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The Influence of Motivational Orientation on Comprehension Monitoring

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The Influence of Motivational Orientation on Comprehension Monitoring

By

Joshua Leon Callman

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DISSERTATION

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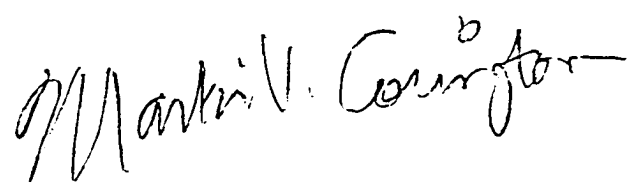
The Influence of Motivational Orientation on Comprehension Monitoring

by

Joshua L. Callman

Abstract

This study investigated that relationship between motivational orientation and comprehension monitoring while studying. It was hypothesized that relatively learning-oriented students would exhibit better comprehension monitoring than relatively performance-oriented students. Data was also collected on several other factors that might be related to both comprehension monitoring and motivation, such as comprehension, self-concept, and general ability. It was found that comprehension monitoring was positively related to learning goal orientation, but unrelated to performance goal orientation. However, subjects who scored relatively high for learning goal orientation and low for performance orientation were not significantly better at comprehension monitoring than their counterparts who were relatively high in performance goal orientation and low in learning goal orientation.



The Influence of Motivational Orientation on Comprehension Monitoring

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to my parents

Table of Contents

I. Introduction

Motivation is a theoretical construct that accounts for the direction and intensity of behavior. Thus, motivation is defined functionally by the observable behavior that it causes. Beliefs, emotions, and cognitive processes are implicated to be involved in motivation by the behavior that they are presumed to impel.

If two people tried hard at a task for a long period of time, they both might be said to be highly motivated. However, since motivation is a concept that describes the internal cognitive and affective processes that caused the behavior, and not the behavior itself, it would be incorrect to assume that their motivation was identical because their outward actions appeared the same. Simply stated, these two persons might have highly divergent reasons, or motives, for their effort and perseverance.

Given two students with approximately equal background knowledge and ability, if one puts more effort and time into studying, it is likely that he or she will achieve more in school. However, different students might try just as hard as each other, yet have very different reasons for learning. It is important for educators to know whether such qualitative differences in student motivation influence academic performance. Does it matter whether a student learns to avoid parental punishment or to attain a promised monetary reward? Or, does it matter whether a student studies even though he hates the subject matter but needs good grades to get into medical school, or because he just happens to be interested in a subject area? What are the effects of studying to show how smart one is as opposed to studying to prove that one in not unintelligent?

Motivational tools, such as rewards and threats, may be efficacious at facilitating academic performance in the short-term. Over a period of time, however, some students may refuse to open a book without the promise of a reward. Others may eventually come to perceive learning as a form of punishment. Therefore, the long-term effects of some types student motivation may be quite different from their short-term consequences. Yet, aside from personal anecdotal histories, the long-term effects of qualitative differences in student motivation are virtually unknown. Even without longitudinal studies, however, there is a growing body of evidence that indicates that qualitative differences in student motivation have an immediate and significant impact on how students learn.

A. The Present Study

The conceptual framework of "goal orientation" has provided one way in which qualitative differences in student motivation have been shown to influence the process of learning. Students who learn in order to gain positive judgements and avoid negative judgments of competence possess a "performance" goal orientation (Dweck, 1986). On the other hand, students whose main concern when learning is to increase competence have a "learning" goal orientation. Since their primary interest is the task itself, and not how well their performance will be evaluated, learning oriented subjects are often referred to as "task-involved". On the the other hand, since performance oriented students, are mainly concerned with how they will be evaluated, they are also called "ego" or "performance-involved".

Task and performance-involvement should not be construed as isolated psychological characteristics. They are better understood as part of a

greater network of the beliefs, attributions, expectations, and affect of individual students. For example, the belief that ability is malleable, or an incremental conception of ability, is regarded as a precursor to having a learning goal orientation (Dweck, 1986). Task-involvement is also associated with the tendency to make effort-related attributions for academic successes and failures (Ames and Ames, 1984b). These factors are not permutations of psychological variables that have been randomly thrown together, but are logically related to each other. Self-improvement is a viable goal for those who believe that they have a reasonable chance of improving themselves. Whether improvement takes place or not depends on the effort that is made. A similar rationale connects performance goal orientation with having an entity conception of ability and the tendency to make ability-related attributions. Students who believe that their skill will not substantially improve are left with the goal of attaining high evaluations of that ability, or avoiding low evaluations if they have a low self-concept of their ability. For these students, evaluations reflect mainly on ability, and not effort. In fact, the less effort to attain a particular result, the more ability they would appear to have relative to others who put in more effort to attain that result.

Task-involved students have been shown to engage in more self-instructions and self-monitoring cognitions (Ames, 1984). It has also been demonstrated that they tend to be more self-directed and are more likely to be able to transfer what they have learned to new situations (Farrell and Dweck, in press). In contrast, performance oriented students don't value learning for its own sake, but in order to achieve some other goal. Their motive in learning, therefore, is to be able to show all the necessary symptoms of having learned for whatever goal they have in mind. In achieving that end, they depend on externally imposed guidelines to direct their effort. Consequently,

this motivational orientation has been shown to be associated with relatively shallow-level learning strategies (Nolen, 1988).

The central underlying assumption of the present study is that these earlier results suggest that an important way in which qualitative differences in student motivation influence academic achievement is by their effect on student self-regulation (Lepper, 1988). In other words, qualitative differences in student motivation affect self-regulatory or metacognitive processes, such as planning, checking, and monitoring, which control when and where more specific cognitive processes will be enacted when students are trying to learn and solve problems. Yet, there exists only the bare bones of a model documenting the relationship between student motivation and the process of learning. The purpose of this study, therefore, is to extend and elaborate upon this pre-existing conceptual base by collecting data to estimate the relationship between students' motivation and one relatively well-defined aspect of their self-regulatory study activities, comprehension monitoring.

This study employed the taxonomy of comprehension monitoring standards developed by Baker (1984, 1985a, 1985b). Baker's perspective is that it is desirable to study comprehension monitoring as a multidimensional trait. She has proposed three basic standards by which persons can evaluate their understanding: lexical, syntactic, and semantic. Lexical standards of comprehension monitoring are applied in the evaluation of individual words. The syntactic standard involves the evaluation of what makes sense grammatically. Lastly, the semantic standard of comprehension monitoring, which itself has multiple facets, "requires consideration for the meanings of individual sentences and the text as a whole" (Baker, 1985b, p. 156).

Like most previous investigations on comprehension monitoring (for reviews, see Baker, 1985b; Markman, 1981; Wagoner, 1983) the present study

also measured students' awareness of errors intentionally introduced in text. Student motivation was varied by two techniques. First, subjects were preselected for this study on the basis of a motivational questionnaire that indicated that they tended to be either relatively highly task involved or relatively more performance involved. Secondly, groups of subjects were studied in one of two experimental conditions. One experimental condition was intended to be performance involvement enhancing while the other was intended to deter performance involvement.

To provide a more complete picture of the dynamics of the interaction between motivational orientation and academic performance, other potentially relevant variables were also measured. These other factors included comprehension of the same essay that was being used to measure comprehension monitoring, academic ability, and academic self-concept.

B. Hypotheses

The main hypothesis of this study was that subjects who are more highly task-involved engage in a higher degree of self-regulatory cognitive processes when studying an essay relative to subjects who are more performance-involved. Task-involved subjects should, thereby, exhibit a greater tendency to be better at comprehension monitoring. Several ancillary hypotheses follow from this central prediction:

First, the influence of motivational orientation on comprehension monitoring should be greater for those types of comprehension monitoring that require a greater depth of self-regulatory cognitive processing. Discovering internal and external inconsistencies, which necessitate keeping two facts in mind and comparing them for contradictions, is presumed to be

more cognitively demanding than detecting lexical errors, which only necessitates staying sufficiently aware of the text to parse for nonsense words. Thus comprehension monitoring for internal and external inconsistencies is hypothesized to be more influenced by motivational orientation.

Secondly, the increased depth of self-regulatory cognitive involvement with the text that leads to better comprehension monitoring should also lead to better text comprehension. Therefore, relatively higher task orientation should be associated with higher comprehension. Again, this effect should be more significant for those measures of comprehension that rely on an increased level of self-regulatory cognitive interaction with the text. In other words, rote memory of facts is less likely to be influenced by task involvement than synthesis of concepts from within the essay or transfer of concepts from the essay to a new situation.

Finally, other researchers have indicated that task orientation is associated with incremental conception of ability and effort-related attributions. It then follows that relatively high scores for incremental conception of ability and tendency toward effort-related attributions should be associated with increased comprehension and comprehension monitoring, just as task orientation.

II. Background

In recent years researchers have distinguished distinctive patterns of student beliefs, attributions, affect, and expectations that are associated with qualitatively different types of student motivation. A key issue for educators is how these cognitions are related to different performance outcomes. The underlying hypothesis of the present study is that an important way in which qualitative differences in student motivation influence academic achievement is by their effect on student self-regulation. In other words, qualitative differences in student motivation affect self-regulatory or metacognitive processes, such as planning, checking, and monitoring, which control when and where more specific cognitive processes will be enacted when students are trying to learn and solve problems.

To measure the relationship between self-regulation and motivation, this study concentrated on the motivational characteristics associated with the concept of goal orientation. Yet, evidence that supports the proposed connection between student motivation and student self-regulation from various other sources within the educational and psychological literature should not be disregarded. Therefore, the following overview will survey three general areas of research that have provided evidence relevant to the connection between motivation and self-regulation.

The first area of research is the study of student motivation itself. Several workers in this field have investigated the effects of differences in student motivation on the application of problem-solving and study strategies in the classroom environment. Moreover, the discussion of this area of background knowledge is of particular relevance to the present study

because it will explain how the concept of goal orientation is related to other similar motivational conceptualizations. Secondly, there is the work of researchers who are primarily concerned with self-regulatory processes, but have implicated motivational factors in their analyses of antecedent conditions that are necessary to bring about educationally desirable metacognitive results. Finally, a third area of investigation linking student motivation with student self-regulation is represented by the results of studies correlating students' motives with qualitative aspects of their approaches to learning and studying by several European and Australian workers.

A. Motivational Research

One feature of school environments that has been reported to have substantial effects on student achievement and motivation is classroom goal structure. As defined by Ames and Ames (1984a, p. 39) goal structure "refers to how students are evaluated in relation to each other and to a goal". In classrooms with competitive goal structures students work against each other toward some objective. Noncompetitive goal structures may be cooperative, in which "students work with each other for a common goal", or individualistic, where "students work toward independent goals" (Ames and Ames 1984a, p. 39).

Environments with competitive goal structures force students to compare their accomplishments with each other. This enhances students concerns with performing well in order to demonstrate high ability (Ames and Ames, 1984a, 1984b). In settings with individualistic goal structures, "students are focused on the task" (Ames and Ames, 1984b, p. 539), or are task-involved.

The objectives of these task-involved students are self-referenced, or judged with respect to their own previous achievements. Hence, they tend to employ a conception of ability that implies that self-improvement is possible (Jagacinski and Nicholls, 1984; Nicholls, 1984a, 1984b; Nicholls and Miller, 1984). Also, in individualistic environments, "effort or trying is perceived as the route to mastering the task" (Ames and Ames, 1984b, p. 539). In contrast, when goal structures are competitive, knowing that one has improved does not provide adequate information by which ability can be judged. The competitor still needs to know how everyone else did. Since some students may not be able to do better than others, no matter how hard they try, competitive goals tend to promote the belief that ability with respect to the task at hand is relatively stable (Jagacinski and Nicholls, 1984; Nicholls, 1984a, 1984b; Nicholls and Miller, 1984). Those with high ability do well while those with less ability are relegated to second or third-class scholastic status. Furthermore, competitive situations also augment the perception that effort, instead of being a pathway to success, is a compensation for a lack of ability.

The motivational differences between competitive and cooperative environments described above are well summarized by Dweck's concept of "goal orientation". Those who learn "to gain positive judgements" and "avoid negative judgements of competence" possess a "performance" goal orientation (Dweck, 1986, p. 1040). Thus, performance goal orientation describes the motivational state that tends to be promoted by a competitive goal structure. On the other hand, students whose main concern when learning is to "increase competence", as would be expected in individualistic environments, have a "learning" goal orientation (Dweck, 1986, p. 1040). The parallels between different goal structures and different goal orientations also extends to students perceptions of the stability of ability. An "entity" theory of

ability, or belief that intelligence is fixed is believed to be a precursor to a performance goal orientation (Dweck, 1986, p. 1041). An "incremental" theory of ability, or belief that intelligence is malleable, is thought to promote a learning goal orientation (Dweck, 1986, p. 1041). It is important to note, however, that the connection between particular goal structures, which are external environmental characteristics, and particular goal orientations, which are internal motivational states, are not ironclad. As Ames and Ames (1984a, 1984b) have pointed out, it is quite possible for individualistic goal structures to have motivational consequences that are very similar to those of competitive goal structures (i.e., they can also promote performance goal orientations in students). This functional similarity apparently occurs when external standards and interpersonal comparisons are made salient.

Differences in goal structure and goal orientation are not only associated with differences in student motivation (Block, 1984; Covington, 1984; Dweck, 1986), but also lead to differences in students' academic behaviors that are logically consistent with the differences in motives for learning that are engendered by these conditions. Competitive students, who are trying just to get high scores, depend on externally imposed guidelines to direct their effort. They tend to act as passive recipients of information. Task-involved non-competitive students, who associate academic success with increased understanding (Nicholls, et al., 1985), tend to employ volitional self-regulatory learning processes that facilitate increased comprehension. For instance, Nolen (1988, p. 270) compared the application of deep-level processing strategies and surface-level processing strategies of task-involved students with students who had "the desire of superior performance of a task relative to other people", which she referred to as exhibiting "ego-orientation". She considered deep-level strategies to include "discriminating important

information from unimportant information, trying to figure out how new information fits with what one already knows, and monitoring comprehension", while surface-level strategies involve "simply reading the whole passage over and over, memorizing all the new words, and rehearsing information" (Nolen 1988, p. 271). As expected, Nolen found that deep-level strategies were positively related to task-involvement while ego-oriented students tended to use only surface-level strategies.

There have been several other studies that provide data that are consistent with these results. Carol Ames (1984), for example, reported that, in individualistic settings, students engaged in self-instruction and self-monitoring cognitions more than students in competitive situations. Russell Ames (1983) provided evidence that students in competitive environments tend to ask for less assistance than noncompetitive students. Also, Farrell and Dweck (in press) found substantially greater transfer for learning oriented students than for performance oriented students for a physical science instructional unit.

To summarize, differing goal orientations provide students with different rationales for learning and, thereby, different relationships with the subject matter to be learned. In a competitive goal structure environment learning is valued only for the sake of attaining high evaluations. Whether students succeed or fail depends on whether they receive high or low grades, not whether they have learned or not. There is no reason to learn anything beyond what is expected to be on the test or to be concerned with retaining the subject matter after the final exam is over. Students will rely on externally imposed guidelines to figure out what they need to "absorb". In contrast, in noncompetitive situations, or when students don't have to be so concerned with how they are doing relative to everyone else in their class, learning can

be its own reward. Learning is not done to perform, but to do or to understand something. Here, there is no detachment of learning from ability. Learning is what builds ability. These students should also tend to be relatively more likely to employ internal standards to judge what has been accomplished and what has yet to be done. Thus the employment of self-regulatory processes, which involve both the use of internal standards and engagement in the task beyond what is explicitly specified as part of the goal, would tend to be facilitated by these conditions.

Besides goal structure and goal orientation, another approach to motivation, that centers on cognitive differences mediated by intrinsic and extrinsic motives for learning, has also produced results that are relevant to this discussion. Similarly to both having a learning goal orientation or working within an noncompetitive goal structure, intrinsic motivation, or learning something because you want to instead of because you have to, has been shown to have beneficial effects on academic achievement (Asher, 1980; Benware and Deci, 1984). However, unlike either of these other motivational constructs, self-determination in goal-setting is an inherent implication of intrinsic motivation (Deci and Ryan, 1986). Nonetheless, all three of these motivational approaches share the common consequence of promoting self-referent standards in judging progress towards goals. In fact, Butler and Nisan (1986) found intrinsic motivation of students to be higher when given task-relevant feedback (learning goal conditions) as opposed to normally distributed numerical grades (performance goal conditions). As recognized by Dweck (1985, p. 296), "a critical ingredient in eliciting and enhancing intrinsic motivation could be an emphasis on learning goals".

