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LOYOLA UNIVERSITY CHICAGO

# IS THE LEARNING PROCESS PREDICATIONAL OR MEDIATIONAL? THE EFFECT OF PREDICATE AND SUBJECT CUEING ON TIME TO RECALL WORDS

A THESIS SUBMITTED TO THE FACULTY

IN CANDIDACY FOR THE DEGREE OF

MASTER OF ARTS

DEPARTMENT OF PSYCHOLOGY

BY

CONNIE MARIE VAUGHN

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JANUARY 1993

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# INTRODUCTION

Increasingly in psychology there is a perception of a need to explain human behavior in terms of agency (Bandura, 1989; Harre, 1984; Howard, 1986; Manicus & Secord, 1983; Rychlak, 1988, 1991; Williams, 1992). Human agency refers to the hypothesized capacity of persons to actively contribute to their behavior above and beyond the influence of biological and sociocultural stimulations. That is, an agent may behave in consonance with, in addition to, in contradiction of, or without regard for such influences (Rychlak, 1988). American psychology's traditionally reductionistic image of the person, by contrast, attempts to account for the behavior of human beings entirely in terms of its biological and/or sociocultural antecedents. Such a view, inherited largely from the Baconian science fear of anthropomorphizing the physical world, restricts the causal base of explanations in psychology and "mechanicomorphizes" (Allport, 1940) the human being. Many researchers no longer believe that this non-agential image of the person can accommodate psychology's empirical findings or theoretical growth.

Each researcher committed to agential explanations of human behavior has struggled with the problem of the empirical demonstration of agency. Among solutions offered to this problem, Logical Learning Theory (LLT; Rychlak, 1988) seeks to

delineate the specific properties of human learning and cognition which may support a view of persons as agents. The LLT line of reasoning suggests that for human beings to be agents, the very process of human cognition must be telic or agential. Hence, the theoretical claim for human agency is empirically defensible to the extent that the pro forma psychological equipment of human beings, in a Kantian sense, can be shown to support a capacity for intentionality. A predicational process of cognition, in which meaning is extended logically from wider to narrower patterns of meaning, can supply one aspect of an empirically testable explanatory base for human agency. However, a mediational process of cognition, in which meaning is constituted mechanistically from external inputs, is implicit in the assumptions of traditional, mainstream theories of learning and cognition. These theories thereby reject the possibility of agency without ever putting the possibility to test.

The present thesis seeks evidence for human agency by confronting the assumptions of mediational theorizing with those of predicational theorizing in a verbal learning task. That is, the present studies test the predictions of theories of cognition that rely on linear, efficient-cause associations against the predictions of LLT, a predicational theory of cognition that emphasizes patterned, formal-cause meanings. Participants are asked to learn words under one of two experimenter-given predications (categories). They are then

cued to recall the words with their predication in either the subject or the predicate position of the cue sentence. Logical Learning Theory predicts that cueing with the predication in the predicate position of the sentence should facilitate recall. Mainstream cognitive theories predict that cueing with the predication in the subject position of the sentence should facilitate recall. Findings in accord with the predictions of LLT would support a predicational view of cognition and an agential view of the person; whereas findings in accord with the predictions of mainstream cognitive theories would support a mediational view of cognition and a mechanistic view of the person. These two types of theories and their contrasting empirical predictions will be elaborated in the review of literature below.

# REVIEW OF LITERATURE

## Theoretical Factors

### Predicational vs. Mediational Theorizing

Historically, explanations of human learning in psychology moved from earlier behavioristic or stimulus-response theorizing to the current emphasis on cognitive or information processing theorizing (Knapp, 1986). Cognitive theories are widely viewed as vast improvements over the restrictive, anti-mentalist position of behaviorism (Anderson & Bower, 1973; Knapp, 1986). Whereas stimulus-response psychology regarded (indeed, felt it was only appropriate to regard) the organism "between" the stimulus and the response as an unknowable "black box," cognitive psychology seeks to place the internal workings of this black box on center stage. This shift in theorizing, which occurred in the late 1950s and 1960s, opened the door to explanations focussed on mental organization that were not acceptable in the intellectual climate of academic psychology thirty or so years ago. In this sense, the "cognitive revolution" has freed psychology from the limiting hegemony of behaviorism.

But this case can be (and, I believe, has been) overstated. As Weizenbaum (1976), a respected critic of computer models of human reasoning, states,

> The only difference between Skinner's position and that of the theory under discussion [Newell and Simon's (1972) information processing theory] -- and this difference is important from one point of view but totally irrelevant from another -- is that Skinner refuses to look inside the black box that is the person, whereas the theory sees the inside as a computer. (p. 175, emphasis added)

Not only Newell and Simon's theory, but cognitive psychology in general, has made the computer the dominant metaphor for the human mind (Knapp, 1986). Weizenbaum makes the point that neither the conception of the person as a black box nor the conception of the person as a computer allows the person to be, in Skinner's (1974) polemic, "an initiating, creative agent" (p. 189). This lack of human agency is precisely the deficiency in modern cognitive theories as well as behaviorism that Logical Learning Theory (Rychlak, 1988, in press) seeks to address. Despite the changes in theories of learning introduced by cognitive psychology, the person as modeled after the computer is no more an agent (see Introduction), and perhaps is less one, than the person modeled after the rat.

To clarify why this is so, it is helpful to consider LLT's distinction between "predicational" and "mediational" theorizing. Predication, by definition, involves the act of affirming, denying, or qualifying broader patterns of meaning in relation to narrower or targeted patterns of meaning (Bugaj & Rychlak, 1989). Predication is a logical process of meaning extension, always proceeding from the wider context of meaning, or predication, to the narrower context of meaning, or target. For example, if we say, "Sushi is Japanese," we

are targeting one concept (sushi) by subsuming or predicating it with another concept (Japanese) that acts as a broader context of meaning. This simple logical relationship is illustrated by Euler circles in Figure 1. The larger, subsuming circle represents the concept "Japanese," and the smaller, subsumed circle represents the concept "sushi." The figure shows that we are framing the meaning of the target concept "sushi" by extending the meaning of the predicating concept "Japanese" to it. Of course, many other predications of "sushi" are possible. For example, we might say, "Sushi is eaten," in this case predicating our target concept "sushi" with the broader concept "eaten." Other types of relationships between predicates and targets are also possible. The denial in the meaning of "A tamale is not Japanese" is represented in Figure 1 by the smaller circle "tamale" lying outside the broader circle "Japanese." And the qualification in the meaning of "Some automobiles are Japanese" is represented by the smaller circle "automobile" partially overlapping the broader circle "Japanese." Among this infinity of possible predicational contents, as well as the ever-present possibility of denying or qualifying whatever we may affirm, it is up to the person to frame his or her personal meanings, and to take a position with respect to those meanings. For this reason, we must take an "introspective" or first-person perspective in explaining cognition as a predicational process (Rychlak, in press).

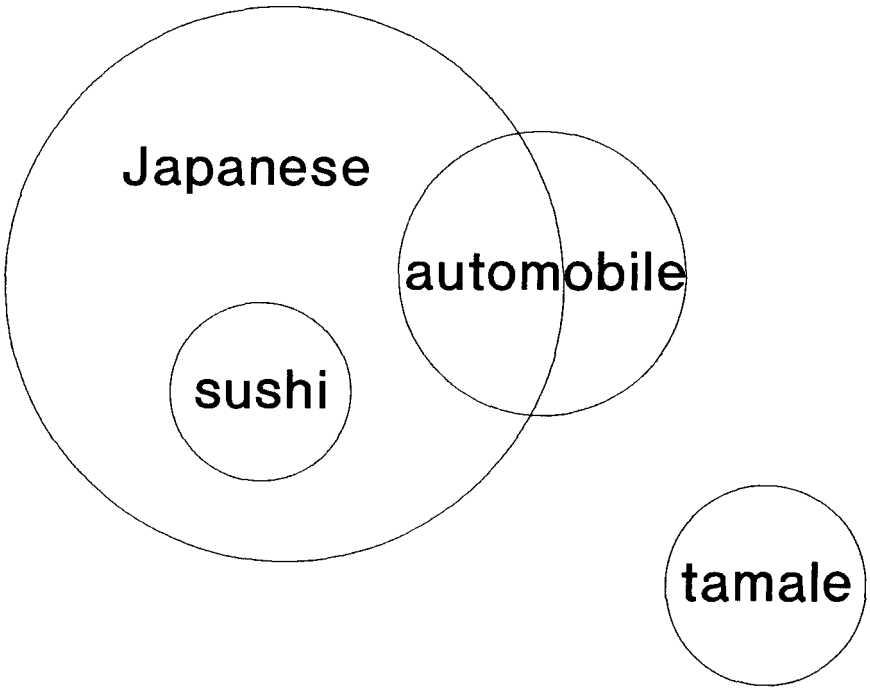


Figure 1. Euler circles showing predication of sushi as Japanese (affirmation), automobile as sometimes Japanese (qualification), and tamale as not Japanese (denial).

Hence, predication signifies a logical and creative process, a process that relies intrinsically on pattern and intention. It is a concept that draws on the meanings of formal and final causation rather than material and efficient causation (Rychlak, 1988). However, it is typically overlooked in psychology's efforts to "account for" behavior via cause-effect sequences, that the cause of an event may in fact be interpreted according to any of these several meanings. Material causation explains events in terms of underlying substance; formal causation explains events in terms of patterned organization; and final causation explains events in terms of ends or intentions (Rychlak, 1991). Only efficient causation, which explains events in terms of a force or impetus pushing them along, is carried in the meaning of "cause-effect." An antecedent impels a consequent along the arrow of time, in the machine-like or mechanistic process that characterizes explanations relying on efficient causation (Rychlak, 1991; Slife, 1981). And this particular brand of causation forms the basis for mediational rather than predicational theories.

Mediation, by definition, involves extrinsic factors in its process: something that is taken in or that is inputted, which was not initially a part of the mediational process, comes indirectly to direct that process (Bugaj & Rychlak, 1989). In other words, learning is passive and accretional, built up from past inputs. The mediational process only

conveys meanings; it does not create them. For example, after separately taking in the words "sushi" and "Japanese" and perhaps connecting words such as "is," the mediational process can combine these distinct units into the sentence, "Sushi is Japanese." This process might be diagrammed in the associative network (Wyer, 1989) fashion of Figure 2. The nodes "sushi" and "Japanese" are discrete units, which were input and then connected to form a mental representation of Japanese as an attribute of sushi. (The node "eaten" is shown as another associated attribute of sushi.) A mediational process underlies all of psychology's mainstream theories of learning, whether behaviorist or cognitive, which rely ultimately on the connection or association of concepts via principles such as frequency and contiguity (see Anderson & Bower, 1973, for a sympathetic treatment of associationistic models that arrives at a similar conclusion). Such theories depend on antecedent events external to the person to explain human learning, and therefore support some form of efficient cause environmental determinism rather than formal-final cause human agency. It should be noted that we take an "extraspective" or third-person perspective in explaining cognition as a mediational process (Rychlak, in press); that is, we view cognition as a process that can be understood entirely from the external point of view of an observer of the process.

It is my belief, drawn from the critiques made by LLT

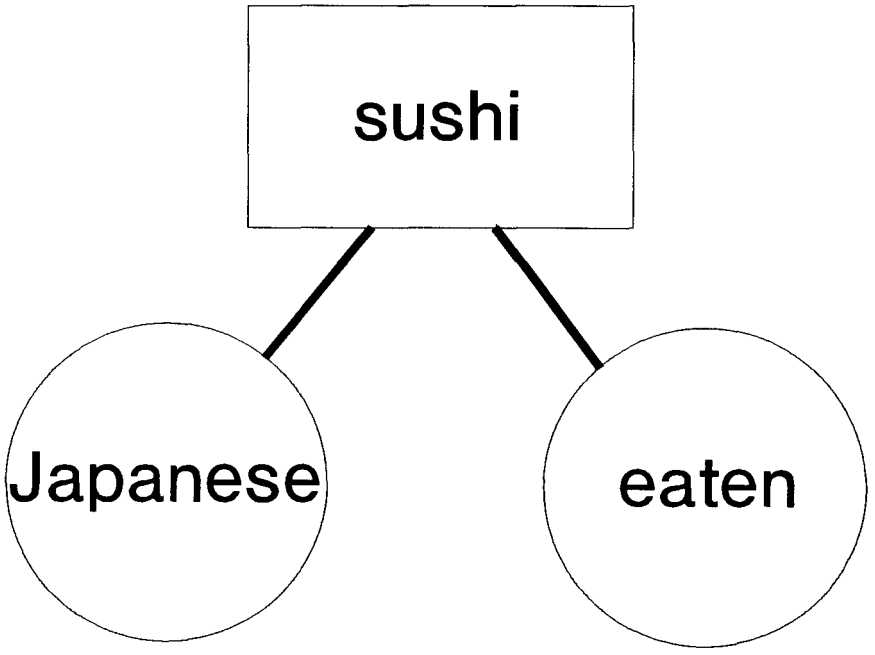


Figure 2. Associative network representation of concept node "sushi" with Japanese and eaten as attributes.

