SOUND SYMBOLISM:

A POSSIBLE PIECE IN THE PUZZLE OF WORD LEARNING

by

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(Under the direction of Paula J. Schwanenflugel Ph.D.)

ABSTRACT

Sound symbolism is the notion that the relationship between word sounds and word meaning is not arbitrary for all words, but rather that there are a number of words in the world's languages for which sounds and their symbols have some degree of correspondence. It has been theorized by some cognitive anthropologists that sound symbolism is a remnant of early languages that were much less complex and that these languages matched sounds and meaning. The present research is an interdisciplinary work examining the potential role sound symbolism may play in vocabulary development. This research investigates whether an implicit knowledge of sound symbolism could be a possible route to vocabulary learning. Findings from four separate studies suggest that sound symbolism does serve as a useful clue in vocabulary learning, with adult participants able to generate more correct definitions for sound symbolic words presented in isolation than for non-sound symbolic words. Further, a fifth study examined the effects of sound symbolic words embedded in context. The results of this study suggest that adult word learners are able to combine the sound symbolic information present in sound symbolic words with context information resulting in greater word learning than either sound symbolic information or contextual information alone. This research sets the stage for developmental studies intended to examine the effects of sound symbolism on children's word learning.

INDEX WORDS: sound symbolism, vocabulary development, word learning

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B.S., Louisiana State University, 1997

M.A., The University of Georgia, 1998

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2002

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August 2002

DEDICATION

To Mom, you are the model for my life. To Dad, for all your love and support. To Kevin for being the best big brother a girl could ever hope for. To Stacy, I love you more than you could ever imagine. To my family, no matter where we go, on earth or elsewhere, you will always be in my heart. You will always be my heart.

ACKNOWLEDEGEMENTS

Thanks to my wonderful committee for all their help and support: Paula J. Schwanenflugel, Jeri Benson, Steven Stahl, Overton Brent Berlin and Martha Carr. Also, thanks to Knut Hagtvet for all his help along the way

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CHAPTER 1

INTRODUCTION

For decades, researchers in the area of vocabulary acquisition have been faced with the question of how people learn new words. The answer to this question has proved to be complex as there are several contributors to vocabulary acquisition. Research has suggested that one source, word learning within context, accounts for the majority of word learning. However, how word learners go about using context as a source of word learning has not yet been determined. Beyond context, there are other "mediating variables" that account for word learning (Sternberg and Powell, 1983). In the research presented here, I focus on word features as a major mediating variable in the learning of unknown words, both within context and in isolation.

Empirical evidence shows that certain properties of words such as concreteness, grammatical part of speech and word difficulty influence word learning. The present research explores the potential role that a relatively unexplored word property, *sound symbolism*, may play in word learning. Sound symbolism refers to the controversial notion that the relationship between word sounds and word meaning is not arbitrary for all words, but rather there is a subset of words for which sounds and their symbols have some degree of correspondence. Moreover, I present evidence that word learners can capitalize on this systematic feature of words to facilitate their word learning. Before tackling the issue of sound symbolism, however, a review of what is already known about word learning is in order.

Sources of Vocabulary Learning

Understanding children's vocabulary growth is important as their vocabulary knowledge is related to their reading comprehension skills, intelligence, content area knowledge, and reasoning skills (Stahl, 1999). According to Jenkins and Dixon (1983), there are four overall sources from which vocabulary can be learned: 1) "explicit reference, " a situation in which another person explicitly provides the word learner with the definition of the unknown word, either through a dictionary or through oral instruction; 2) "labeled examples," a case in which a label accompanies an object or event; 3) "verbal context," a case in which the unknown word is learned through either the oral or written context in which it is presented; and 4) "morphological analysis," in which the word learner knows the meaning of the word *predict* and learns the meaning of the word *predictable* by analyzing it into its morphological units *predict-able.*

In both the first and second situations a more knowledgeable other provides the definition of the unknown word for the word learner. For this paper these two sources of vocabulary learning will be combined and discussed as one source labeled "word learning through direct instruction" or "direct vocabulary instruction." The third source "verbal context" involves the learning of an unknown word through exposure to the word within both written and oral context. This source of vocabulary learning will be discussed as "word learning within context." The fourth source of vocabulary learning will be discussed as a word property that contributes to word learning, as this type of word learning involves the inflection of an already known morphological base word and not the learning of a completely new concept.

How does Vocabulary Learning Occur?

It is estimated that anywhere from 300 to 500 words per year can be taught through direct vocabulary instruction (Stahl, 1999). Rates of vocabulary growth per year, for young word learning children, seem to be at least ten times this much (Nagy and Anderson, 1984). As such, direct vocabulary instruction cannot be the main source of vocabulary growth. This being the case, researchers began examining word learning within context as a possible major contributor to vocabulary growth. Word learning within context occurs in both written and verbal situations. However, to date the majority of empirical research in this area has focused on word learning within written context, due largely to the fact that vocabulary acquisition research has existed as an area of reading research. In this review the phrase word learning within context will refer to word learning within a written context. While reading this review, however, it is important to remember that although word learning does occur within written context it is likely that a great deal of word learning also occurs in the complicated multi-modal contexts typical of everyday discourse.

Early Studies of Word Learning within Written Context

Numerous studies have been conducted examining word learning within written context. This area of research began with Elivian's 1938 study examining children's word learning from story reading. Elivian found that fifth and sixth grade students could identify the meanings of approximately 22% of above grade level words they had read in a story. Moreover, participants of high reading ability were able to identify the meanings of approximately 52% of these words. This early work was continued by Gibbon (1940) who examined word learning from context in 234 college freshmen. Gibbon's participants were given sentences and paragraphs containing 24 unknown words, and 52% of them were able to use context to construct the meanings of these words.

Two decades later Ames and Quealy took up this work. Ames (1966) created 556 simulated words and used these words to replace real words in context. The 12 advanced graduate students who participated in his study were accurate in judging the meanings of 334 of the 554 simulated words (60%). Quealy (1969) implemented Ames' simulated word task with 72 senior high school students and found that these students were accurate in judging the meanings of 42% of the simulated words.

These early studies all support the idea that word learning within context could be a major source of vocabulary growth. Decades after these pioneering studies word learning within written context has become the focus of much research. This modern research has examined various issues related to word learning within context including: 1) the influence of multiple exposures to a word within context, 2) the idea that exposure to a word within context might lead to only a partial increase in word knowledge, 3) the influence of a time delay on word learning within context, and 4) the influence of context when a priori word knowledge is taken into account.

Modern Studies of Word Learning within Written Context

The earliest of the modern studies of word learning within written context examined the influence of multiple exposures to a word within context. Jenkins, Stein and Wysocki (1984) exposed their participants to target words in 0, 2, 6 or 10 paragraphs over a 10-day period. The context of each paragraph was highly suggestive of the meaning of the target word. Two days after the completion of all paragraph readings 120 fifth grade participants completed two definition measures to determine the amount of word learning attributable to word exposure within context. First, participants completed a supply definition task in which each target word was presented in a sentence and participants wrote a meaning for each word. Next, the participants completed a multiple-choice task in which they selected a definition for each target word from a list of five choices. The results of this study showed an effect of context in the supply definition task, with an overall 17.1% correct for no contextual word presentations 33.8%, 46.4%, and 50.2% correct for the 2, 6 and 10 contextual word presentations, respectively. This effect was also found in the select definition task, with overall means of 39.5%, 53.7%, 65.7%, and 72.4% for the 0, 2, 6 and 10 contextual word presentations, respectively. An examination of the number of context presentations showed, however, that this effect was significant only after six contextual word presentations. This research suggests, then, that a single exposure to an unknown word within context does not have a significant influence on word learning, and that multiple exposures to a word within context are needed for word learning.

How, then, do we explain Elivian, Gibbon, Ames and Quealy's findings? All four of these studies found that word learning occurred after just one exposure to an unknown word within context. Given this discrepancy it is pertinent to point out that Jenkins et al. failed to discuss both their scoring of the definitions supplied by participants, and their selection of distractors for the multiple-choice task. One is left to assume that an all or nothing method of scoring was used, as there was no discussion of credit having been given for partially correct word definitions. Thus, it is possible that Jenkins et al.'s participants gained some amount of word knowledge from a single exposure to a word within context, but that complete word knowledge was not gained until participants were exposed to a word six or more times.

A subsequent study of word learning within context performed by Nagy, Herman and Anderson (1985) was designed to examine the possibility that a single exposure to a word within context might result in only partial word knowledge. Nagy et al. (1985) designed their study to test the assumption that '[word] learning from context proceeds in terms of small increments, so that any one encounter with a word in text will be likely to produce only a partial increase in knowledge of that word" (p.236). Employing natural texts and naturally occurring unknown words, to correct for any biases that experimenter-constructed texts might create, Nagy et al. (1985) had 70 eighth grade participants read either a narrative or an expository text and respond to a multiple-choice test on 30 targeted words. The questions in the multiple-choice test were at three levels of difficulty to allow for the assessment of partial word knowledge. The easiest level required only general knowledge of the target word and the most difficult level required a large amount of conceptual knowledge of the target word. After passage readings participants were interviewed about the meaning of each target word, and the scoring of these interviews also allowed for the assessment of partial word knowledge. A score of 0 was given for no correct word knowledge, a score of 1 or 2 was given for differing levels of partial word knowledge, and a score of 3 was given for complete word knowledge. Analysis of both types of data showed a significant effect of word learning with only one exposure to a word within context. The results of a regression analysis showed that 1.2% of the variance in the interview data and .6% of the variance in the multiple-choice test data were accounted for by learning within context. Thus, when allowing for a partial increase in word knowledge an effect, albeit small, of one exposure to a word within context can be found.