The qualitative differences between intrinsically and extrinsically motivated students seems to parallel the differences in self-regulation re-

ported to be caused by goal structure or goal orientation. For example, in their studies Condry and Chambers (1978) found that, like students with learning goal orientations, intrinsically motivated students were "focused on the way to solve the problem rather than the solution" (p. 69). These students showed a greater degree of self-involvement and and self-control over skills that led to "more careful, logical, and coherent in their problem-solving strategies" (Condry and Chambers, 1978, p. 69). Meanwhile, like performance oriented students, those who were extrinsically motivated were more "answer oriented" and preferred "performance rather than progress" (Condry and Chambers, 1978, p. 68). These students made less efficient use of information and available resources and required more information for a solution. Overall, Condry and Chambers (1978, p.74) concluded that the process of learning when extrinsically motivated was "other initiated, other directed, and other terminated" while, when intrinsically motivated, it was "self initiated, self directed, and self terminated". These results are also consistent with Butler and Nisan's (1986) demonstration of a lack of efficacy by extrinsically motivated students when tasks require a higher degree of regulation of problem-solving strategies. They showed that, while intrinsically and extrinsically motivated students did equally well on a straightforward "quantitative" task (doing anagram-like problems), intrinsic motivation was associated with higher scores on divergent thinking measures. Thus, Butler and Nisan (1986, p. 215) concluded that, by fostering extrinsic motivation, grades "may encourage an emphasis on quantitative aspects of learning" and "depress creativity".

These data have led theorists concerned with intrinsic motivation to postulate that this factor may well affect student's "depth-of-involvement" (Lepper and Malone, 1987, p. 270). A plausible explanation for this connection

was offered by Kruglanski. He proposed that extrinsic motivation leads to continuous analysis of the situation to determine what activities are not "absolutely indispensable to goal attainment" (Kruglanski, 1978, p. 95). These purportedly nonessential activities can then be curtailed or discontinued. In other words, extrinsic motivation promotes trying to attain goals by doing as little as possible.

Before concluding this section, one aspect of the cognitive constructs involved in motivation that were discussed above, and will be of empirical importance for the study that will be described later, should be mentioned. This is that concepts such as intrinsic and extrinsic motivation, as well as performance and learning goal orientation, are not mutually exclusive personal attributes. For instance, students can learn because they both have to and because they want to. Similarly, students can be interested in the subject matter in addition to being concerned with getting good grades. Therefore, measurement methods cannot assume that a high score for one factor necessarily indicates a low score for its complementary factor. In other words, high intrinsic motivation does not imply low extrinsic motivation.

B. Metacognition and Self-Regulation

Like motivation, metacognition is a rather chimeric concept that encompasses several related, and sometimes overlapping, theoretical subtopics. The two general areas within metacognition distinguished by Brown (1987) are self-awareness of cognitive processes and the self-regulation of these processes. Self-regulation is considered to include such non-domain specific processes as planning, organizing, rehearsing, checking, and monitoring. Much has been written about the informational requirements for the em-

ployment of these mental activities in learning. These include the knowledge that is required to execute a particular form of self-regulation, as well as knowledge of the efficacy and appropriateness of that operation in particular situations. However, possession of the informational requirements alone does not guarantee that someone will actually use a self-regulatory process. That is, someone may know how to execute self-regulatory study strategy, and also that that strategy would be useful and effective in his or her current situation, but still not use it as extensively as this knowledge would seem to dictate. Such circumstances can be explained, however, by the invocation of motivational factors. For example, Brown (1978, p. 81) mentioned "feelings of competence" as a factor that has a significant influence on self-evaluation, and thereby, on metacognition. Or, as Flavell (1987, p. 26) wrote "developing sense of the self as an active cognitive agent and as the causal center of one's own cognitive activity", or "an internal locus of cognitive control", "could promote the monitoring and regulation of one's own cognitive enterprises". Moreover, there is evidence that the influence of motivation on self-regulation extends beyond perceptions of competence and control. Kuhl and Wassiljew (1985), for example, found that, when playing a game, subjects who were high in intrinsic task-involvement tended to generate action plans that were more complex than subjects who were low in task-involvement.

Yet, it would be inaccurate to characterize theorizing about the relationship between self-regulatory study strategies and motivation as concerned only with the influence of motivation on self-regulation. There has been equal, if not greater, emphasis on the reciprocal aspect of this connection, the effects of self-regulation on motivation. For example, Covington (1983, p.157) advocated a "strategic self-management approach to achievement", involving "self-conscious planning, organizing, and the orchestration of one's personal

resources such as ability", because of the motivational advantages that would accrue via students' "increased sense of personal control" over their learning. Corno and Mandinach (1983, p.89) posited that the self-regulatory processes of "cognitive engagement", such as "selective attention, personal standard setting, and self-observation during the task", are "critical to the onset and maintenance of student motivation in classrooms.". Similarly, Corno and Rohrkemper (1985, p. 58) theorized that as students "learn to use the social, academic, and personal resources available to them, or become "self-regulated learners", aspects of intrinsic motivation will then follow.

Finally, some theorists have addressed the bidirectionality of causality that emerges from considering both the influence of motivation on self-regulation and the influence of self-regulation on motivation. McCombs (1984, p. 200), for example, postulated that "self-control of learning is a function of the student being motivated to, and having the skills and abilities to take personal responsibility for his or her own learning" and "it is necessary for students to know themselves, what's important to them, and their learning competencies and abilities", or possess "metacognitive self-awareness", in order to maintain intrinsic motivation to learn. Thus, there is a "recursive and reciprocal relationship" between the processes involved in motivation and self-regulation (McCombs, 1986). Ames (1987) also perceived student self-regulation as closely tied to the motivational construct of self-efficacy:

> "How self-regulatory processes are used depends on the students' sense of personal competence in a somewhat reciprocal manner. While perceptions of competence are viewed as necessary precursors to the effective use of self-regulatory skills, training children in self-regulatory skills is also regarded as a way in which students can gain a sense of competence" (p. 129).

The studies that have considered the relationship between metacognition and learned helplessness highlight the bidirectional nature of the connection between self-regulation and motivation. The potential effects of

metacognition on motivation was demonstrated by Cullen (1985). She showed that providing metacognitive strategies for coping with failure helped avert the manifestation of learned helplessness in learning disabled boys. On the other hand, a reciprocal pattern of causation was discovered by Diener and Dweck (1978). They found that helpless students engaged in fewer self-monitoring and self-instruction cognitions than mastery-oriented students.

Other studies that reflect an awareness of the complex and bidirectional interconnections between motivation and self-regulation include those by Kurtz and Borkowski (1984) and Borkowski and Krause (1985). In the former, it was found that students' with attributional styles that were effort-related, as opposed to those that tended toward ability or task-related causes, showed greater strategy use and higher metamemory. However, since attributions were measured after metamemory and strategy training, the extent to which effort-related attributional style was the cause or effect of effective strategy use was unclear. The second study, therefore, was intended to clarify the effect of attributions as antecedents of metacognitive training. In this study, children were taught an elaboration strategy for remembering paired-associates. It was found that "attributional beliefs about effort were apparently precursors of strategy use at transfer rather than the result of it" (Borkowski and Krause, 1985, p. 563).

Finally, the interdependence of self-regulation and motivation is also indirectly evidenced by two noticeable parallels between these two areas of study. First, there are strong resemblances between many of the factors that are used as experimental variables in both motivation and metacognition (Weinert, 1987). Secondly, there seems to be a certain degree of inseparability of the metacognitive processes and motivational conditions that are

important in the promotion of student learning. As Corno and Mandinach (1983, p. 89) observed there is a general convergence in theories of learning and theories of motivation in identifying processes such as "selective attention, personal standard setting, and self-observation during the task" as important. Or, as McCombs' (1984) pointed out, self-control is a key consideration in current conceptualizations of both learning and of motivation. Also, Collins et al. (in press) have acknowledged the importance of making learning meaningful, useful, and intrinsically motivating in facilitating the development of expertise. In sum, there is an apparent correlation between desirable metacognitive processes and desirable motivational conditions. They both direct students to become more involved in the process of learning, as opposed to the product of learning. The students' goals, then, are not just to learn or solve problems, but also to be effective learners and problem-solvers.

C. Research on Approaches to Learning

The investigations of various European and Australian workers on the relationships between student motivation, instructional context, and approach to learning also provide relevant background data. The earliest of these studies, those of Marton and Saljo (1976a, 1976b), used qualitative clinical interview techniques to show that differences in learning outcomes between students can be traced back to qualitative differences in student approaches to learning. They identified two distinguishable approaches to learning from their interviews with students, surface-level and deep-level approaches. The surface level approach "was characterized by a blind, spasmodic effort to memorize the text; these learner seemed, metaphorically

speaking, to see themselves as empty vessels, more or less, to be filled with the words on the pages" (Marton and Saljo, 1984, p. 40). When using the surface-level approach "the student directs his attention towards learning the text itself (the sign), ie., he has a 'reproductive' conception of learning which means that he is more or less forced to keep a rote-learning strategy" (Marton and Saljo, 1976a, p. 7). In contrast, the deep-level approach was characterized by a complementary set of student intentions, study strategies, and relationships between the learner and the material to be learned. For instance, the deep-level approach student "is directed towards the intentional content of the learning material (what is signified), ie., he is directed towards comprehending what the author wants to say about, for instance, a certain scientific problem or principle" (Marton and Saljo, 1976a, p. 7). In order to achieve this objective, deep-level students "tried to understand the message by looking for relations within the text or by looking for relations between the text and phenomena of the real world, or by looking for relations between the text and its underlying structure" (Marton and Saljo, 1984, p. 40). Thus, deep-level approach students "seemed to have seen themselves as creators of knowledge who have to use their capabilities to make critical judgements, logical conclusions, and come up with their own ideas" (Marton and Saljo, 1984, p. 40). The divergent intentions inherent in deep and surface-level approaches to learning thus lead to different learning processes, and thereby, different learning outcomes. Therefore, a key conclusion from this work is that there is strong coordination between student intentions and student learning processes. As Marton and Saljo (1984, p. 39) wrote, that in reading text *"students who did not get "the point" failed to do so simply because they were not looking for it"* [italics from original].

Svensson (1977) independently analyzed the data used in the Marton and Saljo studies mentioned above. He drew similar conclusions, though his terminology was a bit different. Svensson (1977) identified two approaches to learning which he called "atomistic" and "holistic". The atomistic approach was "indicated when students described their activities as involving: focusing on specific comparisons, focusing on parts of the text in sequence (rather than on the more important parts), memorizing details and direct information indicating a lack of orientation towards the message as a whole" (Svensson, 1977, p. 238). The second learning approach in Svensson's taxonomy is, again, the opposite of the first. This, holistic, approach "was characterized by students' attempts: to understand the overall meaning of the passage, to search for the author's intention, to relate the message to a wider context and/or to identify the main parts of the author's argument and supporting facts" (Svensson, 1977, p. 238). While there are detectable differences in emphasis between the conceptualizations of learning approaches deduced by Svensson and by Marton and Saljo, they are not inconsistent either with each other or with similar taxonomies developed by other workers, such as Pask (1976) [for discussions of distinctions between these formulations see Marton and Saljo, 1984; Marton, 1985; Enwistle, 1986].

Fransson (1977) hypothesized that the deep approach to learning should be associated with intrinsic motivation to learn while the surface learning approach would, in a similar way, be linked with extrinsic motivation. His intrinsically motivated experimental group consisted of first-year education students reading a passage about the examination system in their Education Department. The extrinsically motivated experimental condition consisted of sociology students directed to read the same passage and told that they would have give an oral report about the material which would be

videotaped. Interestingly, these experimental manipulations did not have the expected effect of facilitating a particular learning approach. However, when the data were re-analyzed with respect to the students' perceptions of whether they felt interested (indicating intrinsic motivation) or threatened or anxious (indicating extrinsic motivation) did lead to a conclusion that supported the initial hypothesis.

The "distinctive methodology" and "striking initial findings" of Marton, Saljo, and their coworkers were a catalyst that set in motion research using more wide ranging interviews by researchers at Lancaster, Surrey, and the Open University (Entwistle and Marton, 1984). Entwistle and his colleagues at Lancaster combined qualitative interview techniques with quantitative analyses of questionnaire data to investigate the relationships between the contrasting motivations and study methods of students (Enwistle, 1986). In general, the results of these findings were consistent with Marton and Saljo. However, evidence was obtained that indicated that there was a third major approach to learning, which was named "strategic", that was characterized by gearing learning activities in accord with the preferences of the teacher, the grading scheme, or other evaluation criteria. They found this approach to learning was linked to "achievement motivation", which they defined as motivation to attain the highest possible grades. Thus, Enwistle (1986) summarized his results:

> "The task presented by the lecturer is perceived by the student in terms of potential relevance on the one hand and of task requirements on the other. There appears to be a tension between these perceptions, analogous to the tension between visual and acoustic perceptions of surrounding. Concentration on one pushes the other into the background. Thus if a student finds the material interesting or if relevance is demonstrated by the lecturer, intrinsic motivation is aroused and the approach becomes deep - if other conditions are favourable (e.g. previous knowledge, time available). In contrast, if the task requirements are at the forefront, the task being seen as an external imposition, then the dominating motivation becomes fear of failure, and a surface approach becomes more likely. If the student is more concerned with competition or academic self-esteem, then achievement motivation

leads to a strategic approach, with an emphasis on efficient time management.".

Meanwhile, in Australia, Bigg's analyses of his motivational and study strategy questionnaire data were yielding very similar results (Figure 1). He identified three dimensions, each consisting of an associated pair of student motives and student strategies. He proposed that these results reflected "a 'psycho-logic' in how people construe their situations and what they decide to do about them" (Biggs, 1984, p. 118). In other words, students adopt a study strategy that is consistent with their motive for learning. If they are learning because they are interested in the subject, they will "find out as much as he or she can about it and work out what it all means, whether or not the student is tested on the content" (Biggs, 1984, p. 118). On the other hand, if "a student decides he or she wants only to pass, then it makes sense to the student (if not to the teacher) to rote learn only those facts and details on which the student knows (or guesses) he or she will be tested" in order to "display all the symptoms of having learned" (Biggs, 1984, p. 118). Yet, Biggs (1984, p. 119) also pointed out that students may "endorse any or all of these motives" (i.e, the dimensions are independent) .

The various studies mentioned above reached conclusions that either implicitly or explicitly imply that there is a significant connection between student motivation and student self-regulation. For example, Entwistle (1986) listed several aspects of comprehension monitoring as the defining features of a deep approach to learning. These included "relating new ideas to previous knowledge, relating concepts to everyday knowledge, relating evidence carefully to conclusions, and critically examining the logic of the argument" (Entwistle, 1986). Students that utilize these study strategies are clearly employing far more of their self-regulatory capabilities than surface

approach students who are occupied with identifying "discrete elements for tests" and memorizing "those elements without integration" (Entwistle, 1986). Biggs' discussions are particularly relevant in this regard because he is very direct in describing the connection between motivation and self-regulation. Biggs (1984, p. 118) postulated that students' "self-regulatory systems" are represented by the strategies that they adopt. In another paper, he defined "metalearning" as those subprocesses of metacognition that are involved in learning and studying in institutional setting (Biggs, 1985). He then pointed out that metalearning is "most likely to be involved with the deep approach, so that in the search for meaning, the student is aware quite self-consciously of the 'clicks' of comprehension and the 'clunks' of incomprehension" (Biggs, 1985, p. 202).

D. Summary of Background Literature

The central implication of the literature discussed above is that student motivation has a significant impact on student self-regulation. Yet, clarification is needed on both the motivational and self-regulatory sides of this emerging equation. For instance, the motivational factors that are emphasized by some workers are perceived control and self-efficacy (Ames, 1987; Corno and Mandinach, 1983; Corno and Rohrkemper, 1985; Thomas, 1980). Their general reasoning is that, in order to use a self-regulatory strategy, students must realize not only that that strategy would be useful but also that they possess the ability to apply it effectively. However, other researchers implicate intrinsic interest and perceived task usefulness as the sparkplugs of self-regulation (Biggs, 1984; Condry and Chambers, 1978; Fransson, 1977).

From this view, students' intentions in acting, or their state of task-involvement, are the key motivational antecedents of self-regulation.

Differing theoretical perspectives and areas of emphasis also confound attempts to characterize how self-regulation is affected by motivation. For example, since there is neither a definitive taxonomy of self-regulatory processes involved in learning nor standardized methodologies for their measurement, descriptions of student self-regulation by researchers range from very specific types of processes to general evidence of "self-instruction" or "self-monitoring". It is not possible to compare these descriptions cross-situationally in a very exact manner. Secondly, indirect measures, such as self-reports and different performance outcomes, have often been used as sources of evidence regarding student self-regulation. While performance outcomes do seem to indicate differences in student depth-of-processing, they, once again, do not allow precise classification and characterization of the the self-regulatory processes that were purportedly involved in their attainment. Self-reports, on the other hand, are susceptible to vagrancies in subjects' honesty, forthrightness, conscientiousness, and awareness. As a consequence of these methodological problems, as well as a simple lack of basic research, many questions about differences in self-regulatory processes that ensue from differences in motivational factors remain unanswered. For instance, the extent that specific self-regulatory processes are affected by motivation, and whether some self-regulatory processes are affected more than others, remains unclear.