(Rychlak, 1988, 1991), and in agreement with Weizenbaum's (1976) statement above, that despite changes introduced in theories of learning by the cognitive revolution, current cognitive approaches are still mediational and cannot support human agency. The problem with this situation is not that theorists are not free to specify the learning process as mediational and human beings as mechanistic, if this is the point of view they wish to support. Instead, the problem is that the language of cognitive psychology currently offers no non-mediational alternative, and traps all psychologists working within it into explaining human learning as a mediational process, whether they wish to or not. This happens because, while the nature of mental contents are debated by the various cognitive theories, the nature of the learning process itself is simply not questioned. Process is equated with computer-like information processing (Knapp, 1986). Logical Learning Theory offers a predicational alternative to this view, and uniquely, a cognitive basis for the assertion of human agency.

I will now review the more widely cited cognitive theories bearing on learning and recall, including organizational factors in memory (Bower, 1970), levels of processing (Craik & Lockhart, 1972), encoding specificity (Tulving & Thomson, 1973), spreading activation theory (Anderson, 1985; Anderson & Bower, 1973; Bower, 1981), and associative network theories (Hastie & Carlston, 1980; Srull,

Lichtenstein, & Rothbart, 1985; Wyer, 1989; Wyer, Bodenhausen, & Srull, 1984), in order to clarify with greater specificity why these theories are mediational, and to lay the groundwork for extrapolating their predictions under the conditions of my study's design.

## Overview of Mediational Theorizing in Cognitive Psychology

Organizational factors in memory. Bower's (1970) paper on organizational factors in memory represents an early attempt to reinterpret learning experiments in a more cognitive or mentalistic fashion. He reviews a range of experimental examples demonstrating the importance of organizational strategies for memory. These organizational principles have become well known in cognitive psychology. For example, Bower (1970) demonstrates that in paired associates learning, cued recall improves if subjects can discern or invent a rule that generates the correct "response" for the "stimulus" word or item. Serial recall (the recall of the items of a list in correct sequence) is aided when subjects group the items into chunks or "perceptual units." Free recall improves when subjects develop "better integrated chunks" (p. 34, emphasis added) or subjective groupings of the items. In all learning contexts, ambiguous words appear to be understood according to the mental set of the subject.

These assertions certainly receive no argument from the predicational theorist! In fact, from a Logical Learning Theory point of view, they read like a catalog of examples of

the predicational process. Formal cause, the principle most fundamental to predication, is inherent in the very idea of organization, and is articulated in the ideas of rule following (Rychlak, 1992), grouping, integration, and mental set (Rychlak, 1988). Moreover, Bower's (1970) analysis specifically refutes some of the mediational principles of earlier S-R theorizing. He points out that mere repetition of the same serial list does not improve recall if subjects do not learn the list in the same chunks each time. Similarly, longer exposure to words in a free recall context does not improve recall if subjects must change the groupings of the words they are learning. As Bower (1970) states, "The results support the view that increasing stability of subjective groups is normally a concomitant of, perhaps even a cause of, increasing free recall with practice trials" (p. 35, emphasis added). In such statements, it would seem that Bower is giving the formal cause priority over the efficient cause expressed in S-R principles of association. Bower (1970) even emphasizes that mental relations deal with "meanings...not words" (p. 37), suggesting to the predicational theorist the priority of final cause and intention over associated inputs.

However, Bower's (1970) own favored explanations of the mental phenomena he outlines so well remain couched in the extraspective computer lingo of information processing theories. He posits a "central processor" that directs searches of "hierarchical list structures" in memory

retrieval. The lack of agency or personal directedness of this processor, as well as the absence of an introspective perspective, is underscored by Bower's need to place the word know in quotes, in his remark that "the central processor 'knows' what subset of features of the stimulus word to examine" (p. 43). Furthermore, Bower (1970) retains the mediational S-R concept of "associations" (pp. 26, 33) or "links" (p. 43) as the pathways that connect our discrete mental contents together. In this (very common) mixed metaphor of computer structure and S-R associationism, organization benefits the subject by giving the central processor a retrieval plan, and also by "strengthening" the associations between the items that are to be remembered. This contrasts with a predicational explanation, in which memory benefits from organization because cognition is inherently organizational and meaning-giving. We see that for Bower (1970), the formal and final causes do not rest as explanations themselves, but must be subsumed by the efficient cause. Ultimately, his is a mediational model, in which mental organization is built up from associated inputs, and not a predicational model, in which organization is implicit in the act of predicating one concept of another.

Encoding specificity. Tulving's principle of encoding specificity represents a significant contribution in the history of cognitive psychology that continues to enjoy popularity (see Anderson, 1985; Eysenck & Keane, 1990).

Tulving and Thomson (1973) introduced the principle of encoding specificity to explain why in some circumstances, contrary to the predictions of other cognitive theories, subjects failed to recognize words that they were able to recall. Cognitive theories such as the generation-recognition model (Tulving & Thomson, 1973) posit recall as a two-step sequence in which the person first generates the target item and then recognizes it. Therefore, the probability of successful recall of an item cannot exceed the probability of successful recognition of it. Tulving and Thomson's (1973) own experiments demonstrate conditions under which this model fails. Specifically, when subjects are able to generate target words that appear on lists they have previously learned, but do not view the words in the context of the cues learned with those target words, they frequently fail to recognize the target words. However, subjects are able to recall many of the target words if they are presented with the original cues. Tulving and Thomson (1973) offer the principle of "encoding specificity" as explanation:

> All these data suggest that the effectiveness of a particular cue depends on how the to-be-retrieved item was encoded at input. The recognition failure of recallable words represents an extreme case of the general principle that encoding determines the trace, and the trace determines the effectiveness of retrieval cues. (p. 370)

Tulving and Thomson (1973) conclude that each memory episode is stored with contextual information specific to its occurrence, and that only cues from this encoding context will

facilitate retrieval of the memory. It seems hardly necessary to belabor the point that Tulving and Thomson (1973) employ an extraspective computer-based model in their explanation.

Again, LLT embraces the implications of these experimental demonstrations, while offering an alternative explanation from the perspective of a non-mediational theory. Recall the discussion of the process of predication. In this process, the meaning of a target item always depends upon the broader context of meaning -- the predication -- that is extended to it. Essentially, "predication" and "context" are equivalent terms in LLT (Rychlak, 1988). Memory for an event is achieved by the re-predication of the same meaningful relations among items (Rychlak, in press). The introspective LLT line of reasoning suggests that, in learning lists of target words and cues as in the Tulving and Thomson (1973) studies, subjects attempt to predicate the target words with the cue words. For example, the subject learning the cue-target pair "glue-chair" may say to herself, "It is possible to put a chair together with glue." It is not at all surprising to the Logical Learning theorist that the subject's memory is better facilitated by the establishment of her initial predicating context, that is, by the presentation of the list cues, than by other "associates" to the target words, including even the target word by itself. Without the initial predication, the meaningful relationship is not drawn, and the subject does not remember.

Moreover, LLT is able to explain easily the "asymmetry of associations between list cues and target items" (Tulving & Thomson, 1973, p. 368). That is, it is easier to remember a target item in the context of its initial predication (the list cue) than it is to remember the list cue in the context of the target item. This is almost self-evident from the nature of the predicational process, which, unlike associationistic processes, is inherently directional, proceeding from wider to narrower contexts of meaning (in this case, from the list cue to the target item). Once again LLT gains its particular explanatory power from its recognition of the formal cause.

Levels of processing. Craik's levels of processing framework represents another historically significant contribution to cognitive psychology that continues to enjoy popularity (see Anderson, 1985; Eysenck & Keane, 1990). In their 1972 article, Craik and Lockhart express dissatisfaction with the "box approach" to memory that is fundamental to the "computer analogy on which information flow models are based" (p. 673). They suggest that experimentally demonstrated distinctions between short term and long term memory might be viewed not as evidence for the existence of multiple memory stores, but instead as evidence for the impact of processing limitations on encoding operations. According to Craik and Lockhart (1972), if a person is able to process a perceived item at a "deeper level" during encoding, retention will

automatically be improved. They state that "at deeper levels the subject can make more use of learned cognitive structures so that the item will become more complex and semantic" (Craik & Lockhart, 1972, p. 679). Deeper levels of processing, then, signify increased elaboration according to previously learned material (Craik & Lockhart, 1972). This principle is widely used to explain the better retention subjects demonstrate in incidental memory tasks of words that they treat semantically (according to their meaning) rather than structurally (according to their spelling or appearance). Presumably, words treated semantically are processed more deeply.

As with Bower (1970), we find these theorists criticizing other mediational theories for specifically mediational aspects of that theorizing -- but then offering alternative constructs that are themselves mediational. For example, Craik and Lockhart (1972) emphasize that increased processing time will not benefit memory unless deeper processing occurs during that time. Such statements reflect an ambiguity, perhaps even a circularity, in the meaning of "deeper." In the absence of the formal-final cause ideas of meaning and meaningfulness (Rychlak, 1988), it is difficult to explain why some sorts of processing, such as "semantic" processing, are deeper than others, such as "structural" processing. At best, we are left with an extraspective counting of linkages among mental contents to explain depth of processing (Craik & Lockhart, 1972). In LLT, of course, meaning-extension stands

as a central principle in its own right (Rychlak, 1988). A subject extends meaning to, or predicates, the items we experimenters have him learn, and these predications vary in meaningfulness to him. The subject will remember items he has predicated more meaningfully because those predications introspectively play a more central organizational role (formal cause) in his cognition. Most people find predicating a word according to a semantic category to be more meaningful to them than predicating the word according to its structural features. In the LLT explanation of the depth of processing phenomenon, then, the mediational concept of depth is replaced by the predicational concept of meaningfulness.

Spreading activation theory. The next two theories to be discussed, Anderson's (1990; Anderson & Bower, 1973) spreading activation theory and Wyer and Srull's (Srull et al., 1985; Wyer, 1989) associative network theory, are variants of the currently dominant network model of memory (Eysenck & Keane, 1990). Generally speaking, network theories conceptualize memory extraspectively as a set of concept nodes that are arranged via associations into a hierarchical organization. They retain the mechanistic underpinnings of British Empiricism and American Behaviorism, as they reduce mental organization to associations that are built up between elements through frequency and contiguity (Anderson & Bower, 1973). According to proponents Anderson and Bower (1973),

even in these cognitive theories, associations are still the "glue" that connects mental items together (p 31).

Spreading activation theory's leading proponent has been the well-known cognitive psychologist John R. Anderson. Anderson's (1990) famous ACT* system is an artificial intelligence model of human problem solving, which includes a semantic network of "declarative" knowledge and a production system of "procedural" knowledge. In essence, the former encompasses the body of "facts" that one knows in a given domain, and the latter encompasses the skills or procedures one has learned to employ in that domain. Knowledge structures of either kind function only when they are activated above a threshold. The level of activation of a knowledge structure is a function of the strength of pathways or associations to that structure, and the number of competing pathways that cause interference with the activation of that structure (Anderson, 1985). In other words, the model assumes that knowledge is stored in the brain in a form that the electro-chemical activity of the brain activates in some way to (efficiently) cause memory and behavior. In his undergraduate textbook, Anderson (1985) goes so far as to cast nearly his entire discussion of the basic concepts and principles of memory in terms of spreading activation theory (see his chapter 6). For Anderson, remembering is activation. Anderson's colleague Bower, whose early paper on organization I reviewed above (Bower, 1970), himself interprets the

phenomenon of mood-state-dependent memory in terms of a spreading activation model in which emotions are nodes in the semantic network (Bower, 1981). He states,

> When activated above a threshold, the emotion unit transmits excitation to those nodes that produce the pattern of autonomic arousal and expressive behavior commonly assigned to that emotion....Activation of an emotion node also spreads activation throughout the memory structures to which it is connected, creating subthreshold excitation at those event nodes. (p. 135)

Whereas LLT interprets state-dependent memory facilitation in terms of the formal cause re-establishment of the person's original predicational context (Rychlak, in press), Bower (1979) interprets it according to a material-efficient cause neuronal activity that excites memories that are linked to an emotion node.