A second study by Nagy, Anderson and Herman (1987) showed that a single exposure to a word within context could produce word learning even after a time delay. This study is more comparable to the Jenkins et al. (1984) study, which had participants read stories over a 10-day period. For this study Nagy et al. (1987) had 418 third, fifth and seventh grade participants read two of four grade level texts, and then take a multiple-choice test one week later. Unlike their earlier study, however, the multiple-choice test used in this study assessed only full word knowledge. With these two significant changes, inclusion of a time delay and assessment of only full word knowledge, Nagy et al. (1987) still showed that one exposure to a word within context accounted for .8% of the within subject variance. Thus, in conditions similar to Jenkins et al.'s, Nagy et al. (1987) found an effect of one exposure to a word within context on word learning. It seems, then, that even complete word knowledge can be attained after only one exposure to a word within context, again, however, this effect is small.

Nagy et al. (1985, 1987) even admit that the probability of gaining complete knowledge of an unknown word from one exposure within context is small. Using the amount of target word knowledge from the passages participants did not read as an estimate of prior word knowledge for words from the passages participants did read they were able to estimate vocabulary growth. Extrapolating the findings of the first study and estimates of the volume of children' s reading Nagy et al. (1985) state 'the odds that a child in the middle grades will acquire a full adult understanding of an unknown word as a result of one exposure in a natural context may lie between .05 and .11" (p.250). With all of the words children are exposed to within context, this amount of word learning within context could account for the discrepancy between the number of words children can learn through direct vocabulary instruction, 300 - 500 words per year, and the estimates of children's overall vocabulary growth, 3000 – 5000 words per year (Nagy et al., 1985).

Others have also supported the view that people can acquire knowledge of an unknown word after a single contextual exposure. Stahl (1989) had 182 sixth graders read either the original version of a 500-word passage taken from a social studies textbook, or a difficult version, created by substituting every sixth content word with an above grade level synonym. All participants were given a multiple-choice test on the above grade level words placed in the difficult version of the passage. His results showed that children who read the difficult version of the passage learned approximately 7% of the difficult words from context in contrast to the children who had not had such exposure. Like Nagy et al.'s (1987) multiple-choice test Stahl's test allowed for only full word knowledge.

The finding of word learning as a function of context has been found even when stringent controls have been placed on the presence of a priori word knowledge. Schwanenflugel, Stahl and McFalls (1997) had participants complete a vocabulary checklist to establish the level of a priori word knowledge their 43 fourth grade participants had for target words. They had participants first write sentences or definitions for words they thought they knew and then check off any words that they thought seemed familiar. Words for which children had only domain knowledge or which they deemed "familiar" were designated "partially known" words. Words for which children could not think of a sentence or which they did not deem "familiar" were designated "unknown." This checklist allowed th e investigators to assess differential vocabulary growth, as a function of a word's a priori knowledge level. The participants then read two of four stories containing the difficult vocabulary (including both the partially known and unknown words). Three days later each participant completed a multiple-choice test on the target words from all four stories. This multiple-choice test allowed for a partial gain in word knowledge by allowing participants to select from four options: a) the correct definition; b) a partially correct definition, which reflected general domain knowledge, but which lacked the specific characteristics associated with the word; and c) two incorrect definitions. The scoring of this multiple-choice test ranged from 0-2. A score of 2 was given when participants selected the correct definition for the target word, a score of 1 was given when the partially correct definition was selected, and a score of 0 was given if either of the incorrect definitions were selected.

Their results showed similar growth rates for both the words that were unknown and partially known before story reading. There was a relative growth rate of 23% and 22%, for unknown and partially known words respectively, as a function of story reading. Schwanenflugel et al.'s study suggests, then, that a priori word knowledge level should also be accounted for in any study of word learning. When differing levels of a priori knowledge are accounted for, the ability to observe and identify changes in word knowledge increases considerably. Thus, when accounting for a priori word knowledge level a partial increase in word knowledge may also need to be taken into account. The sensitivity to changes in word learning as a function of context in Schwanenflugel et al.'s study might be attributed to both accounting for a priori knowledge and allowing for a partial increase in word learning.

The results of Nagy et al. (1985, 1987), Stahl (1989), and Schwanenflugel et al.'s (1997) studies contradict the findings of Jenkins et al. (1984), and suggest that one exposure to an unknown word within context can result in either partial or full word knowledge. Given this type of discrepancy in the word learning within context literature, a meta-analysis was conducted to detect some of the systematic features of the research that is lacking when only a single low power study, such as Jenkins et al., is examined. Swanborn and DeGlopper (1999) included 20 experiments of word learning within context in their meta-analysis, all of which met the following five criteria: a) word learning was assessed in the word learner's native language; b) no attention was drawn to the targeted vocabulary words; c) participants were not aware that the purpose of the individual studies was to assess the learning of new vocabulary; d) natural text was used or constructed text was constructed to appear natural; and e) participants encountered each of the targeted words only once. The effect sizes resulting from the individual experiments used in this meta-analysis ranged in value from .03 to .54 (Gordon, Schumm, Coffland & Doucette 1992; Konopak, 1988). The results revealed, consistent with Nagy et al. (1985), that the average probability of word learning within context is .15, with a 95% confidence interval of .11 to .22.

There are two main problems with this meta-analysis, however, and with the studies presented in this review. First, there is no controlled way to assess which aspects of context might have been responsible for word learning. The 20 experiments presented in Swanborn and DeGlopper's meta -analysis all used natural contexts, but what clues to the meanings of the unknown words did the contexts contain? Second, many of the studies did not control for other factors, such as word properties, that might influence word learning. As will be discussed in detail later, it has been shown in the word learning literature that word properties such as grammatical part of speech, word concreteness, morphological transparency and word difficulty influence word learning. Many of the studies cited above and many of those used in Swanborn and DeGlopper's meta-analysis controlled only for word grade level and no other word properties.

How is it possible for one study of word learning within context to find an effect size of .03 and for another to find an effect size of .54? Some of this variation might be attributable to participants or task characteristics, but it is also possible that context characteristics and properties of the unknown words themselves were important. The .03 effect may have been due to contexts that were not very informative or words that were conceptually abstract. The effect of .54 may have been due to contexts that contained known synonyms for the unknown word or the unknown word itself may have had a known morphological base. It is unlikely that these studies all had equally informative contexts and equally difficult words and word properties. A study of word learning within context should control for the aspects of context that lead to word learning and for other factors, such as word properties, that lead to word learning. Before one can do this, however, one must know what aspects of context facilitate word learning and what other factors help or hinder word learning.

How does Context Facilitate the Learning of an Unknown Word?

Swanborn and DeGlopper's meta -analysis helped consolidate the literature, to date, on vocabulary growth within context, leading to the general consensus that a great deal of vocabulary growth comes from exposure to unknown words within context. One important question remains, however, how does context facilitate the learning of an unknown word?

In an examination of word learning within different types of context Beck, McKeown, and McCaslin (1983) found that word learning within context was dependent upon the ‘helpfulness” of the context or how much information about the unknown word the context provided the reader. They distinguished four types of contexts based on levels of helpfulness. Contexts that provided the reader with explicit and detailed information about unknown words and led the word learner to the correct meaning of the unknown words were labeled as *directive*. Contexts that provided the reader with general information about unknown words were labeled as *generally directive*. Contexts that were of no use to the reader were labeled as *nondirective*, and contexts that lead the reader to an incorrect meaning for unknown words were labeled as *misdirective*. Using this categorization system, they found that 13 graduate students were able to guess correctly the identity of missing words, 3%, 27%, 49% and 86% of the time in misdirective, nondirective, generally directive and directive story contexts, respectively. Beck et al. did not discuss, however, what aspects led to their classification of contexts, and so left open the question of what contextual factors facilitate word learning.

In an attempt to answer this question Sternberg and Powell (1983) suggested that two basic ideas underlie word learning within context. First, they suggested that some concepts are harder to learn than others due to the characteristics of the context itself. They put forth a list of eight context clues that they believe lead to increased word learning within context:

(a) temporal cues: cues regarding the duration or frequency of X (the unknown word) or regarding when X can occur;
(b) spatial cues: cues regarding the general or specific location of X or possible locations in which X can sometimes be found;
(c) value cues: cues regarding the worth or desirability of X or regarding the kinds of affect X arouses;
(d) stative descriptive cues: cues regarding physical properties of X (such as size, shape, color, odor, feel, etc.);
(e) functional descriptive cues: cues regarding possible purposes of X, actions X can perform, or potential uses for X
(f) causal/ enablement cues: cues regarding possible causes of or enabling conditions of X
(g) class membership cues: cues regarding one or more classes to which X belongs or other members of one or more classes of which X is a member; and
(h) equivalence cues, cues regarding the meaning of X or constraints on the meaning of X.