A final concern that needs to be addressed is that both subjects' pre-existing individual characteristics and the situation or task that they are confronted with influence both their motivation and self-regulation. For instance, Nolen (1987) attempted to promote ego-involvement and task-in-

volvement by instructing students to study to take a test or to study to teach someone else respectively. However, she found that her subjects' own previously established motivational dispositions were more important in determining whether they actually became either ego or task-involved (As mentioned above, Fransson (1977) had the same experience). Similarly, the extent to which students engage in self-regulation is influenced not only by individual differences in ability and motivation, but also by the demands of the environment (Thomas, Iventosch, & Rohwer, in press). Therefore, caution must be taken in generalizing results across situations with different task demands.

In sum, while a general relationship between motivation and self-regulation has been outlined, the specifics of this connection remain hazy. This study was thus intended to bring one area of this picture into sharper focus. The motivational factor that was chosen as the independent variable was goal orientation. This selection was based on the observation that goal orientation seems to integrate and summarize some of the most salient aspects of other motivational variables that have been implicated as related to student self-regulation. Data was thus collected correlating student goal orientation with one relatively well-defined aspect of their self-regulatory study activities, comprehension monitoring. Comprehension monitoring has been implicated by both motivational researchers (Lepper, 1988) and metacognitive researchers (Brown, 1988) as likely to be related to motivation.

III. Materials and Methods

The present study, student motivation was varied in two ways. First, subjects were preselected on the basis of a tendency toward either a relatively higher learning-goal orientation or a relatively higher performance-goal orientation. Secondly, subjects were directed to study in one of two experimental conditions which were intended to promote divergent motivational orientations. Comprehension monitoring was then measured by collecting data on how effectively subjects detected errors in an essay on animal communication. A test of comprehension of this same essay was also administered to the subjects.

A. Subjects

Seventy-four UC Berkeley undergraduates participated in this study. These subjects were selected from the Psychology 1 subject pool in the spring semester of 1988. As described below, selection for this study was based on subjects' responses to a prescreening motivational questionnaire. The 74 subjects were approximately equally divided into four groups, with 18 or 19 subjects in each group (Figure 2). Each of these four groups was distinguished by both the motivation of its subjects and the experimental conditions in which they studied the essay. Of the subjects selected, 43 were females and 31 were males.

B. Materials

During the experiment subjects were requested to study a modified version of an article titled "Animal Communication" by E. O. Wilson (1972, also see Appendix B). The modified animal communication essay contained six lexical errors, six internal inconsistencies, and six contradictions with common everyday knowledge, or external inconsistencies. These eighteen errors were spaced throughout the text so that no more than one occurred in each paragraph and that the essay was still understandable. Lexical errors consisted of scrambled words from the original text. Internal inconsistencies were contradictions within the same paragraph of the essay.

The following are excerpts from the essay that contain examples of the three types of errors. The actual errors are shown in bold text.

Lexical Errors

1) "Nevertheless, the waggle dance, like all other forms of nonhuman communication studied so far, is severely limited in comparison with the verbal language of human **gebsin.**"

2) "This graduated form of communication is perhaps most **kistringly** developed in aggressive displays among animals."

Internal Inconsistencies

1) "The chimpanzees are also capable of learning rudimentary rules of syntax and even of **inventing short questions** and statements of their own. ... . **Nor are chimpanzees capable of generating their own questions.**"

2) "**Although they do not use scents or odors to communicate with members of their own species,** a wide range of other cues are employed to distinguish mates, offspring and in the case of social mammals the subordinate or dominant rank of the peers ranged around them. In some species of mammals special secretions are employed to **impart a personal odor signature** to part of the environment or to other members in the social group."

External Inconsistencies

1) "Lizards **raise their fur** to give an impression of greater size." [Reptiles, like lizards, have no fur.]

2) "**Certain birds of prey, such as canaries,** learn to discriminate the territorial call of their neighbors from those of strangers that occupy territories farther away." [Canaries are not birds of prey.]

As stated above, at the time of the prescreening, subjects filled out a motivational questionnaire. Several other instruments were also administered to the subjects during the experiment itself. All of these instruments are included in the appendices and are described below.

Prescreening Motivational Questionnaire

The prescreening questionnaire measured six motivational factors and academic self-concept with a seven point Likert scale (1= strongly disagree, 7= strongly agree). These six factors were learning goal orientation, performance goal orientation, concurrence with entity conception of ability, concurrence with incremental conception of ability, tendency toward effort-related attributions for academic performance, and tendency toward ability-related attributions for academic performance. This instrument contained four items to measure each motivational factor and a single item to measure academic self-concept.

The motivational items on the Prescreening Motivational Questionnaire addressed the students attitudes and beliefs about school in general. The academic self-concept item was the same as the item used by Covington and Omelich (in press, a) to measure self perception of ability. It was directed at the individuals' perception of their ability to do well in their introductory psychology class.

Concurrent Motivational Questionnaire

The Concurrent Motivational Questionnaire was very similar to the Prescreening Motivational Questionnaire. It measured the same six motivational factors with four items each and academic self-concept with a single item. However, in this case, the motivational items were not directed at subjects' beliefs and attitudes about school in general. Rather, this instrument examined the subject's motivational outlook during the experimental session, in which it was administered. In addition, the academic self-concept item was also directed locally, at subjects perception of

their ability to do well on the task that they were assigned during the experiment.

Lorge-Thorndike Vocabulary Test

This study employed a shortened Lorge-Thorndike vocabulary test, as used by Covington and Omelich (in press, b), to provide an independent measure of ability. This test consisted of an eleven item multiple-choice vocabulary test. Scoring was done on a scale from 0 to 11, depending on how many items were answered correctly.

Comprehension Test

Each subject received a set of eight questions to test his or her comprehension of the animal communication essay. Four questions were intended to test rote memory. In other words, answering these questions required only that subjects repeat facts that were presented in the text. The other four questions attempted to measure more complex problem solving skills. Two of these items asked subjects to develop a synthesis by comparing and contrasting information presented in different parts of the essay. The other two items were directed at subjects' ability to transfer data from the essay to a new situation.

The following are examples of rote memory, synthesis, and transfer items from the Comprehension Test.

Rote Memory
What is one of the features of human communication that the author claims to be likely to be traceable back to its origins in other animals?

Synthesis
Describe how courtship communication in bees and dance flies is similar and how it is different.

Transfer

The redshank is often known as the 'sentinel of the salt-marsh'. It is first to spot danger and first to raise the alarm. The redshank's alarm call is shrill. Unlike other calls, the alarm call warns not only other redshanks but also birds of other species; curlew, plovers, gulls soon follow with a chorus of concern. Suppose that you have been commissioned to study the warning communication of the redshank. What characteristics of animal communication systems would you seek to describe in your study?

When the Comprehension Tests were scored, each item was worth up to 2 points. Therefore, the highest possible score was 8 for rote memory, and 4 each for synthesis and transfer. Overall, the test was scored on a scale from 0 to 16 for all of the measures of comprehension combined.

Error Form

Comprehension monitoring was measured by finding out the extent to which the subjects identified the intentionally introduced errors while studying the essay. To accomplish this they were given an instrument, the Error Form. The Error form listed all eighteen errors and inconsistencies in the order that they appeared in the essay. Each error or inconsistency was shown emboldened within an excerpt of text from the essay. Following each excerpt, there was a brief explanation of why the emboldened text could be considered to be an error. For example:

11) "The pheromone is presad through the colony when workers lick the queen's body and regurgitate the material back and forth to one another." ["Presad" is not a word.]

The Error Form was distributed to the subjects with the following instructions. Subjects were told that they should put one of three responses after each error. First, they could mark that they detected and underlined the error when they had studied the essay. Secondly, they could note that they missed the error when studying the text. Finally, if the subjects had been aware of the error when they had studied the text, but had some explanation for why they did not underline it, they were asked to write down this

explanation. Below is an error and a typical explanation for why it may have not been underlined.

Error
"In other species the male [dance fly] wraps aluminum wire around the freshly captured offering, rendering it more distinctive in appearance, a clear step in the direction of ritualization."

Explanation
I thought that maybe they lived in garbage dumps where there were scraps of aluminum laying around.

The option of explaining why they did not underline errors was allowed to insure that subjects' failure to underline errors was truly due to a lack of comprehension monitoring and not because they figured out what they believed to be a reasonable explanation for why an inconsistency actually made sense (see Baker, 1985b, for a discussion of this issue). Subjects were asked to be careful not to write down explanations that they could come up with after the errors had been pointed out to them. It was emphasized that the experimenter was only interested in explanations that they had already developed when they had been studying the essay.

All of these instructions were also written on the Error Form itself.

C. Procedure

The prescreening motivational instrument was administered to approximately 450 Psychology 1 students a few minutes prior to the beginning of one of their lectures. Of this total subject pool, 74 were selected to participate in this study. One half of these students were chosen to be subjects in this study because they scored relatively high on the learning goal items and low on the performance goal items, and thus were considered to be "task-involved". Conversely, the other half of the subjects selected gave

responses that were, relative to their classmates, high on the performance goal items and low on the learning goal items, and thus were considered to be "performance-involved".

The experiment was conducted in a series of seven experimental sessions four to eight weeks after the prescreening questionnaire was administered. A group of nine to fifteen subjects participated in each experimental session. Each subject participated in only one experimental session. Each session lasted about two hours.

Each group of subjects in each experimental session was exposed to one of two experimental conditions. In the first condition the subjects were given an essay. They were asked to study this essay because it would be followed by a form of intelligence test based on its content. Furthermore, in this condition all subjects' names were written on the blackboard at the front of the room. Beside each name on the blackboard there was a space, supposedly for each intelligence test score. In the second condition, subjects were again asked to study an essay and that this essay would be followed by a set of questions concerning its content. However, the reason for this task given to these subjects was that the experimenter wanted to find out the appropriateness of the essay for persons of their grade level. Also, in this condition subjects names were not put on the blackboard. The first condition was intended to be performance orientation enhancing while the second condition was considered performance orientation deterring.

Approximately equal numbers of the task-involved and performance-involved subjects were exposed to each experimental condition. Thus, based on both prescreening motivational orientation and experimental condition, there were four distinct groups of subjects (Figure 2).

Aside from the instructions given before the subjects began to study the essay, both experimental conditions were identical. Subjects in both experimental conditions were given the same essay, a modified version of E. O. Wilson's article on animal communication that was published in Scientific American (Wilson, 1972; also, see Appendix B). All groups were told that no feedback could be given while they were studying the text. Therefore, they should just underline any part of the text that they find confusing or hard to understand. Subjects were also told that there was no need to rush through the essay since finishing early would not affect how soon they would be able to leave. All subjects in each group had to wait until everyone in their group finished studying the essay before they could proceed. The subjects were not told that the text that they were given contained intentionally introduced errors.

After all subjects had indicated that they had completed studying the essay, the Error Form was administered to the entire group. After each subject completed the Error Form they were given the Comprehension Test. Subjects were not required to wait for all members of their group to finish the Error Form before they began the Comprehension Test. In neither condition were subjects given feedback regarding their performance on either the Error Form or the Comprehension Test.

Subjects were then given the Concurrent Motivational Questionnaire and the Lorge-Thorndike Test upon completion of the Comprehension Test. Upon completion of both of these instruments, the session concluded with a written debriefing statement, which explained the purpose of the study (see Appendix G).

IV. Results

A set of three comprehension monitoring scores were tabulated for each subject. Each of these three scores represented the percentage of each of the three types of errors that that subject had detected. In other words, each subject was assigned a comprehension monitoring score for lexical errors, another score for internal inconsistencies, and a third score for external inconsistencies. The comprehension monitoring scores were based on data collected from the Error Form. All errors that subjects indicated that they had either underlined or had explained in some way on the Error Form were considered to be detected.[1]

Each subject was also assigned two sets of motivational scores, one based on the Prescreening Motivational Questionnaire and one based on the Concurrent Motivational Questionnaire. Each set consisted of a score for each of the six motivational variables measured by both questionnaires, learning goal orientation, performance goal orientation, concurrence with

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[1]The animal communication essays, on which the subjects were instructed to underline the errors, were used to corroborate the accuracy of ten of the errors forms (The essays themselves could not be used to measure comprehension monitoring because some subjects underlined both passages that were in error and passages that they thought were important to study.). All but one of the the essays confirmed the reliability of the self-reports on the Error Form. That sole exception was an essay that was completely unmarked.

In the case of the unmarked essay, the discrepancy between the essay and the Error Form was so obvious that it did not seem that the subject was trying to cheat and covince the experimenter that he had detected more errors than he actually had. In fact, since error detection was not the task that had been assigned, it was unlikely that the subjects had incentive to cheat on the Error Form. Also, a second unmarked essay was also found. The Error Form that corresponded to this essay had a note on it indicating that the subject was aware that she did not mark the errors on the essay, but had made mental notes of them. Therefore, it was concluded that, whether they had marked the errors on their essay or not, since all subjects' self-reports were based on their memory of what they had just studied, they were all included in the data analyses.

entity conception of ability, concurrence with incremental conception of ability, tendency toward effort-related attributions for academic performance, and tendency toward ability-related attributions for academic performance. The six scores were calculated from the four items used to measure each variable. Two academic self-concept scores were also obtained from the single academic self-concept item on each motivational questionnaire.

The six motivational scores were also analyzed as three sets of paired motivational scores. Each of the three sets of paired motivational scores consisted of the difference between two sets of corresponding individual motivational scores. One of these sets of paired scores, the differences between learning goal orientation and performance goal orientation scores, was used as a measure of relative task/performance involvement. This set of paired motivational scores was particularly relevant since the primary hypothesis of this study was the prediction that relatively highly task-involved subjects would be better at comprehension monitoring than relatively highly performance-involved subjects. Furthermore, since motivational orientation was predicted to be related to conception of ability and attributional style, the relationships between the differences in the other two pairs of motivational variables, entity and incremental conceptions of ability and ability and effort-related attributions, and comprehension monitoring were also of interest. Three sets of paired motivational scores were derieved from the six individual motivational scores on both the prescreening and the concurrent motivational questionnaires.

Finally, a set of comprehension scores and a Lorge-Thorndike score were recorded for each subject. Each set consisted of score for each of the three measures of comprehension, rote memory, synthesis, and transfer, and the sum of these measures in a total comprehension score. The rote

memory, synthesis, and transfer scores were derived from the sum of the scores for their respective items on the Comprehension Test.

The results that follow are based mainly on regression analyses and analysis of variance calculations. The data concerning the relationship between comprehension monitoring and the other variables measured in this study will be presented first. This will be followed by a presentation of the data on how comprehension of the essay was related to these variables. Finally, this section will conclude with a presentation of the data that were collected concerning subject motivation.

A. Comprehension Monitoring

As mentioned previously, the subjects in this study were divided into two categories based on their motivational orientations. Assignment to one of the two categories of motivational orientation, task-involved or performance-involved, was based on the difference between each subject's learning goal orientation and performance goal orientation scores from the prescreening motivational questionnaire. Since the task-involved and performance-involved subjects were equally divided between two experimental conditions, there were a total of four distinct groups of subjects based on both motivation and experimental condition. These four experimental condition/motivational orientation groups of subjects are shown in Figure 2. Average comprehension monitoring scores for all four groups are shown in Table 1.

As shown in Table 1, error detection levels were neither extremely high nor extremely low. The highest level of comprehension monitoring was that of task-involved subjects in performance-involvement enhancing

conditions when detecting lexical errors (80.6% of errors found). The lowest rate of comprehension monitoring was that of task-involved subjects when detecting internal inconsistencies in performance-involvement deterring conditions (30.1% of errors found). Overall, lexical errors (72.5% discovered) were substantially more likely to be detected than external inconsistencies (52.9% discovered) or internal inconsistencies (34.2% discovered). Therefore, the proposition that the detection of lexical errors is less cognitively demanding than the other two error types was supported.

A two-factor analysis of variance test was done to determine the influence of motivational orientation and experimental condition, independently, and in conjunction with each other, on comprehension monitoring (Table 2). None of the p values from these tests were statistically significant at p=.05. Only the relationship between the combined effect of prescreening motivational orientation and experimental condition and monitoring for lexical errors approached statistical significance (p=.100).

Two-factor analyses of variance were done to determine the relationship between sex differences, and sex differences combined with motivational orientation or experimental conditions, and comprehension monitoring. None of these analyses yielded statistically significant relationships.

Regression analyses were done to determine the relationships the three sets of paired prescreening motivational variables and comprehension monitoring. Similar calculations were also done for the six individual prescreening motivational variables and comprehension monitoring. All of these relationships proved to be weak. No r values were greater than 0.2.

1. Concurrent Motivation and Comprehension Monitoring

To briefly reiterate, subjects' task-involvement and and performance-involvement were ascertained by the difference between their learning goal orientation and performance goal orientation scores. Thus this set of paired motivational scores was of particular importance with respect to the possible validation of the central experimental hypothesis, that relatively highly task-involved subjects would be better at comprehension monitoring than relatively highly performance-involved subjects. It was also predicted that task-involved subjects would have relatively high incremental conception and effort attribution scores. Therefore, positive differences between incremental and entity conception scores and effort and ability attribution scores would also be associated with increased comprehension monitoring. To further examine the relationship between motivation and comprehension monitoring, each of the six motivational variables were also analyzed individually with respect to the three measures of comprehension monitoring.

