EMOTIONS IN NONDIRECTED TEXT LEARNING

RICHARD M. RYAN, JAMES P. CONNELL, AND ROBERT W. PLANT

UNIVERSITY OF ROCHESTER

ABSTRACT: Two studies examined the influence of emotions on nondirected learning. Nondirected learning is conceptualized as learning which occurs in the absence of external prompts, reinforcements, or specific instruction. In Study 1, one of two expository texts was given to ninety-two undergraduate subjects for the ostensible purpose of obtaining attitudinal and emotional ratings. Two separate measures of motivational and emotional factors and perceived comprehension were administered immediately following the subjects' reading of the text. No mention of later testing occurred. After a brief delay, subjects' recall of the texts was obtained and scored using a propositional coding scheme. Correlational results revealed that factor-analytically derived dimensions of interest-enjoyment and task involvement were positively associated with perceived comprehension text recall, while ego-involvement, shame, and hostility were negatively related to these same variables. Study 2 was conducted: first, to replicate the emotion dimensions obtained in Study 1 on a larger, combined sample; second, using the larger samples to specify and test a "path model" of the indirect influence of emotions on nondirected learning through perceived comprehension; and, third, in Study 2 alone, to assess the stability of the recall measure over a ten-day period and the effects of verbal aptitude on the relations between the variables in the path model. The discussion focuses on the significance of motives and emotions for nondirected learning and the implications of the current study for organismic learning theories.

The psychologies of learning and cognition focus primarily upon learning which is prompted, reinforced, or otherwise externally directed. In contrast, there has been relatively less research on the processes involved in nondirected learning, that is, the pickup and retention of information in the absence of specific external direction to learn. This phenomenon is particularly relevant to "active organism" learning theories, where environmental control of learning is not assumed (Schwartz a Lacey 1982; Deci & Ryan 1985). On a more intuitive level, the relative neglect of nondirected processes is surprising given that much information that is acquired and remembered throughout life is learned without external pressure, reward, or instruction (Kirsch & Guthrie 1984; Neisser 1982).

When learning accrued in the absence of external direction has been examined

Direct all correspondence to: Richard M. Ryan, Department of Psychology, University of Rochester, Rochester, NY 14627.

Learning and Individual Differences, Volume 2, Number 1, 1990, pages 1–17.

ISSN: 1041–6080.

experimentally it has traditionally been referred to as "incidental learning" (Ausubel 1963; Postman & Keppel 1970; Klaver 1984). McGeoch (1942), an early reviewer in this area, defined incidental learning as that which occurs "without a specific motive or a specified formal instruction and set to learn the specific material in question" (p. 299). In these paradigms, subjects who are reinforced or directed to learn target material are contrasted with those who are equally exposed to the target stimuli, but without the external prompts. As Postman & Senders (1946) pointed out, the term "incidental" implies that such unprompted learning is haphazard or accidental. However, it is a plausible hypothesis that what appears to be accidental or incidental with respect to external conditions or imposed sets may be, in fact, highly organized with respect to both cognitive and motivational factors. It is the central hypothesis of the current studies that nondirected learning can be predicted in part on the basis of specific motivational and emotional processes.

EMOTIONS AND MOTIVES IN NONDIRECTED LEARNING

Emotions theorists have long argued that emotions can play an activating, even determinative role with respect to cognition under some circumstances (Tomkins 1962). Mowrer (1960), for example, stated that "the emotions play a central role, indeed an indispensable role in those changes in behavior or performance which are said to represent "learning" p. 307).

Motives and emotions can be hypothesized to influence nondirected learning at all stages of the process; orientation, acquisition, storage, and recall. Yet, both data reviewed by Zajonc (1980) and phenomenological reflection suggest that these factors would exert their most profound effects at the stage of information pickup. Such a naive phenomenological analysis was provided a century ago by James (1890) who specifically cited the emotion of *interest* as having a central role: "Millions of items in the outward order are present to my sense which never properly enter into my experience. Why? Because they have no *interest* for me. *My experience is what I agree to attend to*" (p. 402).

The thesis that interest plays a significant role in the processes by which persons select and retain information was also shared by several of James' near contemporaries (e.g., Engle 1904; Woodworth 1918; McDougall 1908). Later, Bartlett (1932) in his "constructive" theory of remembering was to forward the idea that even the perception of stimuli which are later remembered is directed by interest and feeling (Greenwald 1981).

Other theorists concerned with the explication of active organismic processes have continued to emphasize the role of interest in intellectual development and natural organization of learning. Piaget (1981), for example, pointed out that interest acts as the motor which energizes the processes of assimilation in cognitive growth. Tomkins (1962), in his theory of emotions, argued that interest was so important for thought and memory that its absence would be functionally equivalent to the destruction of brain tissue! This viewpoint is reiterated by Izard

(1977) whose differential emotions theory suggests that interest is the fundamental motivation mobilizing and guiding action associated with learning. As such, this emotion plays an important role in the development and elaboration of intellectual capabilities, and perhaps information acquisition and storage.

Similarly, intrinsic motivation theories have also maintained that interest, or more specifically *interest-enjoyment*, is of primary importance for nondirected learning. Interest-enjoyment is the central affective accompaniment of intrinsically motivated behaviors and is maximized under conditions of optimal challenge and absence of extrinsic pressures toward a specific goal (Csikszentmihalyi 1975; Deci & Ryan 1985). In experimental research, measures of interest-enjoyment have frequently been used as the operational index of intrinsic motivation, as an alternative to behavioral indices (e.g., Harackiewicz 1979; Ryan, Mims, & Koestner 1983; Engle & Ross 1978). Intrinsic motivation is hypothesized to underlie learning in many situations where persons take in or assimilate information because of its inherent interest, novelty, or challenge.

