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Predicational Organization and Its Enhancement of Memory

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CHAPTER I

INTRODUCTION

How is information organized to form memory? To answer this question, researchers have explored memory by utilizing different contexts, testing materials, learning activities and skills already present in learners (Bransford, 1979). Manipulating the initial learning conditions and the types of memory measures given at recall is one of the main ways researchers study memory.

There are several ways researchers have manipulated initial learning conditions (often termed "encoding") to study how and what types of information are remembered. The following situations have been shown to improve memory at encoding: providing relevant contexts with the information to be learned (Pearson, 1974; Anderson & Ortony, 1975); self-generated meanings (Nairne, Pusen, & Widner, 1985; Salmecka & Graf, 1978); the elaboration of meanings (Craik & Tulving, 1975), and the elaboration of meaning logically consistent with the targeted meaning (Stein & Bransford, 1979). These types of studies stress the active nature of a learner at encoding as imperative for later remembering, as well as the necessary role of understanding the meaning of targeted information in a given context for later retrieval.

Memory measures provide contrasting ways to study how information is remembered (often termed "retrieved"). Memory is often measured primarily using three types of tasks: free recall, cued recall, and recognition. A *free recall* task requires

participants to remember what they were previously exposed to without any additional help (e.g., if given the word "tree," the participant would have to recall it without any prompts). A *cued recall* task provides participants with a cue to assist them in remembering what they were previously asked to study (e.g., recalling "rain" when given "umbrella"). A *recognition* task requires that participants identify a previously studied item from among a novel group of items (e.g., choosing "rain" from among "hail" and "snow"). In the present study I used the cued recall task because I was interested in studying the effects of different cues on memory.

Researchers have used the above recall measures to study the types of "retrieval" conditions that lead to better memory. Tulving and Thomson (1973), in their well-known study, found that retrieval cues encoded with the target words (i.e., at the time of learning) facilitated recall better than strong associates of the target words and the target words themselves. Similarly, Fisher and Craik (1977) found that when the semantic characteristics of a word were emphasized at encoding, a semantic (i.e., meaning-based) cue was a better cue to recall than a phonemic (i.e., sound-based) one. On the contrary, when phonemic characteristics were emphasized at encoding, a phonemic cue produced greater recall than a semantic cue. Tulving and Thomson (1973) called this phenomenon the encoding specificity principle. These findings emphasize the importance of the initial organization of learning information in influencing later recall, given that the cues at recall approximate this initial organization.

Information-processing approaches using the computer metaphor (for review, see Raaijmakers & Shiffrin, 1992) have generally been used as a theoretical explanation for

how memory is organized and how the above enhancers of memory facilitate recall. For example, in the encoding specificity principle, Tulving and Thomson (1973) suggest that the finding occurs because retrieval conditions are similar to encoding conditions. These authors believe that a matching process must occur between retrieval conditions and already encoded information. A matching explanation relies on the computer metaphor.

There are some problems with using this approach. One is that models based on the computer metaphor have a difficult time explaining imprecision in human memory. For example, experiments have shown that participants tend to remember a general abstraction of what they have learned rather than the exact wording of the information being studied (Sachs, 1967). Another problem is that models based on the computer metaphor often make the assumption that there are ways in which the information learned is stored in the neurophysiology of the brain. Although studies have shown correlations between cognitive activities and brain physiology (such as Cohen & Servan-Schreiber, 1992), it is still too early to base a theory of memory on these merely correlational connections.

Joseph Rychlak (1994) in his recent book Logical Learning Theory (LLT), proposes an alternative way to understand memory in the context of human learning. He does not attempt to appeal to a model that requires a reductionism based on the neurophysiology of memory at its simplest level or one that must model into its framework human imprecision in learning. Rather, his perspective attempts to account for why it is that the comprehension of meaning is so important for learning; why it is that the active role of the learner in organizing, elaborating, and generating the meanings to be

learned enhances memory; and finally, why it is that matching encoding conditions at recall is not enough to explain improvements in memory. Although he does not deny that on some level memory may affect the neurophysiological and chemical processes of the individual, or vice versa, he believes that memory can be studied without reducing it to such a theoretical level of explanation.

Many authors support the view that memory can be studied without appealing to a neurological explanation. Watkins (1990) writes:

> Students of memory overlook the fact that, for them, the memory trace is merely a metaphor, and in doing so confuse psychology with physiology....Worse yet, the current movement to integrate cognitive psychology with neuroscience and artificial intelligence bodes an even more entrenched confusion in the foreseeable future. (p. 334)

Watkins further expresses that if cognitive scientists were to recognize the meaninglessness of the memory trace metaphor, they might devote greater attention to studying remembering in the context in which it occurs.

To avoid reductionism, Rychlak explains memory in what he calls the Logos realm. "Logos grounds draw from the patterned order of events to explain matters according to processes like predication, construing, or mental activity" (1994, p. 316). The Logos is the realm of patterns qua meaning, where meaning is generated by the individual's cognitive (predicational) process perhaps limited by the brain's physiology but not a product of it. Rychlak describes the individual's cognitive process as a single meaning-creating process that is time-independent with meaning flowing immediately

and logically from wider contexts to narrower targets about which the meanings are referring (p. 15). As we move through a realm of patterns in living our lives, it is how we use one pattern to target another that enables us to learn, to broaden our knowledge and understanding. Contrary to computer based information-processing perspectives, this type of framework, which will be described in detail in this thesis, accounts for the intentional aspects of human reasoning. In studying memory it is important not to forget that it is part of the overall process of human thinking in which agency and choice play a central role.

In the present experiment, participants were asked to organize the meaning of groups of three sentences. Each grouping contained: a metaphor (e.g. "A tree is an umbrella"), a sentence elaborating the subject word of the metaphor (e.g. "A tree provides shelter") and a sentence elaborating the predicate word of the metaphor (e.g. "An umbrella gives protection"). Twenty-four such triplets were ordered by subjects. Following this idiographic patterning, participants were then given a cued recall test using both the subject and predicate of the metaphor as cues to recall the metaphor in question.

In the following chapter, a predicational model of learning proposed by Rychlak in his book Logical Learning Theory will be described in some detail. Following this, some of the research from the current literature exploring memory enhancers both at encoding (such as the role of meaning and context, self-generation of meanings and the elaboration of meaning) and at retrieval will be presented. Along with the above findings, current emphasis on explanations using the computer metaphor and how they differ from

a predicational explanation will be discussed. Finally, the current experiment on a predicational organization of memory will be presented.

CHAPTER II

LOGICAL LEARNING THEORY

In order to understand a predicational model of learning it is helpful to distinguish it from mediational models of cognition (Rychlak, 1994, p. 13). Consideration of the following distinctions will assist in a discussion of the differences between mediational and predicational theorizing: introspection versus extraspection, final and formal causes versus material efficient causes, and top-down versus bottom-up theorizing (Rychlak, 1991, pp. 1-14). A comparison of these differences will provide a framework for later describing Rychlak's (1994) predication model in more detail.

The ancient Greeks first spoke about predicating when they suggested that we reason from universals to particulars. They felt that when we seek to categorize (or predicate) the world we use wider ranges of meaning to describe and lend understanding to narrower targeted meanings. Current research supports the fact that humans naturally form categories from as early as two years of age (Kagan, 1981). Rychlak argues that predicating or categorizing meaning is the process used in thinking. He defines the predicational process as "the logical act of affirming, denying, or qualifying precedently broader patterns of meaning in sequacious extension to narrower or targeted patterns of meaning" (1994, p. 15). I will elaborate on this definition more throughout this section.

Mediational theorizing is the predominant model used in academic psychological

explanations of behavior, such as stimulus-response psychology (e.g., Miller and Dollard, 1941) and information-processing models based on the computer metaphor (e.g., Anderson and Pirolli, 1984). Rychlak defines a mediational process as "a mechanical process in which something that is produced elsewhere and is taken in or input comes to play a role in the process that was not initially a part of or intrinsic to it" (Rychlak, 1994, p. 316).

Mediational and predicational models differ in that the former utilizes an extraspective approach while the latter depends on an introspective one. Mediational models, in viewing human cognition extraspectively, utilize a third-person perspective (Rychlak, 1994). Such a perspective does not consider the person's active involvement in the process. It suggests that the person is merely an instrumentality; information is input into the brain, processed and sent back out in the form of responses. Meaning is not important for explaining how information is transformed into responses. In contrast, a predicational model views cognition introspectively or from a first-person perspective whereby the creation of meaning is intrinsic to the process (Rychlak, 1994). The person as a creator of meaning, personally affirms patterns of meanings as a precedent which extends sequaciously (necessarily) to a target.

John Searle (1980) provides a metaphor for mediational modeling in his Chinese-room thought-experiment. He has us imagine a room containing a person who speaks English. This person has a set of rules in English for converting one set of Chinese characters into another set. A person standing outside the room could send questions, in Chinese, to the person inside. The person inside the room could match the characters

composing the questions with characters corresponding to answers as instructed by the rule book. This person could then pass the answers back out of the room, never understanding the meaning of these Chinese questions and answers. Nevertheless, the person standing outside the room, unaware of the rule book, might think that the person inside understands Chinese. Searle suggests that this is how a computer processes information. To the person standing outside the room, it appears that the person in the room has grasped the meaning of Chinese, when really, all that has occurred is a matching process. Similarly, a computer appears to grasp the meanings when it generates an output from its inputs. However, the computer is using a rule book that has been programmed by a human. The computer cannot interpret or understand the meaning of the information that it processes. Rychlak would describe the computer metaphor, utilized as the basis for mediational modeling of cognition, as being an extraspectively framed theory. Similarly to Searle, Rychlak does not feel that this is an accurate account of human thinking.

Rychlak further differentiates between mediational and predicational models based on their employment of the different Aristotelian causes. Aristotle (as cited in Rychlak, 1994, p. 7) believed that anything in nature could be viewed in terms of one of four possible causes. The first is the *material cause*. This type of cause is used to explain something based on the kind of substance that constitutes it. For example, the material cause of a chair is the wood from which it has been made. The second cause is known as an *efficient cause*. This cause is used to describe the relation between events in a time-ordered fashion. This cause tries to capture the impetus, or thrust influencing events,

much as when one rolling billiard ball strikes another, causing the latter to move. Aristotle's third cause, the *formal cause*, explains an event in terms of its "essence." A shape, pattern, or ordering of elements often describes the essence of an event. Thus, in contrast to a material cause, the formal cause, is more of an abstraction that is greater than the sum of its elemental pieces. An example of a formal cause is the order in a math derivation or a tornado funnel which can be identified by its distinctive pattern. Aristotle's fourth cause is called a *final cause*. A final cause is used to describe purpose or intention. Aristotle defined this cause as "that [purpose, intention] for the sake of which" something takes place or exists. Rychlak believes that we must describe human thought in terms of final causes. This is because humans behave intentionally, framing goals and purposes for their actions. A predicational model is based on formal and final causality from an introspective perspective.

Mediational models attribute human thought to material and efficient causes (Rychlak, 1994). They employ the use of a physical substrate such as nodes and links between nodes (i.e., a material cause) and hold that the stimulus activates a pattern of linked nodes which elicit a response (i.e., an efficient cause) [e.g., Anderson & Pirolli, 1984]. This form of explanation is very similar to the behaviorists' attempt to explain behavior in terms of stimuli (S) and responses (R). Models based on the computer metaphor have taken behaviorism one step further by operationally defining what is between the S and the R. However, their definition appears to be a continuation of the S-R, efficient-cause account; only now there are many more S-Rs occurring inside the brain, all of which are mini-associations. Mediation deals with the ordering of motions. In

contrast, predication is concerned with the ordering of meaning (Rychlak, 1991, p. 7). The former process requires the passage of time and is unintentional (behavior is not directed toward purposes or goals) while the latter views thought as both immediate and intentional.