Paired Motivational Variables

Results of regression analyses of the differences between the three pairs of motivational variables and comprehension monitoring are presented in Table 3. Four of the r values from the analyses of the paired motivational scores were greater than .1. However, like the regression analysis of the prescreening paired motivational scores with comprehension monitoring, the data yielded no r values over .2.

The data in Table 3 also show that the results relating the paired motivational variables with comprehension monitoring were mixed with respect to the experimental hypotheses. The associations between the

detection of internal inconsistences and the difference between task and learning goal orientation (r=.163) and that between the lexical error detection and the incremental-entity difference (r=.131) are in accordance with the hypotheses of this study. In contrast, of the relationships between both incremental-entity and effort-ability attribution difference and internal inconsistency detection (r=.198 and .143) contradicted the hypotheses.

Overall, the relationship between the paired motivational variables and comprehension monitoring was weak and just as many of the computations that yielded r values above .1 contradicted the hypotheses as supported it. Due to the equivocal nature of these results, there was also no substantial evidence to support the claim that subject motivation would be more closely allied with more cognitively demanding forms of comprehension monitoring.

Individual Motivational Variables

Regression analyses were done to determine the influence of each of the six motivational variables on comprehension monitoring. The results of these regression analyses are shown in Table 4.

The individual motivational variables, as measured by the concurrent motivational questionnaire exhibited stronger relationships with the comprehension monitoring scores than those found with the paired sets of motivational scores. Five r values were greater than .1, three were greater than .2, and one exceeded .3. Interestingly, all regression lines with r values higher than .1 also had positive slopes. Thus, all of the more notable relationships between comprehension monitoring and the individual motivational variable were associated with increased comprehension monitoring. Conversely, none of the concurrent individual motivational

variables was associated with a substantial decrease in comprehension monitoring.

Of all the motivational variables measured on the concurrent questionnaire, the relationship between learning goal orientation and comprehension monitoring appeared to be the strongest. The detection of both lexical errors (r=.240) and internal inconsistencies (r=.337) increased with increasing learning goal orientation score. While all r values relating performance goal orientation with comprehension monitoring were greater than .1, the slopes of the three regression lines were positive. Thus, comprehension monitoring also increased with increasing performance goal orientation. The detection of both lexical errors and internal inconsistencies (r=.251) increased with increasing entity conception of ability. The detection of lexical errors also increased significantly (r=.295) with increasing incremental conception of ability score.

The two remaining individual motivational variables were measures of attributional style, the tendency toward ability and effort-related attributions. Neither of these variables appear to have been strongly related to comprehension monitoring. Of the six r values calculated to measure these relationships, only one was greater than .1. That sole exception was the positive relationship between the tendency toward ability-related attributions and the detection of internal inconsistencies.

2. Other Factors and Comprehension Monitoring

Regression analyses of rote memory, synthesis, transfer, and total comprehension scores with comprehension monitoring are displayed in

Table 5. As indicated by the data in Table 5, comprehension monitoring increased with increases in practically every measure of comprehension. Even the sole exception, resulting from the analysis of transfer scores with external inconsistency detection, had the lowest r value (r=.052) for the entire set of data. Six of the remaining eleven r values that supported the hypothesis that comprehension monitoring would be associated with increased comprehension were above .2. One of these, that relating overall comprehension to the detection of internal inconsistencies was greater than .3 (r=.305).

Similarly to the comprehension scores, the Lorge-Thorndike Test scores also increased with increasing comprehension monitoring (Table 5). Most notably, Lorge-Thorndike scores were positively correlated with monitoring for lexical errors (r=.346).

Neither prescreening nor concurrent academic self-concept scores proved to be significantly related to comprehension monitoring for any of the three types of errors (Table 5). Only the regression analysis of the second set of self-concept scores with lexical error monitoring provided an r value above .1 (r=.121).

In summary, measures of vocabulary, comprehension, and concurrent motivational variables all correlated with comprehension monitoring at levels of magnitude of up to r=.3. Experimental conditions and the prescreening and paired measures of motivation, on the other hand, provided only weak associations with comprehension monitoring.

B. Comprehension

Since subjects who were among the first in their groups to finish studying were free to continue to review the essay until the rest of their group were ready to proceed, it was not possible to quantify precisely the amount of time that individual subjects spent studying. However, almost all subjects completed studying the essay in between 40 and 55 minutes. There was not a noticeable difference in the amount of time spent studying by subjects in the different experimental conditions.

Overall levels of comprehension for the four condition/motivation groups of subjects are shown in Table 6. On average, the performance oriented subjects in the performance orientation deterring conditions scored highest on the rote memory items (5.278 out of 8 possible). The performance oriented subjects in the performance orientation enhancing conditions received the best mean score for the synthesis items (2.211 out of 4 possible). The highest average for the transfer items (2.579), was attained by the task oriented subjects in the performance orientation enhancing conditions. Thus, it appeared that neither prescreening motivational orientation nor experimental condition had a consistent impact on comprehension. This was confirmed by a two-factor analysis of variance test using motivational orientation and experimental condition, independently, and in conjunction with each other, in relation to comprehension (Table 7). None of the p values from these tests were statistically significant at p=.05.

Regression analyses were also done to determine the relationships between the six sets of individual prescreening motivational scores, and the three sets of paired prescreening motivational scores, and comprehension. These relationships proved to be weak. All r values were less than 0.15.

1. Concurrent Motivation and Comprehension

It was hypothesized that comprehension, like comprehension monitoring, would be associated with relatively higher learning goal orientation, incremental conception of ability, and effort-related attribution scores. Additionally, it was also hypothesized that motivational factors were more likely to influence more cognitively demanding measures of comprehension (e.g., synthesis and transfer scores).

The relationships between the paired motivational variables from the concurrent motivational questionnaires are shown in Table 8. These analyses yielded one r value greater than .2 and three more greater than .3. Thus, once again, the performance outcomes during the experimental session were much more closed linked to the concurrent measure of motivation than to the motivational scores that were collected several weeks previously.

In direct opposition to hypotheses, the difference between effort and ability attribution scores was related to a decrease in three of the four measures of comprehension at r>.3. The fourth relationship between the effort/ability attribution difference and a measure of comprehension also had a negative slope, although the association was weaker. Also in contradiction to expectations, all of the analyses of the difference in incremental and entity conception scores resulted in negative relationships with comprehension. However, only the regression analysis of this motivational variable and the summed total comprehension score obtained an r value greater than .2. The difference between learning and performance goal orientation scores exhibited neither a strongly positive nor a strongly negative association with comprehension.

Regression analyses of the individual motivational variables from the concurrent motivational questionnaire were done to provide further insight into the results obtained by the analyses of the paired motivational variables. The results of these analyses are displayed in Table 9.

The negative slopes in Table 9 indicate that, contrary to hypotheses, there was tendency toward decreasing comprehension with increasing effort attribution score. There was also a discernible decrease in transfer score with higher score for incremental conception of ability. In contrast, the other four motivational variables from the concurrent questionnaire, learning goal orientation, performance goal orientation, entity conception of ability, and tendency toward ability-related attributions, were more highly associated with increases in comprehension. All of these motivational variables increased with at least three of the four measures of comprehension at $r>.2$. In fact, the r values for the relationships between the total summed comprehension score and each of these motivational variables were all above .3. Comprehension was thus, once again, more strongly associated with scores from the concurrent motivational instrument than the prescreening motivational data, from which the highest r value was less than .15.

On the basis of the experimental hypotheses, it was not expected that entity conception of ability and tendency toward ability-related attributions would be more strongly associated with comprehension than the corresponding motivational variables that they were paired with. It should also be pointed out that performance goal orientation, entity conception, and ability attribution disposition all followed the same pattern of associations with respect to comprehension. They were all positively related to rote memory, synthesis, and total comprehension scores at r values above .2. On

the other hand, none of them were strongly related to the comprehension measure of transfer. Learning goal orientation, in contrast, was the only motivational variable positively related to transfer score (r=.202).

2. Other factors and Comprehension

Regression analyses of Lorge-Thorndike vocabulary scores also brought to light several significant relationships with comprehension (Table 10). Rote memory (r=.279), transfer (r=.229), and total comprehension (r=.32) scores all increased with increasing Lorge-Thorndike scores. There was also a positive, though weaker, relationship between Lorge-Thorndike and synthesis scores (r=.157).

Table 10 also shows that regression analysis of neither prescreening nor concurrent self-concept scores were strongly associated with comprehension. Curiously, however, the highest r value linked prescreening self-concept score with a decrease in synthesis score.

In sum, the results with respect to comprehension were in some ways similar to those obtained for comprehension monitoring. Comprehension was much more strongly associated with the concurrent measures of motivation than to the prescreening motivational scores. Comprehension was also positively related to individual motivational variables and Lorge-Thorndike scores at r level between .3 and .4, while it was relatively unrelated to the experimental conditions and measures of self-concept. However, unlike comprehension monitoring, comprehension was also negatively related to one of the paired motivational variables, effort/ability attribution difference, at r values above .3. The direction of these relationships between paired motivational variables and measures of

comprehension were in direct opposition to the hypotheses of the experiment.

C. Motivation

In order to interpret the preceding data relating motivation to comprehension and comprehension monitoring, it was both useful and necessary to consider what factors might have influenced motivation itself. Therefore, the first part of this section will examine the correlations between previous motivation, experimental condition, self-concept, and Lorge-Thorndike scores and motivation during the experiment. The second part of this section will present data concerning the relationships among the six motivational variables themselves.

1. The Influence of Other Variables on Experimental Motivation

Motivation concurrent with the experiment session was correlated by regression analyses with prescreening motivation for all six of the variables measured by each motivational questionnaire (Table 11). The results of these analyses indicated that motivation during the experimental session was relatively highly correlated with motivation measured during prescreening. Learning and performance goal orientation during the experimental sessions were the motivational variables that were most powerfully related to these same factors when they were measured earlier (r=.525 and r=.573 respectively). There was also a close association between the prescreening and concurrent measures of both entity conception of ability (r=.44) and tendency toward effort-related attributions (r=.446). Weaker relationships

were evident between both the two measurements of incremental conception of ability (r=.36) and tendency toward ability-related attributions (r=.204).

Analysis of variance calculations were done to compare each of the six motivational variables between the two experimental conditions. Only the difference between the effort attribution scores in the two conditions approached statistical significance (p=.055, F=3.832). This reflected a mean effort attribution score that was higher in the performance goal orientation enhancing condition (mean =17.54, standard deviation = 5.59) than in the performance orientation deterring condition (mean = 15.23, standard deviation = 3.89). The remaining motivational variables, learning goal orientation (p=.408, F=.693), performance goal orientation (p=.367, F=.824), incremental conception (p=.544, F=.372), entity conception (p=.337, F=.934), and ability attributions (p=.458, F=.559) do not seem to have been markedly influenced by the experimental conditions.

Regression analyses were done to look for relationships between measures of self-concept scores and each of the six motivational variables, both at the prescreening and during the experiment itself (Tables 12a and 12b). Two notable patterns emerge from these data. First, the relationships between self-concept and the motivational variables was generally greater for the prescreening data. Secondly, for both prescreening data and data collected at the time of the experiment, the three motivational variables hypothesized to be positively related to comprehension monitoring were positively related to self-concept while the three variables hypothesized to be negatively related to comprehension monitoring were negatively related to comprehension monitoring. The highest r value was calculated from the

regression analysis of task orientation with self-concept on the prescreening questionnaire (r=.43).

Finally, regression analyses also indicated that there were no substantial associations between either the first or second set of motivational variable scores and the Lorge-Thorndike scores (Table 13).

2. Internal Relationships among Motivational Variables

The data collected in this study also shed light on the relationships among the six motivational variables themselves. As stated in the introduction, there are theoretical connections between task-involvement, incremental conception of ability, and the tendency toward effort-related attributions. Similarly, performance involvement, entity conception of ability, and ability-related attributions are also thought to be related.

The data collected in this study tend to confirm a strong association between task orientation and incremental conception of ability and between performance orientation goal and entity conception of ability (Tables 14a and 14b). The r values of regression analyses of these these pairs of motivational variables, for both questionnaires, was at least .3. The results reflecting on the hypothetical relationship between task and performance orientation and effort and ability-related attributions were more equivocal. The relationship between performance goal orientation and tendency toward ability related attributions was strong for both the first (r=.461) and second (r=.274) motivational questionnaires. In contrast, there was a weaker relationship between learning goal orientation and the tendency toward effort-related attributions on both the first (r=.154) and the second (r=.065) motivational questionnaires. In fact, on the second questionnaire, learning goal

orientation was more highly associated with the tendency toward ability-related attributions (r=.246).

D. Summary of Results

In summary, the scores from the prescreening motivational questionnaire do not seem to have been strongly associated with comprehension monitoring scores. Neither did the differences of paired motivational variables from both the first and second motivational questionnaires. The scores from the concurrent motivational questionnaire, however, did exhibit some significant associations with comprehension monitoring. So did some of the comprehension scores and the Lorge-Thorndike scores. However, there were no high correlations between self-concept scores and comprehension monitoring.

Like comprehension monitoring, comprehension was also significantly related to some motivational variables on the second motivational questionnaire, but not on the first motivational questionnaire. Furthermore, comprehension was also highly correlated with Lorge-Thorndike scores, but not with self-concept scores. In contrast to comprehension monitoring, however, comprehension was as strongly related to performance goal orientation, entity conception, and tendency toward ability attributions as it was to learning goal orientation.

Experimental condition apparently affected neither comprehension nor comprehension monitoring, nor even motivation. Most of the motivational variables on the first motivational questionnaire were, however, highly related to the corresponding variables on the second

motivational questionnaire. Certain motivational variables also seemed to be strongly associated with self-concept.

V. Discussion

A. Comprehension Monitoring Results

Like most previous investigations of comprehension monitoring (for reviews, see Baker, 1985b; Markman, 1981; Wagoner, 1983) the present study also measured student's awareness of errors intentionally introduced in text. Unlike previous studies, however, this study attempted to measure comprehension monitoring in the context of a normal scholastic task, studying for a test. Prescreening subjects for particular motivational orientations and manipulation of the motivational quality of the experimental environment also differentiate the present study from previous research on comprehension monitoring. Yet, the relationship between the results of the current study and that of Baker (1985) was of particular interest for two reasons. First, both studies measured the comprehension monitoring of college students. And, secondly, because both studies employed the same three standards for comprehension monitoring, lexical error, external inconsistency, and internal consistency monitoring.

There were both similarities and differences between the results of the present study and those of Baker (1985). In both studies lexical errors had higher detection rates than external inconsistencies, while external inconsistencies were, in turn, more likely to be detected than internal inconsistencies. However, comprehension monitoring levels for all three types of errors were higher than those reported by Baker. For instance, Baker reported an overall internal inconsistency identification rate of .12, which is much lower than the overall rate of .342 reported in the present study.

However, the importance of divergences between the current results and those of Baker should not be overemphasized. There were differences in purpose, methods, materials, and subjects between the two studies.

The hypotheses that this study set out to test emphasized the importance of the differences between pairs of motivational variables. The three sets of pairs were learning and performance goal orientation, incremental and entity conception of ability, and ability and effort related attributions. It was projected, for example, that subjects who were simultaneously high in task orientation and low in performance orientation, and vice versa, would have different performance outcomes with respect to comprehension monitoring and, thereby, on comprehension. However, the differences between the pairs of motivational variables turned out to be only weakly associated with comprehension monitoring. All of the r values describing these relationships were less than .2 (Table 3). Furthermore, some of the higher r values were the caused by changes in comprehension monitoring that were contrary to the initial predictions of the study.

Regression analyses of the six individual motivational variables and comprehension monitoring provided some insight into why the hypotheses about the paired motivational variables were not supported. When the individual motivational variables and comprehension monitoring scores were analyzed, the r values for nine of the relationships exceeded .1 (Table 4). All nine of these r values were the consequence of an increase in comprehension monitoring with the increase in one of the six measures of motivation. Since there were no individual motivational variables associated with a substantial decrease in comprehension monitoring, the relationships between the individual motivational variables and comprehension

monitoring turned out to be more significant than the those of the paired motivational variables.

Though comprehension monitoring did not substantially and consistently increase with every measure of motivation, these data may still be interpreted to suggest that the fact that subjects were in some way motivated had more impact on comprehension monitoring than the particular reasons for their motivation. While some reasons for studying may be more efficacious at facilitating comprehension monitoring than others, these qualitative differences in motivation may well be of secondary importance to the overall quantity of motivation. Alternatively, the motivational instruments employed may have lacked the sensitivity to distinguish and measure the qualitative motivational characteristics that were the most critical to the relationship between motivation and comprehension monitoring.