Another term used for an interested, intrinsically motivated engagement with an activity is "task involvement." deCharms (1968) defined task involvement as a condition where the motivation for a high level of involvement in an activity stems from its intrinsic properties, such as its challenge or novelty. He contrasted task involvement with "ego-involvement" in which the motivation for action stems from self-esteem related or external evaluative pressures (Greenwald 1981). One would expect learning of a task-involved nature to be accompanied by the task-related affect of interest, and that of an ego-involved nature to be associated with pressure and tension (Ryan 1982; Plant & Ryan 1985) or self-focused affects, particularly the emotion of guilt (Lewis 1971). This task- versus ego-involvement dimension, indexed by emotions, should have a direct relation to aspects of nondirected learning, with increasing task involvement associated with greater task-oriented attention, thus facilitating acquisition and retention.

A number of studies have examined the effects of intrinsic versus extrinsic motivational conditions on "incidental" learning. Johnson & Thomson (1962), for example, provided either extrinsic rewards or no rewards to subjects in a serial learning task. Nonrewarded subjects remembered more nontarget nonsense syllables presented during the task than did rewarded subjects. Similarly, McNamara & Fisch (1964), in another serial learning study, demonstrated that rewarded subjects recalled fewer task-irrelevant words which were added on the periphery of the stimulus cards containing target words. Those task-irrelevant words which were recalled by rewarded subjects tended to be those most proximate to the target words. These and other studies (e.g., Bahrick, Fitts, & Rankin 1952; Benware & Deci 1984) suggest that extrinsic reward conditions tend to narrow the field of attention to those stimuli which are goal relevant, while intrinsic conditions result in less attentional constriction.

In a recent study, Grolnick & Ryan (1987) investigated how individual differences in intrinsic versus extrinsic motivation affected children's text recall in both

directed and nondirected learning conditions. Results revealed an interaction effect such that individual differences in motivation were highly predictive of recall but only under nondirected learning sets. Children who had a more intrinsic motivational orientation showed greater recall.

Given the evidence that intrinsic motivation and interest-related affects may be particularly important in organizing nondirected learning, the present study attempts to further examine this phenomenon in a young adult sample. The advantage of this age group is the opportunity it affords to assess emotions and subjective experiences in a differentiated manner and to relate these processes to recall outcomes.

While interest or intrinsic motivation can be expected to facilitate recall of nondirected-learning material, other emotional states are predictably influential in the opposite direction. A variety of negative emotions, including those associated with outward hostility, a negative self-focus, or fear, may, if present, produce a "functional interference" with spontaneous epistemic processes. Izard (1977), for example, has pointed out that hostility, represented by the discrete emotions of anger, contempt, and disgust, can have "constricting" effects upon cognitive processes, which could potentially reduce the organism's effective assimilation of the field. Similarly, Izard claims that fear is the "most constricting" of all emotions, also having a narrowing effect upon perception and thought. It can be accompanied as well by uneasiness or tension, resulting from the experience of threat. As such it can have disorganizing effects on cognitive functioning.

In Study 1, the relation of potentially facilitating and inhibitory emotions and motivational states to nondirected learning of written information was examined. Measures derived from Izard's (1977) differential emotions theory and from research on intrinsic motivation (Ryan 1982; Ryan et al. 1983), as well as self-ratings of comprehension, were related to recall of text material that was presented in a context where there was no explicit instruction, pressure, or external reinforcement to retain the information, that is, a nondirected context. In Study 2, these same variables were investigated along with a follow-up recall measure and a measure of verbal aptitude.

As a method of eliciting nondirected learning, we needed a procedure that would orient subjects to read text material but without arousing suspicion that they would later be tested. To do so, we first administered a sample text to which subjective reactions were requested. The target tests were then introduced such that subjects still expected that reading was being done in order to provide subjective ratings about the text. This avoided the suspicion that may have arisen were subjects asked to "just read" the text, which could prompt some toward "intentional" learning. It also circumvented the need to introduce an extraneous "incidental" task (e.g., counting the number of "E"s), which can actually direct subjects' attention away from meaningful aspects of the text (T.A. Ryan 1981). Thus, although no set can be completely "neutral," the present strategy approached a true "nondirected" learning situation without some of the difficulties posed by other paradigms.

STUDY 1

METHOD

Subjects. Subjects were undergraduate psychology students (n = 92) who participated in partial fulfillment of course requirements. Equal numbers of each sex were randomly assigned to either the Text 1 or Text 2 conditions. Subjects were tested in a single group session in a large, well-proctored auditorium.

Procedure. Upon reporting to the experiment, subjects were given two sealed envelopes and a pencil and were seated at a desk by a proctor. A sample text and questionnaire were then distributed. Subjects were told that they would be asked in this experiment to read some factual information such as that presented in the sample. They were informed that after reading the text material they would be answering questions concerning their reactions to the text which were similar to the questions following the sample text. The sample questions contained items such as "I thought this was interesting information" or "I was very relaxed while reading this material," rated on 7-point scales. Subjects were given a minute to look over the sample text and questions, and then these were returned to the experimenter.