Rychlak points out that the distinction between predicational and mediational models has a historical precedent in the discussion over the interpretation of an idea. Today this discussion would take the form of a debate over whether thought occurs from the bottom-up or the top-down. This distinction can be viewed by comparing the explanation of ideas given by Immanuel Kant and John Locke. Locke (Rychlak, 1994, pp. 25-32) believed that the mind was a *tabula rasa* and therefore all ideas entered and were imprinted from the outside world. He felt that the simplest meanings ("atomic" meanings) when added together formed more complex meanings. Thus, as complexity increases so does the level of abstractness of the meanings. For Locke, a more complex and abstract idea can be used without referring to the simple basic meanings that constitute it. For example, in order to understand the concept of a living room, the Lockean model would hold that first one must understand the basic components of a living room, such as a couch, a coffee table, and arm chairs. This theory has often been referred to as a bottom-up theory of human reasoning because simple meanings are taken in from reality, and then "add up" to higher level, abstract meanings. Material and efficient causes are employed to explain how simple ideas (least abstract) are combined (by efficient-cause association) to form more complex ideas (increasingly abstract).

In contrast, Kant (Rychlak, 1994, pp. 25-32) considered the fact that abstraction

does not always increase with increasing complexity. For Kant, the individual as a conceptualizer categorizes or predicates the world into meanings by actively bringing to bear a mental frame of reference onto experience. Kant distinguishes between the phenomenal and noumenal realms. The phenomenal realm is where the reasoner's understanding resides; it is the point from which the reasoner's perception of reality influences the way the world is perceived and understood. On the other hand, the noumenal realm is the source of all sensations (i.e., "things in themselves"). But to perceive or conceptualize these sensations as having - or likely to have - certain meanings is more than an "input" process. Rychlak uses the example of a stock market. Even if in reality the stock market is not doing well, investors, with the hopes that the market improves, will invest their money in stocks. If enough investors share these hopes, by a self-fulfilling prophecy, they will invest their money and the market will improve. The investors are conceptualizing the market in a top-down way. The meaning they bring to bear on the situation is positive despite the fact that the reality of the situation is negative. This is very different from the Lockean idea which only permits humans to work with what reality gives them and then build upon that. The Kantian perspective is *pro forma* because from birth the individual actively organizes the world from his or her unique perspective. Meaning always begins with the most abstract level (a formal cause) which provides the context that is sequaciously (i.e., logically or necessarily) extended in a final-cause fashion to the meanings targeted at lower levels of abstraction.

A predicational model, thus, requires that the person actively creates (introspective theorizing) patterned meaning (formal cause) for some purpose, goal or

intention (final cause) utilizing his or her unique perspective as a context for patterning meaning (a top-down perspective). This process can best be illustrated using as a model the circles introduced by the mathematician, Leonhard Euler (Reese, 1980, p. 160). Rychlak and Barnard (1993) offers the example that:

> when we frame the belief that 'Alice is reliable,' we are taking a wider range of meaning *(reliability)* within which we construe and thereby lend meaning to a narrower range of meaning *(Alice).* This logical process can be modeled through use of Euler circles, in which case the smaller circle labeled 'Alice' would be framed within and therefore take meaning from the larger circle, labeled 'reliable people,' or some such attribution (i.e., other people besides Alice are reliable). [pp. 155, 156]

Meaning is extended sequaciously to the target being framed for some purpose or intention. Rychlak uses the terminology of meaning-extension to emphasize that this is a time-independent process with the logical extension of meaning occurring immediately once the proper alignment of meaningful contents takes place. Thus, "the patterning of meaning forming in a predication extends to the least understood or most poorly known target(s) having relevance to the predicating meaning in question" (1994, p. 51). It is in the very fact that humans are interested in what they do not know that meaning is logically being extended in this direction; that is, from what is known (the wider realm or predicating context) to what is not known (the target).

How does learning occur? First, it is important to make a distinction between the process and the contents of learning. Predication per se is a process, one that frames

meanings and then extends them into ongoing experience. Rychlak utilizes the term contents to describe that which is framed by the predicational process. The contents of the predicational process are patterned meanings that might take many forms (e.g., images, symbols, words, or memories). For example, we might extend two different predications: one that "All humans are mortal," and another that "All humans are biased." The first predication extends the meaning of mortality to human beings while the second predication extends the idea of biases to human beings. Mortality and bias are two different contents being processed by the same (unchanging) process. The target for both predications is human beings, but the predicating meaning under extension differs.

Learning occurs when certain predicate meanings are extended to certain targets, enriching the person's understanding of these targets. In order for a person to learn that people are mortal, or that they have biases, the meanings of "mortality" and "bias" must first be targeted for meaning-extension. A person might first target the word mortality or "mortal being" while attending a funeral during childhood. A person might learn about bias when observing a referee call fewer offenses for a favored team. Once these targets are sufficiently enriched by meaning so that the person can subsequently use them as predicate meanings, learning has taken place. Thus, learning is always a matter of former targets being used now as predicating content meanings in the predication process. It should be noted that this interpretation of learning is based on process, not content. Unlike models based on the computer metaphor (e.g., Raaijmakers & Shiffrin, 1992), this is a logical process whereby the contents are created by the process and not merely mechanically "processed" by it.

The predicating meanings that we create grow and become the basis of our knowledge. Rychlak uses the term *prememory* to describe the knowledge base of predications that frame further learning. As we move through life, we frame new meanings. As we come to use these meanings again and again, they become assumptive knowledge or prememory. As Rychlak (p. 48) notes, one must know to know.

Memory, too, reflects this process versus content distinction. For Rychlak, memory as a content is "a target that has been extended meaning several predications previously and is then reconceptualized once again in the present" (p. 316). Memory as a process describes: "the cohesiveness and clarity of a tightly organized precedent meaning that is extended sequaciously in ongoing experience" (pp. 316, 317). This organization of meaning is created individually by the person. Therefore, the more tightly and richly organized the precedent meanings, the better the memory will be.

Memory for meaning does not depend on the truth of the meaning in the physical world but rather, it depends on the truth of the meaning for the person. Meaning is extended predicationally by the person to enhance his or her understanding of ongoing experience, even if learning is false or erroneous. For example, two people may have very different meanings (or attributions) about what occurred in a certain situation. If the meaning has been organized well, interfused with other relevant meanings, the ability to use these meanings as subsequent predications will be greatly improved. Not surprisingly, self-generating and elaborating meaning improves memory.

CHAPTER III

REVIEW OF RELATED LITERATURE

Memory at Encoding

Emphasis on Meaning and Context

Meaning seems to play a central role in memory. Sachs (1967) showed that the general meaning of a phrase is what subjects remember even after they have forgotten the exact wording of a sentence. Sachs gave students some passages to read with sentences such as the following, "He sent a letter to Galileo, the great Italian scientist." Sachs then gave students a recognition test for memory of this sentence at various time intervals. Students were presented with two types of foils. One type retained the underlying meaning of the sentence while changing its surface structure (for example, "A letter about it was sent to Galileo, the great Italian scientist"). The other foil changed both the surface and the underlying structure of the sentence (for example, "Galileo, the great Italian scientist, sent him a letter about it"). Sachs found that students, when tested immediately, were good at recognizing both types of foils as being different from the sentence they originally read. However, after 30 seconds, students mistakenly identified as being correct those foils that preserved the underlying meaning of the original sentences (the first one described above). This study is interesting because it suggests that beyond the immediate moment, for something to be remembered the underlying meaning must be

extracted. People do not seem to remember by holding in their minds the exact phrasing of what they hear.

Bransford (1979, p. 124), too, notes that the acquiring of ideas seems to involve more than comprehending and storing a series of sentences. Many studies show that prior knowledge allows the learner to make (predicative) inferences from the material he or she is learning to assist in the recall of that information. For example, Anderson and Ortony (1975) found that participants' interpretations of identical words in a sentence are a function of the sentence context and the person's prior knowledge. These experimenters gave participants pairs of sentences such as (1) "The container held apples" and (2) "The container held the cola." Participants were then presented with cues that they had not previously seen. It was found that when cued by the word basket, participants showed improved memory for the first sentence, and when cued by the word "bottle" participants were better able to remember the second sentence. Adding to the recall context by providing a cue that is relevant to the specific meaning expressed seems to improve memory for the sentence in question. This implies that subjects are creating meaningful patterns at encoding, allowing them to relate the material that they are learning to prior knowledge. This meaning is generated without any external input beyond what is provided in the stimulus to be encoded.

Further support that participants create meaning from prior experience to understand information they are currently learning was given by Anderson, Pichert, Goetz, Schallert, Stevens and Trollip (1976). They gave students two different types of sentences. For example, students were given either (1) "The woman was outstanding in

the theater" or (2) "The woman worked near the theater." The experimenters felt that students would infer from the context that "the woman" in the first sentence was an "actress" but that they would not be able to infer this from the second sentence. This is indeed what they found. When using "actress" as a cue to recall, students were able to recall the first sentence but not the second. Additionally, "actress" was a better retrieval cue for the first sentence than the word "woman." Again, this study suggests that people seem to bring to bear what they already know to a new learning situation, utilizing their own context to give meaning to what they are trying to make sense of (learn, etc.).

The importance of context seems to be significantly related to meaning and memory. As the above studies show, people tend to draw on prior knowledge to help them understand the information that they are trying to learn. However, what if the information that they are trying to learn is difficult to understand? Will memory for the learned information not be as good?

Bransford and Johnson (1972) gave students passages describing a situation that requires prior understanding of the context to be able to make sense of it. For example, the first phrase in the sentence is "If the balloons popped, the sound would not be able to carry since everything would be too far away from the correct floor." It was predicted that without a picture showing a bunch a balloons elevating a stereo speaker to a young woman's apartment window, participants would have difficulty making sense of this phrase. Bransford and Johnson gave one group of participants a picture providing a context for the paragraph prior to giving the participants the paragraph to read. They then gave a second group no picture, a third group received the picture after the participants

had read the passage, and a final group received a partial picture prior to reading the passage. The experimenters found that participants given the picture prior to learning the passage had almost double the recall for the passage that the other three groups had. Therefore, having a predicating context that enables understanding during encoding seems to greatly facilitate memory. Again, memory is not the result of merely inputing sentences into the brain. The words must have meaning for the learner; they must be given in a context that provides the learner with a chance to extend meaning sequaciously from the predicating context to the sentence as a target. As was shown in this study, words without very much meaning are difficult to remember.

How is meaning described by theorists? Many of the current explanations of memory rely on information processing explanations of human reasoning utilizing the computer metaphor (e.g., Raaijmakers and Shiffrin, 1992). For example, in the network model, long-term memory consists of nodes that are connected by links. According to Anderson and Pirolli (1984) the nodes represent concepts or cognitive units while the links describe associations among concepts. Through study, links between concepts learned together are formed and acquire strength. They are said to be activated; this activation spreads throughout the network links, making knowledge an effect of various sources of activation. Meaning, then, is carried in the relations between items stored in memory.

Rychlak claims that computer-based information-processing models rely on signs or surrogate destinations (i.e., nodes in network theories) as associated stand-ins for environmental influencers; that is, "based on the frequency and contiguity of past

experience, such environmentally produced surrogates are bonded together and input cognitively, totally without intention" (1994, p. 321) Instead of using signs, Rychlak stresses that meaning must be represented symbolically. He writes that "symbols are always more pregnant with meaning than we actually appreciate, because symbols include the contextual ramifications of a wider compass than our focused thought requires at the moment" (p. 90).