Sterberg and Powell used the following example to demonstrate these context clues:

> 'At dawn, the *blen* arouse on the horizon and shone brightly.' This sentence contains several external contextual cues that could facilitate one's inferring that *blen* probably means *sun*. 'At dawn' provides a temporal cue, describing when the arising of the *blen* occurred; 'arose' provides a functional descriptive cue, describing an action that a *blen* could perform; 'on the horizon' provides a spatial cue, describing when the arising of the *blen* took place; 'shone' provides another functional descriptive cue, describing a second action a *blen* could do; finally 'brightly' provides a stative descriptive cue, describing a property (brightness) of the shining of the *blen* (p. 882-883).

Sternberg and Powell, however, failed to empirically examined this proposed categorization system. Therefore, the question of which context clues are actually used by word learners faced with an unknown word in context is still unanswered.

Sternberg and Powell also suggested that other factors, they labeled "mediating variables," help explain word learning within context that cannot be explained by contextual clues alone. For example, a high density of unknown words or insufficient topic knowledge may make context less useful. Also, the importance of the unknown word to understanding the context will determine the amount of effort a reader devotes to gaining word knowledge. Sternberg and Powell's idea of mediating variables suggests that aspects other than contextual helpfulness influence word learning within context. One such aspect may be constraints on possible word meanings.

Constraints on Word Learning

Perhaps one of the more surprising findings from the literature on word learning within context is that unknown words can be learned even when the context itself is not particularly helpful. For example, how is it that Beck et al.'s (1983) participants guessed correctly the meanings of 27% of unknown words in nondirective contexts? There must be something other than contextual helpfulness helping to drive the learning of an unknown word. One proposed theory is that in the early stages of word learning certain constraints help word learners narrow down the possible meanings for an unknown word.

This idea of a constraint, or bias that limits the possible definitions considered by word learners for a novel word, stems from Quine's (1960) word learning puzzle. In this puzzle Quine asks how a child faced with the presentation of the word *gavagai* as a rabbit runs by understands that *gavagai* means rabbit. This word learning situation is an example of Jenkins and Dixon's "labeled example" source of word learning, in which a label, *rabbit*, accompanies an object, *a running rabbit*. The puzzle is that in this situation *gavagai* could mean not only rabbit, but running, a running rabbit, rabbit ears, rabbit fur, a rabbit running fast, or numerous other things. This puzzle, then, is analogous to almost any word learning situation, other than when a definition is explicitly stated, where there are countless possibilities as to the meaning of an unknown word. In an attempt to solve this puzzle researchers came up with the idea of constraints or bias' on word learning.

Markman (1991) has proposed three constraints on the meanings of object labels: the whole-object constraint, the mutual exclusivity constraint, and the taxonomic constraint. The whole object constraint suggests that when hearing a new label, young language learning children assume that the label refers to an object as a whole. The mutual exclusivity constraint, also known as the one-to-one mapping principle (Slobin, 1973; Pinker, 1984), suggests that young children assume that any given object has one and only one label. The taxonomic constraint suggests that young children assume that a label for a new object places that object with other objects of the same taxonomic category and not objects that are thematically related. All these proposed constraints on word learning would help a young word learning child limit the number of hypothesized word definitions in various ways.

Markman's three constraints on word learning have limited application, however, as they may be restricted not only to the learning of new object labels, but also to very young children in the early stages of word learning, when children's vocabularies are very limited. Of more interest than these early word learning constraints are constraints that emerge based on the structure of word meanings in English. According to Nagy and colleges (Nagy and Gentner, 1990; Nagy and Scott, 1990), through experience with the language English speakers come to have implicit knowledge of how English words can be defined. For example, an English speaker should know that English verbs do not include reference to the time of day in which the action they portray takes place. Hence, there is no English verb that means "to go to sleep late." Nagy and colleagues suggest that English speakers have a constraint for what constitutes a possible word meaning in English.

In an attempt to support this hypothesized constraint Nagy and Gentner (1990) examined the utility of four potential constraints on English word meanings: a) a taxonomic constraint, the constraint that nouns tend to reflect taxonomic rather than thematic relations; b) a durative constraint, the constraint that nouns are differentiated in terms of long-term rather than short-term properties; c) a time of day constraint, the constraint that English verbs possess no reference to the time of day in which the action they portray occurs; and d) a cessation constraint, the constraint that English verbs generally do not have meanings of the form "to stop an action." Sixty -eight college undergraduates were asked to discriminate among four phrases varying in contextual and lexical appropriateness including: 1) a contextually appropriate and lexically appropriate phrase, 2) a contextually appropriate but lexically inappropriate phrase, 3) a contextually inappropriate but lexically appropriate phrase, and 4) a contextually inappropriate and lexically inappropriate phrase. Participants performed two multiple-choice tasks: 1) a non-linguistic task for which they chose a phrase that correctly fit into a blank in a sentence, and 2) a linguistic definition task for which a pseudoword was placed in a sentence and participants chose the phrase that defined the pseudoword. The results showed that when asked to define a pseudoword, participants were more likely to choose the phrase that was contextually as well as lexically appropriate, displaying knowledge that the meaning of a word encountered in context must be both contextually and lexically appropriate. Thus, participants understood that a thematic relation or a short-term property difference would not define an English noun, and that an English verb would not refer to the time of day in which the action took place or to the stopping of an action.

In a continuation of this work Nagy and Scott (1990) examined the use of word schemas, or the various kinds of knowledge about words that can be applied in learning new vocabulary, when evaluating the possible meanings of an unknown word. Forty-two seventh grade, tenth grade and college undergraduate participants were asked to rate the plausibility of both "well-formed" and "conceptually ill-formed" definitions for made-up nouns and verbs. The ill-formed definitions included internal elements of negation, for example "to stop sewing," and elements of location or time, for example "to wake up early," not used in English. Their results showed a significant main effect for well-formedness, with the well-formed definitions rated as more plausible (M=2.55) than the ill-formed definitions (M=2.16), on a 1 (implausible) to 4 (plausible) scale. Participants, then, made use of an overall word definition schema when evaluating hypotheses about possible English word meanings.

Nagy and colleges support for the idea that English speakers have intuitive knowledge of how English words can be defined suggests that older word learners have constraints on possible word meanings based on experience with word meanings in English. Despite Nagy and Gentner (1990) and Nagy and Scott's (1990) interesting findings, questions remain. Even if older word learners are able to eliminate impossible word meanings, based on experience with word definitions, countless possible meanings remain. How does one choose from these possible meanings and select one meaning? The above constraints only allow a word learner to narrow down a words meaning to all those that are possible in English. These constraints do not explain how a final decision is made when numerous possibilities remain.

Constraints on word learning and word definitions can only take us part of the way in the question of how words are learned. Deak (2000) suggests that these constraints interact with other factors such as the environment, context, or prior knowledge to create a much more complex system of word learning. This complex system of word learning cannot be explained by word constraints and contextual helpfulness alone but must include other factors. Sternberg and Powell (1983) believed that other factors, their "mediating variables," influence word learning.

Some of these factors may be properties of the unknown word itself. Included in Sternberg and Powell's list of mediating variables was a word property, word concreteness. This property suggests that the concreteness of the concept represented by the unknown word will influence word learning. Sternberg and Powell, then, believed that some unknown words might be harder to learn than others based on properties of the unknown word itself. This idea has been supported in the research literature.

Word Properties and Word Learning

There are several word properties that researchers have identified as important in word learning: word concreteness, grammatical part of speech, morphological transparency, and word difficulty. The present research proposes a new addition to this list of word properties, *sound symbolism*. Like the research on context, the research on word properties and their influence on word learning has spanned several decades, and I will review this research before discussing sound symbolism.

Grammatical Part of Speech

Work on word properties and their influence on word learning began with Brown's (1957) work showing children's ability to use a word's part of speech to correctly guess at the word's meaning. For his study, Brown showed preschoolers a picture that displayed an action (e.g. kneading) being performed on a mass substance (e.g. red confetti) in the presence of a singular object (e.g. a container). Three pictures followed that reproduced the action, the mass substance or the singular object. The children where shown the first picture in conjunction with a new word that was either a verb, a mass noun, or a particular noun, and were asked to choose which of the remaining pictures displayed what was named in the first picture. Brown's results showed that the children were more likely to choose the picture that matched the grammatical category in which the word was introduced than any other picture. Brown concluded that "while the part-of-speech membership of a word does not give away the particular meaning, it does suggest the general type of that meaning, whether action, object, substance, or whatever" (p. 4-5). Thus, Brown showed that preschoolers are able to determine the part of speech of an unknown word, and are able to use this knowledge to eliminate possible meanings for a word.

Adults appear to use part of speech as a clue for abstracting relevant properties from context. Nagy and Gentner (1990) had 56 undergraduates read a story containing two presentations of a nonsense word, used as either a noun or a verb. In the first presentation the word occurred in rich context and in the second it occurred in vague context. Participants were asked to speak about the second event in which the word appeared. Their results showed that participants who read the nonsense word as a noun, encoded object properties from context, whereas participants who read the word as a verb encoded action properties from context. Thus, the part of speech of an unknown word may determine what contextual information adult word learners use to gain information about a word's meaning, helping them move closer to a correct meaning for the unknown word. It seems, then, that in a word learning situation children and adults are able to determine a word's part of speech and are able to use this knowledge to narrow down the possible meanings for an unknown word.