More recently, Anderson (1990) has questioned the necessity of tying a theory of cognition to pseudo-physiological constructs like activation. He reflects that his previous concern has been to create a cognitive model that is "neurally plausible" (p. 2), but that what happens at the "level" of neuron functioning is in fact conceptually independent of what happens in the logic of cognition (Anderson, 1990). Rychlak (in press), the author of LLT, has taken this type of idea even farther in his discussion of the different grounds of explanation. Explanations grounded in the Bios, the domain of the life sciences, most usually employ an extraspective account of events in terms of material and efficient causation. By contrast, explanations grounded in

the Logos, the domain of human reasoning and cognition, ideally employ an introspective account of events that may include formal and final causation. The Logos is not beholden to the Bios to support its explanations, any more than the Bios is beholden to the Logos. Therefore these grounds are not conceived in terms of rank-ordered "levels" of explanation, but rather as separate and independent, yet internally consistent, frames of reference, which the theorist may draw upon according to his or her explanatory goals and predilections. An LLT perspective would find spreading activation theory not only mediational, but also misleading in its insistence that cognitive theories (Logos) must explain cognition in terms of brain activity (Bios).

Associative network theory. Associative network theory has been elaborated predominately by those researchers studying person memory (e.g., see Hastie, Ostrom, Ebbesen, Wyer, Hamilton, & Carlston, 1980). Although the present studies do not employ specifically a person memory task, associative network theory will be reviewed because its principles are representative of some of the most current thinking in cognitive psychology.

According to associative network theory, information about a person is represented hierarchically as nodes in a propositional network, with the person as the highest-level node, trait or category information as the next-highest-level nodes, and specific behavior episodes as the lowest-level

nodes (Wyer, 1989). Associative links, which are formed by the contiguous apprehension of behavioral episodes (Hastie & Carlston, 1980), or by thinking about behavioral episodes in relation to the person's traits and to each other (Wyer et al., 1984), connect these nodes to each other and to the "higher-order" person node (Srull et al., 1985). Memory retrieval is accomplished via a search that begins at the person node and follows associative paths to activate lower-level trait and then behavior nodes (Srull et al., 1985; Wyer, 1989). The likelihood of retrieval of behavioral or trait target information increases with stronger associations of that target node to more abstract nodes, and with a greater number of same-level nodes directly associated to the target node (Wyer et al., 1984).

Of all of the cognitive theories reviewed above, it is perhaps easiest to see the mediational assumptions in this theory. The processes of encoding and retrieval are again described from an extraspective perspective, as easily descriptive of the computer as the human being. Further, these processes are conceived of as efficiently caused, with the characteristics of the input (its abstractness, relevance and congruity with previous input) determining its place in the nodal hierarchy and the number and strength of associations to it (Wyer, 1989). Moreover, level of abstractness is fixed in the network and confounded with the particular meaning of the item (person, trait or behavior);

whereas in a predicational model, any concept can be predicated of another to give a different meaning to it. For example, we can say, "A man is a tree," predicating "man" with the concept "tree," which might suggest to us such meanings as that a man is always growing and developing, or that a man goes through seasons in his life. But we can as easily reverse the predication, saying "A tree is a man," which might suggest to us such meanings as that a tree is also alive, or that a tree is an individual among other trees (Rychlak, in press). Predication is an active and continuous process of meaning creation, not a passive evoking of past inputs.

Logical Learning Theory: A Predicational Alternative

It is my hope that the above discussion of major cognitive theories in contrast to LLT will facilitate better understanding of the distinction between mediational and predicational models of memory and cognition. The continued high visibility of mediational theories such as associative network theory suggests that a substantial contingent of cognitive psychologists still find the traditional information processing metaphor a promising model for human cognition. Some have made this choice from a knowledgeable position of the history and implications of their stance. Others, perhaps, have simply never known of a serious "scientific" alternative, or have not followed the implications of this line of thinking for concepts they might prefer to endorse such as human agency. Logical Learning Theory offers an

alternative, predicational view of human reasoning that is at once methodologically rigorous and theoretically supportive of human creativity, freedom, and responsibility. It builds on a modern philosophy of science that acknowledges the centrality of meaning to human affairs, the multiple meanings of causality, and the necessity of an introspective and reflexive theory of human psychology (Howard, 1986; Manicus & Secord, 1983; Polanyi, 1962; Rychlak, 1988, 1991, in press; Slife, 1981; Williams, 1992). I will now turn to a review of the empirical successes of LLT research and the development of the present studies.

## Empirical Factors

### Research on Logical Learning Theory

Research on affective assessment. Early research on LLT (1963-1983) centered around the construct of affective assessment (Rychlak, 1988, 1992). Affective assessment is defined as the innate capacity that people have to render oppositional judgments of their circumstances, in the sense of good-bad, like-dislike, or prefer-disprefer (Rychlak, 1992). Affective assessment is understood in LLT as a sort of transcendental predication, a meaning which people extend from birth into all of their ongoing experience. Rychlak and his colleagues have conducted extensive experimentation demonstrating the independence of affective assessment from various mediational concepts based on frequency or contiguity, which they group together under the term "association value"

(Rychlak, 1988, 1992). For example, even when measures of association value are held constant, a "liked over disliked" facility in learning both words and CVC trigrams is still demonstrated (Rychlak, 1990). In studies using a range of levels of association value for CVC trigrams, level of affective assessment has been shown to be statistically independent of level of association value; and measures of affective assessment load on different factors from measures of association value in factor analyses (Rychlak, 1988). Moreover, studies of learning style have demonstrated that subjects (such as psychiatric patients) who predicate the learning task, themselves, or their life circumstances negatively rather than positively show diminished or even reversed "liked over disliked" learning rates, in effect extending the meaning of their general negativism into the specific tasks with which they are faced (Rychlak, 1990). Altogether, evidence has supported the LLT assertion that affective assessment stands as a sort of formal-cause Kantian category in its own right, a meaning that people employ as a fundamental means of organizing their learning.

In the course of LLT's development, affective assessment came to be understood as a key example of the more general cognitive principles of oppositionality and predication. Oppositionality is seen in the bipolar nature of the "liked vs. disliked" distinction. More generally, oppositionality signifies a bipolar relation between meanings in which one

pole delimits and hence enters into the definition of the other pole, and vice versa (Rychlak, 1990, in press). Predication (discussed in detail above) is seen in the extension of the meaning of affective assessment into ongoing experience -- essentially, the predication of that experience as "something liked" or "something disliked." Taken together, oppositionality and predication -- the ability to see multiple possibilities and to structure personal meanings -- form the basis of LLT's claim for human agency (Rychlak, in press). As the present studies investigate aspects of predication but not oppositionality, relevant LLT research on predication will be reviewed. (Please note that the term participant will be used in place of the term experimental subject in discussing the studies dealing with predication, including the present studies, in order to distinguish references to these persons from references to the grammatical subject of a sentence.)

Research on predication. In two studies investigating the roles of both predication and oppositionality in learning, Rychlak and his colleagues examined the importance of the learner's establishment of specific meaningful relationships between learned items (formal cause), in contrast to the mediational view in which learned items hook up, or are associated, in an undifferentiated and automatic way (efficient cause) (Rychlak, Williams, & Bugaj, 1986). Using CVC trigrams, these investigators created instances of four different ways of relating or predicating items: unqualified

affirmation (e.g., "HIB is always VIC"), qualified affirmation (e.g., "HIB is sometimes YAT"), negative affirmation (e.g., "HIB is never QIN"), and oppositional affirmation (e.g., "HIB is opposite JOQ"). This is essentially a paired-associates design, once common in verbal learning research, in which in this case the left-hand term is held constant with four different right-hand items relating to it. Participants were presented with the left-hand item and its four predications, and asked to recall the appropriate right-hand items. Because the right-hand items are in the predicate position of English syntax, LLT postulates that participants will consider them the broader context of meaning, or predication, which target the left-hand item in the subject position of the sentence. Of course, the point here is that CVC trigrams ("nonsense syllables") suggest no common meanings in and of themselves. Participants in this task must establish meaning solely through the (formal cause) syntactical relationships presented to them. Indeed, as Rychlak and his colleagues predicted, the type of predicating relationship influenced participants' ability to correctly recall the predicating trigrams, with oppositional relationships serving as the best learning heuristic (Rychlak et al., 1986). Hence, all "associations" between items are not created equal, but depend on the nature of the meaningful relationship -- the predication -- that the learner draws between the items.

Ulasevich (1991) investigated both affective assessment and predication more generally. He constructed a series of sentences describing a person, such as "When it comes to dancing, John is _____." The word completing this sentence would predicate John in the realm of dancing (or whatever realm of behavior is described). For some participants, the word completing this particular sentence was "graceful," which would be a positive predication, and for others it was "clumsy," which would be a negative predication. Participants were asked to learn a series of eight such statements, four positive and four negative. Following LLT, Ulasevich (1991) predicted that because affective assessment is such a fundamental predication, used by people to order their memories prior even to semantic organization, then during learning trials, participants would learn the correct affective quality of the word completing the sentence even before they had learned the word itself. This prediction was confirmed, with participants regularly able to anticipate the affective quality of the sentence ending on an earlier learning trial than they were able to anticipate the actual word. Furthermore, when participants offered an incorrect word to complete the sentence, this word was usually affectively correct. Apparently participants extended affective meanings to the words in order to learn them, supporting the LLT contention that predication is basic to the process of learning.

Finally, Rychlak and his colleagues have conducted a series of experiments on predication in which participants are cued with either the subject or predicate of a target sentence (see Rychlak, in press, chapter 5). For example, in one of the most recent of these studies (Rychlak, Stilson, & Rychlak, 1990), participants received a list of 24 sentences such as "A tennis racket can be used as a spaghetti strainer. A rock can be used as a paperweight." Participants were asked to recall as many of these sentences as possible after one reading. They were then cued with a word from the sentence in order to help them recall more of the sentences. The cue could be either the subject of the sentence ("tennis racket," "rock,") or the predicate of the sentence ("spaghetti strainer," "paperweight"). Logical Learning Theory predicts that predicate cueing should be more facilitative to recall, because the predicate, by virtue of its position in the formal-cause structure of a sentence (and regardless of its content), represents the broader meaning which extends to the target meaning in the subject of the sentence. This is exactly what has been cross-validated in several studies (Rychlak, in press; Rychlak, Stilson, & Rychlak, 1990).

## The Present Studies

The present studies include two closely related experiments which continue the line of inquiry of LLT research on predication, empirically pitting the predictions of LLT against those of mediational theorizing. As outlined in the

review of research above, LLT argues that syntax reflects our semantic (i.e., meaning-making or predicational) process, and that predication is represented linguistically in English syntax by the predicate of a sentence. That is, the predicate of a sentence represents the broader context of meaning that subsumes the meaning of the target under consideration, which itself is represented by the subject of the sentence. (Strictly speaking, the verb plus the object of a sentence is referred to as the "complete predicate." The verb gives us the relation obtaining between the targeted subject and the conceptualizing object. The research on predication by Rychlak et al., 1986, described above, demonstrates the conceptual importance of the specific relation between subject and object as represented by the verb. However, in the present studies, the verb "to be" is held constant, and only the object of the sentence is varied. Hence, in the context of the present studies, the object alone will be referred to as the predicate.)

For example, in the sentence "Sushi is Japanese," the word Japanese predicates the target word sushi. Likewise, in the sentence "Sushi is eaten," the word eaten predicates the target word sushi. According to LLT, we implicitly understand this organization whenever we encounter a sentence. In fact, as reviewed above, LLT research has predicted and found that cued recall for sentences is facilitated when the cue word is the sentence predicate rather than the sentence subject.

Essentially, grammatical structure reflects an introspectively meaningful cognitive organization. Supplying participants with their broader context of meaning (the predicate of the sentence) allows them to extend that meaning to the target (the subject of the sentence), reestablishing their initial predication and recalling the sentence. The reverse of this procedure, supplying participants with the subject of the sentence so that they must recall the predicate of the sentence, works less well because it does not suggest the same meaningful organization initially established by the participants when they read the sentences.