Fodor and Pylyshyn (1988) provide an example showing that symbols must contain more meaning than the computer-based theories are capable of subsuming. They note that a person can understand the concepts "boy," "girl," and "love" and the sentences "the boy loves the girl" and "the girl loves the boy." However, in order to understand the subject and the predicate in each of the above sentences, the person must be able to represent these two concepts so that each is kept distinct from the additional contexts of "the beloved" and the "lover." This implies that knowledge must be capable of being shared across numerous different contexts because it would be impossible to have every piece of knowledge ever to be used readily available for representation. Information-processing models have difficulty assuming these types of description because of the very fact that their representations generally use "unary" (one-place) predicates to describe single, fixed objects (McCarthy, 1988, p. 44). As Churchland (1986, p. 36) notes, models of learning and memory basing processing complexity on associations between nodes may be postulating a system with more units than would actually be possible in the nervous system.

Another problem with the representation of meaning by computer-based models is

that meaning is represented extraspectively. As described in Chapter 2, Rychlak (1994) defines an extraspective description as one that frames theoretical explanations "of things or events in the third person ('that, it, him, her,' etc.), that is, from the perspective of the observer"(p. 313). This type of explanation does not take into consideration why particular meanings are important for the person. Alverson (1994) suggests that "'meaning' in human language must in some fundamental way be *the expression in human language of human experience*" (p. 8, italics in original). He suggests that language is not to be seen as a system described apart from the species; rather language is generated from an innate capacity which we then use, introspectively, to communicate meaning. Meaning is not equal to language per se; rather it is the reason for using language. Alverson suggests that it would be impossible for everyone to represent the world as it actually is. Instead, we must each represent it from our own perspective. Network theories of meaning deny "that meaning is an intrinsic feature of mental states" (Churchland, 1986, p. 344). Rychlak (1991) stresses the importance of providing an introspective account of the reasoner as opposed to the extraspective view of reasoning taken by network theorists.

Providing an introspective description of meaning that accounts for the importance of representing meaning symbolically (and not as mere signs), has implications for memory. If meaning is communicating peoples' beliefs and intentions, then the meaning they intend to convey should be correlated with what they will remember. For example, why should a person remember something that does not provide him or her with any meaning? It is, therefore, not surprising that many studies have found that participants who generate their own meanings produce greater recall than participants

who are given meanings by the experimenter. The following section will describe some of these findings.

The Generation Effect

Improved retention has been found to be the result of the learner taking an active role in interpreting the material to be learned (Wittrock, 1989). For example, Sodian, Schneider, and Perlmutter (1986) asked children, aged 4 and 6, to play with toys that could be sorted by color (red, blue, etc.) and taxonomically (animals, utensils, etc.). They found that 4-year-olds had better memory for the toys following sorting them into categories than the children who simply played with them. Children who sorted the toys had been told to "put all those toys together that go together." Categorizing the toys required the children to actively think about the meaning of the toys. This suggests that how meaning is organized by the learner influences memory. Incidentally, category derives from the Greek Kategoria, which means predicate.

Improvement in memory has been shown for items that are self-produced by the participants rather than simply read. This has been called the "generation effect" (Nairne, Pusen, & Widner, 1985). Salmecka and Graf (1978) found this advantage in memory regardless of the context under which the participants would generate material. They gave one group of participants one word of a pair and asked them to generate another word based on a rule the experimenters provided. To ensure that all participants were generating the same examples, they were given the first letter of the word they were asked to generate (for example, *rapid-f)*. The second group of participants were expected to simply read word pairs given by the experimenter. Pairs of words were created

according to the following five rules: associate (e.g., lamp-light), category (e.g., ruby-diamond), opposite (e.g., long-short), synonym (e.g., sea-ocean), and rhyme (e.g., save-cave). Memory was much improved for the participants in the generate condition over the participants who merely read the word pairs. Furthermore, evidence for this effect was found under free recall, cued recall, and recognition conditions.

Salmecka and Graft (1978) provide an explanation for the generation effect based on a spreading of activation model of cognition. They propose that the generation-effect advantage over reading is observed because of the additional requirement that semantic or lexical memory (a person's preexisting knowledge about verbal information) must be searched in order to access an entry in the mental lexicon. Nairne et al. (1985) tested the lexical activation theory. They conducted three experiments. First, they showed that a generation effect could not be found when participants were asked to read or generate nonword items. For example, in the generate condition participants would be given a nonword and asked to generate another nonword, given an initial letter, based on a rule (e.g., using the rhyme rule: PRAB F____). For the read condition, subjects might be given both words of the pair of rhyming nonwords (e.g., PRAB FRAB). One group of participants was told the nonwords were actual words that are rare and another group was told that they would be receiving nonwords. A generation effect was not found for either group. Because nonword items have no location in lexical memory, they should not produce the generation effect. This supported the lexicon activation theory.

Next, Nairne et al. (1985) tried to produce a generation effect when participants were provided with definitions for the nonwords. If semantic memory were being

activated these new meanings should have provided an advantage for the generation effect. They again did not find a generation effect for defined versus nondefined nonwords; however, defined words produced significantly greater free recall than nondefined nonwords. In a post-experimental discussion, participants told experimenters that they had attended to the meaning of the defined nonwords throughout both the read and the generate conditions. Nairne et al. suggest that because the participants were treating the defined nonwords as "meaningful," these nonwords must be represented in lexical (i.e., semantic) memory. Nairne et al. then conclude that because the defined nonwords do not produce a generation effect, representation in lexical memory is a not sufficient condition for producing the generation effect.

In a final experiment, Nairne et al.(1985) tested whether a generation effect could be produced with words of varying frequency in language. Higher frequency words are thought to have a greater "spread of activation" (more associates) than low frequency words. They felt that if words of high and low association value did not produce a significant generation effect then representation in the mental lexicon should be both necessary and sufficient to produce an effect (confirmation of the findings from their experiment using defined nonwords). Nairne et al. found a generation effect for high frequency words (high association value) but not for low frequency words (low association values). Additionally, they found that recall was significantly higher for low frequency words than nonwords suggesting that nonwords and low frequency words are not functionally identical. They concluded that this effect could not be due solely to representation in the mental lexicon, since low frequency words are represented in the

mental lexicon but do not produce a generation effect. They feel that the generation effect depends on a word's number of associates measured by its frequency of use in the language. I will first describe another study before summarizing the implication of these findings for LLT.

Crutcher and Healy (1989) suggest that the generation effect is the result of a combination of an appeal to semantic memory involvement (Nairne et al., 1985), in addition to the added effort made by the individual in producing the self-generations. In support of the effortful explanation, researchers have found that generation requires increased involvement of consciousness and heightened arousal (Jacoby, 1978). This latter explanation suggests that the effect is due to factors intrinsic to the process of generating meaning. Crutcher and Healy (1989) found that the participant's ability to actively find the solution to a problem was more important to recalling a response than the actual overt production of that response. They asked participants to generate the solution to math problems under two conditions: one where participants were given the answers to the problems and one where they were not. Both conditions produced high levels of recall for the answers. In contrast, two additional conditions required participants either to memorize the answers when not asked to generate the solutions or to find the answers but with a calculating device, short-cutting self-generation of the solution. These two latter conditions produced lower levels of recall.

Crutcher and Healy (1989) conclude that it is not important whether participants produce a response; rather, it is essential that participants engage in cognitive operations linking the generated response to other information in memory. Naire et al.'s (1985) and

Crutcher-Healy's (1989) findings, although explained using information-processing terminology, support the predication model in many ways. These findings suggest that meaning is important to the generation effect. Words that are highly related and therefore more likely to be meaningful produce a generation effect. Unrelated words (low-association value) and nonwords do not produce a generation effect because both have little meaning for the learner. Furthermore, solving a problem rather than merely being given or producing a response with a calculator makes the response more meaningful and results in a generation effect. Thus, the self-generation of meaning has a potent organizing effect on memory. This is consistent with Rychlak's suggestion that the creation of meaning is done introspectively and intentionally.

Elaboration

Research has also shown that elaborating on the meaning of the material to be remembered improves memory for that information. To elaborate a meaning is to provide additional information about the target (or the to-be-remembered) item. For example, Craik and Tulving (1975) had participants judge whether words would fit in a sentence frame, thus requiring participants to focus on the semantic characteristics of the words. The sentence frames were given as cues to assist recall. Craik and Tulving found that the more complex the frames were, the better the recall. However, Stein and Bransford (1979) found that complexity does not assist recall unless the sentence frame is logically consistent with the targeted phrase. Thus, memory for a base sentence such as "The bald man read the newspaper" is improved when the experimenter provides a "why" explanation for the sentence (i.e., "The bald man read the newspaper to look for a hat

sale"). Stein and Bransford called these types of elaborations "precise" because the elaboration clarifies the significance of the base sentence. However, when the elaborated meaning is "imprecise" (i.e., "The bald man read the newspaper while eating his breakfast"), memory for base sentences is worse than memory for base sentences alone without any type of elaboration. Imprecise elaborations are semantically congruent with the base phrase but do not clarify the target's importance.

These findings are interesting because they stress that recall at retrieval, to a large extent, depends on whether the question asked at recall was answered during exposure at the time of acquisition. Again, this study stresses the role of the information's meaning for the learner as being important to later memory for the information.

A study by Morris, Stein, and Bransford (1979) further stresses that the type of meaning an elaboration contains influences recall. They were interested in exploring the role of prior information on memory for a target paragraph. They were also interested in understanding what type of prior information would facilitate recall. If participants are given a paragraph with sentences such as "The group felt sorry for the fat man but couldn't help chuckling about the incident" or "The greatest praise went to the bald man for his resourcefulness," they would have difficulty understanding these sentences. Participants had no previous understanding of the context that specifies the details about "the incident" or the reasons for "chuckling" or "praising." First Morris et al. gave participants (group one) a paragraph containing sentences such as the above examples. A second group (group two) received the same paragraph except with many of the adjectives in different locations. For example, they had sentences such as "The group felt

sorry for the bald man but couldn't help chuckling about the incident" and "The greatest praise went to the fat man for his resourcefulness." Both groups recalled each paragraph equally well.

Next the experimenters gave the two groups more information about their target paragraphs by way of a paragraph preceding presentation of the target paragraph. The experimenters were testing if recall for the target paragraph would be facilitated when it was elaborated by a prior paragraph that was consistent with the participants' prior knowledge. Each group received identical prior paragraphs except that adjectives were moved to locations that were consistent with information about the target paragraph. For example, group one was given the "precise" paragraph which contained phrases such as the "The fat man had gotten stuck in a cave," or "The bald man had made a fur hat." Group one could therefore draw on their prior knowledge to relate their prior and target sentences in a meaningful way. Group two was given the "imprecise paragraph" where "The fat man had made a fur hat," and "The bald man had gotten stuck in a cave." For group two, there was less of a meaningful relationship between the sentences given in the prior and target paragraphs with that of participant's prior knowledge.

As already noted, Morris et al.(1979) found that both groups equally recalled their target paragraphs when no prior paragraph was given. When given the prior paragraph, group one (with the precise prior paragraph) recalled 66% of their target paragraph while group two (with the imprecise paragraph) recalled only 30% of their target paragraph. Group two, when given the imprecise paragraph, recalled about 3.3% less of the target paragraph than group one and two having received the target paragraph alone. In addition,

even when given an extra practice trial on their additional paragraph, group two (with the imprecise paragraph) still did not improve their recall significantly (41% compared to 30%). Furthermore, all the words in the two paragraphs were identical except that they were combined differently. Therefore, differences could not be due to word frequency (i.e., one group was more familiar with the words) or word imagery (i.e., one group had words they were better able to imagine). Both paragraphs had no differences in syntactic structure so this, too, cannot account for differences. Finally, practice slightly increased (not significantly) recall for group two but not any more than for both groups without the additional paragraph.