Other research on word part of speech and its influence on word learning has examined children's very early word production to determine if it is biased towards certain grammatical word types. Gentner (1982) presented evidence from several studies of the very early stages of children's word production and showed that children's production of verbs lagged far behind that of nouns. Greenfield and Smith (1976) observed two children in a longitudinal study of language production, and showed that the children's first words occurred at 7 to 8 months of age and were referentially used nouns. The children did not produce their first verbs until 13 or 14 months of age, after having acquired several nouns (as sited in Gentner, 1982). Another examination of children's speech production, a longitudinal study of three children from 8 months to 2 years of age, showed that verbs lagged behind nouns not only in the children's production, but in their comprehension as well (Goldin-Meadow, Seligman, and Gelman, 1976). The uniformity of these results suggests that the part of speech of an unknown word is related to the ease with which it is acquired for both a child's early word production and their comprehension. It seems, then, that nouns may be easier to acquire than verbs.

Despite these observational findings some have questioned the relationship between part of speech and word learning. Choi and Gopnik (1995) have shown that input to a child may be more important in determining the prominence of nouns over verbs. Schwanenflugel, Stahl and McFalls (1997) suggest that whether nouns are easier to learn than verbs might not be due to part of speech but to other characteristics of the nouns being learned. Unlike other studies, they found that non-nouns were acquired more easily than nouns when presented in context. As they pointed out, however, most of the nouns used in their study did not refer to whole concrete objects. Instead, their nouns referred to mass substances or abstract concepts, and as such, may have been more difficult to learn. Schwanenflugel et al. (1997) and Choi and Gopnik's (1995) findings suggest that Greenfield and Smith (1976) and Goldin-Meadow et al.'s (1976) results may not have been due to the grammatical characteristics of nouns, but instead to the fact that most early acquired nouns refer to concrete objects with discrete boundaries. Thus, it may not be a word's grammatical characteristic that makes it easier to learn but the concreteness of its referent.

Word Concreteness

In some of the earliest word on concreteness effects in early word acquisition Brown (1957) examined the nouns and verbs present in children's speech and compared them with those of adults. He found that children's early language was much more concrete than adults or, as he defined it, children's vocabulary had more words whose referents had a "characteristic visual contour" or size (p. 2). Brown found that 16% of adult nouns had a characteristic visual contour and 39% had size implications, compared to 67% of children's nouns with characteristic visual contour and 83% with size implications. Brown also compared children's verb referents to those of adults. In his study a verb was considered concrete if it named "animal [including human] movement." Brown found that 33% of adult verbs had a concrete referent compared to 67% of children's verbs. This research suggests that young children use more concrete nouns and verbs than adults.

These findings of concreteness effects in word acquisition are not relegated to early word learning, but are ubiquitous throughout childhood. Schwanenflugel (1991) demonstrated that the discrepancy in concrete and abstract words used by adults and children persists through middle school. To examine concreteness effects develop-mentally, Schwanenflugel selected 198 high frequency adult words from the Kucera and Francis (1967) adult language corpus and compared those with words found in Rinsland's (1945) language corpus for children grades 1 through 8. Her results showed that by first grade children have acquired only 25% of adult high frequency abstract words compared to 80% of concrete words. By fifth grade children have acquired approximately 70% of adult high frequency abstract words compared to 95% of concrete words. It is not until around eighth grade that this developmental trend in concreteness effects disappears, with children having acquired nearly 100% of adult high frequency concrete and abstract words.

This influence of concreteness is evident not only in the acquisition of spoken words but also in the acquisition of words during reading. Schwanenflugel et al. (1997) found that for words that were already partially known before story reading, word concreteness was positively related to changes in word learning, accounting for 12.15% of the variance in definition test scores. All of these findings suggest that the concreteness of an unknown word's referent influences the ease with which it is learned in both verbal and written contexts.

Morphological Transparency

Another proposed word property that may have an influence on word learning is morphological transparency or the idea that words can be members of families because they are morphologically derived from the same base word. For example, the word *teacher* is morphologically derived from the word *teach* and therefore, *teach* and *teacher* are members of the same morphological family. According to Nagy and Anderson (1984) for every word a child learns, it is estimated that there is an average of one to three additional morphologically transparent related words that should also be understandable to the child. A child with knowledge of one member of a word family should be able to use that prior word knowledge to help them derive the meanings of morphologically related words, as this situation requires the inflection of a known morphological base and not the learning of a completely new concept.

Wysocki and Jenkins (1987) examined this idea by training 217, fourth, sixth, and eighth grade participants on one of two word sets. Two weeks later participants were tested, in both weak and strong contexts, on words that were morphologically related to the words in both training sets. Implementing Nagy et al.'s (1985) idea that word learning may proceed in small increments, Wysocki and Jenkins used two methods of scoring: 1) partial word knowledge scoring, which allowed for definitions that showed general word knowledge or definitions that showed knowledge of the transfer word along with knowledge of its grammatical form; and 2) strict scoring, which allowed for only full word knowledge. Their findings showed that training on one member of a word family led to more word learning (98% for lenient scoring and 52% for strict scoring) for other members of the same word family. Morphological transparency and prior knowledge of a morphological base word, then, are word factors that should be considered by researchers of vocabulary growth. These findings of morphological transparency and its influence on word learning support the thinking of several researchers who suggest that how difficult a new word is to learn is affected by different states of prior knowledge.

Word Difficulty

Nagy, Anderson and Herman (1987) suggest that how difficult a word is to learn is dependent upon the state of the word learner's knowledge, such that certain types of knowledge make the task of word learning easier. Based on this idea, Nagy et al. (1987) examined the property of "word difficulty" and its influence on word learning within context. Using a categorization system developed by Graves (1984), Nagy et al. (1987) divided their target words into four categories:

> a) Words that were in the students' oral vocabulary but they could not read.
> b) New meanings for words that were already in the students reading vocabulary with one or more other meanings.
> c) Words that were in neither the students oral vocabulary nor their reading vocabulary and for which they did not have an available concept but for which a concept could easily be built.
> d) Words that were in neither the students' oral vocabulary nor their reading vocabulary, for which they did not have an available concept, and for which a concept could not easily be built.

Their results showed that word difficulty, as defined by this system, was significantly related to word learning within context. They found a .06 probability of learning a word at the simplest level of word complexity and a -.01 probability at the most difficult level of complexity. Graves system, then, seems to be a viable means of classifying the different states of word difficulty, and these states of word difficulty seem to influence word learning within context.

Overall, then, part of speech, word concreteness, morphological transparency and word difficulty have all been shown to influence word learning within written context. Nagy and Gentner (1990) showed that an unknown word's part of speech influenced the contextual information adults looked to for information about possible meanings. Schwanenflugel et al. (1997) showed that concrete words were acquired more easily within context than non-concrete words. Wysocki and Jenkins (1987) showed that morphologically transparent words were learned more easily in context than non-transparent words, and Nagy et al. (1987) showed that word difficulty influenced the ease with which a word was learned within context. All these studies suggest that context itself cannot completely account for word learning within context and that properties of an unknown word have some influence on word learning.

This research on word properties suggests that features of words can help or hinder word learning in both verbal and written contexts. One other word factor, however, which has not yet been touched on may also need to be added to this list of word properties that influence word learning, sound symbolism. Sound symbolism is the idea that, for some words present in today's languages, the relationship between sound and meaning is not arbitrary, as has been the common thinking for so long. Sound symbolism is the idea that, for some words, there is a correspondence between sound and meaning.

Sound Symbolism: A Possible Piece in the Puzzle of Word Learning

It has been a long-held belief among scholars of language that languages are made up of arbitrary sounds that come together to create words, the main meaning carrying units of language. For example, in his book a *Course in General Linguistics* Saussure (1959) wrote, 'the bond between the signifier and the signified is arbitrary" (p. 67). Over the years, however, a minority of linguists and anthropologists have come to question this belief, and have begun studying the linguistic phenomenon of sound symbolism.

Empirical examination of the phenomenon of sound symbolism began with the work of noted linguist Edward Sapir. Sapir explored what he called "phonetic symbolism," a type of expressive symbolism that speakers use in the field of speech dynamics (stress and pitch) and phonetics. Sapir's work motivated a great deal of other linguists and anthropologists to study the possibility of a non-arbitrary correspondence between word sounds and word meaning. This line of research has since come to be known predominantly as "sound symbolism, a nonarbitrary, one-to-one relation between acoustic and motor-acoustic [word] features and meaning . . ." (Ciccotosto, 1991, p.1).

Very early in the study of this phenomenon of sound symbolism, Sapir (1929) examined English speakers' impressions of the symbolic magnitude of different vowels and consonants. For this work Sapir used invented word pairs built on a consonant, vowel, consonant model, for example *mal* and *mil*. Sapir had participants select the non-word that represented the *large* and the non-word that represented the *small* variety of some arbitrarily selected meaning. For *mal* and *mil,* small versus large tables were compared. Sapir showed that English speakers intuitively felt that the vowel *a* was symbolic of greater magnitude than the vowel *i*. So, his participants thought that *mil* referred to the small table and *mal* referred to the large table.