Subjects were then asked to set aside all materials except the first envelope. They were told that when signaled to begin they were to open the envelope and read the enclosed material which contained the text. They were given three and one-half minutes for this task. Pilot testing had shown this was sufficient time for all subjects to read the texts. After this reading period, subjects were instructed to complete the text-rating and emotion questionnaires, for which eight additional minutes were required. All materials were then returned to Envelope 1 and given back to the experimenter. Subjects had only the second envelope before them. They were then told:

> This completes our text-rating experiment. Because we don't want this first experiment to interfere with what follows we'd like you to set all the materials aside and for the next few minutes to just sit quietly at your desk. Please don't talk of do other activities, but rather simply sit and relax. I'll let you know when we will start the next task.

The purpose of this period of inactivity was to allow subjects to get some time away from the text prior to recall while minimizing interference from other activities.

After four minutes, subjects were asked to open the second envelope which contained two blank sheets of paper. Subjects were instructed to write on this paper "everything you remember from the essay you read earlier, in as much detail as possible." They were urged to record any titles, sentences, ideas, or facts they might recall. Subsequently, the free-recall sheets were collected, the nature of the experiment was explained to all participants, and any questions they had were answered.

Development of Nondirected-recall Measure. Memory for any meaningful elements derived from the written texts served as the operational definition of nondirected recall. Accordingly, we developed a measure that could be used to code remembered elements of stimuli against the original semantic base. In this endeavor, we followed the lead of Kintsch (1974) in coding each text into propositions. In Kintsch's system, a proposition consists of a predictor and arguments, and there are specified rules as to how these may be combined. Our goal was modest, however, in that we did not attempt to construct or code the higher order structure of the text, but simply to code the number of propositions recalled. Thus, texts were broken down into their propositional units and recalled information was matched against this list. For each match a score of one was awarded.

Since nondirected recall is neither ordered nor worded rotely, but rather appears in whatever organization and form the subject emits, some judgment was required to determine whether a match existed. In addition, we discovered in various pilot attempts that the more natural the semantic structure of the propositions listed in the coding scheme the more efficient it was for naive coders to reliably match them against subjects' performance. Thus, for example, the propositional structure of the sentence "the snow melts slowly" is in Kintsch's system two propositions: (Melt, Snow) and (Slow, Melt). In our scheme, these would be listed as "the snow melts" and "the snow melts *slowly*," underscoring the word "slowly." This specified that the underlined element was essential to be scored for a second proposition above and beyond "the snow melts," a strategy developed following earlier systems which had resulted in occasional redundant scores. Similarly, the sentence "the apparatus was developed by brothers" would be coded as two propositions, "the apparatus was developed" and "developed *by brothers*." The semantic base, once coded using the above procedure, was then employed as the standard against which raters matched the subject's written recall. Raters were instructed to score any written recall if it captured the "gist" of a proposition, even if not its rote wording. Thus, if a subject recalled the above two propositions as "the brothers developed the machine" they would be scored for both propositions, that is, they had recalled the essential and meaningful information therein.

Three raters were given brief (one-hour) training on the final coding scheme and they independently scored all of the recall performances on the two texts. Their results were intercorrelated to ascertain the reliability of the total recall score. Intercorrelations ranged from .95 to .97, with an average of .96, indicating high consistency.

The two texts had been chosen so as to be approximately equal in terms of the total number of propositions. Text 1, entitled "A new advance in medical technology," contained 141 propositions. It described a technique for blood analysis in quite specific terms. Text 2, entitled "Personal experience in literature," contained 132 propositions, and was an expository essay on how Rudyard Kipling's works were derived from his life experiences. These topics were selected for their contrasting thematic content. The mean number of propositions recalled (representing the

average of the three raters) for Text 1 was 31.43 (SD = 13.77) and for Text 2 was 31.32 (SD = 13.68), with ranges of 0–59 and 0–61, respectively.

Questionnaire Measures. Two self-report measures were administered to all subjects immediately following the reading period to assess the subjective experience of emotions and other reactions to the text material. The first of these questionnaires is called the Intrinsic Motivation Inventory (IMI), a 16-item adaptation of post-experimental questionnaires used in previous research (Ryan 1982; Ryan et al. 1983). The questionnaire assesses interest-enjoyment and pressure-tension related to a given activity on 7-point scales. Prior research has shown significant correlations between the interest-enjoyment items from this scale and behavioral "free-choice" measures of intrinsic motivation. In addition, pressure-tension ratings have been positively related to externally controlling environments (Ryan et al. 1983) and intrapsychic, self-esteem related pressures (Ryan 1982; Plant & Ryan 1985). For the purposes of the present research, three items were added to the inventory in order to assess subjects' perceived comprehension of the text. Both interest-enjoyment and comprehension ratings concerned ratings of the text content per se, whereas pressure-tension questions assessed subjects' feelings while reading the text. A principal components factor analysis of the 16-item version was performed and Cattell's scree test indicated a three-factor solution. A Promax (oblique) rotation of the three factors was then performed and the resulting factor pattern revealed an eight-item interest-enjoyment factor, a five-item pressure-tension factor, and a three-item factor tapping perceived comprehension. No other eigenvalues exceeded 1.0 and all variables' primary loadings were on their appropriate factors. Primary loadings of all variables exceeded .7 and cross-loadings were all less than .3. Factor scores were then estimated for the three factors (interest-enjoyment, pressure-tension, and perceived comprehension) using a unit weighting procedure recommended by Wackwitz & Horn (1971).

The second questionnaire administered following the text-reading period was the Differential Emotions Scale (DES; Izard, Dougherty, Bloxom, & Kotsch 1974). The DES is a 30-item emotion checklist in which subjects rate their experience of the specific emotions on 5-point scales. The thirty items have been shown in previous research to reliably index ten fundamental emotions (each assessed by three items) as outlined in Izard's (1977) differential emotions theory. The DES can be administered as a "state" questionnaire, and in this case subjects were asked to rate the emotions they experienced while reading the text.