In the present studies, I am predicting that cued recall will be facilitated when a cue's grammatical predicate (as opposed to its grammatical subject) is the same as the predication with which a person originally subsumed the target word. In this case, we are not dealing with participants who are learning a sentence and being cued with a word taken from that sentence. Instead, participants are learning an item in a general category (i.e., predicating the item by that category), and then being cued for recall of the item with a sentence containing both that category and new information. To illustrate using the example in the previous paragraph, it is expected that the cue "the eaten item that is Japanese" will better facilitate recall for the participant who has already predicated sushi as Japanese, whereas the cue "the Japanese item that is eaten" will better facilitate recall for

the participant who has already predicated sushi as eaten. Notice that both cues contain identical information, that the item is eaten and that it is Japanese. Only the grammatical position of the information is different. (This feature of the design makes the studies different from the encoding specificity research paradigm, in which participants are cued with either a presented cue or an extralist cue. Here both of these types of cues are contained in the cue sentence. The "specificity" being tested is for grammatical position, not type of cue.) The cue sentence represents an organization of meanings by virtue of its grammatical structure, which may or may not coincide with the way in which the participant has already organized his or her meanings. If it does, then recall is facilitated. If it does not, the participant must reorganize his or her meanings to successfully recall the target item.

Predicational vs. mediational interpretation of reaction time. The present studies differ from past LLT research in that reaction time rather than learning trials, sentences recalled, etc., is used to operationalize facility of recall. This is somewhat of a departure for LLT research. Because LLT does not conceptualize cognition in terms of efficient causation, reaction time is not used to track stages of cognitive processing, as it is in the "chronometric analyses" of information processing experiments (Eysenck & Keane, 1990; Siegler, 1983). In chronometric analyses, studies are

"designed to test the hypothesis that processing proceeds through independent (additive) serially executed stages" (Siegler, 1983). For these researchers, the alternative to independent, additive, serially executed stages is not the formal cause predicational process of LLT, but rather the same component stages occurring in parallel (Eysenck & Keane, 1990; Hastie & Carlston, 1980; Siegler, 1983). Reaction time is assumed to track a sequence of extraspectively conceived "simple basic actions," borrowed from the computer to include recoding, storing, copying, moving, erasing, and comparing symbols (Simon, 1985, p. 24). From this perspective, the time it takes to remember a target item reflects the duration and ordering of the stages of cognitive processing. The mediational assumption that memory and cognition take place through timebound stages, however, is not tested.

By contrast, cognition viewed as a predicational process creates meanings through conceptual relations, in an immediate rather than mediate fashion; that is, without regard for the passage of time (Rychlak, 1991; Slife, 1981). Logic, pattern, and organization inhere in the meaning of formal causation and do not depend on the timeline of efficient causation for their existence. From such a perspective, the introspectively meaningful pattern or organization of cognition is assumed to be fundamental. Efficiently caused processing stages are not inherent to meaning, which can be understood fully in terms of formal-final cause conceptual relations. The efficient cause,

however, can act as an instrumentality for the formal and final cause (Rychlak, 1988). Efficiently caused events can be understood as occurring under the direction of formal-final cause organization and intention. From this perspective, the time it takes to remember a target item ultimately reflects the effortfulness or difficulty one has in extending meaning to recreate an introspectively meaningful predication of the item.

Predicational vs. mediational predictions for the present studies. The contrast between the predicational and mediational interpretations of reaction time enables an elegant test to be made of the mediational assumption of memory as efficient cause processing. As I discussed above, LLT predicts that cued recall will be facilitated when a cue's grammatical predicate (as opposed to its grammatical subject) is the same as the category with which a person originally subsumed the target word. This prediction rests on the assumption of a formal cause structure in both language syntax and introspective meaning. Moreover, facilitation of memory will in this case be measured by shorter response time. The exciting thing about this design is that, because of their efficient cause interpretations of reaction time and cognition, mediational theories would make the opposite prediction! That is, they would predict that cued recall will be facilitated when a cue's grammatical subject, not its grammatical predicate, is the same as the category with which

a person originally subsumed the target word. Whereas much of my argument for LLT so far has involved merely a novel interpretation of known results, the present studies offer a clear cut test of competing predictions.

Why do I contend that mediational theories of cognition would make the opposite prediction? Because mediational theories rely ultimately on the efficient cause rather than the formal cause, they have no reason to assign importance to the pattern represented in grammatical position. Associations between mental items are essentially indistinguishable; at best they are "tagged" according to the relation they signify, using another association (Hastie et al., 1980). Organization may be built up from associated items like structures erected from tinker toys; however, there is no sense of the inherent meaningful organization in which a broader context of meaning subsumes a narrower, targeted context. When the formal cause pattern of grammar is disregarded in favor of the efficient cause arrow of time, only an item's sequence in the sentence becomes important. What comes first can be processed first, and the participant's advantage lies in receiving the category she learned earlier (subject position of sentence) rather than later (predicate position of sentence). For example, in contrast to LLT, these theories would predict that the cue "the eaten item that is Japanese" would lead to faster recall for the participant who has categorized sushi as eaten; whereas the cue "the Japanese item that is eaten" would lead

to faster recall for the participant who has categorized sushi as Japanese. Freedman and Loftus (1971), working within a spreading activation model, make exactly this prediction for exactly the above reasons: the category with which the participant subsumes the target will better facilitate recall if it is given first, because this allows a head start in the "search" process. Their recall process is mediate, with recall requiring time for searching, whereas LLT's is immediate, with recall occurring as soon as the predicational pattern is apprehended. Although Freedman and Loftus' (1971) claim was made over twenty years ago, we have not yet seen it tested against a predicational claim. The present studies will make this test.

## STUDY 1

### Statement of the Problem

#### Hypotheses

Hypothesis I: It is predicted that participants who learn target words under an experimenter-given predication will respond faster to cue sentences when that predication is in the predicate position of the sentence, and respond slower to cue sentences containing identical information when that predication is in the subject position of the sentence.

Hypothesis II: It is predicted that participants who learn target words under no experimenter-given predication will show no overall difference in their response times to these two types of cue sentences.

#### Rationale

Hypothesis I follows from the discussion of LLT in the review of literature above. Logical Learning Theory suggests that grammar reflects the underlying predicational process of cognition. Specifically, a predication is represented linguistically by the predicate of a sentence, and the target of the predication is represented by the subject of a sentence. Thus, a cue sentence represents a meaningful cognitive organization by virtue of its grammatical structure, which may or may not coincide with the way in which the participant has already organized his or her meanings (in this case, around the experimenter-given predication). Participants must reestablish their initial predication in

order to recall the sentence. Therefore, recall will be facilitated when the cue sentence represents the same organization as the participant's introspective organization, i.e., when the predicate of the cue sentence contains the participant's initial predication. Otherwise (i.e., when the subject of the cue sentence rather than the predicate contains the participant's initial predication), the participant must reorganize his or her meanings to successfully recall the target item. Reaction time will be used to measure ease or facilitation of recall, without assuming that an efficient cause process is directing cognition.

Hypothesis II is also implied by the discussion of LLT in the review of literature above. Participants who are not supplied with an experimenter-given predication must supply an organization to their learning of the target words themselves. They might spontaneously predicate the words according to the experimenter's categories or according to some other idiosyncratic categories. For any one participant, recall will still be facilitated if his or her initial predication is in the predicate position of the cue sentence. However, across a group of participants employing a variety of different predications, the facilitation of one type of cue sentence over another is expected to cancel out.

# Method

## Participants

Participants were 44 undergraduate students (16 male, 28 female) enrolled in introductory psychology courses at Loyola University of Chicago. All participants were native English speakers. Participation in the experiment partially fulfilled a course requirement.

## Independent Variables

Learning task condition. There were two experimental learning task conditions, designated the Action and Ethnic conditions, as well as a Control condition. Table 1 shows the target words that were learned, arrayed according to both "action" and "ethnic" predications or categories. The "action" predication signified the action or use of a target word (i.e., ridden, worn, eaten), and the "ethnic" predication signified the national or ethnic association of a target word (i.e., Mexican, Japanese, [American] Indian). Participants in all conditions learned this same set of nine target words. However, participants in the Action and Ethnic conditions learned these words under the "action" and "ethnic" predications or groupings shown in Table 1, respectively, and participants in the Control condition learned these words with no predication or grouping suggested by the experimenter. Specifically, participants in the Action and Ethnic conditions viewed each predication or grouping following by its three target words on index cards. Participants in the Control

condition viewed only the nine target words on index cards. Moreover, as also shown in Table 1, the frequency of the target words in the English language, according to the Kucera and Francis (1967) list, was held constant to control for any effects of differential familiarity with the target words.

TABLE 1

TARGET WORDS ARRAYED ACCORDING TO BOTH ACTION AND ETHNIC PREDICATIONS

| | ETHNIC PREDICATIONS | | |
|---|---|---|---|
| ACTION PREDICATIONS | Mexican | Japanese | Indian |
| Ridden | burro (1) | rickshaw (1) | canoe (7,2) |
| Worn | poncho (3) | kimono (1) | moccasin (1,2) |
| Eaten | tamale (1) | sushi (2) | venison (1) |

NOTE: The numbers in parentheses reflect a word's appearance per million words on the Kucera and Francis (1967) list. The first number signifies the appearance of the given form of the word. The second number, where shown, signifies the appearance of variations of the word, such as plurals and possessives.

Type of cue sentence. Each of the nine target words in Table 1 can be identified unambiguously, in the context of this learning experiment, as the intersection of a given "action" and a given "ethnic" predication. For example, moccasin is unambiguously identified as the intersection of worn ("action" predication) and Indian ("ethnic" predication). Each cue sentence identified a target word as such an intersection of an "action" and an "ethnic" predication. For example, the cue sentence "Name the worn item that is Indian"

identified the target word moccasin. There were two types of cue sentences, designated Action-Ethnic and Ethnic-Action cue sentences. Action-Ethnic cue sentences contained an "action" predication in the subject position of the sentence, and an "ethnic" predication in the predicate position of the sentence. "Name the worn item that is Indian" is an example of an Action-Ethnic cue sentence. Ethnic-Action cue sentences contained an "ethnic" predication in the subject position of the sentence and an "action" predication in the predicate position of the sentence. "Name the Mexican item that is eaten" is an example of an Ethnic-Action cue sentence.

Specifically, two non-overlapping sets of six cue sentences were created according to the following specifications:

1. Three sentences were Action-Ethnic types of cue sentences, pairing an "action" subject with an "ethnic" predicate, in the form, "Name the [ridden/worn/eaten] item that is [Mexican/Japanese/ Indian]." Each "ethnic" predicate was paired with a different "action" subject.

2. Three sentences were Ethnic-Action types of cue sentences, pairing an "ethnic" subject with an "action" predicate, in the form, "Name the [Mexican/Japanese/ Indian] item that is [ridden/worn/ eaten]." Each "action" predicate was paired with a different "ethnic" subject.

3. No two cue sentences within a set contained the same action/ethnic pairing; that is, no two cue sentences signified the same target word.

4. The sets alternated Action-Ethnic and Ethnic-Action types of cue sentences. Furthermore, one set began with an Action-Ethnic type of cue sentence, and the other set began with an Ethnic-Action type of cue sentence.

Each participant responded to one complete set of six cue sentences. Hence, each participant responded to three Action-Ethnic cue sentences and three Ethnic-Action cue sentences. For example, Participant 3 was randomly assigned to respond to Question Set 2. In this set, cue sentences 1, 3, and 5 were Action-Ethnic cue sentences, and cue sentences 2, 4, and 6 were Ethnic-Action cue sentences. Two different sets of cue sentences were used in order to strengthen claims for the generalizability and non-artifactual nature of the study's results. However, note that the cue sentence set itself was not an independent variable in this design; rather, type of cue sentence (Action-Ethnic or Ethnic-Action), which cuts across the two cue sentence sets, was the independent variable under consideration. Furthermore, it is important to understand that, for participants in the Action and Ethnic conditions, a predication learned by the participant in the learning task was <u>always</u> present in a cue sentence. Only its position in the sentence as a subject or predicate varied. For example, in the Action-Ethnic cue sentence "Name the worn item that is Indian," a predication learned by Action condition participants, <u>worn</u>, was present in the subject position of the sentence; and a predication learned by Ethnic condition participants, <u>Indian</u>, was present in the predicate position of the sentence. Conversely, in the Ethnic-Action cue sentence "Name the Mexican item that is eaten," a predication learned by Action condition participants, <u>eaten</u>,

was present in the predicate position of the sentence; and a predication learned by Ethnic condition participants, Mexican, was present in the subject position of the sentence. Thus, excepting only for word order, participants had precisely the same amount and kind of information available to them in Action-Ethnic and Ethnic-Action cue sentences; that is, one and only one of the predications that they had learned in the learning task. (Appendix C contains the two complete sets of cue sentences used.)