Other evidence for sound symbolism has been obtained by compiling data from actual languages showing examples of sound symbolism. English has been shown to be plentiful in examples of sound symbolism. Bloomfield's (1933) book entitled *Language* included this list of sound symbols present in English:

> [fl-] 'moving light': *flash, flare, flame, flick-er, flimm-er.*
> [fl-] 'movement in air': *fly, flap, flit (flutt-er).*
> [gl-] 'unmoving light': *glow, glare, gloat, gloom, (gleam, gloam-ing, glimm-er), glint.*

> [sl-] ‘smoothly wet’: *slime, sluch, slop, slobb-er, slip, slide.*
> [kr-] ‘noisy impact’: *crash, crack, (creak), crunch.*
> [skr-] ‘grating impact or sound’: *scratch, scrape, scream.*
> [sn-] ‘breath-noise’ : *sniff, (snuff), snore, snort, snot.*
> [sn-] ‘quick separation or movement’ : *snap (snip), snatch (snitch).*
> [sn-] ‘creep’: *snake, snail, sneak, snoop.*
> [j-] ‘up-and-down movement’: *jump, jounce, jig (jog, juggle), jangle (jingle).*
> [b-] ‘dull impact’: *bang, bash, bounce, biff, bump, bat*
> [-es] ‘ violent movement’: *bash, clash, crash, dash, flash, gash, mash, gnash, slash, splash.*
> [-ejr] ‘big light or noise’: *blare, flare, glare, stare.*
> [-awns] ‘quick movement’: *bounce, jounce, pounce, trounce.*
> [im], mostly with determinative [-r], ‘small light or noise’: *dim flimmer, glimmer, simmer, shimmer.*
> [-omp] ‘clumsy’: *bump, clump, shump, dump, frump, hump, lump, rump, stump, slump, thump.*
> [et], with determinative [-r], ‘particle movement’: *batter, clatter, chatter, patter, shatter, scatter, rattle, prattle.* (p.245)

Indeed, when one thinks about the idea of sound symbolism it seems to make intuitive sense. In just a few minutes of brainstorming I fell upon an example of sound symbolism in English that could easily be added to Bloomfield’s list. Think for a moment of the words *swirl, swivel, swift, swig, sweep, swallow, swarm, swim, swing, swipe, switch, swoosh, swoop, swill* and *swoon.* They all bring to mind the idea of a swift, swaying movement.

This compilation of data has shown sound symbolism to be ubiquitous throughout the world’s languages. Ciccotosto (1991) used language samples from 229 languages, representing 10 of the 17 human language phyla, searching for examples of sound symbolism in languages around the world. He found that there was evidence of sound symbolism in almost all the phyla he studied, with its absence in some phyla explained by a lack of data or an ill-defined definition of sound symbolism. Ciccotosto, therefore, showed that sound symbolism is not just a phenomenon of English, but that sound symbolism is present in numerous languages around the world.

It has been theorized that sound symbolism was present in primordial languages as well. In fact, one anthropologic theory is that verbal language began by matching sound and meaning and that the earliest forms of human verbal language always matched sound and meaning (LeCron Foster, 1978). To test this idea, LeCron Foster performed a reconstruction of early human language and showed that "phememes," defined by her as the smallest linguistic unit that combines the features of sound and meaning, were present in primordial languages.

LeCron Foster's phonemic argument suggests that sometime around 50,000 to 75,000 years ago, there was a huge refinement of the semantic and syntactic base of primordial languages. There was also an increase in the complexity of primordial languages, which led to an expansion of the languages. This expansion resulted in a change in the phonological base. The phonological base did not expand; instead, meaning was separated from sound (LeCron Foster, 1978). It was this separation of sound and meaning which created the seemingly arbitrary relationship between the signifier and the signified that we have in present day languages. The extensive amount of evidence for sound symbolism's presence in today's languages, however, shows that this separation of sound and meaning was not a complete one. As noted by Ciccotosto (1991):

> Sound symbolism, under the phememic hypothesis, is based upon gestural cues. Sound carries meaning insofar as it references motor sequences within the hearer's mind, iconically representative of expressed behavior and activity. Conceivably, there is a substratum of this cognitive process present today in all languages. In addition, language learning could be activated with the aid of the partly innate and acquired knowledge of the phememe (p. 104).

Based on the evidence collected by Ciccotosto there does seem to be a substratum of sound symbolism present in many of today's languages. Sound symbolism, then, seems to be the logical link between the earliest forms of human language, which were gestural in form and could iconistically represent expressive behavior and activity, and today's complex verbal forms of language. Today's language still sh ow many remnants of sound symbolism, but have a much more arbitrary relationship between the signified and the signifier.

In the study of sound symbolism there is also a much-heated debate as to whether sound symbols are universal or language-specific (see Hinton, Nichols & Ohala, 1994; Malkiel, 1990). Roger Brown in his 1958 book *Words and Things* noted that "while there is obviously a community, or language-specific, sound symbolism, the fact of a universal sound symbolism, one which operates across all human languages, . . . [is] at best difficult to show to exist" (as cited in Kess, 1992; p.62). Given this, the present paper argues neither for nor against sound symbols as universal or language-specific.

The purpose of this paper is to examine the possibility that sound symbolism may have a role in word learning. This purpose can be served so long as one accepts the statement of Roger Brown that "there is obviously a community, or language -specific, sound symbolism." A language -specific sound symbolism would simply mean that knowledge of sound symbolism in one language would facilitate the learning of only that particular language. To legitimize the study of sound symbolism as a means by which humans learn language, it also needs to be accepted that sound symbolism is a phenomenon present in most of the world's languages. Sound symbolism's presence in only a small percentage of languages would mean that it is not available for most humans as a means of language learning. The evidence gathered to date suggests that at the very least sound symbolism is language-specific and that it is a phenomenon of most of the world's languages (Ciccotosto, 1991). Given the acceptance of these two claims, sound symbolism could prove to be a possible route to the learning of words.

Linguists and anthropologists have studied the phenomenon of sound symbolism and its presence in language extensively, yet its place in word learning has never been examined. A non-arbitrary relationship between word sounds and word meaning could be providing word learners with clues to understand the meaning of an unknown word. Sound symbolism may aid word learners faced with numerous possible meanings for an unknown word, helping them select one meaning. The purpose of the present research is to examine the question of sound symbolism's place in the puzzle of word learning. Though sound symbolism has been shown to be present in many of the world's languages this research will examine only the English language.

The present research consists of five studies conducted on adults, future studies will examine sound symbolism's influence on children's word learning. Study 1 was the initial pilot study examining the role sound symbolism might play in word learning. Studies 2 and 3 were designed to build on the results of Study 1, to create a more reliable and valid measure of sound symbolism's influence on word learning, ruling out potential confounds and scale factors that could influence scale scores. Study 4 was intended to examine the effects of partial word knowledge in a multiple-choice measure of word learning. Study 5 examined the influence of sound symbolism when words were embedded in context. Study 5 assessed whether the combination of context and sound symbolism would yield greater word learning than either alone.

CHAPTER 2

STUDY 1

Study 1 was an initial pilot study of sound symbolism. This study was intended to determine, in a general way, if people have more intuitive knowledge of sound symbolic words than non-sound symbolic words. Obsolete English words were used to preclude the possibility that participants had a priori word knowledge. For this study participants generated written definitions and recognized, in a multiple-choice test, the definitions of 20 sound symbolic and 20 non-sound symbolic obsolete English words presented in isolation. If sound symbolism can help college students infer the meaning of an unknown word, then participants should show better performance on the sound symbolic words when compared to the non-sound symbolic words.

Method

Participants

Thirty adult participants were used in Study 1. Seventeen of these participants were university undergraduates, and 13 were recruited from the University of Georgia community. All participants were native English speakers. Participants ranged in age from 18 to 55 years old. The university undergraduates were all enrolled in introductory psychology classes, and their participation in this experiment fulfilled part of the requirements for their psychology class.

Stimuli

Stimuli for all participants in Study 1 consisted of 20 sound symbolic and 20 non-sound symbolic obsolete English words. These words are presented in Tables 1 and 2. Obsolete words were used in an attempt to control for prior word knowledge. English words were used so that the native English-speaking participants could use their knowledge of English and English sound symbols to help them define the presented words.

To select potential words to serve as sound symbolic stimuli, a compilation of sound symbols and their meanings was made by combining the Bloomfield (1933) and Ciccotosto (1991) lists of various English sound symbols. I restricted the sound symbols used in this research to those that occupy the initial position in words. Also, the above-sited [sw-] sound was added to the list. A survey of Mackay's (1879) *The Lost Beauties of the English Language*, a dictionary of obsolete English words, was performed to obtain 20 obsolete words whose initial sounds matched those of the sound symbols and whose meanings matched the meanings of the sound symbols. A total of seven sound symbols were used from one to four times. Twenty other random obsolete words from *The Lost Beauties of the English Language* were used as non-sound symbolic stimuli if they did not have initial sounds that matched those in the complied list of sound symbols.

