are taught cognitive strategies ("thinking habits") for coping with emotional problems such as anxiety, stress, pain, anger provocations, and depression.

In the network theory, we would represent these cognitive coping responses as "implicit habits" that become associated with (and triggered by) the activation of the relevant emotion node. These coping responses are able to fill short-term memory with distracting or countervailing thoughts and thus prevent the emotional reaction from facilitating itself (via its activated thoughts). In the absence of self-facilitation, the emotion dies out within a few seconds. Thus, the functions of "counting to ten" when a person is provoked to anger are (1) to fill short-term memory with innocuous material, (2) to prevent thinking about angry ideas primed by the provocation, and (3) with the passage of time to allow the initial emotional arousal to dissipate to zero.

Interestingly, people also deliberately use emotional events as modulators of other behaviors they must perform. These sorts of strategies were noted by Lazarus and his colleagues (1980). Thus, to persist in a taxing goal-directed effort (e.g., writing a book), people may use *sustainers*, which rekindle the motivation for completing the task (e.g., imagining the rewards at the end); they may take *breathers* (a rest), which temporarily disengage them from the fatiguing or stressful task, allowing the stress system to recover; or they may use *restorers* (vacations), which allow recuperation from the long, exhausting tasks that overstressed them. These restorative measures are often useful in everyday stress management, and problems such as "job burnout" may result from their neglect.

Of course, emotional controls are not always socially appropriate or available. When they are not, psychological problems may result. For example, the person may overuse certain control strategies and thereby obstruct the natural "flow" of emotional experience. This is exemplified by the overly "inhibited" person who so rarely expresses his feelings that he loses the ability to feel much of anything. Furthermore, attempts at emotional control may backfire, as when a high-strung insomniac tries to command himself to relax and fall asleep and in this way exacerbates his tension. Strategies can also be socially inappropriate and dysfunctional, such as the drug addict who tries desperately to re-create a "high" through chemical means, or the person who habitually dulls the impact of negative emotions with tranquilizers. Finally, as noted earlier, many clinical problems arise from the absence of emotional controls: Examples include the depressive whose spiraling cycle of pessimistic cognitions and negative mood go unchecked; the premature ejaculator who cannot control the intensity of his sexual arousal; and the aggressive person who is easily provoked to outbursts.

In short, control processes can powerfully affect emotional experience. They may be overused, applied inappropriately, or not available. The vast number of them and their ability to enhance or limit the quality of one's experience suggest that it would be useful to gain a more thorough understanding of them. This knowledge could be used not only for furthering a theoretical understanding of emotion but also for therapeutic applications and perhaps the development of educational programs to enhance people's abilities to use control processes beneficially.

Appraisals of emotional events

In this chapter we have examined the cognitive consequences of arousing an emotion, but we have not discussed how emotional reactions are triggered in the first place. Bower and Cohen's (1982) work extends the network model to deal with the elicitation of emotional reactions. In principle, recognizing situations in which one should feel frightened, angry, or sad should not differ greatly from recognizing objects, scenes, and social situations that would be categorized in non-emotional terms. The same issues of stimulus-pattern recognition arise, and complex decision rules will be needed to characterize a person's social discriminations for evoking different emotions.

Bower and Cohen suggested that the initiation of emotional reactions could be modeled in terms of generalized habits, which they called "emotional interpretation rules" or "productions." A production is like an S-R habit designed to recognize a configuration or pattern of relevant variables (the S) that describe a situation; when its pattern is matched (recognized), the production

is fired, causing the appropriate emotional units (the R) to become activated and to thus enter consciousness. An example of such an emotional interpretation rule is: IF someone harms you and he could have prevented it, THEN feel anger at that person. The stimulus conditions for such productions are presumed to exist in an abstraction hierarchy, so that diverse events can come to be categorized, say, as "harmful to you." Furthermore, a given situation or social remark might be recognized by several productions; for example, a sarcastic quip can be interpreted either as merely funny or as a personal attack. Which interpretation is selected depends on the current strength of the different productions. Bower and Cohen handled this issue by supposing that emotional interpretation rules are themselves connected to the emotions they turn on; thus, for example, when someone is feeling angry, productions that result in, or sustain, anger will be temporarily strengthened. Their greater strength implies that these rules will most likely be selected to control the interpretation of ambiguous situations. This means that people will interpret ambiguous emotional signals in a way congruent with their current emotion. These are exactly the sort of emotion-driven interpretive biases that one wants a theory to have.

Reappraisals of events from memory

Bower and Cohen also proposed that an episode causing an emotional reaction would be stored in memory as a triad: the description of the episode, the emotions it aroused, and the emotional interpretation rule by which that episode called forth those emotions. Bower and Cohen noted several reasons for storing the interpretative rule with the episode-emotion connection. One reason is that the rule enables the person later to explain why he had the emotional reaction that he did. A second important reason is that memory of the rule used in the original interpretation is often used in reinterpreting or changing one's appraisal of an earlier event. By replaying the remembered experience and reappraising it according to an altered rule or in an altered context, a different emotional reaction may be assigned to the event.

Some reasons for altering an emotional appraisal can be cited briefly. First, the person may receive *new information*. For example, the anger associated to the event of a friend not showing up for a date might be replaced with guilt when you hear that the friend had been seriously injured in an auto accident on the way to the date. Second, a *change in attitudes or values* may occur between the event and its reappraisal. For example, a teen-ager's contempt for his parents' physical weakness may be replaced later by tolerance and compassion for the infirmities of the aged. Third, a reinterpretation might be prompted by a *shift in evaluation mood*. For instance, a husband who is exhausted and cranky may be very upset with his wife's tardiness in preparing dinner; when feeling rested on the following day, he may reappraise that scene and now feel guilty about his insensitivity. Fourth, an event may *change in importance* because of consequent events. For example, the sadness associated with being rejected from one job would dissipate quickly if soon afterward an offer of a better job was received. Finally, there may be a *change in goals or interests*. Thus, the excitement once associated with a honeymoon experience may be replaced with anger and sadness following a bitter divorce.

To summarize, control processes are used in many ways to alter emotional responses to past, present, and future (anticipated) events. The obvious therapeutic value of such controls is reflected by the many psychotherapies that emphasize methods for altering or coping with emotional associations; for example, aversive conditioning (e.g., McGuire & Vallance, 1964; Thorpe et al., 1964), systematic desensitization (e.g., Wolpe, 1958), and hypnotherapy (e.g., Kroger & Fezler, 1976). Many forms of psychotherapy strive for periodic reappraisals of critical life events and memories of them. Such reappraisals often lie at the heart of insight and growth toward psychological maturity.

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