RESULTS

To examine for sex differences on the emotion/motivation, perceived comprehension, or recall variables, one-way Anovas were calculated for each text and for both texts combined. There were no significant sex effects on recall for either text or for both texts combined. Among the questionnaire variables, there were two significant sex effects on Text 1: females rated the medical-technology-related material

TABLE 1

Intercorrelations among Variables derived from the Intrinsic Motivation Inventory and Total Recall Scores for Texts 1 and 2 (n = 92)

	Pressure-Tension	*Comprehension*	*Recall*
Interest-Enjoyment	−.24**	.40***	.30***
Pressure-Tension		−.36***	−.18*
Comprehension			.46***

Notes: *P < .10.
**P < .05.
***P < .01.

as more interesting and enjoyable on the intrinsic motivation inventory, F(1,44) = 4.35, $p < .05$, and more interesting on the DES, F(1,44) = 4.48, $p < .05$. No sex differences emerged on Text 2 or on the combined ratings. Thus, for subsequent analyses, the data are collapsed across the sex variable.

Table 1 presents the correlations between the interest-enjoyment, pressure-tension, and perceived comprehension factors derived from the intrinsic motivation inventory and the total recall scores. As predicted, subjects' self-report of interest-enjoyment was significantly related to the number of propositions recalled ($r = .30, p < .01$). The more interest-enjoyment reported, the more subjects recalled. Subjects' self-rated comprehension was also positively related to recall ($r = .46, p < .01$). Not surprisingly, perceived comprehension and interest-enjoyment were themselves related positively ($F = .40, p < .01$). The pressure-tension factor from this measure was marginally negatively related to recall ($r = -.18, p < .09$), and significantly and negatively related to perceived comprehension of the texts ($r = -.36, p < .01$).

The correlation of the DES factors with recall performance and with the emo-

TABLE 2

Correlations of Differential Emotions with Total Recall, and Variables Derived from the Intrinsic Motivation Inventory for Texts 1 and 2 (n = 92)

	Recall	*Interest-Enjoyment*	*Pressure-Tension*	*Comprehension*
Interest	.21**	.38***		.30***
Enjoyment		.56***	−.27**	.25**
Surprise		.33***	−.17*	
Distress		−.28***	.38***	
Fear			.54***	−.36***
Guilt	−.24**	−.33***		−.36***
Shame	−.22**	−.25**	.32***	−.40***
Anger		−.31***	.36***	
Disgust	−.24**	−.45***	.31***	−.30***
Contempt		−.41***	.25**	−.21**

Notes: *P < .10.
**P < .05.
***P < .01.

tion/motivation and self-rated comprehension variables from the intrinsic motivation inventory are presented in Table 2. As predicted, interest as measured by the DES was significantly related to recall: the more interested the subject, the more propositions recalled ($r = .21, p < .05$). Both the DES interest and enjoyment factors related to the interest-enjoyment factor of the intrinsic motivation inventory, $r = .38$, $p < .01$, and $r = .56$, $p < .01$, respectively. DES interest was positively related to subjects' ratings of comprehension ($r = .30, p < .01$) as was the DES enjoyment factor ($r = .25, p < .01$). DES interest was also negatively related to self-reports of pressure and tension ($r = -.27$, $p < .01$). These findings suggest that these two different questionnaire measures were interpreted similarly by the subjects. The DES results further revealed that several of the discrete emotions were negatively related to recall performance: shame, guilt, and disgust were correlated, $-.22$, $-.24$, and $-.24$ ($p < .05$), respectively, with the recall score. The remainder of the correlation matrix reported in Table 2 shows general support for the expected convergent relations between the two questionnaire assessments.

In order to examine configural aspects of emotional responses to the learning situation, an exploratory higher-order factor analysis of the ten DES factors was performed using procedures identical to those described previously. Four factors emerged from this analysis: *Hostility* (marked by distress, anger, disgust, and contempt), *Threat* (marked by fear and shame), *Positive Affect* (marked by enjoyment and surprise), and *Task- versus Ego-Involvement* (marked positively by interest and negatively by guilt). As expected, Threat and Task- versus Ego-Involvement correlated significantly with recall in opposite direction, $r = -.21$ and $r = .25$, p's $< .05$, respectively. The results of these secondary analyses bring into focus both the significant inhibitory role of negative self-related affect and the significant salutary influence of task-involvement on nondirected learning processes.

DISCUSSION

Study 1 explored the relationship between emotional and motivational factors, perceived comprehension, and nondirected learning. The findings supported the viewpoint that motivational and emotional variables are coherently associated with perceived comprehension and recall performance. As hypothesized, the strongest predictions of recall and comprehension were from the emotion of interest and the related dimension of task-involvement, both of which are theoretically linked to intrinsic motivation. A variety of negative emotions were found to be inversely related to these same two dependent variables.

This was an initial empirical investigation of emotional and motivational factors contributing to nondirected learning and as such was limited in several respects. First, the study is strictly correlational. No causal modeling was attempted, for example, to test whether the influence of emotions on recall was mediated by perceived comprehension or whether emotions directly predict amount of recall. Neither was any attempt made to manipulate or measure the possible antecedents of the emotion/motivation or other predictors of learning. For example, the influence of verbal ability on this set of variables was not examined. Also, the recall

measure used assessed relatively short-term, immediate recall; no evaluation was made of longer-term direct or indirect effects of the emotion/motivation variables on learning. Finally, the factor analyses of the emotion/motivation measures were performed using a relatively small number of subjects. Study 2 was thus conducted to address these limitations.