All 40 words were intended to be unfamiliar to the participants. As such, Carroll, Davies and Richman's (1971) *Word Frequency Book* was used to determine the frequency of each word. Only one word in this Sound Symbolism Scale appeared in the corpus, *lea. Lea* appeared only twice in the total corpus, all other words were so

Table 1

Study 1 Sound Symbolic Stimuli

Sound Symbol		Stimulus	Definition
[fl-]	'moving light"	flaucht	- a flash of lightning
	'movement in air"	flob	- to move in a clumsy or aimless way
		flabellation	- fanning
		flang	- past of fling
[gl-]	'unmoving light"	glede	- a bright, burning coal
		glimcy	- smooth and shining, mirror like
		glime	- to shine brightly and steadfastly
[sl-]	'smoothly wet"	sloke	- to cool with water
		slive	- to slip down
		sleech	- to dip out water
[skr-]	'grating sound"	scriek	- a cry or sound
[sn-]	'breath -noise"	snite	- to blow the nose
	'quick movement "	snaught	- past of snatch
	'creep"	snoove	- to pry, to sneak
		snoke	- to pry, mainly into holes and corner, to poke one's nose where it has no business
[j-]	'up and down movement'	jactitate	- to toss and turn
		jow	- the swing of a bell

[sw-]	"swift movement"	swaff	- to come one over the other, like waves upon the shore
		swale	- to distend and wave in the wind
		sweg	- to sway to and fro

Table 2

Study 1 Non-Sound Symbolic Stimuli

Stimulus	Definition
lea	- a field
kep	- to catch, to receive
teld	- to build, to erect
jimp	- dainty, well formed, well fitting
reave	- to take away
wode	- mad, furious, wild
meare	- a boundary
bauch	- indifferent, insipid
kith	- to show, to appear
leuch	- past of laugh
aidle	- to earn one's bread indifferently well
nantle	- to fondle, to caress
queme	- to please
targe	- a shield
vade	- to fade quickly, to go to death or decay
bole	- the trunk of a tree
hent	- to hold, to seize
rede	- to advise, to council
mammer	- to hesitate, to doubt
choile	- to overreach

infrequent that they were not found in the total 5,088,721 words examined for this corpus.

Procedure

To examine the possibility that sound symbolism has a role in language learning each participant completed two study phases designed to assess expressive and receptive knowledge of word meanings. The first part of the study, called the "guess phase," presented participants with the 20 sound symbolic and 20 non-sound symbolic words in random order. The participants were asked to perform two tasks for each of the words presented in this phase of the study. First, participants were asked to fit each of the words into one of Dale, O'Rourke and Barbe's (1986) four lev els of word knowledge. Then, they were asked to generate a definition for each word. The following instructions were used in the guess phase of the study:

> The following is a list of words, which I would like you to define as best you can. All of the presented words are real English words. However, they are very likely to be unfamiliar to you. You will be shown each word and then asked to circle the number that represents your level of knowledge for each word:
>
> 1. I never saw it before.
> 2. I've heard of it, but I don't know what it means.
> 3. I recognize it-it has something to do with . . .
> 4. I know it.
>
> Then in the space below each word I would like you to write a definition for each word. If you cannot define the word please write down what you think might be part of the definition, something that you think the word relates to or something that the word makes you think about.

The second phase of the study, called the "recognition phase," presented the same participants with the same list of words. In this phase of the study the words appeared along with several possible definitions. The choices in the recognition phase included: 1) the correct word definition, and 2) three distractor definitions. The distractor definitions were also definitions of obsolete words randomly chosen during a survey of *The Lost Beauties of the English Language*. In the recognition phase of the study the participants simply chose the definition they believed best fit the listed word. The participants were instructed as follows:

> The following is a list of the same words. This time, however, the words will be followed by several possible definitions. Please choose the definition that you think best fits the word. You may look at the definition that you wrote above, but, please do not change any of your above definitions.

All participants completed the two phases (guess and recognition) of the study in the same order. Each participant first guessed at the meaning of the words and then completed the multiple-choice phase of the study. The phases of the study were not counterbalanced as putting the recognition phase before the guess phase would have restricted the range of possible word definitions generated for the guess phase. Having the multiple-choice phase of the study after the guess phase prevented participants from generating definitions restricted to the four choices listed in the recognition phase.

Scoring

Scoring for the guess phase of the study was on a 0-2 scale. A score of 2 was given for a completely correct word definition, a score of 1 was given for a partially correct word definition, and a score of 0 was given for an incorrect word definition. Laird and Agnes' (1999) *Roget's A-Z Thesaurus* was used to determine both correct and partially correct word definitions. A definition was scored as completely correct if it exactly matched the word's definition or if it was found to be a direct synonym for the definition of the word. For example, the stimulus word *glisk* means *to sparkle*. Correct definitions for *glisk* included *sparkle*, *glitter*, *glisten*, *twinkle* and *shine* as they are listed as direct synonyms for *sparkle* in *Roget's A-Z Thesaurus*. A definition was scored as partially correct if it was an indirect synonym for the word's definition or if it had some sort of relationship with the word's definition. Partially correct definitions for *glisk* included *shimmer, bright, light,* and *mirror* as they are listed as synonyms for *shine* in *Roget's A-Z Thesaurus*. Partially correct relational definitions for *glisk* included *polish* and *clean* as they are means of making things sparkle. In instances were participants left the definition area blank or wrote, "don't know," a score of 0 was given. The scoring for the recognition phase of the study was dichotomous, with a score of 1 given when the correct definition was chosen and a score of 0 given when any of the incorrect definitions were chosen.

The primary researcher scored all of the guess phase data. In addition, a naive rater scored one-third of the guess phase data. A Cohen's Kappa index of interrater reliability was calculated for this data. This index is corrected for chance agreement (Cohen, 1968) and revealed an interrater reliability of 89%

Psychometric Analysis

After the data was scored and statistical analyses run the scores from the Study 1 Sound Symbolism Scale were subjected to several analyses intended to examine the reliability and validity of this measure of sound symbolism's influence on word learning.

First, the scores generated from this sample of words were subjected to generalizablity analysis to determine whether they were generalizable to the larger universe of obsolete English words. Next, the scores from the recognition phase of the study were subjected to item analysis to determine item difficulty levels. Lastly, participants' ratings of word based on Dale et al.'s (1986) checklist were examined to determine whether the words used in this scale were really unknown to all participants. The results of these analyses were used in the process of scale development implemented at the end of this study. This process helped create a revised Sound Symbolism Scale for use in Study 2. The results of these analyses are described at the end of the following results section.

Results

Prior to statistical analyses, participants' rankings of words, based on the Dale et al. (1986) checklist, were used to eliminate words for which participants had prior knowledge. Words that participants ranked at a knowledge level of two or above, and for which the correct word definition was either guessed or recognized, were eliminated from analyses. This represented 5.6% of the data.

Only words that were both ranked at a knowledge level of two or above and were guessed or recognized correctly were eliminated to help control the number of words eliminated due to erroneous knowledge level rankings. It seems that in this scale participants had a tendency to rank words at a knowledge level greater than one if they resembled other words in their vocabulary. Participants obviously did not know many of these ranked words as they were not able to either guess or recognize the word's definition. Thus, only ranked words for which knowledge was displayed were eliminated from analyses. Using the word knowledge level rankings in this way controlled for the influence of prior word knowledge so that only words that were completely unknown to participants were included in data analyses.

In the following results the guess and recognition phases of the study are analyzed separately as the guess phase data was scored on a 0 to 2 scale and the recognition phase data was scored on a 0 to 1 scale. Before data analysis, participants sound symbolic and non-sound symbolic item scores from each phase of the study were totaled and then divided by 20 to obtain overall sound symbolic and non-sound symbolic guess phase and recognition phase item averages. This, then, allows for the reporting of results in the same metric as the scales in question. Thus, means for the guess phase data are on a 0-2 scale and means for the recognition phase data are on a 0-1 scale.

Guess Phase

A paired sample t-test comparing the average definition scores for the sound symbolic words to the average definition scores for the non-sound symbolic words showed a significant effect of word type, $t(29) = 5.91$, $p < .01$. A comparison of the means revealed that the sound symbolic words ($M = .29$) yielded 75% more accurate word definitions than the non-sound symbolic words ($M = .07$) when scored at both the partial and full knowledge levels.

As the guess phase data was scored at both the partial and full knowledge levels separate analyses were done comparing the partially correct and fully correct sound symbolic word definition scores to the partially correct and fully correct non-sound symbolic word definition scores. The effect of word type found above remained when scores were analyzed at the partial and full knowledge levels separately. Frequency analysis revealed that 59% of knowledge displayed for the sound symbolic words was at the partially correct level and 95% of knowledge displayed for the non-sound symbolic words was at the partially correct level. A paired sample t-test comparing the average number of partially correct scores revealed a significant effect of word type, $t(29) = 2.95$, $p < .01$, with the sound symbolic words yielding more partially correct word definitions. A paired sample t-test comparing the full knowledge level sound symbolic word definition scores to the full knowledge level non-sound symbolic word definition scores revealed a significant effect of word type, $t(29) = 4.94$, $p < .01$, with the sound symbolic words yielding more correct word definitions. Thus, there was an effect of word type when knowledge levels were analyzed together and when they were analyzed separately.

Recognition Phase

A paired sample t-test comparing the definitions chosen by participants for the sound symbolic words to those chosen by participants for the non-sound symbolic words showed a significant effect of word type, $t(29) = 3.56$, $p < .01$. A comparison of the means revealed that the definitions of the sound symbolic words ($M = .39$) were 31% easier to recognize than the definitions of the non-sound symbolic word ($M = .27$).

Controlling for the Influence of Sound Association

While scoring the guess phase of Study 1, it became apparent that many of the definitions generated for the sound symbolic words contained the sound symbols themselves. For example, the most commonly generated definition for the word *scriek* was *to scream*. As *scriek* means *a cry or sound* the generated definition *to scream* was scored as correct. It remains a question, then, as to whether the effect of sound symbolism is simply a result of word association emanating from the initial word sound, a type of "sound association," or whether sound symbolism goes beyond this kind of initial sound guessing to a more fundamental meaning process.