These results are interesting because they imply that a meaningful relationship between the targeted information and the elaborated paragraph to prior knowledge is important for enriching memory. When the elaborated paragraph is logically consistent with the target paragraph but the elaboration and target sentences are nonmeaningful and inconsistent with prior knowledge, recall is not enhanced by elaboration. These findings provide evidence for the predication model. The prior paragraph serves as a precedent meaning that can be extended to the target paragraph. If the precendent is nonmeaningful by being inconsistent with prior knowledge (i.e., prior predications), it can not provide a context to extend to the target. Memory for the target is impaired. However, when the elaboration's meaning is relevant to both prior knowledge and the target paragraph, it is readily extended to the target. The elaboration enriches the target and memory for the target paragraph is improved.

Requiring participants to self-generate elaborations seems to effectively enhance

memory. Pressley, McDaniel, Turnure, Wood and Ahmad (1987) showed that if participants were asked to provide the answer for the why question (i.e., using Stein & Bransford's procedure, see above), their retention was greater than if the experimenter gave the elaboration. Seifert (1993) provides evidence of many studies showing that self-generation of elaborations by learners is consistently effective in increasing retention for target information over control reading groups.

Nevertheless, self-generated elaborations are not always effective in assisting memory for the target item. As Wood, Willoughby, Bolger, Younger, and Kaspar (1993) suggest, similar to Stein and Bransford's (1979) findings, the effectiveness of an elaboration depends on how consistent and relevant its meaning is with the meaning being elaborated. Wood et al. rated participant's self-generated elaborations in terms of whether elaborations were adequate (a logical explanation of the target fact), inadequate (any elaboration that did not explain the target fact), or a failure to respond. They found that adequate self-generated elaborations produced the greatest recall of target items.

One accepted hypothesis for the success of the self-generated elaboration is that it integrates and organizes new information by encouraging learners to make inferences between new information and prior knowledge (Seifert, 1993; Wood et al, 1993). Although this suggestion is consistent with LLT, Seifert (1993) employs a computer-based explanation. He writes: "Although relating new ideas to prior knowledge is important for learning, it may be the strength of the association between two items that is the prime factor in memory for the item pair"(p. 650). He is suggesting that elaboration is the result of the association of these elaborated items with target items in memory. These

additional associations are thought to increase memory for an item because they enhance the retrievability of target information. Traditional "frequency" theorizing is followed here, in which meaning per se is given little significance as an explanation of the findings.

From LLT's perspective, elaboration is the creation of additional meaning which adds to the predicating context and thus lends greater meaning to the targeted information. Here, meaning is stressed in contrast to associative frequency. Meaning is not important to the traditional explanation where strength of association determines what will later be recalled. Furthermore, the research showing that meaning consistent with the targeted meaning facilitates recall supports LLT. Only meaning that is consistent with the meaning being targeted could be extended to the target. If the meaning was inconsistent or irrelevant, it would not provide a context within which to frame the targeted meaning in the first place. One cannot make sense from nonsense, much less recall what has been so poorly contextualized.

Memory at Retrieval

Rychlak's predicational model predicts that a memory is recovered when the recurrence of the initial meaningful organization is effected or approximated at a later time. In remembering something in the present, a memory content (i.e., a precedent predication) is targeted by a current predicating context. If the meaning can be approximated, recall occurs. For example, a man is reminded of the time he saw the King Tut exhibit in New York. He thinks back and remembers that it was a stormy windy night just like this night. He, then, realizes that he has just exited the library whose hallway is

adorned with Egyptian-type wall hangings. A past predication has been targeted in this similar predicating context of the present. This memory, now the target, can then become the predicating context for further memories. The man then might proceed to think about other museums he has been to or ones that he is interested in seeing. This is not to say that his ideas are merely associated in efficient-cause fashion; rather, a wider realm of meaning is framing a narrower meaning that has been targeted by the predicational process in formal/final-cause fashion.

This process occurs immediately without the necessary requirement of time's passage. Rychlak (1994) writes, "The sense of a flow of time is due to the succession of predicating contexts that are continually being extended, one to the next, in logical order. Each protopoint [i.e., the intiating point for meaning-extension] identifies a new framing of such affirmed meanings, and since one meaning extends to another in precedent-sequacious fashion, a logical flow is sensed"(1994, p. 135). Time itself is a predication. It too is a meaning that is construed by the person to organize the events of her or his life in a way that is useful for the person.

Friedman (1993) provides a review of the research on memory for time. His findings support LLT's conception of memory. He found that there is no evidence for a natural temporal code in human memory. He points out that the notion that a linear chronology is an essential feature of memory is a chronological illusion based on our recent history being biased by a Newtonian notion of linear time. Friedman bases his conclusions on evidence about people's ability to recall the distance of a memory from the present, the location in time of a memory, and the relativeness of memories. For

example, direct retrieval of exact dates does not occur unless some event has important significance for the person and the person has actively rehearsed the date with the contents of memory. Another example Friedman provides is that a common method people employ for recalling the time of an event is to remember events that have occurred close in time to the targeted event and contain clues about when the target event occurred, thereby patterning a context for memory. For instance, a person might remember that something occurred in February because that was near the time of his or her birthday. Friedman suggests that the elementary information for time is the ordinary content of memory. That is, people use their understanding of how different events form patterns and use this to encode time information.

Based on Friedman's review, and consistent with LLT, it seems that humans use linear time as a method for organizing events that assist in later recall. For example, Robinson (1986) found that when months were given as cues to recall in either a forward or backward chronological order, more personal experiences for a given time period were reported than when cues were given in a random order. Friedman (1993) writes:

> If the most important temporal information is locations in patterns of time, then it is clear why memory does not code absolute linear time through a chronologically organized memory store, a refined mechanism for coding distance in the past, or absolute time tags [time information is added at time of encoding and then later recalled] assigned to each event. All of these mechanisms would be extremely inefficient ways of storing cyclic locations (and impossible ways of storing coincidence with patterns that occur at irregular intervals). Any time-tagging

> mechanism would need to label each event and do so on multiple time scales. Chronological memory organization or distance codes would need an essentially impossible level of precision or else cyclic locations would be lost. (p. 60)

Friedman believes that our chronological sense of the past is a result of an ongoing process where we continually integrate information about time from our understanding of time patterns. We use associations between the context and particular memories, connections between events and time names, our understanding of the order in which events occurred, and clues to the age of memories, to give us a sense of time. Friedman, perhaps for lack of better terminology, seems to imply a constructive process similar to Rychlak's but falls back on material and efficient causality when he introduces the notion of associations. However, when Friedman speaks of time patterns, he brings to mind Rychlak's use of formal causes. A logical process, such as the predicational model, constructs meanings or patterns (formal causes), of which time information is a content. This process proceeds because a logical order necessitates a logical progression from the wider context to the narrower target, not because some mechanical time is causally linking meanings (associations) together. Because in psychology we are so tied to a linear model of time, it is difficult for us to imagine learning and memory as occurring in such a time-independent way (Rychlak, 1994).

Friedman's (1993) observation that exact dates for events are not recalled unless they have a great deal of significance for the person stresses the fact that memory seems to have much to do with meaning and the patterns the person constructs for him- or herself. It does not seem that memory is as exacting as a computer-based matching

process would necessitate. In a matching process meaning is irrelevant. In contrast, for the predicational model, meaning is the basis for learning and memory (i.e., meaning is extending logically from the wider context to the meaning being targeted). For example, as previously described, Stein and Bransford (1979) found that asking the "why" question at recall facilitated memory for base sentences that previously had been elaborated with answers to these questions. Participants in the Bransford study needed to understand that a "why" question was asking them to recall information that they had learned. Participants needed to comprehend the meaning behind the words they were learning and organize it in a meaningful way. They needed to infer the relation between these two contexts. A direct or simple matching process of "association" does not capture this meaningful nature of memory that Friedman (1993) is describing.

If humans reason predicationally whereby meaning is extended from the wider context to the narrower target and not in the reverse order, then the wider realm should be a better cue for the target and not vice versa. Studies have found this. Tulving and Pearlstone (1966) found that participants asked to memorize a string of words or categories of words, recalled more words when cued by the categories (the categories being the wider context). Further evidence is provided by Sodain et al.'s (1986) finding that children recall more toys when first asked to categorize them than they do when they simply play with them. Again, the children are utilizing self-generated, wider realms of meaning to organize the targeted items (the toys).

To study the predicational process, Rychlak utilizes the sentence as it provides the simplest example of the predicational process. The subject of the sentence can be viewed

as the target which is framed or described by the wider context, the predicate. For example, in the sentence, "John is reliable," reliable is the predicating context meaning that is extended to the target meaning, John.

Rychlak has repeatedly found support for this hypothesis, in the results of cued recall studies that show a "predication effect." He has demonstrated that participants who have been asked to memorize sentences will better recall them if given the predicate word as a cue to recall as opposed to the subject word (Rychlak, 1994, pp. 147-155). For example, when asked to recall a sentence read earlier like "A brick can be used as a doorstop," participants were cued with either "a brick" (the subject) or "a doorstop" (the predicate). Rychlak found that the predicate cues were significantly better at facilitating recall.

Kroll and Schepler (1987) were interested in studying how information from a prior context sentence is useful in understanding a simile. The prior context they used contained either information relevant to, irrelevant to, or misleading to the meaning of the simile. Furthermore, the subject word of the prior context was either the subject or the predicate word of the target sentence. For example, for the simile, "Her fiance is like a robot," a subject-relevant prior context sentence was "Her fiance is without emotions. " A predicate-relevant one was "A robot is without emotions." Both contexts refer to meaning that is relevant to both the subject and predicate word. Irrelevant contexts for the simile were "Her fiance is a liberal," and "A robot is designed by engineers," for the subject and predicate of the simile, respectively. In this case, both contexts have nothing to do with the overall meaning of the metaphor but the meaning can be attributed to one word of the

simile. Finally, misleading contexts contained ideas that were irrelevant to the overall meaning of the simile but could be attributed to both the predicate and subject of the metaphor. A misleading context was "Her fiance is reliable" or "A robot is reliable."

Participants were first asked to judge the prior context for relevancy, irrelevancy, or misleadingness. They were then given a memory test receiving either the entire prior sentence context as a cue or just the subject or predicate word alone. The results showed that consistently when cued by the predicate-context sentence or by the predicate alone, recall was the greatest. Additionally in the relevant condition, time to make judgments was no different for subject or predicate contexts, indicating that encoding of predicates is not the result of greater time in processing. These studies indicate that the encoding of the predicate seems to facilitate memory for a simile and it confirms Rychlak's persistent finding that the predicate is a better cue for recall.

Metaphor Theories and Experimental Hypotheses

The present research involves memory for metaphors. Initially, participants were given a metaphor as well as two other sentences, one of which elaborated the subject of the metaphorical sentence and the other the predicate. There were several such "triplets" to array. The experimental task asked the participant to align the three sentences in the way that made the greatest sense to them personally. It was expected that predicate elaboration would be aligned before subject elaboration, according to the precedent-sequacious course of meaning-extension postulated by LLT. After completing the arraying of triplets, participants were given a cued recall task for the metaphors, using either the subject or predicate words of the metaphors as cues. Once again, predicate

cueing was expected to result in greater recall than subject cueing. I also expected to find that a combination of predicate elaboration and predicate cueing would lead to the greatest recall of all.