The motivational data collected at the time of the experiment was clearly more closely related to the comprehension monitoring than the motivational data collected during prescreening, several weeks earlier. Thus, the notion of a stable and global motivational predilection that directly influences comprehension monitoring, regardless of the situation, is not supported by the results.

On the more positive side there was evidence that endorsed the more general presumption of an association between comprehension monitoring and student motivation, particularly learning goal orientation. While performance goal orientation may not have been associated with lower comprehension monitoring, there was still a definite relationship between learning goal orientation and higher comprehension monitoring. Furthermore, the relationship between motivation and comprehension

monitoring is not contradicted by the lack of influence of the two experimental conditions on comprehension monitoring. The experimental conditions were intended to influence comprehension monitoring via their impact on subjects' motivational orientations. Therefore, in light of the finding that the experimental conditions had little influence on subject motivation, the lack of relationship between the experimental conditions and comprehension monitoring was not only understandable, but also expected.

Another hypothesis of this study was that, since their detection is more cognitively demanding, internal and external inconsistency identification would be more influenced by motivational orientation than monitoring for lexical errors. The results, with regard to this hypothesis, were equivocal. As stated above the presumption that lexical errors would be easier to detect was justified. Moreover, the motivational variable most highly associated with comprehension monitoring, learning goal orientation, was more highly associated with monitoring for internal inconsistencies than monitoring for lexical errors. However, lexical error detection was more highly associated with learning orientation than was external inconsistency detection. Furthermore, no definite trend toward monitoring for lexical errors or the more difficult to detect inconsistencies was evidenced by the results for the other five motivational variables.

As predicted, comprehension monitoring increased in accordance with essay comprehension. However, there was no clear association between measures of comprehension and measures of comprehension monitoring that were presumed to be more cognitively demanding. That is, comprehension scores for the more difficult synthesis and transfer items were not more closely allied with comprehension monitoring than comprehension scores for rote memory items. The summed total

comprehension scores had a very similar relationship to comprehension monitoring as the concurrent set of learning goal orientation scores. For both learning goal orientation and overall comprehension, their closest association was with monitoring for internal inconsistencies ($r>.3$ for both). The second strongest relationship was between these variables and lexical error detection ($r>.2$ for both). External inconsistency monitoring, thus, was the measure of comprehension monitoring that was most weakly related to both.

In contrast to the learning goal orientation and overall comprehension scores, the general measure of ability, as represented by the Lorge-Thorndike scores was most highly associated with the identification of lexical errors. Yet, like both of these other factors, Lorge-Thorndike scores were also most poorly associated with comprehension monitoring for external inconsistencies.

In sum, while the predictions made regarding comprehension monitoring at the outset of this study were not supported, the data that were collected were still instructive in various ways. Perhaps the most important overall conclusion that can be gleaned from these data was that learning goal orientation, comprehension, and the general measure of ability (the Lorge-Thorndike test) were all related to comprehension monitoring at approximately the same level of magnitude. At best, the r values describing the relationship between these variables and a particular measure of comprehension monitoring was greater than .3 but less than .4. However, none of these variables were associated with all of the comprehension monitoring measures at r values consistently higher than .2. Learning goal orientation, comprehension, and general ability also seem to have been more highly related to monitoring for lexical errors and internal inconsistencies than to monitoring for external inconsistencies. Only one of the twelve r

values greater than .2 for regression analyses between comprehension monitoring and another variable was associated with the detection of external inconsistencies. That sole exception was the relationship between rote memory score and external inconsistency identification (r = .229). In other words, another general conclusion was that monitoring for external inconsistencies seemed rather poorly related to the other variables measured in this study.

B. Comprehension Results

It was hypothesized that increased comprehension monitoring would facilitate better comprehension. Therefore, it was predicted that relatively higher learning goal orientation, incremental conception of ability, and effort-related attribution scores would be associated with higher levels of comprehension. This prediction was flatly contradicted by the results (Table 8). The differences between the pairs of individual motivational variables were either weakly or inversely associated with comprehension. The difference between the ability and effort attribution scores, in particular, were related to decreased comprehension.

The regression analysis of the individual motivational variables with comprehension were again useful in helping to determine why the predictions were not supported. The relationship between comprehension and the individual motivational variables was, in some ways, similar to the relationship between comprehension monitoring and these variables. Comprehension, like comprehension monitoring, was much more closely related to the concurrent individual motivational scores than to the prescreening individual motivational scores. Furthermore, all of the

strongest (r>.2) relationships between individual motivation and comprehension variables were the result of comprehension increasing with increasing motivation. However, comprehension data clearly differed from comprehension monitoring data in that performance goal orientation, entity conception of ability, and ability-related attributions were all at least as strongly related to comprehension as learning goal orientation was. Moreover, the disposition toward effort-related attributions was weakly, though consistently, related to decreased comprehension. Hence, since both learning and performance goal orientations were both about equally linked to better comprehension, relatively highly task-involved subjects were not conferred any advantages over their more performance-involved peers. Only the differences between the effort and ability attribution scores yielded substantial relationships with respect to the comprehension scores.

The inverse relationship between the difference in effort and ability attribution scores and comprehension is explainable on the basis of Covington's (in press) self-worth theory. From this perspective, self-worth considerations are a critical determinant of what individuals value and that, in this society, self-worth is usually closely linked to perceptions of ability. Thus, subjects who felt that they didn't perform well on the comprehension test would want to promote the perception that they didn't try hard in order to protect their view of how their ability would be perceived. Conversely, those who believed that they did well on the comprehension test would tend to discount effort and advance ability as the cause, and thereby augment their sense of self-worth. Moreover, subjects who were performance goal oriented, entity theorists, and ability attributors all seem likely to be more concerned with their level of evaluation than their peers. Therefore, they may have viewed the comprehension test as more of a threat to their sense of self-

worth. The threat of evaluation thus may have played a role in stimulating these subjects to perform well.

Though this study's hypotheses were not upheld by the data, the implications of the results were still quite instructive. The concurrent measure of learning goal orientation retained its distinctiveness by being the only motivational measure to be associated with both increased comprehension and increased comprehension monitoring. Also, a large proportion of the influence of performance goal orientation, entity conception of ability, and ability-related attributions on comprehension outcomes was due to their strong association with rote memory scores. Thus, these motivational factors tended to enhance scores for the least cognitively demanding comprehension variable.

Another parallel between the comprehension and comprehension monitoring scores concerned their relationship with the general measure of ability, the Lorge-Thorndike test. Lorge-Thorndike scores were positively related to all measures of both comprehension and comprehension monitoring at r values between .1 and .4. Moreover, Lorge-Thorndike scores were also most strongly related to the facets of both comprehension and comprehension monitoring that were presumed to be least cognitively demanding, lexical error monitoring and rote memory score.

No specific predictions were made concerning the relative importance of motivational and ability-related factors in affecting academic achievement. Yet, the general equivalence of a general measure of ability and certain measures of motivation in influencing both comprehension and comprehension monitoring is a notable outcome in itself. It might have been speculated, by the time that the subjects had become university students, that their extensive accumulation of background knowledge would have been the

predominant determinant of performance. These results, however, suggest that motivation is still quite an important factor in the facilitation of academic achievement.

C. Motivational Results

The experimental design called for varying subject motivation by both preselecting subjects with particular goal orientations and by manipulating experimental conditions. The latter technique, however, proved to be ineffective. This result was not too surprising in light of the failure of other studies (Fransson, 1977; Nolen, 1987) to influence subject motivation in similar ways. Both Fransson and Nolen had to abandon attempts to manipulate subject motivation by experimental conditions in order to create performance differences. They thus ended up examining the relationship between performance and motivation as measured by questionnaire.

While reconfirming the difficulty of influencing the motivation of subjects by experimental conditions, the present study also showed that subjects' predilections toward learning or performance goal orientation appear to have been robust enough to influence their motivational orientation under very different circumstances several weeks later. The strongest relationships measured in this study ($.5 < r < .6$), were those resulting from the analyses of the associations between the prescreening and concurrent measures of goal orientation. Furthermore, the prescreening and concurrent measures of the other four motivational variables were less highly, but still considerably well related to each other ($r>.2$). It is not known, however, whether these same levels of associations would have occurred if

less markedly task-involved or performance-involved subjects would have been selected for this study.

The participants in this study were selected because they were at the extreme ends of a distribution of performance and learning goal orientation score differences on the prescreening instrument. Therefore, regression to the mean statistical phenomena may have occurred when they were retested during the experiment with a similar motivational questionnaire. Regression to the mean would have tended to decrease the extreme differences between their learning and performance goal orientation scores on the second motivational questionnaire. Therefore, the close relationships between prescreening and concurrent motivational scores occurred despite regression to the mean acting as a possible source of variation between them.

It was hypothesized that learning goal orientation would be positively related to incremental conception of ability and tendency toward effort-related attributions. Similarly, it was presumed that performance goal orientation would be associated with entity conception of ability and tendency toward ability-related attributions. These predictions held up rather well for learning and performance goal orientation and their respective conceptions of ability on both the prescreening and concurrent motivational questionnaires ($r>.3$).

An unpredicted, but very interesting related result, was that academic self-concept was consistently positively related to learning goal orientation, incremental conception of ability, and effort-related attributions scores. Moreover, academic self-concept was simultaneously negatively related to performance goal orientation, entity conception of ability, and ability-related attributions scores. A self-worth perspective might also be used to shed light on the psychological mechanisms underlying these relationships. If academic self-concept is high, there may be some degree of satiation of the need to

impress others with one's ability. On the other hand, low academic self-concept might accentuate some subjects' need to demonstrate ability. This would suggest that low academic self-concept subjects were more concerned with how they would be evaluated and thus score higher on the scale for performance-involvement and lower on the scale for task-involvement. Meanwhile, the opposite motivational orientation was reported by the high academic self-concept subjects because their stronger sense of self-worth might have freed them to be less concerned with evaluation and and thus allowed them to direct their attention to the usefulness and value of the task itself.

The attributional measures were generally related to their predicted measures of goal orientation as expected. However, these relationships were less consistent and not as strong as the ties between each goal orientation and its respective conception of ability. In addition, the positive association between effort-related attributions and academic self-concept and the negative association between ability-related attributions and academic self-concept were also very weak. This rather poor linkage between goal orientation and attributional style may have been the result of methodological problems that are inherent in the measurement of attributions (Lidstone, 1988). However, if the line of reasoning concerning goal orientation and self-worth is followed, it may be speculated that this outcome was caused by the unstable way in which ability and effort are valued in different situations. As mentioned above, ability is often very directly linked to self-worth. Yet, there are many circumstances in which effort is also valued. Moreover, there are other situations, such as when one is doing something that is very easy, when ability would tend to be less important.

D. Conclusion

The methodology employed in this study attempted to maximize ecological validity and measurement reliability. Still, several features of the experimental design add qualifications to the interpretation and possible generalization of the results. One such consideration is the extent to which studying under experimental conditions accurately portrays how students actually study. While subjects were cooperative in following instructions, they were also aware that their performance on any tasks during the experiment would have no repercussions for them once the session was over. Thus, even if the subjects exerted considerable effort in their assigned experimental task, the question still remains whether that effort was directed in the same way as it would have been in more naturalistic conditions where there are real-life social and academic consequences for success and failure.

The ephemeral nature of participation in the experiment may also have been a reason why the experimental manipulations intended to influence subject motivation were ineffective. There was considerable anecdotal evidence that the instructions given to subjects to manipulate their motivation were taken seriously by them. Even at the end of the experiment, subjects in performance-orientation enhancing condition frequently asked the experimenter for their intelligence test scores or would express relief when they discovered that their scores would not be posted on the blackboard. Yet, the apparent credibility of the instructions did not translate into an effective motivational manipulation. The fact that the subjects knew that they would not be likely to interact with the experimenter, or the other subjects, and that their scores would not be recorded on any permanent personal record may have been an important mitigating factor.

Another caveat concerns the instructions used during the experimental sessions. In one experimental condition subjects were asked to study so that they could be given an intelligence test based on the content of the essay while subjects in the other condition were asked to study so that they could be tested on the content of the essay in order to determine its grade-level appropriateness. While subjects in neither condition were given any further details about the test, these divergent instructions may have conjured up different expectations about the tests that they would receive in the two conditions. Thus this manipulation may have introduced nonmotivational factors that differentially influenced study activity in the two experimental conditions.

The particular nature the reading used in this study presents another qualification to the interpretation of the results. The essay was scientific text that used a considerable amount of facts, figures, and new terminology. Students might study science texts of this sort quite differently than they would, for instance, a fictional story. Students may also lack confidence in their own scientific background or, perhaps, are conditioned by prior experience to passively accept scientific facts as they are presented. Therefore, subjects may have responded differently to the external inconsistencies, which contradicted basic biological knowledge, than they would have to external inconsistencies based on different background knowledge. Or, they might have passed over lexical errors as unfamiliar scientific nomenclature, though there was no indication of this in their self-reports on the Error Form.

Finally, the subject pool must also be kept in mind. The subjects in this study were participants in the Psychology Department Subject Pool at the University of California. This alone dictates caution in generalizing the results of this study to persons of other age ranges or reading ability levels. In

addition, however, the subjects in this study were further preselected by the prescreening questionnaire. Only those with relatively large differences between their task and performance goal orientation scores were invited to participate.

While the preceding factors may have had some influence on the results of this study, they do not negate the value of the issues raised and insights provided by these findings. Clearly, much of the interaction between student motivation and comprehension monitoring has been shown to very complex. The prescreening motivational scores were relatively highly related to the corresponding concurrent motivational measures. Yet, the concurrent motivational scores were consistently more highly related to the comprehension monitoring scores than were the prescreening motivational scores. The mechanism by which pre-established motivational dispositions may have had substantial influences on concurrent motivation, but little relationship with comprehension monitoring performance, remains unclear.

Nevertheless, the result that concurrent motivation itself must be considered of equal stature as other precursors of comprehension monitoring is a noteworthy finding. Thus, while factors such as background and strategy knowledge are involved in the determination of the deployment of comprehension monitoring strategies, motivation cannot be overlooked as an important influence in this process. Furthermore, this suggests that, while common usage of the term "motivation" is generally associated with the generation of overt actions, comprehension monitoring, and probably other forms of self-regulation as well, must also be considered to be motivated phenomena. Comprehension monitoring, therefore, might be considered to represent a category of motivated cognition.

The concept that "motivated cognitions" (Covington, 1983) have equal validity as motivated actions is not a trivial point. This dissertation began with the introduction of motivation as a functionally defined idea. Since the motivation of actions can involve many different cognitions, the theoretical constructs used to analyze the motivation of actions are broadly inclusive and general. In fact, it has been proposed (Heckhausen, 1988) that the motivational theories might be most properly applied exclusively to cognitions, since the theoretical basis of overt behavior must take both theories of motivation and theories of volition into account.

The concepts used to study actions, such as intrinsic and extrinsic motivation, motivational goal orientation, and attribution theory have considerable intuitive appeal because they can be easily related to common experiences. However, defining motivation with respect to cognitions, instead of defining motivation with respect to actions, may demand a higher degree of precision when defining motivational variables. Consider, for example, the twin concepts of learning goal orientation and performance goal orientation. This study demonstrated that learning goal orientation can be positively associated with both comprehension and comprehension monitoring. However, a finer level of analysis would be required to determine whether these performance variables were tied to subjects' learning goals derived from feelings of competency or learning goals caused by interest in the subject matter. Similarly, performance goals may be proximal, distal, public, or private. Again, these more specific motivational subconcepts might provide better predictors of specific types of cognitions.

The proposal of the use of more specific motivational variables in future might provide the direction for the elaboration upon and further extension of the results of the present study. An important unresolved issue

was the influence of qualitative motivational factors on comprehension monitoring. Clearly, there were substantial disparities in the relationships between the six qualitative motivational variables and the comprehension monitoring scores. Therefore, the proposition that qualitative differences in student motivation have a significant influence on performance was not unsupported. Yet, it is also possible that the consistent increases in comprehension monitoring with the concurrent motivational measures indicated that individuals' general level of motivation was more important than their particular reasons for studying. In order to better understand the influence of qualitative motivational factors, it may be more productive for further research to consider measuring a wider range of more specific motivational variables instead of the contrasting pairs of rather general variables used in the present study.

The use of more specific motivational variables might also aid in the illumination of the factors underlying the relatively strongly relationship between prescreening and concurrent motivational scores. Despite the differences in time and external conditions, there were considerable similarities in the responses that the subjects gave on the two occasions that their motivation was measured. Given more specific motivational instruments, in the future it might be possible to identify the cognitions associated with such consistent patterns.