With this question in mind a separate analysis was conducted on the guess phase data to control for the influence of sound association. For this analysis any generated definitions containing the same initial sounds as the stimulus words were removed from analysis, as these definitions may have been generated through sound association. This was done for both the sound symbolic and the non-sound symbolic words. For this analysis 45% of the sound symbolic word definitions and 31% of the non-sound symbolic word definitions were eliminated from analysis.

A paired sample t-test analysis was then performed on this new data set containing only definitions not generated through sound association. The results of this analysis revealed that with the influence of sound association removed, there was still a significant effect of word type, $t(29) = 5.03$, $p < .01$. Without sound association the sound symbolic words ($M = .17$) still yielded more accurate word definitions than the non-sound symbolic words ($M = .06$). Thus, the effect of sound symbolism cannot be viewed as resulting from simple sound association.

Psychometric Analsyis

The results of Study 1 were compelling and as such further examination of the influence of sound symbolism on word learning was in order. Before proceeding, however, revisions of the scale were necessary to help control for confounds and scale factors that could influence participants' scores. This process of scale development was intended to create a more reliable and valid measure of sound symbolism's influence on word learners' ability for use in Study 2.

Generalizability Analysis.

Revision of the Study 1 Sound Symbolism Scale began with generalizability analysis. The purpose of this analysis is to determine whether a research sample of measures is generalizable to the universe of measures from which it was generated. In this research, the objects of measurement were the obsolete sound symbolic and non-sound symbolic words, and generalizabilty analysis was used to determine if this sample of words was generalizable to the universe of obsolete English words. The results of generalizability analysis are a generalizablity and reliability coefficient that, if greater than .70, support the claim that the sample measures are generalizable to the larger universe of measures. Thus, to say that the words used in this scale are generalizable to the universe of obsolete English words a generalizability and reliability coefficient of .70 or greater must be obtained.

Generalizability analysis also allows one to perform a decision study (D-study). This analysis estimates the generalizability and reliability coefficients that would result from a hypothetical number of items and participants. D-study analysis allows for a more effective sampling from the universe of admissible observations for future studies.

Data for this analysis was obtained by adding together the scores for the guess and recognition phases of the study for all 40 words to create one total word score for each word. Adding together the item scores simplified analysis by eliminating a nesting facet for the item measure (item: type: scale). As the items in each phase were the same, this simplification of the analysis was acceptable as the analysis was only intended to determine the overall items' generalizability to other obsolete English words. How the items performed in the guess and recognition phases of the study was not of particular concern. Each item had a total score that ranged in value from 0-3, with a maximum score of 2 from the guess phase and 1 from the recognition phase.

The 40 word scores were then separated by word type (sound symbolic and non-sound symbolic). The scores for the sound symbolic and non-sound symbolic words were entered into the GENOVA program (Crick and Brennan, 1984) and a generalizability study (G-study) and a decision study (D-study) were run for both word types separately. The separation of the words by word type was done because inclusion of both the sound symbolic and non-sound symbolic words in a single analysis would have resulted in a nested object of measure (item: type), and a D-study analysis cannot be performed on nested objects of measure. Thus, both the G-study and D-study analyses of the Study 1 data were split by word type and were used to determine if the scores from the obsolete sound symbolic words and the obsolete non-sound symbolic words were generalizable to the larger universe of obsolete English sound symbolic and non-sound symbolic words.

Analysis of the Study 1 data resulted in a generalizability coefficient of .86 for the sound symbolic words and .81 for the non-sound symbolic. A reliability coefficient of .84 was found for the sound symbolic words and .80 for the non-sound symbolic words. Given that these coefficients exceed .70, it can be concluded that the results of Study 1 are generalizable to the larger universe of obsolete English sound symbolic and non-sound symbolic words.

Item Analysis.

In order to ensure that an effect of sound symbolism in the recognition phase of subsequent studies is not a function of the items included in the Sound Symbolism Scale, the recognition phase data from Study 1 was submitted to item analysis. The proportion of correct responses for each item was examined to determine item difficulty. Items that were too easy, received a large proportion of correct responses, or too difficult, received few or no correct responses, were removed from future Sound Symbolism Scales regardless of whether they were sound symbolic or non-sound symbolic. This was done in an attempt to equalize word difficulty between the two word types.

This analysis resulted in the removal of two sound symbolic and six non-sound symbolic words with proportions of correct responses less than .15, as this proportion is below even chance responding. This analysis also resulted in the removal of one sound symbolic and two non-sound symbolic items with proportions of correct responses greater than .61. The proportion of responses received by the distractors was also examined and distractors that received no responses, and were therefore not functioning as distractors, were replaced for subsequent studies.

Controlling of Knowledge Level.

Further scale development consisted of removing any items that were known by participants. Items that were rated by participants as being in levels 2, 3 or 4 of the Dale et al. (1986) checklist and that were either guessed or recognized correctly by two or more participants were removed from future Sound Symbolism Scales. A total of six words, three sound symbolic and three non-sound symbolic, were removed based on participants' prior word knowledge.

Discussion

It was hypothesized that the greatest effect of sound symbolism would be found in the recognition phase of the study, as it was thought unlikely that participants would be able to generate many correct word definitions from merely a word presented in isolation. It was assumed, then, that sound symbolic information would be more likely to help participants recognize word definitions. Surprisingly, this was not the case and the strongest effect for sound symbolism was found in the guess phase of this study, although overall levels of correct guessing were low.

This finding is very promising as to sound symbolism's usefulness in word learning, as the guess phase of this study is more analogous to a real world word learning situation. In the real world word learners are not given a list of definitions to choose from, as in the recognition phase, but instead must construct an unknown word's meaning using the context in which it appears. The guess phase of this study, then, would actually be harder than a normal word-learning situation in that these words were presented in isolation, with no surrounding context from which to draw information about a possible word meaning. In the guess phase of this study the participants had only the word itself from which to determine word meaning. Hence, these findings strongly implicate sound symbolism as a word property from which word learners can draw information about the possible meaning of an unknown word. The results of Study 1 show that this effect remains at both the partial and full knowledge levels and that this effect is not a result of simple sound association with other words that share the same initial phonemic segment. The effect of sound symbolism on word learning, then, warrants further investigation.

CHAPTER 3

STUDY 2

The results of the scale development analyses performed on the Study 1 data were used to revise the stimuli used in Study 2. Words that were excessively easy or excessively difficult, based on the Study 1 item analysis, and words that were known by two or more participants were removed from the Study 2 Sound Symbolism Scale and replaced by other obsolete English words. Also, as Study 1 used a fairly limited number of sound symbols repeatedly, the number of sound symbols represented in the Study 2 Sound Symbolism Scale was expanded. The Study 1 scale contained 7 sound symbols used one to four times each. The Study 2 scale contains 13 sound symbols each used twice. Thus, Study 2 increased the number of sound symbols represented in the Sound Symbolism Scale 2, balanced the number of words per sound symbol, and increased the number of words from 20 sound symbolic and 20 non-sound symbolic to 26 sound symbolic and 26 non-sound symbolic.

Method

Participants

Sixty-nine undergraduates, different from those used in Study 1, completed the Study 2 Sound Symbolism Scale. In addition, 45 undergraduates completed a multiple-choice distractor test intended to clarify a problem encountered with the use of item analysis in the development of the Sound Symbolism Scale. All university undergraduates were enrolled in introductory psychology classes, and their participation in this experiment fulfilled part of the requirements for their psychology class. All participants were native English speakers.

Stimuli

The results of the Study 1 item analysis and knowledge level analysis were used to remove words from the Sound Symbolism Scale 1 that were too easy, too difficult or known by participants. These words were replaced in the Study 2 Sound Symbolism Scale by other obsolete English words obtained from *The Lost Beauties of the English Language*. Study 2 also increased the number of initial sound symbols represented in the Sound Symbolism Scale from the 7 used in Study 1 to 13. The number of times each sound symbol appeared in the Sound Symbolism Scale was also balanced in Study 2 with each of the 13 sound symbols appearing twice in the set of targeted words. The list of sound symbols employed in Study 1, including the Bloomfield (1933) and Ciccotosto (1991) lists, was used in Study 2 to obtain these additional sound symbolic words. One change, however, was the addition of the [tw-] sound found in Nuckolls (1999).

Since the 13 sound symbols appearing in the Study 2 Sound Symbolism Scale were balanced the initial sounds for the non-sound symbolic words were also balanced. The Study 2 Sound Symbolism Scale contained 13 initial non-sound symbolic sounds with two words per sound. Non-sound symbolic initial sounds were defined simply as sounds not appearing in the Bloomfield, Ciccotosto or Nuckolls lists. This type of initial sound balancing was not done for the Study 1 Sound Symbolism Scale. This scale change was intended to prevent any unusual response biases or learning as a function of a particular sound being used repeatedly in the task. The Study 2 version of the Sound

Symbolism Scale, then, contained 26 sound symbolic and 26 non-sound symbolic obsolete English words. See Tables 3 and 4 for a list of the stimuli used in Study 2.

