

Causal Belonging of Affects to Events:  
An Hypothesis about Mood-Dependent  
Retrieval

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Running Head: Mood-Dependent Memory

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## Abstract

This study tests the Causal Belonging hypothesis of mood-dependent retrieval, according to which events and emotions become strongly associated only if they causally belong together. Our subjects worked on 18 verbal ability tasks and received immediate bogus feedback after each, presumably linking positive or negative affect to given tasks. Later, after receiving a positive or negative mood induction, subjects were unexpectedly asked to recall the tasks. Positively-induced subjects recalled more success than failure tasks, whereas negatively-induced subjects recalled more failure than success tasks. Thus, mood-dependent retrieval effects may be observed with materials generating positive or negative affect.

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Mood dependent retrieval (MDR) is said to occur whenever memories stored in a given mood are better retrieved when a similar mood is reinstated. For example, material learned when subjects are feeling depressed would be better retrieved if the subjects are feeling depressed (rather than happy) during testing. Earlier demonstrations of MDR (reviewed in Bower, 1981; Blaney, 1986) have been followed by a mixture of successes and failures in replication of the effect (reviewed in Bower and Mayer, 1989).

Bower (1987) noted that many of the successful demonstrations of MDR involved selective retrieval of autobiographic memories congruent with the subject's mood, whereas more failures arose in experiments in which subjects learned new verbal materials in the context of a prevailing mood that had been induced prior to the learning phase. That observation suggested a "Causal Belonging" hypothesis, namely, that in order to forge a strong association in memory between an event and an emotion, the subject must believe that the emotional reaction causally belongs with the event. If the subject perceives an event as causing his or her affective reaction, then memory for that event will be associated with, or indexed by, that emotion. In turn, the strength of this emotion-to-event association determines MDR.

The idea that the "belonging" of two units experienced together is required in order to form a firm association was proposed long ago by Thorndike (1932) who also reported many supporting demonstrations. Contiguity of two events without belonging was alleged to produce only weak, unreliable associations. Applying this idea to the mixed MDR results is straightforward. A pleasant or unpleasant autobiographical memory is (almost by definition) one for which the affective reaction causally belongs to the event (e.g., a child's sadness upon death of a pet). In contrast, causal belonging is absent in laboratory experiments in which a mood is first induced by some means (e.g., affective music, films, autosuggestions) several minutes before the subject is exposed to a set of words to be learned. Clearly, studying the words does not cause the earlier emotional arousal; rather this arrangement provides only poorly synchronized temporal contiguity between the induced background mood and studying the words to be remembered. Consequently, such arrangements would be expected to produce only weak or unreliable MDR, just as observed. <sup>1</sup>

To test the Causal Belonging hypothesis with laboratory materials, subjects must be exposed to to-be-remembered items which can be causally linked to positive or negative affective reactions. The following experiment arranged these conditions. Subjects worked on a series of distinct verbal tasks with no intention of remembering them; after each task they received evaluative feedback presumed to cause a positive or negative affective reaction to that particular task. Later they

were induced into a positive or negative mood and unexpectedly asked to free recall the experimental tasks. MDR would be revealed by subjects recalling more of those tasks whose presumed affective reaction agreed with their retrieval mood. That is, MDR implies that positive mood subjects would retrieve more of their successes whereas negative mood subjects would retrieve more of their failures.