STUDY 2

METHOD

Eighty-eight undergraduate psychology students participated in this second study following a procedure identical to that outlined in Study 1. However, all subjects were asked to read the same text (#2, Rudyard Kipling) after which they filled out the two emotion/motivation scales, namely the Intrinsic Motivation Inventory (IMI) and the Differential Emotions Scale (DES). After a 12-minute interval subjects were asked to write on a blank sheet of paper all that they could recall of the Kipling text. These recall protocols were later scored according to the same proposition coding system described in Study 1.

These same subjects were asked to return exactly one week later for a follow-up session, presumably to participate in a different experiment. Of the eighty-eight original subjects, all were present for the follow-up. They were, however, unaware that any further questions would be asked regarding the text passage from Week 1. The purpose of this follow-up session was to examine the stability of the recall measure over a one-week period. The identical free-recall instructions were used at this time.

Finally, following the recall period, subjects completed consent forms releasing college records of their Verbal Scholastic Aptitude Test (VSAT) to be used to examine this variable in relation to the emotion/motivation variables, perceived comprehension, and recall measures. Of those participating, sixty-eight subjects both gave consent and had records that were located in the University Office of Records.

RESULTS

In order to increase our confidence in the factorial validity of the motivation/emotion dimension, factor analyses of the IMI and higher-order factor analyses of the DES were conducted using the procedure described earlier on the combined samples from Study 1 and Study 2 ($n = 180$). The results of these analyses confirmed the findings from Study 1 for both scales. On the IMI, the same three factors were indicated—interest-enjoyment, pressure-tension, and perceived comprehension. Similarly, for the DES, four higher-order factors identical to those in Study 1 emerged, and were interpreted as Hostility, Positive Affect, Threat, and Task- versus Ego-Involvement. Factor scores on the emotion/motivation and per-

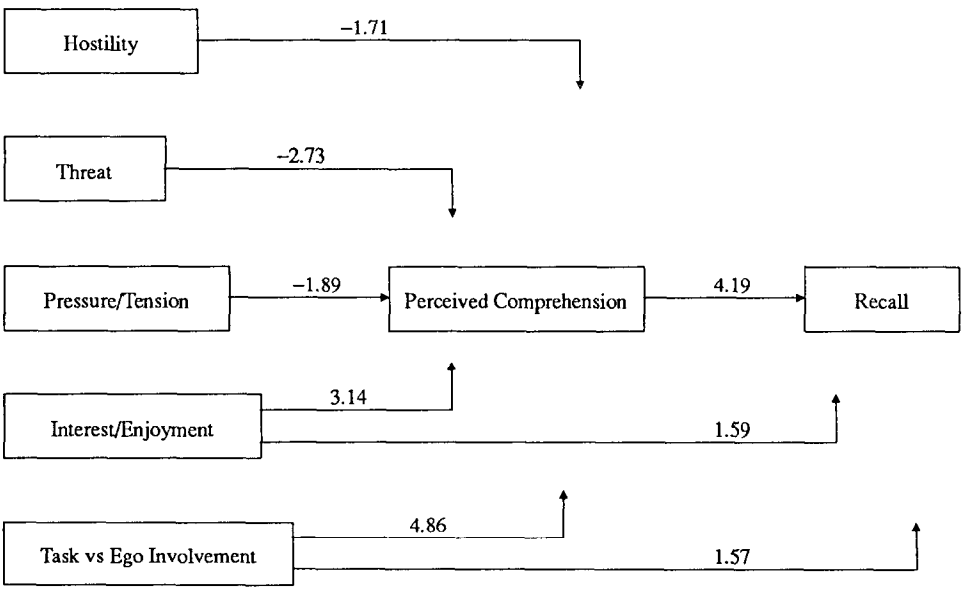
ceived comprehension dimensions were then computed using the unit weighting procedure.

Because both samples were assessed on these two measures and short-term recall, the data were combined to test a path model implied by the correlational findings from Study 1. A recursive model was specified in which the emotion/motivation dimensions were related directly to perceived comprehension which, in turn, predicted recall.[1] This model portrays the influence of emotional/motivational variables as an indirect one, mediated by the subjects' perceived comprehension of the material. Using a two-stage ordinary least squares procedure, regression weights were estimated for each of the hypothesized paths in the model, as well as for paths representing direct influences of emotion/motivation variables on recall. Ratios of regression coefficients to their standard errors are presented in Figure 1 for all hypothesized paths and for those direct paths between emotion and recall whose coefficients exceeded a ratio of 1.5. Negative ratios indicate that higher scores on the emotion/motivation variable predict lower scores on the particular outcome variable; positive ratios indicate the opposite relation between the variables. R^2 values for the two endogenous variables in the model were .38 and .25, for perceived comprehension and recall, respectively (both p's < .0001).

As can be seen in Figure 1, all hypothesized paths had regression values greater

FIGURE 1

A path model of the influence of emotion/motivation variables on recall of textual information (n = 180)



Note: Values on path diagram represent path coefficients divided by their standard errors.