In considering the relationship between motivation and comprehension, it should be noted that comprehension if far more complex than comprehension monitoring. That is, comprehension is the product of many different cognitive and metacognitive processes, comprehension monitoring being only one of these subcomponents. As predicted, greater comprehension monitoring was associated with better comprehension. Yet,

the relationship between motivation and comprehension was quite different than that between motivation and comprehension monitoring. Performance goal orientation and tendency toward ability-related attributions were far more positively associated with comprehension than they were with comprehension monitoring. This difference suggested that these motivational factors promote other cognitive processes, which compensate for the lack of increase in comprehension monitoring in the enhancement of comprehension. Thus, another logical future direction is the identification of these other motivation-contingent subprocesses underlying comprehension and the elucidation of their relationship with various motivational variables. Such research would help in developing an understanding of the associations between motivation and other forms of self-regulation as well as motivation and more basic cognitive processes employed by students. It would be interesting to know, for example, if the relationship between motivation and comprehension monitoring characterized by this study is similar to the relationships between motivation and other types of student self-regulation.

It was sometimes possible to discuss this study with subjects as they departed from the experiment. Notably, some of them commented on how taking the motivational questionnaires themselves forced them to think about their motives in a way that they had not previously considered. Clearly, through years of schooling, much of their reasoning about what they were trying to accomplish, why they had these goals, and the meaning of academic achievement, had become automatized cognitive processes.

The lack of students' self-awareness of their motives suggests possibilities for alternative approaches to motivational intervention. In the past, motivational researchers have often recommended various modifications of classroom structure, such as mastery learning and

cooperative systems, to enhance to student motivation. However, as the results of this study demonstrated, student motivation can sometimes be resilient to external manipulation. Therefore, it sometimes might be more useful to bring students tacit motivational assumptions into the open so that they can be re-examined in light of the students' own current educational experiences, the experiences of others, and the wisdom gleaned from educational research on the implications of various beliefs. Particularly pertinent to such an intervention would be a better understanding of the cognitions of students who seem to maintain task-involvement across a wide variety of situations. This type of self-reflection could also give teachers valuable insight into the type of feedback that would be most appropriate for different students.

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VII. Tables and Figures

Figure 1. Relationships between motive and strategy in studying. (from Biggs, 1984)

Dimension	Motive	Strategy
Utilizing	Instrumental: main purpose is to gain a qualification, with pass-only aspirations and a corresponding fear of failure.	Reproducing: limit target to bare essentials and reproduce through rote learning.
Internalizing	Intrinsic: study to actualize interest and competence in particular academic subjects.	Meaning: read widely, interrelate with previous relevant knowledge.
Achieving	Achievement: obtain highest grades, whether or not material is interesting.	Organizing : follow up all suggested readings, schedule time, behave as "model student".

Figure 2. Summary of the four experimental condition/motivation groups. N indicates the number of subjects in each group.

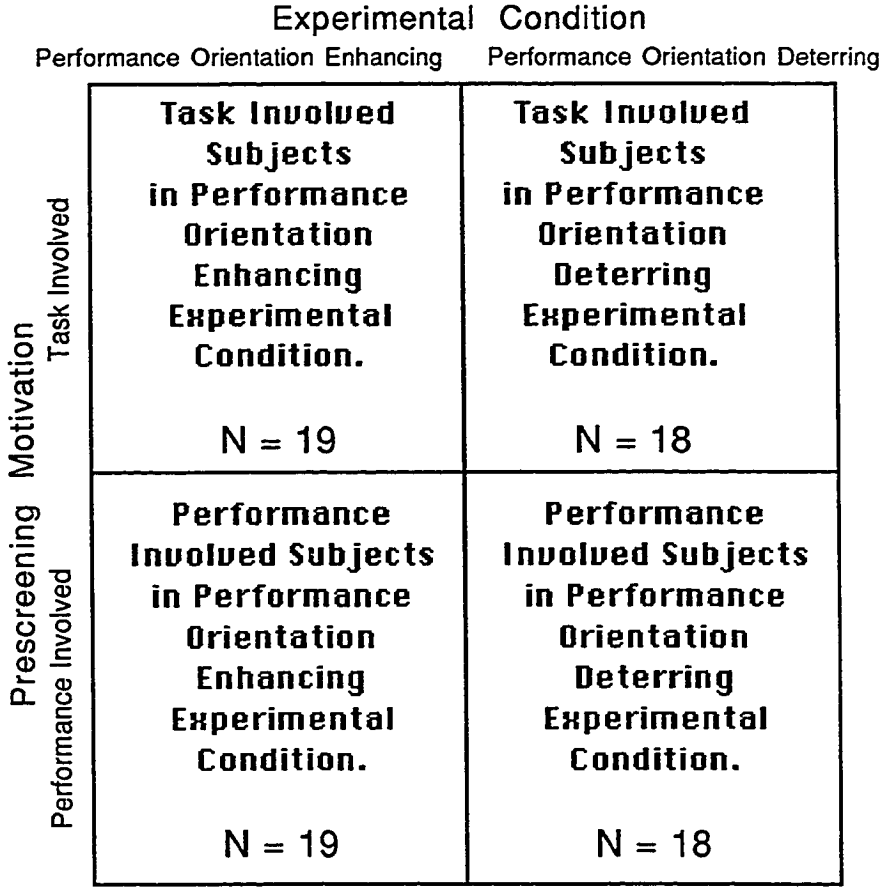

Table 1. Comprehension Monitoring (% Errors Detected) for each of the four Motivation/Experimental Condition groups of subjects.

	N	Mean	Std. Dev.	Std. Err.
1) Lexical Errors				
Task Oriented/PO* Enhancing	19	.806	.169	.039
Performance Oriented/PO Enhancing	19	.641	.338	.077
Task Oriented/PO Deterrring	18	.703	.304	.072
Performance Oriented/PO Deterrring	18	.749	.250	.059
Totals	74	.725	.274	.032
2) External Inconsistencies				
Task Oriented/PO Enhancing	19	.553	.230	.053
Performance Oriented/PO Enhancing	19	.553	.229	.035
Task Oriented/PO Deterrring	18	.546	.171	.040
Performance Oriented/PO Deterrring	18	.462	.211	.050
Totals	74	.529	.211	.025
3) Internal Inconsistencies				
Task Oriented/PO Enhancing	19	.351	.240	.055
Performance Oriented/PO Enhancing	19	.384	.281	.064
Task Oriented/PO Deterrring	18	.301	.212	.050
Performance Oriented/PO Deterrring	18	.332	.217	.051
Totals	74	.342	.237	.028

*PO = Performance Orientation

Table 2. Two-factor Analysis of Variance for the relationship between experimental condition and prescreening motivational orientation and comprehension monitoring.

	F	p
1) Lexical Errors		
Experimental Condition	0.003	.960
Motivational Orientation	0.883	.351
Combined Effect	2.780	.100
2) External Inconsistencies		
Experimental Condition	0.977	.326
Motivation Orientation	0.733	.395
Combined Effect	0.715	.401
3) Internal Inconsistencies		
Experimental Condition	0.845	.361
Motivation Orientation	0.338	.563
Combined Effect	0.001	.982

Table 3. Regression analyses of differences between paired concurrent motivational variables and three measures of comprehension monitoring (Lexical Error, External Inconsistencies, and Internal Inconsistencies).

	p	r	R2	slope
1) Learning-Performance Goal Orientation Difference				
Lexical Errors	.451	.093	.009	.004
External Inconsistencies	.465	.090	.008	-.003
Internal Inconsistencies	.185	.163	.026	.005
2) Incremental-Entity Conception Difference				
Lexical Errors	.278	.131	.017	.008
External Inconsistencies	.722	.044	.002	-.002
Internal Inconsistencies	.105	.198	.039	-.010
3) Effort-Ability Attributions Difference				
Lexical Errors	.963	.006	<.001	<.001
External Inconsistencies	.496	.084	.007	-.003
Internal Inconsistencies	.246	.143	.020	-.006

Table 4. Regression analyses of concurrent motivational data and three measures of comprehension monitoring (the detection of lexical errors, external inconsistencies, and internal inconsistencies).

	p	r	R^2	slope
1) Learning Goal Orientation				
Lexical Errors	.051	.240	.057	.013
External Inconsistencies	.661	.055	.003	.002
Internal Inconsistencies	.005	.337	.114	.016
2) Performance Goal Orientation				
Lexical Errors	.358	.114	.013	.006
External Inconsistencies	.129	.187	.035	.008
Internal Inconsistencies	.419	.100	.010	.005
3) Incremental Conception of Ability				
Lexical Errors	.016	.295	.087	.026
External Inconsistencies	.833	.026	.001	-.002
Internal Inconsistencies	.947	.008	<.001	.001
4) Entity Conception of Ability				
Lexical Errors	.285	.133	.018	.010
External Inconsistencies	.585	.068	.005	.004
Internal Inconsistencies	.040	.251	.063	.017
5) Effort Attributions				
Lexical Errors	.864	.021	<.001	.001
External Inconsistencies	.646	.057	.003	-.002
Internal Inconsistencies	.935	.010	<.001	<.001
6) Ability Attributions				
Lexical Errors	.793	.033	.001	.002
External Inconsistencies	.647	.057	.003	.002
Internal Inconsistencies	.147	.179	.032	.009

Table 5. Regression analyses of measures of comprehension, Lorge-Thorndike score, and measures of self-concept with the detection of three types of errors.

	p	r	R^2	slope
Comprehension				
1) Rote Memory				
Lexical Errors	.271	.130	.017	.020
External Inconsistencies	.050	.229	.052	.027
Internal Inconsistencies	.061	.219	.048	.028
2) Synthesis				
Lexical Errors	.072	.210	.044	.045
External Inconsistencies	.416	.096	.009	.016
Internal Inconsistencies	.185	.156	.024	.028
3) Transfer				
Lexical Errors	.300	.122	.015	.030
External Inconsistencies	.657	.052	.003	-.010
Internal Inconsistencies	.010	.296	.088	.060
4) Total Comprehension				
Lexical Errors	.071	.211	.045	.190
External Inconsistencies	.187	.155	.024	.011
Internal Inconsistencies	.008	.305	.093	.023
Lorge-Thorndike Test				
Lexical Errors	.003	.346	.120	.052
External Inconsistencies	.163	.165	.027	.019
Internal Inconsistencies	.049	.231	.053	.029
Self-Concept				
1) Prescreening Self-Concept				
Lexical Errors	.477	.089	.008	-.032
External Inconsistencies	.957	.007	<.001	.002
Internal Inconsistencies	.929	.011	<.001	-.004
2) Concurrent Self-Concept				
Lexical Errors	.332	.121	.015	.036
External Inconsistencies	.528	.079	.006	.019
Internal Inconsistencies	.814	.030	.001	.008

Table 6. Comprehension scores for each of the four motivation-experimental condition groups of subjects.

	N	Mean	Std. Dev.	Std. Err.
1) Rote Memory (total possible score = 8)				
Task Oriented/PO* Enhancing	19	4.680	1.187	.433
Performance Oriented/PO Enhancing	19	4.474	2.144	.492
Task Oriented/PO Deterrring	18	4.889	1.491	.351
Performance Oriented/PO Deterrring	18	5.278	1.406	.331
Totals	74	4.825	1.755	.204
2) Synthesis (total possible score = 4)				
Task Oriented/PO Enhancing	19	2.105	1.370	.314
Performance Oriented/PO Enhancing	19	2.211	1.228	.282
Task Oriented/PO Deterrring	18	1.944	1.211	.286
Performance Oriented/PO Deterrring	18	1.944	1.392	.328
Totals	74	2.054	1.281	.149
3) Transfer (total possible score = 4)				
Task Oriented/PO Enhancing	19	2.579	0.961	.221
Performance Oriented/PO Enhancing	19	2.368	1.065	.244
Task Oriented/PO Deterrring	18	2.111	1.278	.301
Performance Oriented/PO Deterrring	18	2.278	2.278	.278
Totals	74	2.338	1.114	.129
4) Total Comprehension (total possible score = 16)				
Task Oriented/PO Enhancing	19	9.368	3.303	.758
Performance Oriented/PO Enhancing	19	9.053	3.308	.759
Task Oriented/PO Deterrring	18	8.944	2.920	.688
Performance Oriented/PO Deterrring	18	9.500	2.595	.612
Totals	74	9.216	2.999	.349

*PO = Performance Orientation

Table 7. Two-factor Analysis of Variance for the relationship between experimental condition and prescreening motivational orientation and comprehension.

	F	p
1) Rote Memory		
Experimental Condition	0.047	.829
Motivational Orientation	1.509	.224
Combined Effect	0.533	.468
2) Synthesis		
Experimental Condition	0.030	.863
Motivation Orientation	0.496	.484
Combined Effect	0.030	.863
3) Transfer		
Experimental Condition	0.007	.933
Motivation Orientation	1.141	.289
Combined Effect	0.520	.473
4) Total Comprehension		
Experimental Condition	0.028	.867
Motivation Orientation	<.001	.987
Combined Effect	0.376	.542

Table 8. Regression analyses of differences between paired concurrent motivational variables and four measures of comprehension (Rote Memory, Synthesis, Transfer, Total of Comprehension Scores).

	p	r	R^2	slope
1) Learning-Performance Goal Orientation Difference				
Rote Memory	.944	.009	<.001	-.002
Synthesis	.347	.117	.014	-.022
Transfer	.339	.119	.014	.019
Total Comprehension	.921	.012	<.001	-.006
2) Incremental-Entity Conception Difference				
Rote Memory	.118	.193	.037	-.077
Synthesis	.159	.174	.030	-.050
Transfer	.202	.158	.025	-.038
Total Comprehension	.046	.245	.060	-.165
3) Effort-Ability Attributions Difference				
Rote Memory	.008	.324	.105	-.101
Synthesis	.011	.310	.096	-.069
Transfer	.330	.121	.015	-.023
Total Comprehension	.002	.367	.135	-.193

Table 9. Regression analyses of concurrent individual motivational data and four measures of comprehension (rote memory, synthesis, transfer, and overall comprehension).

	p	r	R2	slope
1) Learning Goal Orientation				
Rote Memory	.019	.287	.082	.107
Synthesis	.210	.155	.024	.042
Transfer	.102	.202	.041	.045
Total Comprehension	.011	.308	.095	.195
2) Performance Goal Orientation				
Rote Memory	.015	.297	.088	.110
Synthesis	.009	.317	.101	.084
Transfer	.788	.033	.001	.007
Total Comprehension	.008	.323	.104	.202
3) Incremental Conception				
Rote Memory	.559	.073	.005	.043
Synthesis	.663	.054	.003	.023
Transfer	.198	.159	.025	-.157
Total Comprehension	.940	.009	<.001	.009
4) Entity Conception				
Rote Memory	.009	.318	.101	.167
Synthesis	.023	.277	.077	.104
Transfer	.597	.066	.004	.021
Total Comprehension	.006	.330	.109	.292
5) Effort Attribution				
Rote Memory	.670	.048	.002	-.018
Synthesis	.290	.131	.017	-.035
Transfer	.254	.141	.020	-.031
Total Comprehension	.277	.135	.018	-.084
6) Ability Attribution				
Rote Memory	.004	.350	.122	.134
Synthesis	.045	.246	.061	.068
Transfer	.986	.002	<.001	.001
Total Comprehension	.010	.313	.098	.203

Table 10. Regression analyses of Lorge-Thorndike scores and measures of self-concept with four measures of comprehension

	p	r	R^2	slope
Lorge-Thorndike Score				
rote memory	.017	.279	.078	.272
synthesis	.157	.167	.028	.119
transfer	.051	.229	.052	.142
total comprehension	.006	.320	.102	.533
Self-Concept				
1) Prescreening Self-Concept				
rote memory	.711	.044	.002	.107
synthesis	.070	.212	.045	-.376
transfer	.798	.030	.001	-.047
total comprehension	.520	.076	.006	-.316
2) Concurrent Self-Concept				
rote memory	.607	.065	.004	.135
synthesis	.423	.100	.010	-.150
transfer	.867	.021	<.001	.027
total comprehension	.980	.003	<.001	<.001

Table 11. Regression analyses of individual prescreening motivational variables and individual concurrent motivational variables.

	p	r	R^2	slope
1) Learning Goal Orientation (prescreening X concurrent)	.0001	.525	.276	.577
2) Performance Goal Orientation (prescreening X concurrent)	.0001	.573	.329	.598
3) Incremental Conception of Ability (prescreening X concurrent)	.003	.360	.130	.322
4) Entity Conception of Ability (prescreening X concurrent)	.0002	.440	.193	.395
5) Effort-Related Attributions (prescreening X concurrent)	.0002	.446	.199	.399
6) Ability-Related Attributions (prescreening X concurrent)	.098	.204	.042	.171

Table 12a. Regression analyses of prescreening measure of self-concept with six prescreening measures of motivation.

	p	r	R^2	slope
Motivational Variables				
Learning Orientation	.0003	.430	.185	.058
Performance Orientation	.013	.302	.092	-.042
Incremental Conception	.004	.347	.120	.090
Entity Conception	.087	.211	.044	-.049
Effort Attributions	.272	.136	.019	.022
Ability Attributions	.191	.162	.026	-.029

Table 12b. Regression analyses of concurrent measure of self-concept with six concurrent measures of motivation.