### Method

Thirty-two Introductory Psychology students participated for course credit. All were nondepressed as indicated by scores less than 10 on the short-form Beck Depression Inventory administered to the class several weeks prior to the experiment. Half the subjects were assigned in random order to receive the positive (or negative) mood induction at the time of recall. Before commencing, all subjects completed a mood evaluation test indicating their current feelings on 1-to-10 bipolar scales labelled happy/not happy, not angry/angry, not depressed/depressed, anxious/calm, high/low, sad/not sad, and relaxed/agitated. They then worked on a series of 18 distinct verbal tasks. These paper-and-pencil tests were taken from a magazine (Michaels, 1989) and puzzle books (Carter, 1986; Carter and Russell, 1987; Shushan, 1984). Example tasks are: (1) Find a word that fits a specific pattern (e.g., S \_ \_ W \_ ) using only given letters (e.g., S E T): answer STEWS; (2) Fill in blanks given clues (e.g., Larry, Moe, and Curly; answer 'Three Stooges'); (3) Find a rhyming word (e.g., \_\_\_\_\_ CHART) given a clue

(Electrocardiogram); answer HEART. Each distinct task was given individually on a separate page including instructions; each page contained many problems of the same type. For each page, subjects were urged to complete as many problems as they could within one minute. Typical scores ranged from one to seven problems completed on a given task. After one minute, subjects were stopped and their performance on each task was immediately scored by the experimenter who then gave each subject bogus feedback regarding how he or she had done "compared to the average score of subjects who took this test" the preceding academic term. Positive (or negative) feedback consisted of the experimenter announcing "On this task, you did better (or worse) than average." The next task was then introduced for the subject to work on.

The bogus feedback pattern was controlled so that each subject received nine positive and nine negative evaluations in random order. Two reversed patterns were used so that half the subjects in each group received positive and half received negative feedback for their performance on any given task. Occasionally (1.4 times each) subjects performed too well or too poorly for the experimenter to plausibly give the pre-specified feedback; in these few instances, performance-appropriate feedback was given on that task, but with a "make-up" alteration in feedback given for the next appropriate task in the series.

As an unobtrusive mood manipulation, after working on the 18 verbal tasks, subjects were asked to recall two positive or two negative experiences from

their lives. They were asked "to think of two personal experiences of your own in which you felt very happy (or unhappy). Recall some specific episode where you feel very happy (depressed): go through that experience in imagination, getting back into those feelings. As you revive and relive the memory of that experience, try to put into words a description of the scene." The instructions were elaborated and asked subjects to describe their emotional scenes aloud into an audio tape recorder while the experimenter left the room. After 90 seconds of describing a first scene, the subject was cued by the experimenter to move on to reviving and describing a second, similar emotional scene, again for 90 seconds. After describing their two personal memories, subjects again completed the mood evaluation scales. They were then unexpectedly asked to try to recall in writing as many of the 18 verbal tasks as possible, and given 5 minutes to do so. Any ambiguities regarding which task a subject was recalling were resolved before debriefing. Finally, subjects were presented again with each of the 18 verbal tasks and asked to rate on a 10-point scale the degree of positive or negative emotion associated with each task. Thereafter, subjects were debriefed, their mood was normalized, and they were dismissed.

## Results

### *Efficacy of Mood Induction*

Mood measures were taken at the outset of the experimental session and later after subjects worked on the tasks and recorded the personal memories. Mood changes from the first to the second measurements were scored so that increasing positive affect yielded positive scores, and increasing negative affect yielded negative scores. Summing across all seven scales, the tasks-plus-negative-memories produced a greater change in unhappiness ( $-9.06$ ) than did the tasks-plus-positive-memories ( $-0.5$ ), with  $F(1, 30) = 7.66, p < .01$ . The seven mood-rating scales varied considerably in their sensitivity to the experimental mood manipulations. Only two of the scales showed a significant difference in pre-to-post change scores for subjects receiving the positive versus negative induction: the sad/not sad scale (changes of  $-2.19$  vs.  $.06$  for negative vs. positive induction subjects,  $p < .001$ ) and the feeling high/low scale (changes of  $-1.19$  vs.  $.63$  for negative vs. positive induction subjects,  $p < .0001$ ). Scores on these two scales were summed to obtain the net mood change score for each subject used in the following analyses. There were no sex differences in mood measures, mood change scores, or recall scores.