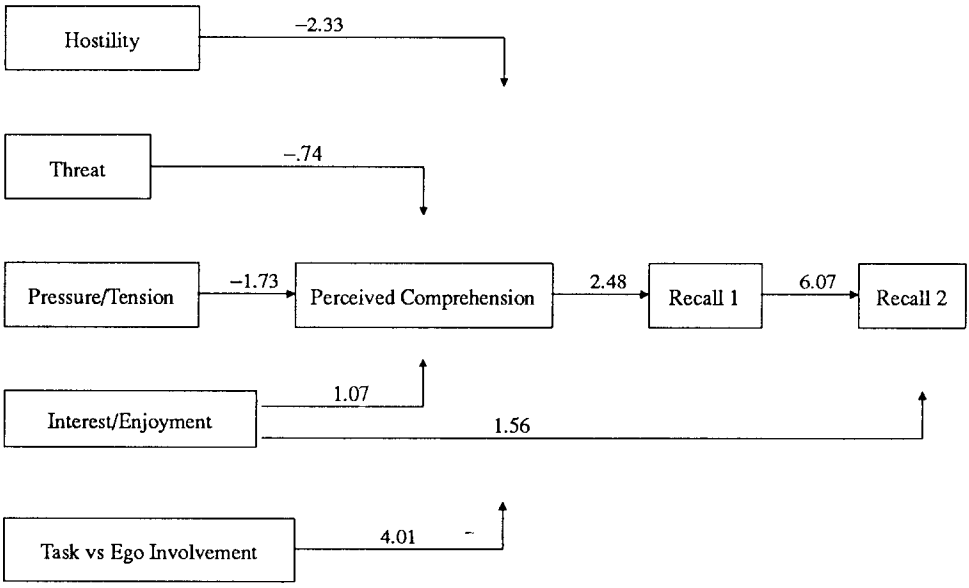
than 1.5 times their standard errors, with task involvement and interest-enjoyment showing the strongest predictive relations to perceived comprehension and the only direct predictive relationships, albeit marginal ones, to recall. Perceived comprehension was the single strongest predictor of recall.

As a test of the hypothesized model's overall statistical fit to the data from the combined sample, a maximum likelihood estimation procedure (LISREL VI; Joreskog & Sorbom 1984) was employed to estimate only the hypothesized parameters specified in Figure 1 (those paths consistent with the "indirect influence" model). The results of these maximum likelihood analyses indicated a good fit to the data, $X^2 = 7.23$, df = 10, $p = .704$.

Next, using only the data from Study 2 (n = 88), we expanded the model in Figure 1 to include the second recall measure. First we compared the pattern of correlations between the emotion/motivation measures, perceived comprehension and the 12-minute and 1-week recall measures (Recall 1 and Recall 2). The pattern of correlations was remarkably similar: for interest-enjoyment, $r = .30$, and $r = .38$ for Recall 1 and 2, respectively, both p's < .01; for task- versus ego-involvement, both r's = .36, $p < .01$; for hostility, $r = -.25$ and $-.23$, both p's < .05. Neither pressure-tension nor threat significantly predicted either of the recall measures. Perceived comprehension was significantly correlated with both recall measures, both r's = $-.43$, $p < .01$.

FIGURE 2

Path model of relations between emotion/motivation variables, perceived comprehension and two recall measures (n = 88)



Note: Values on path diagram represent path coefficients divided by their standard errors.

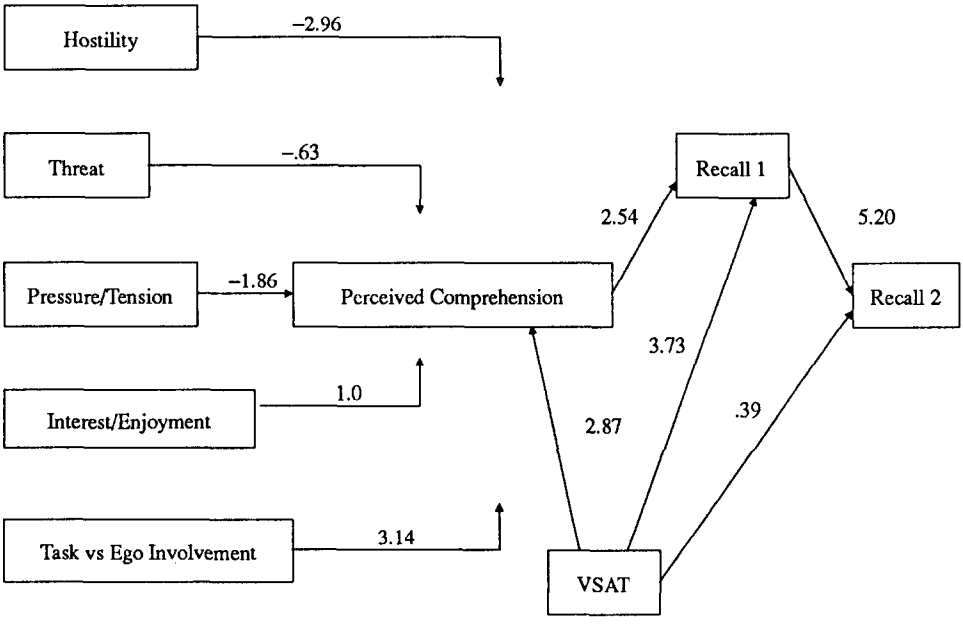
Again using only the data from Study 2 the direct and indirect effects of the emotion/motivation variables and perceived comprehension on Recall 1 and Recall 2 were estimated using the multiple regression procedure described earlier. Ratios of regression coefficient to their standard errors for each of the hypothesized paths and for direct effects exceeding 1.5 times their standard errors are shown in Figure 2. The R^2 values for the three endogenous variables were: .40 for perceived comprehension, $p < .001$; .22 for Recall 1, $p < .002$; and .49 for Recall 2, $p < .001$. Aside from some apparent sampling fluctuation in the emotion/motivation to perceived comprehension relationships, the results support the "indirect effects" model; confirm the stability of the recall measure; and highlight the role of the task- versus ego-involvement measure in the pattern of influences. The overall test of goodness of fit for the indirect effects only model was nonsignificant, $X^2 = 12.82$, df = 16, $p < .69$, indicating a good fit to the data.