Like similes, metaphors provide a perfect example of predication. As Lackoff and Johnson (1980) define it: "The essence of [a] metaphor is understanding and experiencing one thing in terms of another" (p. 5). According to the predicational model, the "predicate" of the metaphor should be the context for understanding the "subject" of the metaphor. Furthermore, metaphors, like all figurative language, depend on the context for the interpretation of their meaning. For example, Gildea and Glucksberg (1983) found that people have difficulty ignoring the figurative meaning of an ambiguous metaphor if they are given a prior context to disambiguate them. The disambiguating context provides a wider realm of meaning that lends meaning to the metaphor (the meaning being targeted).

Current theorists offer different explanations for the interpretation of metaphors. Glicksohn and Goodblatt (1993) have proposed the gestalt interaction theory. It suggests that a metaphor is more than the sum of its parts. The understanding of a metaphor arises from the interaction of thoughts generated by the tenor (the subject of the metaphor) and the vehicle (the predicate of the metaphor) to produce a common ground. This view proposes that the tenor and vehicle are not interchangeable but rather have an asymmetric relationship with the tenor being viewed through the filter of the vehicle.

This theory contrasts with the explanation of metaphors based on comparison theory (Ortony, Reynolds, and Arter, 1978). These authors assert that metaphors are

understood because the tenor and vehicle share a similar property making tenor and vehicle equivalent on this feature. The result is that tenor and vehicle should be interchangeable, making the parts equal to the whole. This type of explanation can be subsumed by computer-based models, which hold that metaphorical meaning is the result of tenor and vehicle association (Verbrugge & McCarrell, 1977). Other researchers have also found an asymmetrical effectiveness of the predicate (vehicle) over the subject (tenor) in producing greater recall of metaphors and similes (Kroll & Schepler, 1987; Rychlak, 1994, pp. 147-155). These studies offer criticism of the comparison theory and lend support to a gestalt interaction theory as well as the predication model.

The explanation of metaphor comprehension by the gestalt interaction theory is in accordance with the logic of predicational theory. The direction of meaning flow is from the precedent (first in logical order) to the seqacious extension of the precedent meaning (the next in logical order). The precedent is always the wider realm of meaning. For example, in a sentence the logical flow of meaning is from right to left even though the sentence is read from left to right. In a paragraph, the topic sentence is the precedent that frames how the rest of the paragraph will unfold. A paragraph that begins with a clearly meaningful topic sentence, is easier to read because the meaning extended later in the paragraph has been placed in a wider (precedent) context for further (sequacious) elaboration. Predication occurs on all levels from that of the sentence to highly abstract accounts and even "universals." The present study explores predication both within the metaphor and within the context elaborating the meaning of the metaphor at both encoding and retrieval. The formal hypotheses to be tested in the present research are

described below.

Hypothesis I

Participants who are asked to align three sentences, one of which is a metaphor and the other two elaborate either the subject or the predicate words of this metaphor, will reflect a significant preference for predicate elaboration first and subject elaboration second.

Rationale I

Since LLT holds that cognition flows from predicate meanings "to" targets, it follows that this logic holds for the course of elaboration as well. That is, when aligning the three sentences, no matter where the sentence stating the metaphor is placed in the order (first, second, or third), we expect participants to align a sentence elaborating the predicate before the sentence elaborating the subject. Considering only elaboration (i.e., ignoring the metaphor sentence) we can therefore say that predicate elaboration will be more likely to be first. This is the precedent location in a logical sequence. Secondly in the logical ordering, the subject word should then be elaborated.

Hypothesis II

When participants are subsequently asked to recall the metaphor's word contents, predicate-word cues will result in more successful recollections than subject-word cues.

Rationale II

Following the precedent-sequacious logic of the predication model, we expect that the predicate cue will produce greater recall because it provides a wider frame of reference that subsumes the target's meaning. The target, being narrower in meaning than

the predicate, should not be as successful at cuing the predicate word. This hypothesis serves as a cross-validation for the predication effect discussed in the above literature review (see especially, Rychlak, Stilson, & Rychlak, 1993). A significant finding will provide further evidence that there is an asymmetry in the sentence, with the predicate word being more effective than the subject-word as a cue to recall. The predication model suggests that this asymmetry is reflective of the fact that the predicate word is the wider realm of meaning that is extended to the subject word that is its target.

Hypothesis III

The combination of predicate elaboration and being cued by the predicate will result in significantly more recollections than other such combinations of elaboration and cueing.

Rationale III

If predicate elaboration is preferred by our participants over subject elaboration, reflective of logical sequencing, and if predicate cueing is helpful to subsequent recall, then we might hypothesize that in comparison to other conditions of this experiment (e.g., subject elaboration and subject cueing) we should find more efficiency in memory for completing the metaphors when the predicate aspects of this experiment are united. I am not making the claim that a matching process might be occurring--that is, matching elaboration to cue. Note that I have not claimed equal facility to the subject elaboration/subject cueing condition as would be expected on the basis of a "matching" hypothesis. My focus is predominantly on the predicate as both initial source of influence on understanding (elaboration) and subsequent recall (predicate cueing).

CHAPTER IV

METHODS

Participants and Design

One hundred and six participants (69 females and 37 males) were drawn from the undergraduate subject pool at Loyola University Chicago. Participants received extra credit in their introductory psychology course for participating. They were informed that all their responses would remain confidential and anonymous.

The present study required participants to array 24 groups of three sentences into the order that made the most sense to them. The three-step grouping is called a "triplet" and is roughly modeled on the syllogism, except of course there is no "fixed" sequencing corresponding to the major premise, minor premise, and conclusion. The main sentence of each triplet is a metaphor, such as "A tree is an umbrella." The two remaining sentences further describe the metaphor. One elaborates the predicate of the metaphor such as "An umbrella gives protection" and the other elaborates the subject of the metaphor such as "A tree provides shelter." Appendix A presents the complete list of metaphors.

Disregarding the placement of the metaphor, two types of self-generated organizations are possible: (1) subject elaboration *preceding* the predicate elaboration

(called the "subject-first elaboration"); and (2) predicate elaboration *preceding* the subject elaboration (called the "predicate-first elaboration"). The dependent-variable measure here is the number of triplets falling into one or the other of these levels. Following the elaboration phase there was a "cued recall" phase. Once again the independent variable was within-subjects at two levels: subject cueing versus predicate cueing. The dependent measure was the number of metaphor completions correctly recalled given the predicate or the subject cues.

Materials and Procedures

The test booklet for part one contained 26 triplets of sentences (one triplet per page). Within each triplet, one of the sentences was a metaphor containing two nouns joined by a verb (e.g., A tree is an umbrella). The other two sentences were constructed such that one sentence elaborated the subject word of the metaphor and the other sentence elaborated the predicate word of the metaphor (e.g., the "subject elaboration" for the above metaphor is "A tree provides shelter" and the "predicate elaboration" is "An umbrella gives protection"). The elaborated sentences were constructed such that the descriptors of both the subject and predicate words of the metaphors used in the elaborations were synonyms (shelter=protection). The words used in the test items were controlled for association value via the Thorndike and Lorge (1944) norms.

Balancing was used to control for possible order effects. The 24 triplets were divided into six blocks of four. For each of the six blocks, a different way of arranging the three sentences in a triplet was constructed. This was done to ensure that an equal number of triplets in a test booklet appeared in each of the six possible orders of

combining the three sentences. Furthermore, six different lists were created by rotating each block one position forward so that every block appeared in a different position on each form. Additionally, the triplets were divided into groups of eight and these groups of eight were rotated in the six possible ways so that the content of the items appeared in different orders on each of the six lists. An extra triplet was added to the beginning and the end of the test booklet to control for primacy and recency effects. The primacy and recency items were identical for all participants, and they were not scored in the data analysis. Because of these additional items, a test booklet consisted of 26 triplets, with 24 actually used in the scoring.

Participants were tested six at a time in a classroom at Loyola University of Chicago. Block randomization was used so that the six participants being tested were each randomly assigned to a different form of the test booklet. Following the signing of informed consent, participants received a set of instructions describing part one of the experiment. They were informed that part two would be a memory test. Participants were given five minutes to quietly read the instructions to themselves. Following this time period, the experimenter slowly read the instructions aloud to the group and asked if there were any questions (see Appendix B for a copy of the Instructions).

Participants were given the test booklets and told that we were studying how people understand metaphors. They were then asked to rewrite the triplets in the order that made the most sense to them on a provided answer sheet. For example, for the triplet "A river is an artery, A river has direction, An artery has a course," they might choose to rewrite the sentences as "An artery has a course, A river has direction, A river is an

artery," if this formulation of the three sentences made the greatest sense to them. Participants were given 45 seconds per page to write down the three sentences until all 26 triplets had been rewritten. Pretesting established this time period as optimal.

Immediately upon completion of part one participants were given a cued recall task to test their memory for the metaphors. Participants received a list of 24 cues, 12 of which were metaphor subjects and 12 of which were metaphor predicates that had been randomly selected to be used as cues in the short-term memory task. Participants were given five minutes to complete the metaphors--providing either a subject or a predicate, depending on condition--for all 24 triplets (the primacy and recency metaphors were not cued). Hence, for half of the metaphors to be recalled, participants wrote in a missing predicate, cued by the subject; and for half of the metaphors participants wrote in a missing subject, cued by the predicate. A second and complementary cue list was constructed and administered to half of the sample. The second form contained the opposite type of cue from what appeared on the first list. Therefore, using the previous example, "A river is an artery," one group of participants received the subject cue, "river" and were expected to recall the predicate word, "artery." While another group of participants were given the predicate cue, "artery" and were expected to recall the subject word, "river." This was to ensure that we tested both types of cue for each metaphor (see Appendix C for copies of Cued-Recall Forms). After the cued recall task, participants were debriefed and allowed to ask questions about the experimental hypotheses and procedures.

CHAPTER V

RESULTS

Hypothesis I

Hypothesis I predicted that participants would arrange more predicate-first elaborations of the triplets than subject-first elaborations. The dependent measure was the number of such contrasting elaborations among the 24 triplets. The triplets were scored in the direction of predicate-first elaborations, so that the higher this score the more times a participant chose to elaborate the predicate first. Thus, a participant who elaborated all of his or her triplets on the basis of "predicates first" received a score of 24. A participant who elaborated none of her or his triplets on the basis of "predicates first" received a score of 0. Table 1 presents the frequency of participants who scored from 0-24 on the experimental task.

Table 1--Predicate-First Elaboration Score and Number of Participants Selecting

	Predicate-First Score	Number of Participants Selecting	Percentage of Sample
Preferred Predicate-First Elaborations	24	5	4.7
	23	3	2.8
	22	3	2.8
	21	5	4.7
	20	3	2.8
	19	3	2.8
	18	4	3.8
	17	7	6.6
	16	5	4.7
	15	3	2.8
	14	9	8.5
	13	11	10.4
Preferred Subject-First Elaborations	12	5	4.7
	11	8	7.5
	10	2	1.9
	9	3	2.8
	8	3	2.8
	7	3	2.8
	6	2	1.9
	5	2	1.9
	4	4	3.8
	3	3	2.8
	2	0	0.0
	1	5	4.7
	0	5	4.7

To test the first hypothesis, we divided the sample on the basis of selecting 13 or more of the predicate-first options. This constituted over half of the triplet organizations possible. In effect, the sample of 101 participants was divided into those who scored 13 or above versus those who scored 11 or below. There were 62 participants who scored 13 or above and 39 participants who scored 11 or below. Five participants were dropped from the sample due to a score of 12, which represented a tie on the predicates-first score. The two-part breakdown of the sample was tested against a 50/50 hypothesis suggesting that chance would predict 50.5 subjects in each of our categories (i.e., subject-first vs. predicate-first). This nonparametric analysis resulted in a significant chi -square (1, N=101) = 5.238, p = .022 (see Table 2). Hence, true to the prediction of hypothesis I, significantly more participants organized their sentences by elaborating the predicate before the subject of the metaphor.