### *Efficacy of Feedback Manipulation*

Subjects later rated the emotion associated with their successful tasks (5.35) as more positive than that associated with their unsuccessful tasks (4.68), yielding a paired  $t(31) = 4.14, p < .01$ . Thus, the feedback manipulation was effective in associating relatively more positive or negative affective reactions to successful vs. failed tasks.

### *Mood Dependent Retrieval*

To state the overall conclusion first: MDR was observed in that subjects in the positive mood induction condition recalled more of their successes than their failures, whereas subjects in the negative mood induction condition recalled more of their failures than their successes. The size of the MDR effect was greater for subjects for whom the induction produced greater mood change. A second conclusion is that the mood induction condition produced no overall difference in total number of tasks recalled.

Mood dependent retrieval was analyzed by examining the recall of successful versus unsuccessful tasks by subjects in the positive compared to the negative induction conditions. Over all 32 subjects, the MDR interaction of mood with success vs. failure recall was in the predicted direction but fell short of significance,  $F(1, 30) = 2.22, p < .15$ . However, that analysis includes many subjects for whom the mood manipulation was ineffective. If we include only

subjects whose mood changed in the direction appropriate to their induction (11 and 14 in the positive and negative induction, respectively), then the MDR interaction becomes statistically significant, with  $F(1, 23) = 4.53, p < .05$ . The MDR interaction becomes even stronger if we examine recall of just those subjects in the upper half of mood-change scores in each induction condition, with  $F(1, 18) = 9.03, p < .01$ . The recall of successes and failures by these subjects who experienced above-median mood shifts appropriate to their inductions is shown in Figure 1. The MDR interaction is clear: subjects in a positive mood recalled more of their successes; subjects in a negative mood recalled more of their failures.

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Insert Figure 1 about here

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An alternative analysis relevant to MDR examined the correlation between subjects' differential recall (indexed by Successes minus Failures recalled, or S-F) and their mood change (using the summed sad/not sad and high/low scales). Using the Cook-Weisberg distance measure (Cook & Weisberg, 1982) to exclude one aberrant subject whose scores unduly influenced the regression line, the resulting correlation of mood and S-F recall among the remaining 31 subjects was  $r = .40, p < .025$ . That is, pooling all subjects regardless of their mood induction condition, the more subjects' mood changed in a positive (or negative) direction, the greater was the change in differential recall in a positive (or negative)

direction, respectively. This correlation is impressive given the small range (+3 to -3) observed in the individual Success minus Failure recall scores.

### Discussion

A prediction of the Causal Belonging hypothesis for mood-dependent retrieval has apparently been upheld. A brief behavioral episode (viz., working on a specific verbal task) that led causally to a presumptive positive or negative affective reaction entered later into a dependent retrieval relation to the person's mood during recall. This outcome would arise if the evaluative feedback caused the affective reaction to become associated with the memory traces of the specific verbal task, and if re-arousal of that affect during the recall phase spreads activation to associated memory traces, increasing their availability. This spreading of activation from an aroused emotion is what has been hypothesized to cause mood-dependent retrieval of those memories associated with that emotion (see Bower, 1981). The Causal Belonging hypothesis refers to the acquisition process — in this case, acquisition of the associations between the verbal tasks and the emotions; it is these associations that are activated and revealed (or not) when subjects later recall while in a congruent (or incongruent) emotional state, respectively.

The fact that the size of MDR increases with a more intense mood during retrieval is consistent with the spreading activation theory. The greater the mood

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## Footnotes

<sup>1</sup>Eich (1990; Eich and Metcalfe, 1989) have also found reliable MDR when the to-be-remembered materials are generated by subjects after induction of an acquisition mood (see also Weingartner, Miller, and Murphy, 1977). While the generation procedure does not involve causal belonging, it does utilize pre-established associations which may have been acquired with belonging and whose selective generation may be mood dependent.

## Figure Captions

Figure 1 Recall of successes and failures by subjects induced to feel positive or negative during recall.