Dependent Variable

The dependent variable used to assess ease of recall was response time; that is, the time taken to give a response to a cue sentence. It was scored specifically as the mean response time, to hundredths of seconds, averaged across the three cue sentences that the participant received of a given type (Action-Ethnic or Ethnic-Action). Therefore, two measures of the dependent variable were obtained for each participant, one for the three Action-Ethnic cue sentences, and the other for the three Ethnic-Action cue sentences. Only correct responses given within a three second time limit were included. (Pre-testing on a separate sample had demonstrated that 88% of responses given within three seconds were correct. Extending the time limit to four seconds increased the percent of correct responses by only one percent, to 89 percent. Therefore, the time limit for responding to the cue sentences was determined prior to this study to be three seconds.)

Participants needed to respond correctly within three seconds to at least one of the three cue sentences of a given type, for it to be possible to calculate the dependent variable. Only 17 participants, or 38%, reponded correctly to all three Ethnic-Action cue sentences within the three second time limit. Another 17 participants (including nine of the 17 above), or 38%, responded correctly to all three Action-Ethnic cue sentences within the three second time limit.

E.g.:

Participant 3 was randomly assigned to respond to Question Set 2. He responded correctly to cue sentences 2, 4, and 6 (Ethnic-Action) in 2.28s, 0.68s, and 1.35s, respectively. He responded correctly to cue sentences 1 and 3 (Action-Ethnic) in 1.23s and 1.15s, respectively. He did not respond correctly to cue sentence 5 (Action-Ethnic) within the three second time limit.

His dependent measure for Ethnic-Action cue sentences was calculated as the mean of 2.28, 0.68 and 1.35, or 1.44s. His dependent measure for Action-Ethnic cue sentences was calculated as the mean of 1.23 and 1.15, or 1.19s.

Procedure

Participants completed the procedure individually. They were randomly assigned to one of the three learning task conditions (Action, Ethnic, or Control condition). Participants in all three conditions completed a learning task and a recall task.

Learning task. Participants in the Action and Ethnic conditions were presented with a series of three triads of index cards. The first card of each triad displayed a category name that was either an action predication or an ethnic predication, depending on the participant's learning

task condition; the second card was blank; and the third card displayed the three target words belonging to that category (as shown in Table 1 above). For example, for an participant in the Action condition, the first card may have said "Worn" and the third card may then have said "poncho, kimono, moccasin." For an participant in the Ethnic condition, the first card may have said "Mexican" and the third card may then have said "burro, poncho, tamale." Similarly, the other triads displayed the remaining action or ethnic predications and target words. Again, it is emphasized that participants in both conditions learned the same complete set of nine target words, but under two different predications (either "action" or "ethnic" predications).

The first time through the cards, these participants were instructed to simply read the cards and try to remember the target words that "go with" the predications. They viewed the predication (e.g., "Worn") for three (3) seconds, the blank card for five (5) seconds, and the target list (e.g., "poncho, kimono, moccasin") for five (5) seconds. After this initial trial, participants viewed the predication for one (1) second; it was then covered by a blank card while they reported which target words they recalled. Regardless of their performance, they then viewed the target list for five (5) seconds. Participants learned the target lists to the criterion of at least four successful anticipations when presented with the predication. Participants continued to

report all three target lists throughout the learning task, even if they learned one or two of the lists to criterion before the third. To control for order effects, the "random starting order with rotation" counterbalancing technique was employed (Shaughnessy & Zechmeister, 1985). That is, the order of target words within target lists followed the order shown in Table 1, but was rotated through the individual participant's learning trials; and also, the order of the predications themselves was rotated across participants. (Exact instructions to the Action and Ethnic condition participants are listed in Appendix A.)

A Control condition was included to examine performance on the recall task of participants who did not learn any experimenter-given predication of the target words. It was impossible to have participants in this condition follow the same learning task procedure of the Action and Ethnic condition participants, where the latter reported groups of target words following the presentation of category names. Grouping or categorizing the words in any way would, according to LLT, suggest a predication of those words to the Control condition participants, which was precisely what this condition was designed to avoid. Therefore, an alternative learning task procedure was designed for Control condition participants.

Participants in the Control condition viewed nine index cards with one target word printed on each card. They were

handed the nine cards in random order (shuffled by the experimenter), with the instruction to memorize the words, and to let the experimenter know when they were through. No predication was given, nor were the words grouped in any way. Thus, they learned the same set of nine target words as the participants in the Action and Ethnic conditions, but with no specific predication suggested. (Exact instructions to the Control condition participants are listed in Appendix B.)

Two issues were involved in the noncomparability of the learning task of the Control condition with that of the Action and Ethnic conditions. First, much less was known about the type of learning strategy employed by participants in the Control condition. They might have spontaneously predicated the target words according to "action" categories or "ethnic" categories, or employed some idiosyncratic predication. In fact, it was this assumption of variability in the predications employed by Control condition participants that undergirded the prediction that these participants would not differ in response time to Action-Ethnic and Ethnic-Action cue sentences. If some participants employed an action predication in learning, others an ethnic predication, and still others different predications altogether, then any advantages of one type of cue sentence over the other should have canceled out.

Second, the Control condition participants had a different and more subjective learning criterion than the

Action and Ethnic condition participants. Hence, it was not known how well these participants learned the target words relative to the participants in the other conditions, or even, perhaps, relative to one another. Systematic differences in learning (Control condition participants learning consistently better or consistently worse than participants in other conditions) would alter the mean response times of Control condition participants by a constant. Since the hypotheses required only comparing the mean response times to Ethnic-Action vs. Action-Ethnic cue sentences within each condition and not across conditions, this would not affect the results of analyses. Nonsystematic differences in learning (some Control condition participants learning better and some learning worse than participants in other conditions) would introduce additional variability into the response times of Control condition subjects, reducing the power of analyses to detect an effect. This design issue is addressed in the Discussion below.

Recall task. Following learning, participants were randomly assigned to respond to one of the two sets of six cue sentences, which were pre-recorded on a tape recorder in order to standardize the presentation. The cue sentences were read on tape by the experimenter, such that exactly three (3) seconds passed between the predication named in the subject position of the sentence and the predication named in the predicate position of the sentence.

E.g.:
"Name the worn item that is Indian."
3 seconds

"Name the Mexican item that is eaten."
3 seconds

Participants were instructed to wait until the end of the question, then answer as quickly as possible (see Appendices A and B for exact instructions). The cue sentences were played on a tape recorder, and these cue sentences and each participant's responses were recorded on a second tape recorder. The amount of time from the end of the cue sentence to the participant's response was later measured in milliseconds with a computer program available at the Parmly Hearing Institute, Loyola University of Chicago, and recorded to the hundredth of a second. This program graphed the amplitude of the tape-recorded sounds on a computer monitor, allowing precise measurement of the pause between the end of the cue sentence and the participant's response. The experimenter completed this measurement procedure blind to participants' learning task conditions, which were not discernable from the tape-recorded information.

Participant loss. Initially, 53 participants signed up for this study. Three participants were lost prior to data collection; two of these were not native speakers of English, and the third was not satisfied with the initial explanation of the experiment. Another two participants completed the experiment but failed to give a sufficient number of correct responses in the recall task. All of these contingencies were

handled during the experiment by replacing the data of these participants with the data of the participants immediately following them. The data of another four participants were discarded after data collection but prior to data analysis, and were not replaced. Three of these participants (one each in the Action, Ethnic, and Control conditions) failed to give a sufficient number of correct responses in the recall task within the time limit of three seconds per cue. The fourth (in the Control condition) was lost due to an error made by the experimenter, of inadvertently setting "voice activation" on the recording tape recorder, such that the pauses between cue sentences and participant responses were not recorded. In all, nine participants were lost from the study, and the data of 44 participants (15 Action, 15 Ethnic, and 14 Control) were retained.

Summary of design. A summary of the design of this study is presented in Table 2.

TABLE 2

SUMMARY OF DESIGN OF STUDY 1

| Learning Task Condition | Participants | Experimental Intervention | Predicted Effect |
|---|---|---|---|
| Action | 15 | Learn words under "action" predication | Shorter response time to Ethnic-Action cue sentences |
| Ethnic | 15 | Learn words under "ethnic" predication | Shorter response time to Action-Ethnic cue sentences |
| Control | 14 | Learn words under no experimenter-given predication | No difference in response times to cue sentences |

## Results

Again, the dependent measure was the participant's mean response time, in seconds, to each type of cue sentence (Action-Ethnic and Ethnic-Action). These data were entered into a 3 (learning task condition) X 2 (type of cue sentence) factorial analysis of variance, with learning task condition a between-subjects variable and type of cue sentence a within-subjects variable. The means and standard deviations for the response times, as a function of the learning task condition and type of cue sentence, are presented in Table 3.

TABLE 3

STUDY 1 MEANS (AND STANDARD DEVIATIONS) OF RESPONSE TIMES TO CUE SENTENCES AS A FUNCTION OF LEARNING TASK CONDITION AND TYPE OF CUE SENTENCE

| TYPE OF CUE SENTENCE | LEARNING TASK CONDITION | | |
|---|---|---|---|
| | Action | Ethnic | Control |
| Ethnic-Action | 1.16 (0.58) | 1.15 (0.56) | 1.36 (0.60) |
| Action-Ethnic | 1.08 (0.43) | 1.12 (0.43) | 0.87 (0.31) |

NOTE: Response times were scored as an participant's mean response time, in seconds, across all three cue sentences of a given type. Only correct responses made within three seconds were included.

Hypothesis I can be tested with the interaction between learning task condition and type of cue sentence, and probed with the simple effects comparisons of mean response times to Ethnic-Action and Action-Ethnic cue sentences for the Action and Ethnic learning task conditions. Hypothesis I predicted that there would be a significant learning task condition X type of cue sentence interaction, with simple effects tests demonstrating that participants in the Action learning task condition responded to Ethnic-Action cue sentences faster, and participants in the Ethnic learning task condition responded to Action-Ethnic cue sentences faster. Contrary to Hypothesis I, there was no significant interaction between learning task condition and type of cue sentence, $\underline{F}(2, 41) = 2.04$, n.s. Furthermore, the simple effects comparison of mean response times to Action-Ethnic cue sentences ($\underline{M} = 1.08$, $\underline{SD} = 0.43$) and Ethnic-Action cue sentences ($\underline{M} = 1.16$, $\underline{SD} = 0.58$) for the

Action learning task condition was not significant, $F(1, 41) = 0.24$, n.s. Likewise, the simple effects comparison of mean response times to Action-Ethnic cue sentences ($M = 1.12$, $SD = 0.43$) and Ethnic-Action cue sentences ($M = 1.15$, $SD = 0.56$) for the Ethnic learning task condition was not significant, $F(1, 41) = 0.01$, n.s.

Hypothesis II can be tested with the interaction between learning task condition and type of cue sentence, and probed with the simple effects comparisons of Mean response times to Ethnic-Action and Action-Ethnic cue sentences in the Control learning task condition. Hypothesis II predicted that simple effects tests would demonstrate that participants in the Control learning task condition showed no significant difference in response times to type of cue sentence. As stated above, there was no significant interaction between learning task condition and type of cue sentence. Moreover, contrary to Hypothesis II, the simple effects comparison of mean response times to Action-Ethnic cue sentences ($M = 0.87$, $SD = 0.31$) and Ethnic-Action cue sentences ($M = 1.36$, $SD = 0.60$) for the Control learning task condition was significant, $F(1, 41) = 7.39$, $p < .01$. That is, Control condition participants responded significantly faster to Action-Ethnic cue sentences than to Ethnic-Action cue sentences.

There was no significant main effect for learning task condition, $F(2, 41) = 0.01$, n.s. There was an unpredicted trend toward significance for type of cue sentence, with

participants responding to Action-Ethnic cue sentences faster than to Ethnic-Action cue sentences, $F(1, 41) = 3.81$, $p < .10$, with the data arraying as follows: Action-Ethnic $M = 1.03$ ($SD = 0.40$), Ethnic-Action $M = 1.22$ ($SD = 0.57$). As stated above, planned comparisons demonstrated that this effect was due entirely to the performance of Control condition participants.