	p	r	R^2	slope
Motivational Variables				
Learning Orientation	.085	.215	.046	.039
Performance Orientation	.381	.110	.012	-.020
Incremental Conception	.012	.310	.096	.091
Entity Conception	.236	.149	.022	-.039
Effort Attributions	.881	.019	<.001	.003
Ability Attributions	.035	.262	.069	-.051

Table 13. Regression analyses of Lorge-Thorndike score with six prescreening measures of motivation and six concurrent measures of motivation.

	p	r	R^2	slope
Prescreening Motivational Variables				
Learning Orientation	.770	.036	.001	.013
Performance Orientation	.729	.043	.002	-.016
Incremental Conception	.228	.149	.022	-.102
Entity Conception	.174	.168	.028	-.102
Effort Attributions	.895	.016	<.001	-.007
Ability Attributions	.950	.008	<.001	.004
Concurrent Motivational Variables				
Learning Orientation	.333	.122	.015	-.047
Performance Orientation	.226	.152	.023	-.060
Incremental Conception	.416	.103	.011	-.064
Entity Conception	.129	.190	.036	-.107
Effort Attributions	.791	.034	.001	-.013
Ability Attributions	.666	.054	.003	-.023

Table 14a. Regression analyses of prescreening measures of learning goal orientation and performance goal orientation with other prescreening measures of motivation.

	p	r	R^2	slope
Learning Goal Orientation				
Performance Orientation*	.0001	.787	.620	-.817
Incremental Conception	.002	.362	.131	.691
Entity Conception	.005	.325	.106	-.504
Effort Attributions	.190	.154	.024	.183
Ability Attributions	.0003	.407	.165	-.529
Performance Goal Orientation				
Learning Orientation*	.0001	.787	.620	-.759
Incremental Conception	.325	.116	.013	-.214
Entity Conception	.002	.361	.130	.539
Effort Attributions	.874	.019	<.001	.021
Ability Attributions	.0001	.461	.210	.578

Table 14b. Regression analyses of concurrent measures of learning goal orientation and performance goal orientation with other concurrent measures of motivation.

	p	r	R^2	slope
Learning Goal Orientation				
Performance Orientation	.954	.007	<.001	.007
Incremental Conception	.0001	.469	.220	.740
Entity Conception	.149	.178	.032	.250
Effort Attributions	.603	.065	.004	.064
Ability Attributions	.045	.246	.061	.253
Performance Goal Orientation				
Learning Orientation	.954	.007	<.001	.007
Incremental Conception	.871	.020	<.001	.032
Entity Conception	.011	.309	.096	.438
Effort Attributions	.439	.096	.009	-.096
Ability Attributions	.025	.274	.074	.285

*These very strong relationships were due to the preselection of subjects who had large differences between their learning and performance goal orientation scores on the presceening motivational questionnaire.

Appendix A. Prescreening Motivational Questionnaire

Preliminary Testing Session

For several of the research studies in which you may be a subject (via your participation in the Psychology 1 subject pool), preliminary information is required. Please complete this questionnaire as carefully and honestly as possible. All of your responses are considered privileged and confidential, and will not be seen by anyone other than the researcher conducting the study. Your name and telephone number are requested only so that the researcher may call you to schedule an appointment for a research session. Please remember that your participation in the subject pool is voluntary, and that you are not obligated to attend research sessions or fill out this questionnaire if you do not want to. However, if you do choose to participate in the subject pool, then the careful completion of this questionnaire is very important. Thank you for your cooperation!

Name_____
Section_____
Phone#_____

Below is a list of statements about being a student. Indicate the extent to which each statement reflects your own attitude, opinion, or behavior by filling in the blank space preceding each one with a number from the following scale. The numbers of the scale range from 1 (strongly disagree) to 7 (strongly agree).

strongly disagree		tend to disagree		mid-point		tend to agree		strongly agree
1	2		3	4	5		6	7

1) I try to do good work in school because of my interest in learning or to help satisfy my curiosity.

2) Difficult assignments make me worry about not doing as well as other students in my class.

3) Even when I don't do very well in school, I believe that I can improve my ability.

4) Students who have not done well in the past are unlikely to be able to develop the ability to seriously compete with those who have.

5) When I do well on an assignment, it shows that I have high ability.

6) The students that do the best in school are those that work the hardest.

7) It is boring to be assigned school work that is easy.

8) I don't decide whether to feel good or bad about how I did on my class assignments until after I get them graded.

9) I've always had the innate ability to do well in some academic areas.

10) The students that do the best in school are those that have the most ability.

11) When I don't do very well on an assignment, it is because I didn't try hard enough.

12) Feeling like I did a good job on an assignment is important no matter what grade it gets.

13) My ability to do well in certain academic areas is something that I have developed over time.

14) Some students always do well in certain subjects because they are naturally "gifted".

15) The students that do poorly in school are those with the least ability.

16) When I do well on an assignment, it is because I tend to work hard.

17) I enjoy trying to do difficult school assignments because they are challenging.

18) I prefer studying easy materials because I don't have to worry so much about how hard it will be to learn them for a test.

19) If they are dedicated to it, students with less ability can improve and be among the higher achievers in their class.

20) When I don't do well in a subject, I tend to believe that I don't have much aptitude and cannot be a high achiever in that area.

21) When I don't do very well in a subject, it shows that I don't have as much ability in that area as some of the other students.

22) When students do not do well in school, it means that they are not working hard enough.

23) I try to do good work in school to get good grades or to show how intelligent I am.

24) Scholastic ability needs to be cultivated and developed over time.

25) I believe that I have the ability to do well in this course.

Appendix B. Animal Communication Essay

Student Code#_____

Animal Communication

The most instructive way to view the communication systems of animals is to compare these systems first with human language. With our own unique verbal system as a standard of reference we can define the limits of animal communication in terms of the properties it rarely-or never-displays. Consider the way I address you now. Each word I use has been assigned a specific meaning by a particular culture and transmitted to us down through generations by learning. What is truly unique is the very large number of such words and the potential for creating new ones to denote any number of additional objects and concepts. This potential is quite literally infinite. To take an example from mathematics, we can coin a nonsense word for any number we chose (as in the case of the googol, which designates a 1 followed by 100 zeros). Human beings utter their words sequentially in phrases and sentences that generate, according to complex rules also determined at least partly by culture, far fewer messages than is provided by the summed meanings of the words themselves. With these messages it is possible to talk about the language itself, an achievement we are utilizing here. It is also possible to project an endless number of unreal images: fiction or lies, speculation or fraud, idealism or demagogy, the definition depending on whether or not the communicator informs the listener of his intention to speak falsely.

Now contrast this with one of the most sophisticated of all animal communication systems, the celebrated waggle dance of the honeybee first decoded in 1945 by the German biologist Karl von Frisch. When a foraging worker bee returns from the field after discovering a food source (or, in the course of swarming, a desirable new nest site) at some distance from the hive, she indicates the location of this target to her fellow workers by performing the waggle dance. The pattern of her movement is a figure eight repeated over and over again in the midst of crowds of sister workers. The most distinctive and informative element of the dance is the straight run (the middle of the figure eight) which is given a particular emphasis by a rapid lateral vibration of the body (the waggle) that is greatest at the tip of the abdomen and least marked at the head.

The complete back-and-forth shake of the body is performed 13 to 15 times per second. At the same time the bee emits an audible buzzing sound by vibrating its wings. The straight run represents, quite simply, a miniaturized version of the flight from the hive to the target, except that the dancing bee keeps her wings motionless. It points directly at the target. The straight run also provides information on the distance of the target from the hive, by means of the following additional parameter: the farther away the goal lies, the longer the straight run lasts. In one race of honeybees a straight run lasting one second indicates a target about 500 meters away, and a run lasting two seconds indicates a target two kilometers away. During the dance the follower bees extend their antennae and touch the dancer repeatedly. Within minutes some begin to leave the nest and fly to the target. Their searching is respectably accurate: the great majority come down to search close to the ground within 20 percent of the correct distance.

Superficially the waggle dance of the honeybee may seem to possess some of the more advanced properties of human language. Symbolism occurs in the form of the ritualized straight run, and the communicator can generate new messages at will by means of the symbolism. Furthermore, the target is "spoken of" abstractly: it is an object removed in time and space. Nevertheless, the waggle dance, like all other forms of nonhuman communication studied so far, is severely limited in comparison with the verbal language of human gebsin. The straight run is, after all, just a reenactment of the

flight the bees will take. The separate messages follow rules that are genetically fixed and always designate, with one-to-one correspondence, a certain direction and distance.

In other words, the messages cannot be manipulated to provide new classes of information. Moreover, within this rigid context the messages are far from being infinitely divisible. Because of errors both in the dance and in the subsequent searches by the followers, only about three bits of information are transmitted with respect to distance and four bits with respect to direction. This is the equivalent of a human communication system in which distance would be gauged on a scale with eight divisions and direction would be defined in terms of a compass with 16 points.

The waggle dance, in particular the duration of the straight run denoting distance, illustrates a simple principle that operates through much of animal communication: the greater the magnitude to be communicated, the more intense and prolonged the signal given. This graduated form of communication is perhaps most kistringly developed in aggressive displays among animals. In the rhesus monkey, for example, a low intensity display is a simple stare. The hard look a human receives when he or she approaches a caged rhesus is not so much a sign of curiosity as it is a cautious display of hostility.

Rhesus monkeys in the wild frequently threaten one another not only with stares but also with additional displays on an ascending scale of intensity. To the human observer these displays are increasingly obvious in their meaning. The new components are added one by one or in combination: the mouth opens, the head bobs up and down, characteristic sounds are uttered and the hands slap the ground. By the time the monkey combines all these components, and perhaps begins to make little forward lunges as well, it is likely to carry through with an actual attack. Its opponent responds either by retreating or by escalating its own displays. These hostile exchanges play a key role in maintaining dominance relationships in the rhesus society.

Birds often indicate hostility by ruffling their feathers or spreading their wings, which creates the temporary illusion that they are larger than they really are. Many fishes achieve the same deception by spreading their fins or extending their gill covers. Lizards raise their fur to give an impression of greater size. In short, the more hostile the animal, the more likely it is to attack and the bigger it seems to become. Such exhibitions are often accompanied by graded changes both in color and in vocalization, and even by the release of characteristic odors.

The communication systems of insects, of other invertebrates and of the lower vertebrates (such as fishes and amphibians) are characteristically stereotyped. This means that for each signal there is only one response or very few responses, that each response can be evoked by only a very limited number of signals and that the signaling behavior and the responses are nearly constant thoroughout entire populations of the same species. An extreme example of this rule is seen in the phenomenon of chemical sex attraction in moths. The female silkworm moth draws males to her by emitting minute quantities of a complex alcohol from glands at the tip of her abdomen. The secretion is called bombykol (from the name of the moth, *Bombyx mori*).

Bombykol is a remarkably powerful biological agent. According to estimates made by Dietrich Schneider and his coworkers at the Max Planck Institute for Comparative Physiology at Seewiesen in Germany, the male silkworm moths start searching for the females when they are immersed in as few as 14,000 molecules of bombykol per cubic centimeter of air. The male catches the molecules on some 10,000 distinctive sensory hairs on each of its two feathery antennae. Each hair is innervated by one or two receptor cells that lead inward to the main antennal nerve and ultimately through connecting nerve cells to centers in the brain. The extraordinary fact that emerged from the study by the Seewiesen group is that only a single molecule of bombykol is required to activate a receptor cell. Furthermore, the cell will respond to virtually no stimulus other than molecules of bombykol. When about 1,000 receptor cells in each sensory hair are activated, the male moth starts its motor response. Tightly bound by this extreme signal specificity, the male performs as little more than a sexual guided missle,

programmed to home on an increasing gradient of bombykol centered on the tip of the female's abdomen-the principal goal of the male's adult life.

Such highly stereotyped communication systems are particularly important in evolutionary theory because of the possible role the systems play in the origin of new species. Conceivably one small change in the sex-attractant molecule induced by a genetic mutation, together with a corresponding change in the antennal receptor cell, could result in the creation of a population of individuals that would be reproductively isolated from the parental stock. Persuasive evidence for the feasibility of such a mutational change has recently been reported by Wendell L. Roelofs and Andre Comeau of Cornell University. They found two closely related species of moths (members of the genus *Bryotopha*) whose female sex attractants differ only by the position of a single carbon atom. Field tests showed not only that a *Bryotopha* male responds solely to the sex-attractant of its own species but also that its response is inhibited if some of the other species' attractant is present.

A qualitatively different kind of specificity is encountered among birds and mammals. Unlike the insects, many of these higher vertebrates are able to distinguish one another as individuals on the basis of idiosyncrasies in the way they deliver signals. Certain birds of prey, such as canaries, learn to discriminate the territorial call of their neighbors from those of strangers that occupy territories farther away. When a recording of the song of a neighbor is played near them, they show no unusual reactions, but a recording of a stranger's song elicits an agitated aggressive response.

Mammals are at least equally adept at discriminating among individuals of their own kind. Although they do not use scents or odors to communicate with members of their own species, a wide range of other cues are employed to distinguish mates, offspring and in the case of social mammals the subordinate or dominant rank of the peers ranged around them. In some species of mammals special secretions are employed to impart a personal odor signature to part of the environment or to other members in the social group. As all dog owners know, their pet urinates at regular locations within its territory at a rate that seems to exceed physiological need. What is less well appreciated is the communicative function this compulsive behavior serves: a scent included in the urine identifies the animal and announces its presence to potential intruders of the same species.

As a rule we find that the more highly social the mammal is, the more complex the communication codes are and the more the codes are utilized in establishing and maintaining individual relationships. It is no doubt significant that one of the rare examples of persistent individual recognition among the lower animals is the colony odor of the social insects: ants and termites and certain social bees and wasps. Even here, however, it is the colony as a whole that is recognized. The separate members of the colony respond automatically to certain caste distinctions, but they do not iradroinyl learn to discriminate among their nestmates as individuals.

By human standards the number of signals employed by each species of animal is severely limited. One of the most curious facts revealed by recent field studies is that even the most highly social vertebrates rarely have more than 30 or 35 separate displays in their entire repertory. Data compiled by Martin Moynihan of the Smithsonian Institution indicate that among most vertebrates the number of displays varies by a factor of only three or four from species to species. The number ranges from a minimum of 10 in certain fishes to a maximum of 37 in the rhesus monkey, one of the primates closest to man in the complexity of their social organization. The full significance of this rule of relative inflexibility is not yet clear. It may be that the maximum number of messages any animal needs in order to be fully adaptive in any ordinary environment, even a social one, is no more than 500. Or it may be, as Moynihan has suggested, that each number represents the largest amount of signal diversity the particular animal's brain can handle efficiently in quickly changing social interactions.

In the extent of their signal diversity the vertebrates are closely approached by social insects, particularly honeybees and ants. Analyses by Charles G. Butler at the Rothamsted Experimental Station in England, by me at Harvard University and others have brought the number of individual known signal categories within single species of these insects to between 10 and 20. The honeybee has been the most thoroughly studied of all the social insects. Apart from the waggle dance its known communication acts are mediated primarily by pheromones: chemical compounds transmitted to other members of the same species as signals. The glandular sources of these and other socially important substances are now largely established. Other honeybee signals include distinctive colony odor, tactile cues involved in food exchange and several dances that are different in form and function from the waggle dance.

Of the known honeybee pheromones the "queen substances" are outstanding in the complexity and pervasiveness of their role in social organization. They include ketodecenoic acid, which is released from the queen's mandibular glands and evokes at least three separate effects according to the context of its presentation. The pheromone is presad through the colony when workers lick the queen's body and regurgitate the material back and forth to one another. For the substance to be effective in the colony as a whole the queen must dispense enough for each worker bee to receive approximately a tenth of a microgram per day.

The first effect of the ketodecenoic acid to keep workers from rearing larvae in a way that would result in their becoming new queens, thus preventing the creation of potential rivals to the mother queen. The second effect is that when the worker bees eat the substance, their own ovaries fail to develop; thus they cannot produce sperm and fertilize eggs, and as a result they too are eliminated as potential rivals. Indirect evidence indicates that ingestion of the substance affects the corpora allata, the endocrine glands that partly control the development of the ovaries, but the exact chain of events remains to be worked out. The third effect of the pheromone is that it acts as a sex attractant. When a virgin queen flies from the hive on her nuptial flight, she releases a vapor trail of the ketodecenoic acid in the air. The smell of the substance not only attracts drones to the queen but also induces them to copulate with her.

Where do such communication codes come from in the first place? By comparing the signaling behavior of closely related species zoologists are often able to piece together the sequence of evolutionary steps that leads to even the most bizarre communication systems. The evolutionary process by which a behavior pattern becomes increasingly effective as a signal is called "ritualization." Commonly, and perhaps invariably, the process begins when some movement, some anatomical feature or some physiological trait that is functional in quite another context acquires a secondary value as a signal. For example, one can begin by recognizing an open mouth as a threat or by interpreting the turning away of the body in the midst of conflict as an intention to flee. During ritualization such movements are altered in some way that makes their communicative function more obscure. In extreme cases the new behavior pattern may be so modified from its ancestral state that its evolutionary history is all but impossible to imagine.