Table 2--Chi-Square Analysis of Participants' Preference for Predicate-First Elaborations Versus Subject-First Elaborations

Number of Predicate-First Elaborations Used

Category	Cases Observed	Expected
1-11 Predicate-First	39	50.50
13-24 Predicate-First	62	50.50
Total	101	

Chi-Square	D.F.	Significance
5.238	1	.022

The decision to divide the participants into two groups around the midpoint of 12 predicate elaborations (i.e., a participant with 12 predicate-first elaborations would also have 12 subject-first elaborations because they determine each other) raises the question: Is this effect real or are participants merely clustered around the middle with a high frequency of participants using mainly 11 and 13 predicate first elaborations? In examining the frequency table of participants' scores (see Table 1), it was found that 10.4% of the cases used 13 predicate organizations compared with 7.5% who used 11 predicate organizations. There is a large percentage relative to the sample of cases at these two points; however, the distribution of the number of predicate-first elaborations does not limit itself to merely the midpoint. The distribution of participants preferring predicate-first elaborations extends the entire range (from 0 to 24 predicate-first elaborations). Furthermore, a greater percentage of participants favor more predicate-first organizations rather than subject-first organizations throughout the entire distribution and not just at the midpoints.

Hypothesis II

Hypothesis II predicted that predicate cueing would lead to the greatest amount of items recalled regardless of the order in which the elaborations were placed. Item recall was assessed by the number of metaphors that could be completed, given either a predicate or a subject cueing. This score could therefore range from 0 to 24 (the primacy and recency metaphors were not included in the recall score). The resultant data were tested using a paired-samples t-test. The total recall given the predicate cue was compared with the total recall given the subject cue for each participant (subject and predicate

cueing was a within-subjects variable). The mean recall for the predicate cue across participants was 6.52 (SD= 3.09), and the mean recall for the subject cue across participants was 5.61 (SD= 2.98). A significant t-value of 4.54 was found ($p<.01$, df= 105). Therefore, in support of hypothesis II, a predicate cuing effect was found for the cued recall task.

Hypothesis III

Hypothesis III predicted an interaction between item organization and type of cue administered at recall. This hypothesis was difficult to test and required some preliminary coding of the data. First, each participant's organized triplets were divided into one of four categories: SS-Total--that is, an item which was subject-organized (chosen by the participant) and subject-cued (experimenter given); SP-Total--that is, an item which was subject-organized and predicate-cued; PS-Total--that is, an item which was predicate-organized and subject-cued; and PP-Total--that is, an item which was predicate-organized and predicate-cued. Because there was an even number of predicate and subject cues given, the total number of items in the SS and SP category totaled 12 and the total number of items in the PS and PP category also totaled 12. There were 10 cases where the participants incorrectly rewrote one of the triplets. In cases such as these the incorrect metaphor was dropped from both part one (organization) and two (cue). For example, one participant rewrote the metaphor twice and forgot the subject elaboration. This triplet was dropped leaving the participant with 23 possible triplets organized. Additionally, the item was eliminated from the cued recall section. This did not seem to be a problem because this item loss amounted to .4% of the total sample items to be organized.

Next, participants' recall scores were divided into one of the four categories based on the above classification. These categories were referred to as SS-Correct, SP-Correct, PS-Correct, and PP-Correct For example, if a participant had correctly recalled a metaphor with a predicate cue, after initially organizing this metaphor with the predicate elaboration first, the participant would have then received a one (one correct) in the PP-Correct category (i.e., predicate organization, predicate cue). Next, the Correct scores were divided by the Total scores resulting in percentage scores with four category names: SS-Percent (SS-Correct/SS-Total), SP-Percent (SP-Correct/SP-Total), PS-Percent (PS-Correct/PS-Total), and PP-Percent (PP-Correct/PP-Total). These percentage scores indicate the number of correctly recalled items given the possible number of items in that category.

A factorial analysis of variance was conducted on the above data with two within-subjects factors each containing two levels. These were Organization (subject or predicate) by Cue (subject or predicate). Percentage scores are often criticized because they allow for the comparison of unequal categories. To meet such criticism an arcsine transformation was used on the above data. Participants were dropped who had missing values in their scores. Missing values resulted when there was a zero in the denominator of the Percent score. This occurred when participants organized all of the items in one way: 24 items with the subject organization or 24 items with the predicate organization. From each category there were 9 (SS), 7 (SP), 8 (PS), and 8 (PP), cases missing. Fortunately, the number of missing scores appears to be approximately equal among the categories. The subject loss constituted a 22 percent decrease in the sample, leaving an N

equal to 83. In Table 3, the untransformed (before and after subject loss) and the transformed means (after subject loss only) are presented.

Table 3--Cells Means for Organization by Cue from both transformed and untransformed data

Pre-Subject Loss (when N=106* for untransformed means):

Cue	Organization: Subject-First	Organization: Predicate-First
Subject	.464 (SD = .322, N=97)	.452 (SD = .294, N=98)
Predicate	.494 (SD = .337, N=99)	.583 (SD = .293, N=98)

*From each cell there were 9(SS), 7(SP), 8(PS), and 8(PP), cases where participants had a zero in the Total score, thus making the Percent score undefined.

Post-Subject Loss (when N=83 for untransformed means):

Cue	Organization: Subject-First	Organization: Predicate-First
Subject	.434 (SD = .320)	.430 (SD = .280)
Predicate	.499 (SD = .332)	.582 (SD = .300)

Transformed Means (when N=83) used in the ANOVA:

Cue	Organization: Subject-First	Organization: Predicate-First
Subject	.582 (SD = .475)	.485 (SD = .368)
Predicate	.610 (SD = .490)	.717 (SD = .471)

The results of the ANOVA conducted using the arcsine transformed data revealed a significant main effect for Cue, F (1,82) =16.79, p<.001. No significant main effect was found for Organization, F (1,82) =.95, n.s.. Finally, there was no significant interaction for Organization x Cue. There was, however, a trend for an interaction between the Organization and Cue variables, F (1,82)= 2.85, p=.095.

The findings from the testing of hypothesis III suggest a trend. Investigation of the arcsine transformed means in Table 3 indicated that predicate organization combined with predicate cueing seems to be the most effective situation. This is also true following the examination of the means for the untransformed data both pre- and post subject loss. This suggested trend was predicted by hypothesis III. See Appendix D for a complete list of the raw data.

Additionally, a t-test was used to assess if there were any differences between transformed Percent scores for the SS and PP conditions. The mean transformed Percent score total for the SS condition was .525 (SD= .475), and the mean transformed Percent score total for the PP condition was .717 (SD= .471). This difference was significant with a t-value of 3.53 (p<.01, df =83). This further supports hypothesis III, suggesting that predicate organization combined with predicate cueing is significantly different from subject organization combined with subject cueing.

Post-Hoc Analyses

In order to examine more carefully the role of triplet organization and memory cue, each metaphor was analyzed individually. For each metaphor item, participants who correctly recalled the item were placed into one of four categories: SS (subject

organization- subject cued), SP (subject organization- predicate cue), PS (predicate organization- subject cue), PP (predicate organization - predicate cue). A series of four-way versus chance chi-squares were used to test the items. The resultant chi-square enabled me to determine by inspection whether any of the four elaboration/cueing alignments (SS, SP, PS, PP) excelled in comparison to the others for the specific metaphor assessed.

Table 4 presents an item-by-item listing of the chi-square run on each of these items (cells contain the number of participants in each category correctly identifying item). Appendix E contains the actual values ($df = 3$) for the three significant chi-squares. As can be seen in Table 4, the findings were minimal, with only three .01 significant findings. In all three cases, PP was ranked highest among the four conditions. Further examination of Table 4 reveals that PP ranked highest in 12 of the 24 analyses, and tied for the top rank on three other chi-square analyses.

It was decided to run a chi-square across the four conditions (SS, SP, PS, PP) on the basis of which one ranked first across 21 metaphors (three had to be dropped due to ties for first place; it should be noted that PP was one of the conditions tying for first in all three of the dropped conditions). With the resultant N of 21, chance would predict the expected frequency of 5.25 "firsts" for each condition. However, the chi-square revealed a significant effect of 12.698 ($df = 3$, $N = 24$), $p < .01$ (see Table 5). This finding supports that the combined effects of predicate organization and cueing is not restricted to a few items but seems to be occurring for most items. In contrast, based on inspection of Table 4, it seems that the subject organization, subject cue combination seems to be the least

effective combination for recall.

To emphasize this difference between the predicate organization, predicate cue combination versus the subject organization, subject cue combination, an additional chi-square was run comparing on each item which condition, the PP or SS, ranked highest. One of the 24 items was dropped because of a tie between the SS and PP condition. The resultant chi-square of 9.78 (1, N = 23) was significant when tested against chance (see Table 5). This lends further support for the fact that predicate organization combined with predicate cueing seems to be more effective than subject organization combined with subject cueing in enhancing recall.

Table 4--Chi-Square Analysis of Triplet Organization and Memory Cue for Each Item

Metaphor/Item	Number of Participants Correctly Recalling Item in Each Category				
	SS	SP	PS	PP	Significance
1. A book is a beacon. N=41	5	13	10	13	NS
2. An airplane is a bird. N=81	19	18	19	25	NS
3. The brain is a sponge. N=67	10	17	21	19	NS
4. A tongue is a weapon. N=83	14	17	25	27	NS
5. A child is a mirror. N=57	14	16	11	16	NS
6. A wink is a message. N=36	13	5	9	9	NS
7. A symptom is a request. N=36	6	6	8	16	NS
8. A city is a beehive. N=68	12	17	24	15	NS
9. A friend is an anchor. N=63	12	16	16	19	NS
10. A smile is a magnet N=49	7	9	8	25	Chi-Square=17.86**
11. A cloud is a mattress. N=59	18	14	8	19	NS
12. A job is a jail. N=70	17	21	13	19	NS
13. A face is a window. N=51	6	9	14	22	Chi-Square=11.51**
14. A clock is a master. N=35	9	4	11	11	NS
15. A gene is a plan. N=31	8	6	9	8	NS
16. Money is a curse. N=40	10	8	8	14	NS
17. An election is a lottery. N=66	16	14	16	20	NS
18. A ship is a plow. N=46	9	12	13	12	NS
19. A scale is a judge. N=46	12	15	8	11	NS
20. Education is a ladder. N=61	10	10	11	30	Chi-Square=19.06**
21. A handshake is a bridge. N=60	12	11	17	20	NS

22. A river is an artery. N=60	17	16	13	14	NS
23. A clue is a key. N=32	9	8	11	4	NS
24. A sea is a desert. N=48	12	12	8	16	NS

** Significant at p<.01

Table 5-- Chi Square Analysis of Highest Ranked Organization and Cue Category for 24 Metaphor Items

Organization and Cue Category for all four conditions

Category	Cases Observed	Expected Frequency
PP	12	5.25
PS	5	5.25
SP	2	5.25
SS	2	5.25
Total	21	

Chi-Square	D.F.	Significance
12.698	3	p<.01

Organization and Cue Category for the PP and SS conditions only

Category	Cases Observed	Expected Frequency
PP	19	11.5
SS	4	11.5
Total	23	

Chi-Square	D.F.	Significance
9.782	1	p<.01

CHAPTER VI

DISCUSSION

Discussion of the Hypotheses

The data analyses supported hypothesis I and II, but were only suggestive of a slight trend for hypothesis III. Participants clearly preferred to elaborate predicate meanings over subject meanings when first exposed to the three experimental sentences. Similarly, when it came to cued recall of the metaphors that were under elaboration, I found as predicted based on previous research, that the predicate word was a better cue to recall than the subject word. Hypothesis III suggested that a significant interaction for recall would be found when the metaphor was both elaborated with the predicate first and cued by the predicate meaning. Although statistical significance was not reached, there was a trend ($p<.10$) in support of hypothesis III.