Finally, it was observed that participants in the Ethnic learning task condition took fewer trials to criterion ($M = 2.60$, $SD = 1.45$) to learn the target words than participants in the Action learning task condition ($M = 3.60$, $SD = 2.59$). However, a $t$-test performed on number of trials to criterion indicated that this difference was not significant, $t(22.05) = 1.31$, n.s., separate variance estimate.

## Conclusion

The experimental hypotheses were not confirmed. Participants did not respond significantly faster to cue sentences containing the predication they learned in the predicate position of the sentence rather than in the subject position. On the other hand, the predictions of the mediational model were not confirmed, either. Participants did not respond significantly faster to cue sentences containing the predication they learned in the subject position of the sentence rather than in the predicate position. There was some evidence suggesting that participants might have found the Ethnic predications of the target words to be easier to learn than the Action

predications, with participants who learned the Ethnic predications taking an average of one fewer trial to reach learning criterion than participants who learned the Action predications (although the large variability in number of trials to criterion prevented this result from reaching significance). Likewise, there was evidence of marginal significance that participants found sentences with an Ethnic predicate to be better recall cues than sentences with an Action predicate, answering them an average of 0.19s faster. As stated above, planned comparisons demonstrated that this effect was due entirely to the performance of Control condition participants, who answered cue sentences with an Ethnic predicate significantly faster than cue sentences with an Action predicate by an average of 0.49s.

## STUDY 2

Logical Learning Theory posits that predication is one of the processes which defines human thinking, and for this reason predication is reflected in our language. Logical Learning Theory emphasizes that predication is not produced by language nor otherwise dependent on it (Rychlak, 1988, in press). With respect to Study 1, LLT would claim that it is not a linking or association of the predicate and target words that would produce a facilitation of one type of cue sentence over another. Rather, it is the process of extending the meaning of a particular predication to target items that produces such facilitation, regardless of the way in which the predication and target items are symbolized. To address this distinction, a replication study was designed to seek support for the hypotheses of Study 1, this time using geometric symbols (triangle, circle, square) instead of words to represent the predications learned by participants. This manipulation was devised to eliminate the associational advantages participants might be presumed (under mediational theorizing) to have received in Study 1 when they saw the same word as a predication during the learning task that was present in the cue sentence in the recall task. Participants in Study 2 will organize their learning around these

predications whether or not they verbally label or even recognize them as such. Then, when asked to recall a word according to those predications, these participants must "at the moment," immediately frame the relevant predication -- realizing, if they did not already, that they have a ready-made organization. Logical Learning Theory emphasizes that it is actually this formal-cause organization, not associational linkages between items, that facilitates recall.

## Statement of the Problem

### Hypothesis

> Hypothesis I: It is predicted that participants who learn target words under a predication represented with a symbol will respond faster to cue sentences when that predication is represented with a word in the predicate position of the sentence, and respond slower to cue sentences containing identical information when that predication is represented with a word in the subject position of the sentence.

### Rationale

As discussed immediately above, predication is understood in LLT as a process that is prior to language and not dependent on it. Therefore, this process should be able to be demonstrated whether verbal labels are employed or not. Excepting that symbols rather than words represent the predications that participants learn, Hypothesis I of Study 2 is identical to Hypothesis I of Study 1, and follows from the same line of reasoning presented in Study 1 above. Recall will still be facilitated when the cue sentence represents the same organization as the participant's introspective organization, i.e., when the predicate of the cue sentence

contains the participant's initial predication, whether he or she labelled it as such or not.

## Method

### Participants

Participants were 23 undergraduate students (9 male, 14 female) enrolled in introductory psychology courses at Loyola University of Chicago. All participants were native English speakers. Participation in the experiment partially fulfilled a course requirement.

### Independent Variables

Learning task condition. There were two experimental learning task conditions, designated the Action and Ethnic conditions, as in Study 1. (There was no Control learning task condition in this study.) Action and Ethnic learning condition participants again learned the set of nine target words from Study 1 under "action" or "ethnic" predications, respectively (refer to Table 1, p. 41).

Type of cue sentence. Participants responded to one of the same two non-overlapping sets of six cue sentences created for Study 1. Hence, each participant responded to three Action-Ethnic cue sentences and three Ethnic-Action cue sentences (defined as in Study 1). Recall that the cue sentence set itself was not an independent variable in this design; rather, type of cue sentence (Action-Ethnic or Ethnic-Action), which cuts across the two cue sentence sets, was the

independent variable under consideration. (Appendix C contains the two complete sets of cue sentences used.)

Dependent Variable

As in Study 1, the dependent variable used to assess ease of recall was response time; that is, the time taken to give a response to a cue sentence. It was scored specifically as the mean response time, measured to hundredths of seconds, averaged across the three cue sentences that the participant received of a given type (Action-Ethnic or Ethnic-Action). Therefore, two measures of the dependent variable were obtained for each participant, one for the three Action-Ethnic cue sentences, and the other for the three Ethnic-Action cue sentences. Correct responses given within a three second time limit were included. Only nine participants, or 38%, reponded correctly to all three Ethnic-Action cue sentences within the three second time limit. Another nine participants (including five of the nine above), or 38%, responded correctly to all three Action-Ethnic cue sentences within the three second time limit.

Procedure

Participants completed the procedure individually. They were randomly assigned to one of the two learning task conditions (Action or Ethnic condition). Participants in both conditions completed a learning task and a recall task.

Learning task. This task was identical to the learning task of the first study, with the exception that the first

card of each triad, which represents the predicate, displayed a symbol (triangle, circle, or square) instead of a category name. For example, for an participant in the Action condition, the first card may have displayed a circle, and the third card may then have said "poncho, kimono, moccasin" (the implied predication here being "things that are worn"). For an participant in the Ethnic condition, the first card may also have displayed a circle, and the third card may then have said "burro, poncho, tamale" (the implied predication here being "things that are Mexican"). Similarly, the first card of the other triads displayed symbols of the remaining action or ethnic predications, and the third card displayed the corresponding target words. For each participant, the symbols corresponding to each predication remained the same throughout the learning task. For example, for Participant 1, who was in the Ethnic learning task condition, a square always symbolized the "Mexican" predication in Table 1, a circle always symbolized the "Indian" predication, and a triangle always symbolized the "Japanese" predication. The pairing of symbols with target words was randomly assigned to each participant from three different possible orderings within each learning task condition. For example, for Participant 4, the next participant in the Ethnic learning task condition, a square symbolized the "Japanese" predication, a circle symbolized the "Mexican" predication, and a triangle symbolized the "Indian" predication. As in Study 1, it is emphasized that

participants in both the Ethnic and Action conditions learned the same complete set of nine target words, but under two different predications (either "ethnic" or "action" predications).

The first time through the cards, participants were instructed to simply read the cards and try to remember the target words that "go with" the symbols. They viewed the symbol (e.g., a circle) for three (3) seconds, the blank card for five (5) seconds, and the target list (e.g., "poncho, kimono, moccasin") for five (5) seconds. After this initial trial, participants viewed the symbol for one (1) second; it was then covered by a blank card while they reported which target words they recalled. Regardless of their performance, they then viewed the target list for five (5) seconds. Participants learned the target lists to the criterion of at least four successful anticipations when presented with the symbol. As in Study 1, participants continued to report all three target lists throughout the learning task, even if they learned one or two of the lists to criterion before the third. Furthermore, to control for order effects, the "random starting order with rotation" counterbalancing technique was again employed (Shaughnessy & Zechmeister, 1985). That is, the order of target words within target lists followed the order shown in Table 1, but was rotated through the individual participant's learning trials. (Exact instructions to participants are listed in Appendix A.)

Recall task. This task was identical to the recall task of the first study. Following learning, participants were randomly assigned to respond to one of the two pre-recorded sets of six cue sentences. Participants were instructed to wait until the end of the question, then answer as quickly as possible (see Appendix A for exact instructions). The cue sentences were played on a tape recorder, and these cue sentences and each participant's responses were recorded on a second tape recorder. The amount of time from the end of the cue sentence to the participant's response was later measured in milliseconds with a computer program available at the Parmly Hearing Institute, Loyola University of Chicago, and recorded to the hundredth of a second. This program graphed the amplitude of the tape-recorded sounds on a computer monitor, allowing precise measurement of the pause between the end of the cue sentence and the participant's response. The experimenter completed this measurement procedure blind to participants' learning task conditions, which were not discernable from the tape-recorded information.

Participant loss. Initially, 27 participants signed up for this study. One participant was lost early in the learning task, stating she felt "bored" by the task and wished to leave. Another two participants completed the experiment but failed to give a sufficient number of correct responses in the recall task. These contingencies were handled during the experiment by replacing the data of these participants with

the data of the participants immediately following them. The data of another participant were discarded after data collection but prior to data analysis, and were not replaced. This participant (in the Action condition) failed to give a sufficient number of correct responses in the recall task within the time limit of three seconds per cue. In all, four participants were lost from the study, and the data of 23 participants (11 Action and 12 Ethnic) were retained.

Summary of design. A summary of the design of this study is presented in Table 4.

TABLE 4

SUMMARY OF DESIGN OF STUDY 2

| Learning Task Condition | Participants | Experimental Intervention | Predicted Effect |
|---|---|---|---|
| Action | 11 | Learn words under "action" predication | Shorter response time to Ethnic-Action cue sentences |
| Ethnic | 12 | Learn words under "ethnic" predication | Shorter response time to Action-Ethnic cue sentences |

## Results

Again, the dependent measure was the participant's mean response time, in seconds, to each type of cue sentence (Action-Ethnic and Ethnic-Action). These data were entered into a 2 (learning task condition) X 2 (type of cue sentence) factorial analysis of variance, with learning task condition

a between-subjects variable and type of cue sentence a within-subjects variable. The means and standard deviations for the response times, as a function of the learning task condition and type of cue sentence, are presented in Table 5.

TABLE 5

STUDY 2 MEANS (AND STANDARD DEVIATIONS) OF RESPONSE TIMES TO CUE SENTENCES AS A FUNCTION OF LEARNING TASK CONDITION AND TYPE OF CUE SENTENCE

| TYPE OF CUE SENTENCE | LEARNING TASK CONDITION | |
|---|---|---|
| | Action | Ethnic |
| Ethnic-Action | 1.44 (0.49) | 1.03 (0.42) |
| Action-Ethnic | 1.06 (0.39) | 0.87 (0.35) |

NOTE: Response times were scored as an participant's mean response time, in seconds, across all three cue sentences of a given type. Only correct responses made within three seconds were included.

Hypothesis I can be tested with the interaction between learning task condition and type of cue sentence, and probed with the simple effects comparisons of Mean response times to Ethnic-Action and Action-Ethnic cue sentences for the Action and Ethnic learning task conditions. Hypothesis I predicted that there would be a significant learning task condition X type of cue sentence interaction, with simple effects tests demonstrating that participants in the Action learning task condition responded to Ethnic-Action cue sentences faster, and participants in the Ethnic learning task condition responded to Action-Ethnic cue sentences faster. Contrary to the hypothesis, there was no significant interaction between

learning task condition and type of cue sentence, $F(1, 21) = 0.99$, n.s. Further, the simple effects comparison of mean response times to Action-Ethnic cue sentences ($M = 0.87$, $SD = 0.35$) and Ethnic-Action cue sentences ($M = 1.03$, $SD = 0.42$) for the Ethnic learning task condition was not significant, $F(1, 21) = 1.14$, n.s. Finally, the simple effects comparison of mean response times to Action-Ethnic cue sentences ($M = 1.06$, $SD = 0.39$) and Ethnic-Action cue sentences ($M = 1.44$, $SD = 0.49$) for the Action condition was significant, $F(1, 21) = 5.75$, $p < .05$, with the means aligning in the opposite direction to that predicted. That is, Action condition participants responded significantly faster to Action-Ethnic cue sentences than to Ethnic-Action cue sentences.