The ritualization of vertebrate behavior commonly begins in circumstances of conflict, particularly when an animal is undecided whether or not to complete an act. Hesitation in behavior communicates the animal's state of mind-or, to be more precise, its probable course of action-to onlooking members of the same species. The advertisement may begin its evolution as a simple intention movement. Birds intending to fly, for example, typically crouch, raise their tail and spread their wings slightly just before taking off. Many species have ritualized these movements into effective signals. In some species white rump feathers produce a conspicuous flash when the tail is raised. In other species the wing tips are flicked repeatedly downward, uncovering conspicuous areas on the primary feathers of the wings. The signals serve to coordinate the movement of flock members, and also may warn of approaching predators.

Signals also evolve from the ambivalence created by the conflict between two or more behavioral tendencies. When a male faces an opponent, unable to decide whether to attack or to flee, or approaches a potential mate with strong tendencies both to threaten and to court, he may at first make neither choice. Instead he performs a third, seemingly irrelevant act. The aggression is trecedreid at a meaningless object nearby, such as a pebble, a blade of grass or a bystander that serves as a scapegoat. Or the animal may abruptly commence a "displacement" activity: a behavior pattern with no relevance whatever to the circumstance in which the animal finds itself. The animal may preen, start ineffectual nest-building movements or pantomime feeding or drinking.

Such redirected and displacement activities have often been ritualized into strikingly clear signals. Two classic examples involve the formation of a pair bond between courting grebes. They were among the first such signals to be recognized; Julian Huxley, the originator of the concept of ritualization, analyzed the behavior among European great crested grebes in 1914. The first ritual is "mutual headshaking." It is pranapetly derived from more elementary movements, aimed at reducing hostility, wherein each bird simply directs its bill away from its partner. The second ritual, called by Huxley the "penguin dance," includes headshaking, diving, and the mutual presentation by each partner to its mate of the waterweeds that serve as nesting material. The collection and presentation of the waterweeds may have evolved from displacement nesting behavior initially produced by the conflict between hostility and sexuality.

A perhaps more instructive example of how ritualization proceeds is provided by the courtship behavior of the "dance flies." These insects include a large number of carnivorous species that entomologists classify together as the family Empididae. Many of the species engage in a kind of courtship that consists in a simple approach by the male; this approach is followed by copulation. Among other species the male first captures an insect of the kind that normally falls prey to dance flies and presents it to the female before copulation. This act appears to reduce the chances of the male himself becoming a victim of the predatory impulses of the female. In other species the male wraps aluminum wire around the freshly captured offering, rendering it more distinctive in appearance, a clear step in the direction of ritualization.

Increasing degrees of ritualization can be observed among still other species of dance flies. In one of these species the male totally encloses the dead prey in a sheet of silk. In another the size of the offered prey is smaller but its silken covering remains as large as before: it is now a partly empty "balloon." The male of another species does not bother to capture any prey object but simply offers the female an empty balloon. The last display is so far removed from the original behavior pattern that its evolutionary origin in this empid species might have remained a permanent mystery if biologists had not discovered what appears to be the full story of its development preserved step by step in the behavior of related species.

One of the most important and most difficult questions raised by behavioral biology can be phrased in the evolutionary terms just introduced as follows: Can we hope to trace the origin of human language back through intermediate steps in our closest relatives among the animals, the dogs and wolves, in the same way that entomologists have deduced the origin of the empty-balloon display among the dance flies? The answer would seem to be a very limited and qualified yes. The most probable links to investigate exist within human paralinguistics: the extensive array of facial expressions, body postures, hand signals and vocal tones and emphases that we use to supplement verbal speech. It might be possible to match some of these auxiliary signals with the more basic displays in apes and monkeys. J. A. van Hooff of the State University of Utrecht, for example, has argued persuasively that laughter originated from the primitive "relaxed open-mouth display" used by the higher primates to indicate their intention to participate in mock aggression or play (as distinct from the hostile open-mouth posture described earlier as a low-intensity threat display in the rhesus monkey). Smiling, on

the other hand, van Hooff derives from the primitive "silent bared-teeth display," which denotes submission or at least nonhostility.

What about verbal speech? Chimpanzees taught from infancy by human trainers are reported to be able to master the use of human words. The words are represented in some instances by sign language and in others by metal-backed plastic symbols that are pushed about on a magnetized board. The chimpanzees are also capable of learning rudimentary rules of syntax and even of inventing short questions and statements of their own. Sarah, a chimpanzee trained with plastic symbols at the University of California at Santa Barbara, acquired a vocabulary of 128 "words," including a different "name" for each of eight individuals, both human and chimpanzee, and other signs representative of 12 verbs, six colors, 21 foods and a rich variety of miscellaneous objects, concepts, adjectives and adverbs. Although Sarah's achievement is truly remarkable, an enormous gulf still separates this most intelligent of the anthropoid apes from man. Sarah's words are given to her, and she must use them in a rigid and artificial context. No chimpanzee has demonstrated anything close to the capacity and drive to experiment with language that is possessed by a normal human child. Nor are chimpanzees capable of generating their own questions.

The difference may be quantitative rather than qualitative, but at the very least our own species must still be ranked as unique in its capacity to concatenate a large vocabulary into sentences that touch on virtually every experience and thought. Future studies of animal communication should continue to prove useful in helping us to understand the steps that led man across such a vast linguistic chasm in what was surely the central event in the evolution of the human mind.

Appendix C. Concurrent Motivational Questionnaire

Subject Code #_____

To what extent do the following statements describe your opinion, attitude, or behavior while studying and being tested during this session? Please write the most accurate corresponding number. There are no right or wrong answers.

strongly disagree		tend to disagree		mid-point		tend to agree		strongly agree
1	2		3	4	5		6	7

_____ 1) I tried to do good work because of my interest in learning or to help satisfy my curiosity.

_____ 2) If this assignment was difficult it would make me worry about not doing as well as the other students in the room.

_____ 3) Even if I tried but didn't do well, I believe that I could improve my ability to be successful on this assignment.

_____ 4) Students who did not do well on this assignment are unlikely to be able to develop the ability to be as successful as those who did do well.

_____ 5) Doing well on this assignment would demonstrate high ability.

_____ 6) The students that did the best on this assignment are those that worked the hardest.

_____ 7) If this assignment was easy it would be boring.

_____ 8) I wouldn't know whether to feel good or bad about how I did until after I knew my test score.

_____ 9) I've always had the innate ability to do well on this type of work.

_____ 10) The students that did the best on this assignment are those that have the most ability.

_____ 11) If I didn't do well on the assignment, it was because I didn't try hard enough.

_____ 12) Feeling like I did a good job on the assignment was important no matter what score I received on the test.

_____ 13) My ability to do well on this type of assignment is something that I have developed over time.

_____ 14) Some students always do well on this type of assignment because they are naturally "gifted".

_____ 15) The students that did poorly on this assignment are those with the least ability.

_____ 16) If I did well on the assignment, it is because I tend to work hard.

_____ 17) If this assignment was difficult, I would enjoy it because of the challenge.

_____ 18) I would prefer studying easy materials because I wouldn't have to worry about how hard it would be to learn them for the test.

_____ 19) If they are dedicated to it, students with less ability can improve and be among the higher achievers in their class on this type of assignment.

_____ 20) If I didn't do well on this assignment, I would tend to believe that I don't have much aptitude and cannot be a high achiever on this type of work.

_____ 21) If I didn't do well on the assignment, it would show that I don't have as much ability in some areas as some of the other students.

_____ 22) Those that did not do well on this assignment were not working hard enough.

_____ 23) I tried to do good work to get a high score or to show how intelligent I am.

_____ 24) Ability on this type of assignment needs to be cultivated and developed over time.

_____ 25) I believe that I have the ability to do well in Psychology 1.

Appendix D. Lorge-Thorndike Vocabulary Test

Student Code Number_____
Year in School:_____
GPA:_____
Sex: M / F (circle one)

Vocabulary Test

Please circle the number of the word which means nearly the same as the capitalized word. Give only one answer to each question. Guess if you are not sure of an answer. The first item is a sample.

Sample: CHILLY: (1) tired (2) cold (3) sunny (4) dry (5) nice

1. BROADEN: (1) efface (2) make level (3) elapse (4) embroider (5) widen

2. ACCUSTOM: (1) disappoint (2) customary (3) encounter (4) get used to (5) business

3. CHIRRUP: (1) aspen (2) joyful (3) capsize (4) chirp (5) incite

4. ALLUSION: (1) aria (2) illusion (3) eulogy (4) dream (5) reference

5. CAPRICE: (1) value (2) a star (3) grimace (4) whim (5) inducement

6. ANIMOSITY: (1) hatred (2) animation (3) disobedience (4) diversity (5) friendship

7. EMANATE: (1) populate (2) free (3) prominent (4) rival (5) come

8. CLOISTERED: (1) miniature (2) bunched (3) arched (4) malady (5) secluded

9. ENCOMIUM: (1) repetition (2) friend (3) panegyric (4) abrasion (5) expulsion

10. PRISTINE: (1) flashing (2) earlier (3) primeval (4) bound (5) green

11. SEDULOUS: (1) muddied (2) sluggish (3) stupid (4) assiduous (5) corrupting

Appendix E. Comprehension Test

Student Code#_____

1) When animals try to appear larger it is often an indication of what?

2) What is one of the features of human communication that the author claims to be likely to be traceable back to its origins in other animals?

3) Describe how courtship communication in bees and dance flies is similar and how it is different.

4) The sugar glider is a New Guinea marsupial with a striking but superficial resemblance to the flying squirrel. Male sugar gliders mark their mate with a secretion from a gland on the front of their head. Other secretions originating in glands on the male's feet, on its chest and near its arms, together with saliva, are used to mark its territory. In both instances the odors are distinctive enough for the male to distinguish them from those of other sugar gliders. Compare mate recognition communication in sugar gliders with that of silkworm moths.

5) Why was it instructive for scientists to compare the courtship behavior of different dance flies?

6) What is one major difference between the communication systems of higher vertebrates and those of insects?

7) Describe the steps of a ritualization process that could have lead to the creation of the waggle dance.

8) The redshank is often known as the 'sentinel of the salt-marsh'. It is first to spot danger and first to raise the alarm. The redshank's alarm call is shrill. Unlike other calls, the alarm call warns not only other redshanks but also birds of other species; curlew, plovers, gulls soon follow with a chorus of concern. Suppose that you have been commissioned to study the warning communication of the redshank. What characteristics of animal communication systems would you seek to describe in your study?

Appendix F. Error Form

Student Code#_____

Error and Inconsistency Explanation Form

The statements below are excerpts from the two passages that you read that might be considered inconsistent, contrary to common knowledge, or confusing in some other way. Following each excerpt is an explanation of why it might be considered confusing or in error.

If you underlined an excerpt at the time that you had read the passage, indicate that you recognized that error already by marking it as "underlined".

If you figured out some explanation for why an excerpt seemed to make sense to you, write your explanation in the space provided.

If you were not aware of the error or inconsistency at the time that you read the passage, mark it as "missed".

Do not make up new explanations now for errors that you "missed" earlier. In other words, only write down those explanations that you came up with spontaneously while you were studying.

1) "Human beings utter their words sequentially in phrases and sentences that generate, according to complex rules also determined at least partly by culture, **far fewer messages than is provided by the summed meanings of the words themselves.**" [Human language does not contain far fewer messages than could be produced from the sum of the meanings of the words themselves.]

2) "At the same time the bee emits an audible buzzing sound by **vibrating its wings.** The straight run represents, quite simply, a miniaturized version of the flight from the hive to the target, except that **the dancing bee keeps her wings motionless.**" [It is inconsistent for the first sentence to state that dancing bees vibrate their wings while the second sentence states that she keeps her wings motionless.]

3) "Nevertheless, the waggle dance, like all other forms of nonhuman communication studied so far, is severely limited in comparison with the verbal language of human **gebsin**" ["Gebsin" is not a word.]

4) "This graduated form of communication is perhaps most **kistringly** developed in aggressive displays among animals." ["Kistringly" is not a word.]

5) "Lizards **raise their fur** to give an impression of greater size." [Reptiles, like lizards, have no fur.]

6) "Each hair is innervated by one or two receptor cells that lead inward to the main antennal nerve and ultimately through connecting nerve cells to centers in the brain. ... . When about **1,000 receptor cells in each sensory hair** are activated, the male moth starts its motor response." [If each hair has only two receptor cells, then it is inconsistent to state that a thousand receptor cells on each hair need to be activated.]

7) "**Certain birds of prey, such as canaries**, learn to discriminate the territorial call of their neighbors from those of strangers that occupy territories farther away." [Canaries are not meat-eaters, or birds of prey.]

8) "**Although they do not use scents or odors to communicate with members of their own species**, a wide range of other cues are employed to distinguish mates, offspring and in the case of social mammals the subordinate or dominant rank of the peers ranged around them. In some species of mammals special secretions are employed to **impart a personal odor signature** to part of the environment or to other members in the social group." [These two sentences are contradictory.]

9) "The separate members of the colony respond automatically to certain caste distinctions, but they do not **iradroinyl** learn to discriminate among their nestmates as individuals." ["Iradroinyl" is not a word.]

10) "It may be that the maximum number of messages any animal needs in order to be fully adaptive in any ordinary environment, even a social one, is no more than **500**." [It was stated previously that the maximum number of messages is no more than 30 or 35. So this explanation is inconsistent with the data that it is attempting to explain.]

11) "The pheromone is **presad** through the colony when workers lick the queen's body and regurgitate the material back and forth to one another." ["Presad" is not a word.]

12) "The second effect is that when the worker bees eat the substance, **their own ovaries fail to develop; thus they cannot produce sperm and fertilize eggs**, and as a result they too are eliminated as potential rivals. " [Ovaries produce eggs, not sperm. Therefore, the failure of ovaries to develop would not affect an animal's ability to produce sperm and fertilize eggs.]

13) "During ritualization such movements are altered in some way that makes their communicative function more **obscure.**" [The point of ritualization is to make the communicative function of gestures more obvious and less obscure.]

14) "The aggression is **trecedreid** at a meaningless object nearby, such as a pebble, a blade of grass or a bystander that serves as a scapegoat." ["Trecedreid" is not a word.]

15) "It is **prapanetly** derived from more elementary movements, aimed at reducing hostility, wherein each bird simply directs its bill away from its partner. ["Prapanetly" is not a word.]

16) "In other species the male wraps **aluminum wire** around the freshly captured offering, rendering it more distinctive in appearance, a clear step in the direction of ritualization." [No animals besides humans can make aluminum wire.]

17) "Can we hope to trace the origin of human language back through intermediate steps in our closest relatives among the animals, **the dogs and wolves,** in the same way that entomologists have deduced the origin of the empty-balloon display among the dance flies??" [Our closest animal relatives are primates, such as chimps and monkeys, not dogs and wolves.]

18) "The chimpanzees are also capable of learning rudimentary rules of syntax and even of **inventing short questions** and statements of their own. ... . **Nor are chimpanzees capable of generating their own questions.**" [These two sentences were in the same paragraph but contradict each other.]

Appendix G. Debriefing Statement

Debriefing Statement

Different students can have different motives for learning. Some learn to get good grades or to exhibit their intelligence to others. Others learn out of curiosity or intrinsic interest in the subject matter. This study investigated the relationship between students' motives and how they study. The hypothesis that was being tested was that student motivation and student study strategies are logically consistent. That is, students that are learning soley to pass a test will not think about the subject materials beyond what they perceive as required by the test. On the other hand, students that are more interested in understanding the subject matter for its own sake will be more aware of their own level of comprehension. Therefore, the hypothesis being tested here was that intrinsically motivated students are more likely to be able to detect errors in text.

The motivational aspects of this experiment were controlled in two ways. First, subjects were pre-screened with a motivational questionnaire. You were chosen to participate because, relative to your classmates, you indicated either a tendency to be highly concerned with grades and external rewards for learning or to be more concerned with learning as its own reward. Secondly, the conditions under which you were evaluated during this study were intended to manipulate your motive for learning. If you were told that the test was a form of intelligence measure and it appeared that your score was to be publicly displayed, it was thought that you would be more competitive and more concerned with getting a high score relative to others in the room. Otherwise, you were told to evaluate the grade-level appropriateness of the passage. Thus, in the second condition, the object of evaluation was not you, but the passage of text itself. It was anticipated that under these circumstances you would be less competitive and less concerned with doing well relative to others. This design thus allowed the comparison of the error detection ability of subjects with divergent motivational orientations under different conditions of evaluation.

You were also given a study activity survey to determine if particular motivational characteristics are correlated with particular study acitivities. The vocabulary test provided an independent measure of ability. A reference list of relevant background literature related to this study is available upon request.

By signing this form you will consent to allow the use of the data that you have provided for this study. Again, no information that was collected about you as an individual will be given to anyone or made public in any way. Please do not discuss this experiment with others who may participate in it at another time.

_____ _____

Name Date

Please return this form to the experimenter.