Finally, in Study 2, we examined whether verbal aptitude as measured by VSAT scores was related to the emotion/motivation dimensions, perceived comprehension and the two recall measures; and, more specifically, whether the influence of VSAT on each class of variables would alter the paths in the direct effects.

VSAT was significantly correlated with task- versus ego-involvement, $r = .25$, $p < .05$; perceived comprehension, $r = .31$, $p < .01$; Recall 1, $r = .49$, $p < .001$; and Recall 2, $r = .33$, $p < .01$. VSAT was entered into the path model as a direct effect on each of

FIGURE 3

Path model of relations between emotion/motivation variables, perceived comprehension, and two recall measures, and VSAT (n = 68)



Note: Values on path diagram represent path coefficients divided by their standard errors.

the three endogenous variables along with the significant direct effect predictors specified in the "indirect effects only" model. VSAT was found to have a unique and significant direct effect on perceived comprehension and Recall 1 but not on Recall 2. All hypothesized paths in the "indirect effects only" model remained at similar magnitudes relative to their standard errors. The final model including the VSAT direct effects is shown in Figure 3. The overall goodness-of-fit of this model was $X^2 = 15.27$, df = 17, $p < .58$, again indicating good fit to the data. These results demonstrate that the hypothesized influences remain present even when one controls for the effects of VSAT on the other variables in the model.

DISCUSSION

The present studies assessed emotional processes associated with nondirected learning. Operationally, nondirected learning was defined as learning which occurred in the absence of apparent external inducement, direction, or set. By employing the term nondirected, as opposed to the more traditional term "incidental," we hoped to convey that such learning is neither accidental nor haphazard, and we hypothesized that it would in fact systematically relate to emotional states.

Results of the current study support the notion that motivational and emotional factors can play a significant role in the determination of nondirected learning. As specified in our derived models, measures of "interest-enjoyment" and "task-involvement" were each positively associated with recall, while negative emotions, particularly hostility, were negatively related to recall. Emotions also related directly to experienced comprehension of the text, which in turn directly predicted subsequent recall. Negative emotions generally had the opposite impact on perceived comprehension and thus on recall. This pattern of influences was maintained even when the effects of verbal ability per se were taken into account.

The particular emotional/motivational states experienced by subjects in this study were neither induced nor controlled. Factors which led students to feel "interest," "pressured," or "hostile" while reading these materials were not a focus of investigation. We speculate, however, that many of the same factors known to facilitate interest or intrinsic motivation in other settings would also facilitate performance on nondirected learning, while alternatively those factors which undermine interest would inhibit such performance (Ryan, Connell, & Deci 1985). A comparison of facilitative versus inhibitory sets of nondirected learning on learning processes and outcomes would be a reasonable next step in this research. Furthermore, a comparative assessment of the influence of internal states on nondirected versus directed learning situations is also warranted.

The path models presented were developed for descriptive purposes, that is, to most appropriately and parsimoniously display the interrelations among variables. The model analytically separates, for example, experienced comprehension and emotional states, when in fact both are appraisals or reactions to the reading task. Causal relations between comprehension and emotions are best construed as reciprocal.

Finally, we have made no attempt to investigate the cognitive mechanisms

through which motivational and emotional processes can be assumed to operate. Undoubtedly there are a variety of such cognitive factors that exert influence on recall outcomes. We assume that greater involvement and interest on the part of subjects leads to more elaborate and deeper processing (Brewer & Nakamura 1984; Craik & Tulving 1975; Reder 1980).

The present study, despite its limitations, demonstrated that factors influencing nondirected learning for meaningful verbal material can be investigated using the recall paradigm developed for this study. Second, the results suggest that the human information processor is indeed, as Norman (1980) stated, *not* an artificial intelligence, but rather an animate being whose epistemic activity is embedded in a system of interacting (and possibly regulating) motives and emotions. Further, the study underscores the notion that learning can occur without specific external direction and can be related in such instances to motivational factors. Continued study of nondirected learning may lead to increased understanding of learning in natural contexts (Neisser 1982), as well as in more structured educational contexts (e.g., Grolnick & Ryan 1987), and eventually to a fuller organismic epistemology.

ACKNOWLEDGMENT: Support provided by the Office of Naval Research under Contract N000014-76-C-001 with the Center for Naval Analysis of the University of Rochester.

NOTE

1. The positive affect dimension was excluded from this and all subsequent analyses due to its lack of significant relations to the outcome variables in Study 1 and in the combined sample.

REFERENCES

Ausubel, D.P. (1963). *The psychology of meaningful verbal learning.* New York: Grune & Stratton.

Bahrick, H.P., Fitts, P.M., & Rankin, R.E. (1952). "Effects of incentive upon reactions to peripheral stimuli." *Journal of Experimental Psychology, 44,* 400–406.

Bartlett, F.C. (1932). *Remembering: A study in experimental and social psychology.* London: Cambridge University Press.

Benware, C., & Deci, E.L. (1984). "Quality of learning with an active versus passive motivational set." *American Educational Research Journal, 21,* 755–765.

Brewer, W.F., & Nakamura, G.V. (1984). "The nature and functions of schema." Vol. 1, pp. 119–160 in R.S. Wyer & T.K. Srull (Eds.), *The handbook of social cognition.* Hillsdale, NJ: Erlbaum.