It should be emphasized that I did not expect a metaphor that had been both initially elaborated and cued by the subject meaning would be readily recalled in part two of the experiment. In other words, I did not have a "matching" thesis in mind. Hence, the level of the experimental effect was expected to be carried exclusively in the "PP" condition, as compared to all three of the remaining conditions. As it turned out the PP condition did, indeed, perform the best out of all four conditions (i.e., SS, SP, PS, and PP), but this difference was not sufficient to bring about a significant ANOVA

interaction.

Nevertheless, considering that there was a .10 level trend in the interaction, and a consistent superiority in the item-by-item analysis for the PP condition, I conclude that there is enough taking place in the data to warrant further investigation. Based on the findings of this study, it appears that having a metaphor cued by its predicate meaning outweighs the factor of how it was initially organized. Actually, I cannot say with any certainty that people do in fact elaborate the meanings of a sentence--metaphorical or otherwise--in the manner that was artificially arranged. It would not detract greatly from LLT to find that the predicational cueing at recall is more relevant to memory than elaboration at initial organization. Indeed, I plan to look into this further by conducting a study in which participants will be given irrelevant elaborations--that is, elaborated meanings that have no real significance for the metaphor in question. In a study of this sort, the predication cueing at recall should prove even more important than in the present study. Now I will turn to some possible criticisms of the design. I will take this up hypothesis by hypothesis.

The significant findings for hypothesis I support a predication model's claim that reasoning flows from broader precedent meanings to narrower targeted meaning. In the results section, the question was raised as to whether the larger frequency of participants falling close to the midpoint in preferring the predicate organization is merely an artifact. Inspection of a frequency table of participants' preferences for predicate-first elaborations indicates that this was not the case. As previously mentioned, although there were clusters of participants at the midpoint, there were also participants extending the range of

the distribution with larger frequencies favoring a preference for the predicate organization. It should also be noted that it was not surprising to find many participants falling near the midpoint. This can be explained by the fact that participants did not readily become acclimated to the task. During the first five to eight items, participants tended to switch around the order of the three sentences by rotating through a few ways of organizing the triplets. Additionally, in the instructions, participants were discouraged from choosing one particular pattern to encourage that they approach every triplet individually. Therefore, it was expected that there would be few participants choosing solely a predicate-first or solely a subject-first organization. The distribution of frequencies supporting participants' preference for predicate-first organizations supports what I expected to find.

The findings for hypothesis II, a significant predicate cueing effect, replicated previous studies; the fact that the predicate word in a phrase often serves as a better cue to recall than the subject word has been shown many times before (Kroll & Schepler, 1987; Rychlak, 1994, pp. 147-155). A study by Glicksohn (1994), not done in support of LLT per se, further supports the predicate cueing effect. He gave participants metaphors and similes in both a forward (A is B, A is like B) and reverse (B is A, B is like A) order and tested participants' reported ratings of imageability (of A and B), complexity (both A and B), interest (both A and B) and similarity (between A and B). He found that an interaction between these variables was not dependent on the degree of imageability of the tenor (i.e., the subject or target word [A in the above example]) nor on the degree of similarity between the tenor and vehicle (i.e., the predicate word [B in the above example]). Instead,

the degree of vehicle imageability was predictive of how complex and interesting the metaphors and similes were judged to be. This finding implies that the vehicle or predicate, compared to the tenor, plays a more significant role in interpreting the overall meaning of the metaphor than vice versa. Furthermore, tenor and vehicle similarity has no effect on the findings suggesting that an association between similar terms is not responsible for interpreting the meaning of the metaphor. Glicksohn's study, along with the findings of this research, continues to emphasize the asymmetry in effectiveness of cueing that the predicate has over the subject, thus, lending support to the predication model advanced by LLT.

Hypothesis III predicted that the combination of predicate organization selected by the participant and predicate cuing by the experimenter would lead to higher levels of recall than the other categories. Although nonsignificant, a higher mean for the PP group and a nonsignificant trend, suggest that there is something unique occurring under the predicate organization-predicate cueing condition that does not seem to occur for the other combinations. Some limitations in the study may have made this third hypothesis difficult to test.

Additional evidence that predicate organization combined with predicate cueing is very effective has been presented by Kroll and Schepler (1987). To reiterate, Kroll and Schepler found recall to be the greatest when participants were given the predicate context at encoding and the predicate cue at retrieval (PP); next greatest recall was for those given the predicate context followed by the subject cue (PS); third was subject context followed by predicate cue (SP); and fourth was subject context followed by

subject cue (SS). In their study, a predicate organization seems to override the effects of cue, with the predicate cue being better than the subject cue. This is in contrast to the current study's findings that found cue to be a more important determinant of recall than organization.

Some differences between the present study and Kroll and Schepler's (1987) might indicate why a significant organization by cue effect was not found. First, in this study, participants received both the subject and the predicate elaboration sentence for every metaphor. In contrast, in Kroll and Schepler's study, participants received only one elaborating context (either a subject or a predicate elaboration). Therefore, the effects of receiving both types of elaboration might make it more difficult to isolate an effect. For example, participants may not actually be thinking about the predicate elaboration in the first position although they have written it in this way on their answer sheet. Second, Kroll and Schepler were able to give participants an even number of items in all the conditions because they provided participants with the elaborations. In the present study, the participants chose the organization (predicate or subject). Self-chosen organizations resulted in an unequal number of items in groups. This made the four conditions more difficult to compare. A secondary problem of self-chosen organizations was that of participants choosing only one type of organization throughout the task. This led to missing values and the need for dropping participants from the sample.

The trend observed for hypothesis III and significant results of hypotheses I and II seem to violate the encoding specificity hypothesis (Tulving and Thomson, 1973), which suggests that information can be recalled if retrieval conditions match encoding

conditions. In this study, the predicate organization-predicate cue combination seemed to be more effective than the subject organization-subject cue combination. This was supported by a significant t-test revealing that participants had larger recall scores when in the PP rather than the SS condition. Furthermore, a significant chi-squared analysis revealed that most items were correctly recalled by more participants who had organized the item with the predicate elaboration first, given the predicate cue, than those who had used the subject elaboration first, given the subject cue. It would seem that if encoding specificity were to apply the SS and PP (matched encoding and retrieval) conditions should produce equally high levels of recall, while the SP and PS (unmatched encoding and retrieval) conditions would produce less. Kroll and Schepler's (1987) findings also support this criticism of encoding specificity. Although there is much evidence to support encoding specificity, it is necessary to closely look at the results of those studies. For example, although Fisher and Craik (1977) found that a semantic cue led to greater retrieval of semantically-encoded words while, similarly, a phonemic cue lead to greater recall of phonemically-encoded words, they also found that cued recall was higher for semantic encoding and cue conditions than for rhyme encoding and cue conditions. Additionally a semantic cue (mean = .43) was no different from a rhyme cue (mean =.40) in assisting recall for words phonemically encoded. Therefore, as the predication model predicts, a meaningful organization at encoding and retrieval leads to successful retrieval, not the mere matching of encoding and retrieval conditions.

Finally, the post hoc item-by-item analysis again shows the trend of predicate organization combined with predicate cuing leading to the greatest recall. The highest

amount of recall across items tended to fall in the PP category while the lower levels tended to fall in the SS category. Additionally the item-by-item analysis suggests that predication is not something that is seen strongly in a few items whose effect is lessened by equally significant effects in the other direction (i.e., items which were recalled by participants who preferred the subject organization and received a subject cue). Rather, most of the items show this asymmetry favoring the predicate organization-predicate cue combination.

Study Limitations

A criticism of this study might suggest that the participants did not truly attend to meaning during the organization phase of the experiment. Although not told to look for a pattern, participants generally did notice a pattern: A is B, A is...., and B is .....(in any of 6 possible orders.) The question is, could participants rewrite the triplets using a pattern without attending to meaning? An attempt to control for this was made by informing participants prior to the experiment that they would be tested on their memory. This way participants might feel compelled to attend to the meaning of the sentences that they were rewriting even if they chose a particular pattern that they preferred. This, of course, is not enough to ensure that participants will attend to meaning.

It seems that, due to the nature of the task, attention to meaning could not be completely avoided. In order to recognize a pattern participants had to first identify the metaphor from among the three sentences. Therefore, they could not avoid attending to the meaning of the metaphor. Even if participants did not fully comprehend the elaborations, they had to at least read the subject word of each elaborated sentence to

determine the preferred order. Evidence that participants were comprehending the full elaborations, in addition to the metaphor, comes from the fact that sometimes they responded incorrectly to the cued recall by answering with one of the predicates in the elaboration. For example, for the metaphor "A friend is an anchor," when given the cue word "friend," participants might given "dependable" (i.e., the predicate from the subject elaboration of this metaphor) instead of "anchor."

Furthermore, it seems that there were different degrees to which participants could attend to the meaning that might additionally explain variability in the results. Meaning could be attended to on the level of the individual sentences and on the level of the combined meaning of a triplet. Therefore, it was possible that some participants, who grasped the elaborations' connections to the metaphor, were able to draw more inferences about the material and consequentially remember more than those who merely figured out what the metaphor was and organized it with the other two elaborations. The fact that people have varying abilities to draw inferences about material depending on the context they bring to the task, and the resulting increase in memory due to inference making, is supported by many studies that were cited in Chapter 3 (see especially Anderson et al., 1976; Bransford & Johnson, 1972).

For those participants who were able to understand meaning on the level of the triplet, the order of the organization of the three sentences would have no effect on memory because they would have a precedent meaning that was broader than the triplet itself. That is, the subject organization would be just as effective as the predicate organization. For example, Bransford (1979, p. 126) notes that some novelists

deliberately attempt to arouse the readers curiosity by not beginning a story with the broadest context. Therefore, the reader begins to read without truly understanding what the author is talking about. This, in turn, motivates the reader to continue reading to uncover the context. However, it should be noted that although stories sometimes will begin in this way, the author will surely explain what he or she meant by the end of the book. The even broader precedent meaning framing the reading of the book is this predicate that it is all right to be confused at first.

At the outset of this study, participants did not have very much time to think about the broader meaning of the triplets. However, as the participants adjusted to the task they became faster at identifying the metaphor and rewriting the sentences. Therefore, during the second part of the organization task, the participants would have had more time to frame an understanding that transcended the meanings of the individual sentences. Organization (predicate- or subject-first elaboration), for these items, might not have been important for memory. Alternative forms were used to control for increased practice with the items. However, this problem may have taken away from possibly observing effects due solely to organization of the triplets. One possible way to solve this problem could be achieved by giving the participant a series of practice trials with the triplets, followed by a decrease in the exposure time that they have to spend with each triplet during the actual study phase.

Future Directions

Although meaning plays a central role in the predicational model, it is often difficult to show how meaning is more than a series of associations between words. This

study seems to stress as other studies have shown, the importance of context in determining meanings. Even in a sentence, a predicate cue--which establishes a context--can better facilitate recall than a subject cue. There seems to be an inherent asymmetry that current information processing models based on the computer metaphor need to explain. The irony is that a predicational model of learning and memory relies on this asymmetry for its explanation. Remembering, one aspect of thinking, flows logically from the broader context to the narrower meaning being targeted. Craik and Jacoby (1979) describe predication occurring in memory without even recognizing it as such. "Thus memory is to be understood as the system 'setting the stage,' or acting as a background for the interpretation of novel and familiar events [i.e., the predicating ground]...the cognitive system can work in a variety of modes ranging from 'comprehension'- in which past learning serves as the background [again, predicating context] and attention focuses on the incoming events- to 'remembering'- in which case new inputs (retrieval cues) act as the background and the attentional focus is on reactivation of some encoded aspect of past experience"(pp. 162, 163). Information-processing language may be used throughout this quote but the idea of broader contexts targeting past memories in very consistent with the predication model.