There was an unpredicted significant main effect for learning task condition, with participants in the Ethnic learning task condition responding to cue sentences faster than participants in the Action learning task condition, $F(1, 21) = 5.33$, $p < .05$, with the data arraying as follows: Ethnic $M = 0.95$ ($SD = 0.39$), Action $M = 1.25$ ($SD = 0.47$). There was also an unpredicted significant main effect for type of cue sentence, with participants responding to Action-Ethnic cue sentences faster than to Ethnic-Action cue sentences, $F(1, 21) = 6.11$, $p < .05$, with the data arraying as follows: Action-Ethnic $M = 0.96$ ($SD = 0.38$), Ethnic-Action $M = 1.23$ ($SD = 0.49$). As stated above, planned comparisons demonstrated that

this effect was due entirely to the performance of Action condition participants.

It was observed that participants in the Ethnic learning task condition took fewer trials to criterion ($M$ = 3.50, $SD$ = 2.24) to learn the target words than participants in the Action learning task condition ($M$ = 4.91, $SD$ = 2.70). However, a $t$-test performed on number of trials to criterion indicated that this difference was not significant, $t(21)$ = 1.37, n.s., pooled variance estimate.

## Conclusion

The experimental hypothesis was not confirmed. Participants did not respond significantly faster to cue sentences containing the predication they learned in the predicate position of the sentence rather than in the subject position. In fact, the predictions of the mediational model were partially confirmed. Participants in the Action condition responded significantly faster to Action-Ethnic cue sentences, which contained the predication they learned in the subject position of the sentence, than to Ethnic-Action cue sentences, which contained the predication they learned in the predicate position of the sentence.

Two lines of evidence suggested that participants found the Ethnic predications of the target words to be easier to learn than the Action predications. First, participants who learned the Ethnic predications took an average of 1.41 fewer trials to reach learning criterion than participants who

learned the Action predications (although the large variability in number of trials to criterion prevented this result from reaching significance). Second, participants who learned the Ethnic predications responded to recall cues significantly faster (by about 0.30s) than participants who learned the Action predications. Further, there was evidence that participants found sentences with an Ethnic predicate to be better recall cues than sentences with an Action predicate, answering them significantly faster by about 0.27s. As stated above, planned comparisons demonstrated that this effect was due entirely to the performance of Action condition participants, who answered cue sentences with an Ethnic predicate significantly faster than cue sentences with an Action predicate by an average of 0.38s.

## DISCUSSION

It would seem that the present studies provide little in the way of confirmation for the original experimental predictions that were based on LLT's predicational model of learning. In no case was cued recall faster when the cue's grammatical predicate was the same as the predication with which the participant originally subsumed the target word. In one case (the Action learning task condition of Study 2), cued recall was faster when the cue's grammatical subject was the same as the predication with which the participant originally subsumed the target word. This result provides support for the predictions of mediational models of learning as outlined above, although it was not robust in the sense of being replicated across other experimental conditions or studies. Although the design of the present studies was intended to provide a clear cut test of the competing predictions of predicational and mediational theorizing, the largely nonsignificant results are inconclusive.

A look at the unpredicted significant results of the studies, as well as informal observations of participants, may provide some clues as to the failure of the design to perform as anticipated. First, it was observed that despite the use of the Kucera and Francis (1967) norms, many participants were

unfamiliar with the meanings of target words used in the studies, especially "rickshaw," "kimono," and "venison." (A number of participants also interpreted "burro" as a Mexican food instead of an animal.) Of course, these participants were unable to meaningfully categorize their unknown words; they struggled through the learning task by rote memorization of the appearance and pronunciation of these words. Therefore, their actual predications of the words were not the meanings that they were assumed to be using for the task. It is estimated that by far the largest proportion of failures of participants to respond quickly or correctly to cue sentences followed from this ignorance of word meanings. This circumstance, in turn, reduced the number of data points from which these participants' response time measures were constructed, decreasing confidence in the reliability and validity of this dependent measure. Furthermore, although some participants with unknown words no doubt successfully guessed the answers to cue sentences, in any case this would not represent the process of establishing and re-establishing known organizations that the studies were designed to engage, and response times for guessing would not necessarily be expected to conform to the predictions for the studies.

Probably most harmful to the studies was the demoralization participants appeared to suffer regarding the experimental tasks when they did not know some of the words. Their comments suggested that they felt frustrated or

embarrassed, and they often appeared merely to endure the experiment rather than to continue to put effort into the tasks. The consistent effort of participants is crucial in a design that measures small differences in response time, and that effort was probably lacking in these studies.

Unpredicted significant findings from the two studies provide further insight into the failure of the design to perform as expected. The design relied on the assumption that the Action and Ethnic predications would be equally meaningful -- essentially interchangeable -- ways for the participants to organize the target words. However, there is evidence that the Ethnic predications of the target words provided a more meaningful organization for participants than the Action predications. In both studies, participants who learned the target words according to the Ethnic predications took fewer trials to reach learning criterion than participants who learned the target words according to the Action predications. And in Study 2, participants who learned the targets according to the Ethnic predications were able to respond to recall cues in general significantly faster than participants who learned the targets according to the Action predications. Although in principle, participants should be able to predicate the target words according to either the Action or the Ethnic meanings, Ethnic predications appear to have been a more central way of organizing meanings for most of these participants. Note that the greater meaningfulness of Ethnic predications for these

participants is simply an empirical result, the reasons for which are not illuminated by the present studies. A predicational view would suggest that these participants have actively elaborated meanings according to Ethnic predications in their personal meaning systems. A mediational view would suggest that these participants have had more exposure to Ethnic concepts.

The greater meaningfulness of the Ethnic predications is corroborated by the informal observations that, first, participants who learned the targets according to the Action predications often spontaneously identified the Ethnic predications of the targets as well, whereas the participants who learned the targets according to the Ethnic predications did not correspondingly spontaneously identify the Action predications; and second, that participants in Study 2, who in a sense had to "catch on" to the predications symbolized by geometric shapes, frequently were unable to identify the Action predications.

With these considerations, it is possible to make sense of the results of the studies using a predicational framework. In all conditions of both studies, cued recall was faster when an Ethnic predication was in the predicate position of the cue sentence. This is exactly the prediction LLT would make if it had been known that Ethnic categories were more meaningful predications to participants. That is, if it had been known that participants in <u>all</u> conditions would favor Ethnic

predications as a means of organizing the target words, then LLT would predict that cued recall would be facilitated for everyone when the Ethnic predication was in the predicate position of the cue sentence. (Likewise, mediational theories would then predict that cued recall would be facilitated for everyone when the Ethnic predication was in the subject position of the cue sentence.)

It is notable that the significance of this result (i.e., participants' faster response times to cues with an Ethnic predication in the predicate position of the sentence) derived in Study 1 from the participants in the Control learning task condition, and in Study 2 from the participants in the Action learning task condition. In both of these cases, participants had a more difficult and ambiguous task than participants in other conditions. Study 1 Control learning task participants had to find a way to organize the target words on their own, without relying on experimenter-given predications; and Study 2 Action learning task participants had to discern an experimenter-given predication, in the absence of verbal labels, that appears not to have been a very meaningful conceptualization for them. It was precisely these participants who benefitted the most from the introduction of a more meaningful predicational pattern, as represented by the cues with an Ethnic predication in the predicate position of the sentence. Whether participants organized the target words according to the more meaningful Ethnic predications

consciously during their initial learning, or framed the more meaningful Ethnic predications for the first time when questioned with the cue sentences, LLT would predict the same outcome: participants would respond faster to cue sentences that reflected their more meaningful organization of the words, which in this case was the cue sentences with an Ethnic predication in the predicate position. (Note that the fact of a significant finding for Control learning task participants obviates the problem of a possible lack of power in their analysis that was discussed in the Method of Study 1.)

There is another possible explanation for the superiority of recall cues with an Ethnic predication in the predicate position. A close consideration of the words employed as predications reveals that the Action predications ("ridden," "worn," "eaten") are past participles -- verb forms that play the role of adjectives. On the other hand, the Ethnic predications ("Mexican," "Japanese," and "Indian") are the adjectival forms of nouns. Hence, the Ethnic predications come closer to a typical object of a sentence, as a "thing-related" item, a categorization that is closer to a noun than a verb. English is an SVO language (Ultan, 1969); it follows a subject-verb-object word ordering. Cue sentences containing a verb-like Action predication followed by an object-like Ethnic predication are more similar to the linguistic ordering of English than are cue sentences containing an object-like Ethnic predication followed by a verb-like Action predication.

(In this interpretation, the two predications in the cue sentences are understood as forming a complete predicate of verb and object, which take as their subject the target words, rather than as forming a complete sentence of subject and predicate.) It is possible that it is this aspect of English grammar that underlies the facilitation of recall by cue sentences with the Ethnic predication in the latter part of the sentence. And again, such a formal-cause patterning would appear to have had the greatest utility for those participants who were initially without a clear organization of the target words.

Of course, both of the above interpretations are post hoc explanations of unpredicted results. While the results of the present studies may be considered suggestive, further research will be necessary in order to place confidence in either of these interpretations. If a difference in the introspective meaningfulness of the predications to the participants is the reason for this pattern of results, then controlling more explicitly for the meaningfulness of the predications, perhaps through pre-testing, might allow a confirmation of the initial predictions of the design. Further, for any attempt at replication of this design, it is recommended that familiarity with the target words be normed on a local sample of participants. If a difference in the grammatical role of the predications in the English language is the reason for this pattern of results, then using only noun-derived adjectives as

predications might allow a confirmation of the initial predictions of the design. On the other hand, the phenomenon of predicational differences produced by different parts of speech also deserves study in its own right, as it supports LLT's crucial contention that all associations are not created equal, and that formal cause has priority in cognition.

I began this thesis with considerations of the empirical demonstration of human agency. Logical Learning Theory proposes that human agency can be supported with evidence for a predicational process of cognition. The present studies were unable to provide clear results in support of cognition as either predicational or mediational. However, the results may be seen as suggestive of yet unexplored aspects of the predicational process as it is reflected in grammatical structure. The explorations begun in the present studies point the way to continued inquiry into the predicational view of cognition and the agential view of the person.

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# APPENDICES

## APPENDIX A

### Instructions to Action and Ethnic Learning Task Condition Participants in Study 1 (Study 2)

This is an experiment on learning. I'm going to have you learn three groups of words of three words each. The words are printed on these cards. I will show you a category name (symbol) on one card, then a blank card, then a group of words on the next card.

The first time we go through the cards, just read them to yourself and try to remember the groups of words. After that, when I show you a category name (symbol), try to tell me the group of words that goes with it. We will go through the cards until you remember all the words four times in a row, because I need you to learn the words really well. Then I will have you try to recall certain words that you have learned.

Any questions?

. . .

Now we will go through the cards the first time. Read the category names and the groups of words to yourself, and try to remember them. (Look at the symbols and read the groups of words to yourself, and try to remember them.) Okay?

. . .

Now when I give you the category name (symbol), try to tell me the group of words that goes with it. After you tell me what you remember, I will show you the group of words again. We will keep doing this until you remember all of the words four times in a row. Ready?

. . .

Now I'm going to have you answer the questions about the words, which I have recorded on this tape recorder. I am going to tape your answers on the other tape recorder. Later I'm going to time how fast you answered.

So answer as quickly as you can. But listen carefully, because you will give your answer based only on the tape; I can't repeat anything for you. Also, think first, because I have to count the first answer you give, and you can't correct it. Wait until the end of the question, then answer as quickly as you can. Okay?

## APPENDIX B

### Instructions to Control Learning Task Condition Participants in Study 1

This is an experiment on learning. I'm going to have you learn nine words. The words are printed on these cards.

I will let you look at the cards until you feel you have memorized the words. I need you to learn the words really well. Then I will have you try to recall certain words that you have learned.

Any questions?

. . .

Now look at the cards and try to memorize the words. You can arrange the cards any way you want. Tell me when you are finished. Okay?

. . .

Now I'm going to have you answer the questions about the words, which I have recorded on this tape recorder. I am going to tape your answers on the other tape recorder. Later I'm going to time how fast you answered.

So answer as quickly as you can. But listen carefully, because you will give your answer based only on the tape; I can't repeat anything for you. Also, think first, because I have to count the first answer you give, and you can't correct it. Wait until the end of the question, then answer as quickly as you can. Okay?