Craik, F.I.M., & Tulving, E. (1975). "Depth of processing and the retention of words in episodic memory." *Journal of Experimental Psychology: General 104,* 268–294.

Csikszentmihalyi, M. (1975). *Beyond boredom and anxiety.* San Francisco: Jossey-Bass.

deCharms, R. (1968). *Personal causation: The internal affective determinants of behavior.* New York: Academic Press.

Deci, E.L., & Ryan, R.M. (1985). *Intrinsic motivation and self-determination in human behavior.* New York: Plenum.

Engle, J.S. (1904). *Analytic interest psychology and synthetic philosophy.* Baltimore, MD: King Brothers.

Enzle, M.E., & Ross, J.M. (1978). "Increasing and decreasing intrinsic interest with contingent rewards: A test of cognitive evaluation theory." *Journal of Experimental Social Psychology, 14,* 588–597.

Greenwald, A.G. (1981). "Self and memory." *The Psychology of Learning and Motivation, 15,* 201–236.

Grolnick, W.S., & Ryan, R.M. (1987). "Autonomy in children's learning: An experimental and individual difference investigation." *Journal of Personality and Social Psychology, 52,* 890–898.

Harackiewicz, J. (1979). "The effects of reward contingency and performance feedback on intrinsic motivation." *Journal of Personality and Social Psychology, 37,* 1352–1363.

Izard, C. (1977). *Human emotions.* New York: Plenum.

Izard, C.E., Dougherty, F.E., Bloxom, B.M., & Kotsch, W.E. (1974). *The differential emotions scale: A method of measuring the subjective experience of discrete emotions.* Unpublished manuscript, Vanderbilt University.

James, W. (1890). *The principles of psychology.* New York: Holt.

Johnson, R., & Thomson, C. (1962). "Incidental and intentional learning under three conditions of motivation." *American Journal of Psychology, 75,* 284–288.

Joreskog, K.G., & Sorbom, D. (1984). "LISREL VI: Analysis of linear structural relationships by the method of maximum likelihood, instrumental variables and least square methods." Mooresville, IN: Scientific Software.

Kintsch, W. (1974). *The representation of meaning in memory.* Hillsdale, NJ: Erlbaum.

Kirsch, I., & Guthrie, J. (1984). "Adult reading practices for work and leisure." *Adult Education Quarterly, 34,* 213–231.

Klaver, K.J. (1984). "Intentional and incidental learning with instructional texts: A meta-analysis for 1970–1980." *American Educational Research Journal, 21,* 323–340.

Lewis, H.B. (1971). *Shame and guilt in neurosis.* New York: International Universities Press.

McDougall, W. (1908). *Social psychology.* New York: Luce & Co.

McGeogh, J.A. (1942). *The psychology of human learning.* New York: Longmans Gren & Co.

McNamara, H.J., & Fisch, R.I. (1964). "Effects of high and low motivation on two aspects of attention." *Perceptual and Motor Skills, 19,* 571–578.

Mowrer, O.H. (1960). *Learning theory and behavior.* New York: John Wiley.

Neisser, U. (1982). *Memory observed: Remembering in natural contexts.* San Francisco, CA: Freeman & Co.

Norman, D.A. (1980). "Twelve issues for cognitive science." *Cognitive Science, 4,* 1–32.

Piaget, J. (1981). *Intelligence and affectivity: Their relationship during child development.* Palo Alto, CA: Annual Reviews, Inc.

Plant, R., & Ryan, R.M. (1985). "Intrinsic motivation and the effects of self-consciousness, self-awareness, and ego-involvement: An investigation of internally controlling styles." *Journal of Personality, 53,* 435–449.

Postman, L., & Keppel, G. (1970). *Verbal learning and memory.* Baltimore, MD: Penguin Books.

Postman, L., & Senders, V.L. (1946). "Incidental learning and generality of set." *Journal of Experimental Psychology, 36,* 153–165.

Reder, L.M. (1980). "The role of elaboration in the comprehension and retention of prose: A critical review." *Review of Educational Research, 50,* 5–53.

Ryan, R.M. (1982). "Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory." *Journal of Personality and Social Psychology, 43,* 450–461.

Ryan, R.M., Connell, J.P., & Deci, E.L. (1985). "A motivational analysis of self-determination and self-regulation in education." Pp. 13–51 in C. Ames & R.E. Ames (Eds.), *Research on motivation in education: The classroom milieu*. New York: Academic Press.

Ryan, R.M., Mims, V., & Koestner, R. (1983). "Relation of reward contingency and interpersonal context to intrinsic motivation: A review and test using cognitive evaluation theory." *Journal of Personality and Social Psychology, 45*, 736–750.

Ryan, T.A. (1981). "Intention and kinds of learning." Pp. 59–84 in G'Ydewalle & W. Lens (Eds.), *Cognition in human motivation and learning*. Hillsdale, NJ: Erlbaum.

Schwartz, B., & Lacey, M. (1982). *Behaviorism, science, and human nature*. New York: Norton.

Tomkins, S.S. (1962). *Affect, imagery, consciousness. Vol. I. The positive affects*. New York: Springer.

Wackwitz, J.H., & Horn, J.L. (1971). "On obtaining the best estimates of factor scores within an ideal simple structure." *Multivariate Behavioral Research, 6*, 3889–3408.

Woodworth, R.S. (1918). *Dynamic psychology*. New York: Columbia University Press.

Zajonc, R.B. (1980). "Feeling and thinking: Preferences need no inferences." *American Psychologist, 35*, 151–175.