As for future directions, a study might be conducted using between group conditions where participants are told in the instructions to actually use a subject or predicate organization. Participants would then still have to attend to meaning to figure out how to organize the triplets; yet this would bypass the problem of using percentages in the results. Many studies using figurative language, including the present one,

construct elaborations containing the subject or predicate of the metaphor or simile in the subject-word position. Studies should be conducted with the elaborated word (subject or predicate) placed in the predicate-word location of the elaboration. This would be interesting if it were then crossed with a cued recall at retrieval to see if there are any interactions.

There are many future directions to be taken; however, if this type of research is to continue, it will require a revolution in thinking. It will be necessary to leave behind Newtonian conceptions of learning and memory in hopes of incorporating a more relativistic perspective such as the one Rychlak (1994) proposes in his Logical Learning Theory.

APPENDIX A

TEST ITEMS

Each item was presented on an individual index card.

1. A book is a beacon.
Beacons throw light.
Books shed light.

2. The brain is a sponge.
Sponges can absorb.
Brains can take-in.

3. Education is a ladder.
Ladders lead upward.
Education is advancement.

4. A smile is a magnet.
Magnets draw things.
Smiles are attractors.

5. A friend is an anchor.
An anchor is reliable.
A friend is dependable.

6. A city is a beehive.
Beehives have swarms.
Cities have crowds.

7. A tongue is a weapon.
Weapons inflict pain.
Tongues can hurt.

8. A ship is a plow.
Plows cut the land.
Ships carve the sea.

9. A scale is a judge.
Judges weigh choices.
Scales estimate values.

10. A handshake is a bridge.
A bridge joins.
A handshake binds.

11. A clock is a master.
A master restricts events.
A clock limits events.

12. A job is a jail.
A jail confines.
A job limits.

13. A cloud is a mattress.
Mattresses bulge.
Clouds billow.

14. A sea is a desert.
Deserts can cover.
Seas can envelop.

15. An airplane is a bird.
A bird can glide.
An airplane can soar.

16. A river is an artery.
An artery has a course.
A river has direction.

17. A gene is a plan.
A plan is a model.
A gene is a guide.

18. Money is a curse.
Curse means distress.
Money means torment.

19. An election is a lottery.
A lottery is a risk.
An election is a chance.

20. A clue is a key.
Keys open possibilities.
Clues uncover possibilities.

21. A child is a mirror.
Mirrors reflect others.
Children imitate others.

22. A wink is a message.
A message is sent.
A wink is directed.

23. A symptom is a request.
A request is an asking.
A symptom seeks an answer.

24. A face is a window.
A window shows inside.
A face reveals within.

APPENDIX B

INSTRUCTIONS

Please put your initials at the top of all forms. This task will require your full concentration. There will be a memory test as part of this experiment.

In this study we are trying to see how well you can combine 3 sentences. One is a metaphor and two sentences describe the metaphor. We would like you to arrange the three sentences so that they make the most sense to you.

Let's take the example: "A tree is an umbrella."
"A tree gives protection."
"An umbrella provides shelter.

The metaphor here is "A tree is an umbrella." In using the metaphor, "A tree is an umbrella," we are trying to describe a tree as being capable of serving the same function as an umbrella. Instead of saying that is gives protection or provides shelter, we use the metaphor, "a tree is an umbrella." This metaphor works because we are able to see a common body of meaning in the words umbrella, protection, and shelter.

But this may not be the right order of the sentences conveying the idea. For example, you might prefer:

An umbrella provides shelter
A tree is an umbrella
A tree gives protection

Or... A tree gives protection
An umbrella provides shelter
A tree is an umbrella

There is no "right" or "wrong" ordering of the three sentences--it all depends on how the meanings strike you.

The experimenter will then guide you through 24 cards each containing a group of three sentences. You will have 45 seconds per card. Do not go to the next card until the experimenter says "next card." Your task is to write down the sentences in the order that makes the most sense to you. Try to focus on the meaning of the sentences and not to some pattern or order you may find. There is no right or wrong order. We want your personal opinion! The experimenter will give you a short memory task when you have finished the first task described above.

APPENDIX C

CUED RECALL FORM

Form A

The following metaphors, taken from Part 1, each have one missing word. Try to remember the missing word for each metaphor. You can begin right away by filling in the blanks with your answers.

A book is _____.
The brain is _____.
_____ is a ladder.
_____ is a magnet.
A friend is _____.
A city is _____.
_____ is a weapon.
_____ is a plow.
A scale is _____.
A handshake is _____.
_____ is a master.
_____ is a window.
A job is _____.
A cloud is _____.
_____ is a desert.
_____ is a bird.
A river is _____.
A gene is _____.
_____ is a curse.
_____ is a lottery.
A clue is _____.
A child is _____.
_____ is a message.
_____ is a request.

Form B

The following metaphors, taken from Part 1, each have one missing word. Try to remember the missing word for each metaphor. You can begin right away by filling in the blanks with your answers.

_____ is a beacon.
_____ is a sponge.
Education is _____.
A smile is _____.
_____ is an anchor.
_____ is a beehive.
A tongue is _____.
A ship is _____.
_____ is a judge.
_____ is a bridge.
A clock is _____.
A face is _____.
_____ is a jail.
_____ is a mattress.
A sea is _____.
An airplane is _____.
_____ is an artery.
_____ is a plan.
Money is _____.
An election is _____.
_____ is a key.
_____ is a mirror.
A wink is _____.
A symptom is _____.

APPENDIX D

RAW DATA FOR ANOVAS

	Correct Scores				Total Scores			
Subject	SS	SP	PS	PP	SS	SP	PS	PP
1	2	2	0	0	12	12	0	0
2	0	1	1	2	3	5	9	7
3	6	5	3	6	8	5	4	7
4	0	0	4	6	0	1	12	11
5	0	0	2	4	2	2	9	10
6	2	0	3	5	5	2	7	10
7	2	1	4	3	4	4	8	8
8	4	8	2	1	8	9	4	3
9	4	1	7	10	5	1	7	11
10	6	5	1	0	11	12	1	0
11	2	0	2	0	4	2	7	10
12	5	5	0	0	12	12	0	0
13	4	7	4	2	8	9	4	3
14	2	0	1	2	6	7	5	5
15	2	0	0	1	9	7	3	5
16	4	0	5	7	5	2	7	10
17	1	2	1	3	5	6	7	6
18	8	10	0	0	12	12	0	0
19	5	5	3	0	5	9	7	3
20	1	3	7	9	3	3	9	9
21	0	1	2	1	2	1	10	11
22	0	1	1	3	6	5	6	7

23	8	8	0	1	12	11	0	1
24	3	6	2	2	9	9	3	3
25	8	4	1	1	10	10	2	2
26	4	6	7	5	4	6	8	5
27	1	0	7	9	1	0	10	12
28	0	0	7	8	0	0	12	12
29	5	7	5	5	6	7	6	5
30	1	0	2	4	1	0	11	12
31	0	2	10	6	0	2	12	10
32	1	2	0	1	5	6	7	6
33	0	2	3	2	2	5	10	7
34	1	0	5	8	1	1	11	11
35	1	6	5	3	3	7	9	5
36	5	6	0	0	12	11	0	1
37	4	1	4	7	6	2	6	10
38	1	1	9	10	1	1	11	11
39	5	7	5	4	5	8	7	4
40	2	2	2	1	5	4	7	8
41	0	0	9	10	0	1	12	11
42	0	0	11	9	0	0	12	12
43	0	0	6	5	0	0	12	12
44	1	5	5	3	5	7	7	5
45	4	5	4	2	5	10	7	2
46	2	2	2	6	6	3	6	9
47	3	3	1	5	7	4	5	8
48	0	2	5	2	3	5	9	7

49	4	2	1	4	9	7	3	5
50	0	1	2	0	3	6	9	6
51	2	0	2	7	5	5	7	7
52	7	7	0	2	10	10	2	2
53	2	6	4	5	6	7	6	5
54	2	2	2	4	7	3	5	9
55	2	1	4	10	4	1	8	11
56	3	3	2	5	6	5	6	7
57	9	11	0	0	12	12	0	0
58	1	1	1	2	6	7	6	5
59	6	0	2	10	6	1	6	11
60	9	9	0	2	12	9	0	3
61	0	0	2	5	0	3	12	9
62	5	6	1	2	9	7	3	5
63	0	1	3	3	2	1	10	11
64	0	1	1	0	8	11	4	1
65	2	2	0	0	11	12	1	0
66	8	4	3	5	8	5	4	7
67	10	9	1	0	11	12	1	0
68	3	1	5	9	6	2	6	10
69	0	3	1	0	8	7	4	5
70	5	3	1	3	10	8	2	4
71	0	4	0	1	10	11	2	1
72	5	5	3	5	8	6	4	6
73	1	3	5	8	1	3	11	9
74	3	2	1	3	5	5	7	7

75	4	0	8	9	4	0	8	12
76	4	2	0	2	11	9	1	3
77	1	1	0	0	9	8	3	4
78	3	3	5	6	5	6	7	6
79	4	3	0	2	10	8	1	4
80	6	7	5	3	6	9	6	3
81	3	5	3	5	6	7	6	5
82	0	1	2	3	1	6	11	6
83	1	2	3	5	6	4	6	8
84	3	5	3	2	4	7	8	5
85	0	0	2	2	0	3	12	9
86	5	2	1	3	6	5	6	7
87	6	7	0	0	12	12	0	0
88	0	0	6	8	0	0	12	12
89	3	1	4	5	7	5	5	7
90	3	2	2	5	7	5	5	7
91	2	0	1	3	7	5	5	7
92	1	1	1	4	6	4	6	8
93	1	6	4	3	4	8	8	4
94	2	4	3	3	5	5	7	7
95	1	5	7	3	2	8	10	4
96	2	2	8	5	3	3	9	9
97	1	2	4	5	2	4	10	8
98	0	0	0	1	5	6	7	6
99	0	1	4	6	2	1	10	11
100	0	1	3	2	3	2	9	10

101	2	4	6	5	5	5	7	7
102	0	0	0	1	10	10	2	2
103	1	1	4	3	5	2	7	10
104	2	0	5	8	2	1	10	11
105	4	2	4	6	8	3	4	9
106	3	4	0	2	11	10	1	2

APPENDIX E

CHI-SQUARES FOR ITEM-BY-ITEM ANALYSIS

Organization and Cue Category for the Item: "A smile is a magnet."

Category	Cases Observed	Expected
SS	7	12.25
SP	9	12.25
PS	8	12.25
PP	25	12.25
Total	49	

Chi-Square	D.F	Significance
17.86	3	$p<.01$

Organization and Cue Category for the Item: "A face is a window."

Category	Cases Observed	Expected
SS	6	12.75
SP	9	12.75
PS	14	12.75
PP	22	12.75
Total	51	

Chi-Square	D.F	Significance
11.51	3	$p<.01$

Organization and Cue Category for the Item: "Education is a ladder."

Category	Cases Observed	Expected
SS	10	15.25
SP	10	15.25
PS	11	15.25
PP	30	15.25
Total	61	

Chi-Square	D.F	Significance
19.06	3	$p<.01$

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

April 2, 1996
Date

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