## APPENDIX C

### Cue Sentence Sets

| Cue Sentence | Response | Type of Cue Sentence |
|---|---|---|
| SET 1 | | |
| 1.Name the Mexican item that is eaten. | Tamale | Ethnic-Action |
| 2.Name the worn item that is Indian. | Moccasin | Action-Ethnic |
| 3.Name the Japanese item that is worn. | Kimono | Ethnic-Action |
| 4.Name the ridden item that is Mexican. | Burro | Action-Ethnic |
| 5.Name the Indian item that is ridden. | Canoe | Ethnic-Action |
| 6.Name the eaten item that is Japanese. | Sushi | Action-Ethnic |
| SET 2 | | |
| 1.Name the ridden item that is Indian. | Canoe | Action-Ethnic |
| 2.Name the Mexican item that is worn. | Poncho | Ethnic-Action |
| 3.Name the eaten item that is Mexican. | Tamale | Action-Ethnic |
| 4.Name the Japanese item that is ridden. | Rickshaw | Ethnic-Action |
| 5.Name the worn item that is Japanese. | Kimono | Action-Ethnic |
| 6.Name the Indian item that is eaten. | Venison | Ethnic-Action |

## APPENDIX D

### Debriefing Statement

In this experiment, we were studying the influence of how you learn something, and how you are asked about it, on how easily (fast) you can recall it.

We believe that people learn by subsuming what they are learning - their "target" - with a broader meaning - a "predicate." This differs from traditional learning theories, because we believe that learning does not mean merely associating two things. Instead, learning means bringing to bear a pattern in order to grasp what is being learned. (In language, this pattern is represented with the grammatical subject acting as the "target," and the grammatical predicate acting as the "predicate.")

In the present study, we showed you sequences of a predicate and three target words on index cards. There are many ways to predicate or group those words, but you learned just one. We then gave you instructions on the tape recorder to recall some of the target words. The predicate you learned was always included somewhere in the instruction, and sometimes it was also the grammatical predicate of the instruction, but other times it was not.

We are hypothesizing that the instructions in which the predicate you learned was also the grammatical predicate of the instruction, made it easier to recall the target. We think people will answer those faster.

This research is based on the theory of Dr. Joseph F. Rychlak, of our Department of Psychology. The book in which this kind of theory is presented is listed below. But if you want to discuss any of this with him, he would be happy to arrange an appointment with you.

Rychlak, J. F. (1988). The psychology of rigorous humanism (2nd ed.). New York: New York University Press.

# APPENDIX E

## Data of Study 1

Key

Part No = Participant number
LTC = Learning task condition
Ques Set = Question set
Ques(n) = Response time (in seconds) to question n

| Part No | Sex | LTC | First Card | Trials to Criterion | Ques Set | Ques1 | Ques2 | Ques3 | Ques4 | Ques5 | Ques6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | F | Action | Eaten | 3 | 1 | 1.34 | 1.08 | 0.52 | - | - | 0.60 |
| 2 | F | Control | - | - | 2 | - | 0.92 | - | - | 1.30 | - |
| 3 | M | Ethnic | Mexican | 2 | 2 | 1.23 | 2.28 | 1.15 | 0.68 | - | 1.35 |
| 4 | M | Action | Ridden | 4 | 2 | 0.71 | 1.08 | - | 0.80 | 0.41 | 1.33 |
| 5 | F | Ethnic | Japanese | 4 | 1 | 0.80 | 1.01 | 1.04 | 1.77 | 0.36 | 0.73 |
| 6 | F | Control | - | - | 1 | 1.65 | - | 0.84 | - | - | 0.65 |
| 7 | F | Control | - | - | 2 | - | 0.80 | - | - | 0.68 | - |
| 8 | M | Ethnic | Indian | 2 | 1 | 0.88 | 2.45 | 0.87 | 2.70 | 0.93 | 0.75 |
| 9 | F | Action | Worn | 2 | 1 | 1.60 | 2.67 | - | - | 0.95 | 0.85 |
| 10 | F | Control | - | - | 1 | 1.04 | 0.68 | 1.39 | 0.75 | - | 0.87 |
| 11 | F | Action | Eaten | 7 | 2 | 2.15 | 1.20 | 0.56 | - | - | - |
| 12 | F | Ethnic | Mexican | 2 | 2 | - | 0.44 | 1.15 | 2.21 | 0.38 | - |
| 13 | F | Action | Ridden | 1 | 1 | 0.80 | - | 1.90 | 0.58 | - | 0.55 |
| 14 | M | Ethnic | Japanese | 2 | 2 | - | - | 1.10 | 0.31 | 0.71 | - |
| 15 | M | Control | - | - | 1 | 1.37 | 1.05 | 0.71 | - | 1.51 | 0.71 |
| 16 | F | Ethnic | Indian | 2 | 1 | 1.20 | - | 0.70 | 2.40 | 0.69 | 0.58 |
| 17 | F | Control | - | - | 2 | 1.35 | 1.41 | 1.11 | - | 0.64 | - |
| 18 | F | Action | Worn | 3 | 2 | - | 1.46 | 0.94 | - | 2.15 | 1.65 |
| 19 | F | Control | - | - | 1 | 1.45 | - | 0.65 | 0.38 | - | 0.82 |
| 20 | F | Action | Eaten | 4 | 2 | 2.58 | 0.61 | 2.14 | - | 0.47 | - |
| 21 | M | Ethnic | Mexican | 2 | 1 | 2.32 | 0.91 | 1.65 | - | 0.73 | 0.69 |

| Part No | Sex | LTC | First Card | Trials to Criterion | Ques Set | Ques1 | Ques2 | Ques3 | Ques4 | Ques5 | Ques6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | M | Action | Ridden | 7 | 1 | - | 2.90 | 1.79 | 0.69 | - | 0.62 |
| 23 | F | Ethnic | Japanese | 2 | 2 | 1.99 | 1.26 | 1.30 | 0.52 | 1.11 | 1.37 |
| 24 | F | Action | Worn | 1 | 2 | 2.95 | 0.38 | 0.63 | 1.20 | 0.26 | 1.80 |
| 25 | M | Control | - | - | 2 | 0.84 | 1.52 | 0.52 | - | 0.95 | - |
| 26 | M | Ethnic | Indian | 1 | 1 | 1.01 | 0.40 | 1.05 | 0.60 | 0.47 | 0.23 |
| 27 | F | Ethnic | Mexican | 4 | 2 | - | - | 2.24 | - | 0.88 | 0.70 |
| 28 | M | Control | - | - | 1 | - | - | 2.80 | - | - | 0.47 |
| 29 | F | Control | - | - | 1 | 1.32 | 1.39 | 0.38 | 0.56 | 0.59 | 0.31 |
| 30 | F | Action | Ridden | 3 | 2 | - | 0.98 | 0.72 | - | 1.29 | - |
| 31 | M | Ethnic | Indian | 6 | 1 | 1.39 | - | 0.93 | - | 0.84 | 0.79 |
| 32 | F | Control | - | - | 2 | - | - | - | - | 2.18 | - |
| 33 | M | Action | Worn | 1 | 1 | 1.16 | 0.37 | 0.24 | 0.13 | - | 0.82 |
| 34 | M | Ethnic | Mexican | 2 | 1 | 1.60 | 1.08 | 0.84 | 0.54 | 0.44 | 0.42 |
| 35 | F | Control | - | - | 1 | 2.15 | 2.77 | 1.78 | 0.99 | - | 0.82 |
| 36 | F | Action | Eaten | 2 | 1 | 0.49 | 2.79 | 0.68 | 0.55 | 0.46 | 0.48 |
| 37 | F | Ethnic | Japanese | 2 | 2 | - | 0.82 | 1.92 | 1.55 | 0.77 | - |
| 38 | M | Control | - | - | 2 | - | 1.09 | 1.37 | 2.66 | 0.63 | - |
| 39 | M | Action | Ridden | 10 | 2 | - | - | 0.86 | - | - | 2.80 |
| 40 | F | Control | - | - | 2 | - | 0.94 | 1.56 | - | 0.93 | 2.65 |
| 41 | F | Action | Worn | 4 | 1 | 1.80 | 0.54 | 0.47 | 0.93 | 0.56 | - |
| 42 | F | Ethnic | Indian | 5 | 2 | - | - | 0.49 | 2.78 | 2.53 | 2.74 |
| 43 | F | Action | Eaten | 2 | 2 | 0.79 | 0.14 | 0.90 | - | - | 0.98 |
| 44 | M | Control | - | - | 1 | 0.61 | 0.73 | 0.34 | 0.84 | 0.65 | 0.13 |
| 45 | F | Ethnic | Mexican | 1 | 1 | 1.64 | 0.63 | 1.01 | 1.08 | - | 0.73 |

# APPENDIX F

## Data of Study 2

Key

Part No = Participant number
LTC = Learning task condition
Ques Set = Question set
Ques(n) = Response time (in seconds) to question n

| Part No | Sex | LTC | First Card | Trials to Criterion | Ques Set | Ques1 | Ques2 | Ques3 | Ques4 | Ques5 | Ques6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M | Ethnic | Mexican | 2 | 1 | 0.99 | 1.55 | 0.43 | 1.09 | 0.50 | 0.23 |
| 2 | F | Action | Eaten | 3 | 1 | 1.37 | 1.06 | 0.48 | - | 0.44 | 0.62 |
| 3 | F | Action | Ridden | 5 | 1 | 1.42 | - | 1.22 | 0.99 | 0.84 | 0.54 |
| 4 | F | Ethnic | Indian | 2 | 1 | 1.00 | - | 0.47 | 0.69 | 1.46 | 0.82 |
| 5 | M | Action | Worn | 5 | 1 | 2.92 | 2.60 | 0.75 | 2.75 | 1.18 | 0.52 |
| 6 | F | Ethnic | Japanese | 9 | 1 | 1.29 | - | 1.29 | - | - | 0.63 |
| 7 | M | Action | Worn | 3 | 2 | 2.57 | 1.48 | 0.90 | - | 0.52 | - |
| 8 | F | Action | Eaten | 5 | 2 | - | - | 1.22 | 2.10 | 0.58 | - |
| 9 | F | Action | Ridden | 3 | 2 | - | 0.79 | - | - | 0.83 | - |
| 10 | F | Ethnic | Indian | 2 | 2 | 2.87 | 0.29 | 0.52 | 2.10 | 1.10 | 0.47 |
| 11 | F | Ethnic | Japanese | 4 | 2 | - | 0.67 | 0.77 | - | 0.38 | 0.07 |
| 12 | M | Ethnic | Mexican | 6 | 2 | 0.51 | 1.14 | 0.54 | 0.53 | 0.10 | 1.04 |
| 13 | F | Ethnic | Japanese | 2 | 2 | - | 1.58 | - | - | 1.24 | - |
| 14 | F | Ethnic | Mexican | 2 | 2 | 1.59 | 1.07 | 1.12 | 0.63 | 0.82 | - |
| 15 | F | Action | Eaten | 8 | 2 | - | 1.88 | 1.11 | - | 0.54 | - |
| 16 | M | Ethnic | Indian | 4 | 2 | - | 1.11 | 0.52 | - | 0.69 | - |
| 17 | M | Action | Worn | 8 | 2 | 2.03 | 1.88 | 1.41 | - | 0.05 | - |
| 18 | F | Ethnic | Japanese | 5 | 1 | 2.27 | - | 0.99 | - | - | 0.82 |
| 19 | M | Ethnic | Mexican | 2 | 1 | - | 0.69 | 0.50 | 0.32 | - | 0.52 |
| 20 | F | Action | Ridden | 2 | 1 | - | 2.42 | 0.96 | - | - | 0.61 |
| 21 | M | Ethnic | Indian | 2 | 1 | 2.85 | 1.07 | 0.69 | 1.99 | 1.02 | 0.63 |

| Part No | Sex | LTC | First Card | Trials to Criterion | Ques Set | Ques1 | Ques2 | Ques3 | Ques4 | Ques5 | Ques6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | F | Action | Eaten | 2 | 1 | 1.04 | 1.16 | 0.72 | - | 2.03 | 0.37 |
| 23 | M | Action | Ridden | 10 | 1 | 1.98 | - | - | - | - | 0.81 |

# VITA

The author, Connie Marie Vaughn, was born in Cincinnati, Ohio on March 10, 1965.

Ms. Vaughn attended Miami University, Oxford, Ohio, where she graduated summa cum laude with the degree of Bachelor of Arts in mathematics and statistics in December, 1987. In 1985, she was elected a member of Pi Mu Epsilon mathematics honorary.

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The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the thesis is now given final approval by the Committee with reference to content and form.

The thesis is therefore accepted in partial fulfillment of the requirements for the degree of Master of Arts.

12/6/92
Date

Joseph F. Rychlak
Director's Signature