All additional sound symbolic and non-sound symbolic words were obtained in the same way as those in Study 1, except for the addition of two obsolete English dictionaries. In Study 2 Halliwall's (1950) *The Dictionary of Archaic and Provincial Words* and Gramb's (1994) *The Endangered English Dictionary* were added as a source of obsolete words. As in Study 1, Carroll, Davies and Richman's (1971) *Word Frequency Book* was used to determine the frequency of each word. Again, only one word in the Study 2 Sound Symbolism Scale appeared in the corpus, *fay*. *Fay,* appeared twice in the total corpus. As in Study 1 the definitions used as distractors in the recognition phase were definitions of obsolete English words. In the Study 2 Sound Symbolism Scale the choices in the recognition phase included: 1) the correct definition, and 2) two distractor definitions.

Another major change in the development of this revised Sound Symbolism Scale occurred in the multiple-choice section. Upon examination of the choices listed for the sound symbolic words it was observed that some of the correct word definitions contained the sound symbols present in the stimulus words. For example, the definition of the sound symbolic word *sweg* is *to sway to and fro*, this definition contains the [sw-] sound symbol present in the target word. As this is a possible clue as to the correct answer, synonyms were used to replace definition words that contained the same sound symbol as the sound symbolic words being tested. In the above example, the definition word *sway* is sound symbolic, and as such it was replaced with a non-sound symbolic

Table 3

Study 2 Sound Symbolic Stimuli

Sound Symbol	Stimulus	Definition
[fl-] "movement in air"	flob	-to move in a clumsy way
	flam	- a rough fall
[gl-] "unmoving light"	glede	- a bright, burning coal
	glisk	- to sparkle
[sl-] "smoothly wet"	sleech	- to dip out water
	slive	- to slip (skid) down
[scr-] "grating impact or sound"	scriek	- a cry or sound
	scroop	- to squeak
[sn-] "creep"	snoke	- to poke one's nose where it has no business
	snoove	- to creep
[sw-] "swift movement"	swaff	- to come one over the other
	sweg	- to sway (wave) back and forth
[st-] "walking movement"	strake	- to walk around
	staffle	- to walk around in a weird way
[tr-] "effortful walking"	trig	- to fall while walking
	trimple	- a wobbly walk
[dr-] "watery, wet"	drook	- to wet
	dreen	- to remove all water

[cr-] "noisy impact"	crunkle	- to squish
	craske	- to smash
[cl-] "a loud sound"	clacker	- a rattle
	clammas	- a loud noise
[gr-] "an angry manner"	grame	- anger
	greme	- to bother
[tw-] "a twisting or pinching motion"	twage	- to pinch; to squeeze
	twigle	- to squirm

Note. Words enclosed in parentheses are synonyms used in the recognition phase of the study.

Table 4

Study 2 Non-Sound Symbolic Stimuli

Stimulus	Definition
reave	- to take away
rax	- to reach
targe	- a shield
tasse	- a cup
maups	- a silly girl
meazy	- dizzy (wobbly)
bourd	- a joke
busk	- to get ready
etyn	- a giant
ettle	- to try
hend	- gentle
henter	- a thief
kith	- to appear
kexy	- dry
wox	- to grow
wode	- mad
fay	- to clean up
fete	- work
goffram	- a clown
gome	- a man

nesp	- to bite
nare	- a nose
weth	- soft
welkin	- the sky
umgripe	- to catch
unco	- strange

Note. Words enclosed in parentheses are synonyms used in the recognition phase of the study.

synonym using *Roget's A-Z Thesaurus.* Thus, the definition *to sway to and fro* became *to wave to and fro.* This change allowed for better control of sound association effects in the recognition phase.

Procedure and Scoring

The procedures and scoring used in both the guess and recognition phases of Study 2 matched those used in Study 1. As in Study 1, the primary researcher scored all of the guess phase data. In addition, a naive rater scored one-third of the guess phase data. A Cohen's Kappa was calculated for this data, and revealed an interrater reliability of 85%.

Psychometric Analysis

As in Study 1 the scores from the Study 2 Sound Symbolism Scale were subjected to psychometric analyses to create a more reliable and valid measure of sound symbolism's influence on word learning for use in subsequent studies. The scores from the Study 2 Sound Symbolism Scale were subjected to generalizability analysis, item analysis and knowledge level analysis. Also, a separate test of the distractors used in the recognition phase was created to obtain more reliable distractors for use in subsequent Sound Symbolism Scales. The results of this test and the scale development analyses are presented at the end of the following results section.

Results

As in Study 1, words that participants ranked at a knowledge level of two or above and for which the correct word definition was either guessed or recognized were eliminated from analyses. This represented 6.1 % of the data. Thus, as in Study 1 the influence of prior word knowledge was controlled. Also, as in Study1, data analysis began by totaling participants sound symbolic and non-sound symbolic item scores for both the guess and recognition phases and dividing this number by the total number of items in each word type (26). Again, allowing for the reporting of results in the same metric as the guess and recognition phases.

Guess Phase

A paired sample t-test comparing the average definition scores for the sound symbolic words to the average definition scores for the non-sound symbolic words showed a significant effect of word type, $t(68) = 14.18$, $p < .01$. A comparison of the means revealed that the sound symbolic words ($M = .23$) yielded 90% more accurate word definitions than the non-sound symbolic words ($M = .02$) when scored at both the partial and full knowledge levels.

This effect was again found when scores were analyzed at the two knowledge levels separately. Frequency analysis revealed that 75% of knowledge displayed for the sound symbolic words was at the partially correct level and 36% of knowledge displayed for the non-sound symbolic words was at the partially correct level. A paired sample t-test comparing the partially correct sound symbolic word definition scores to the partially correct non-sound symbolic word definition scores revealed a significant effect of word type, $t(68) = 13.93$, $p < .01$, with the sound symbolic words yielding more partially correct word definitions. A paired sample t-test comparing the full knowledge level sound symbolic word definition scores to the full knowledge level non-sound symbolic word definition scores revealed a significant effect of word type, $t(68) = 6.04$, $p < .01$, with the sound symbolic words yielding more correct word definitions. Thus, sound symbolism seems to have a fairly general influence on the ability of college students to guess at a word's meaning.

Recognition Phase

A paired sample t-test comparing the definitions chosen by participants for the sound symbolic words to those chosen by participants for the non-sound symbolic words showed a significant effect of word type, $t(68) = 10.74$, $p < .01$. A comparison of the means revealed that the definitions of the sound symbolic words ($M = .51$) were 31% easier to recognize than the definitions of the non-sound symbolic words ($M = .35$). Thus, controlling for the influence of sound association, by replacing definition words that contained the same sound symbol as the stimulus word, did not remove the effect of sound symbolism in the multiple-choice test of participants' word knowledge. This finding further supports the claim that sound symbolism is not a result of simple sound association.

Controlling for the Influence of Sound Association

As with the previous study separate analysis was performed on the guess phase data to control for the influence of sound association. For this analysis 51% of the sound symbolic word definitions were removed from analysis, and 5.4 % of the non-sound symbolic words definitions were removed from analysis, as they contained the same initial sound symbols as the stimulus words and thus, may have been generated thorough sound association. A paired sample t-test analysis was performed on the data set containing only definitions not generated through sound association, and revealed that even with the influence of sound association removed, there was a significant effect of sound symbolism, $t(68) = 11.45$, $p < .01$. A comparison of the means showed that without sound association, sound symbolic words (*M* = .17) still yielded more accurate word definitions that the non-sound symbolic words (*M* =.03). As in Study 1 and the recognition phase of this study the effect of sound symbolism cannot be attributed to simple sound association.

Psychometric Analyses

Further scale revisions were carried out before moving on to the next sound symbolism study. As before, these scale revisions were intended to create a more reliable and valid measure of sound symbolism's influence on word learner's ability and to further control for confounds and scale factors that could influence scale scores. As before generalizability analysis and item analysis was conducted on the scale scores, and items known by two or more participants were replaced before moving on to Study 3.

Generalizability Analysis.

The data for the Study 2 generalizability analysis was generated in the same way as in Study 1, by combining scores from the guess and recognition phases and dividing analysis by word type. Analysis of the sound symbolic words resulted in a generalizability and reliability coefficient of .95. Analysis of the non-sound symbolic words resulted in a generalizabilty and reliability coefficient of .82. Thus, with 26 sound symbolic and 26 non-sound symbolic words and 69 adult participants the words used in the Study 2 Sound Symbolism Scale are generalizable to the universe of obsolete English sound symbolic and non-sound symbolic words.

Item Analysis.

As in the previous study item analysis was performed on the recognition phase data and the proportion of correct responses for each item was examined to determine item difficulty. Items that were too easy, or too difficult were replaced regardless of whether they were sound symbolic or non-sound symbolic. In this analysis all words were found to have received a proportion of correct responses above .15 and therefore, no words were thrown out because they were too difficult. This analysis did reveal three sound symbolic words with a proportion of correct responses greater than .77. These words were removed from future Sound Symbolism Scales. No non-sound symbolic words had proportions of correct responses greater than .77.

Controlling of Knowledge Level.

As in Study 1, any items that were rated by participants at a knowledge level of two or above and were guessed or recognized correctly by two or more participants were removed from subsequent Sound Symbolism Scales. A total of ten words, seven sound symbolic and three non-sound symbolic, were removed based on participants' prior word knowledge.

Test of Distractors.

During item analysis of the recognition phase data from Study 1 item discrimination indexes were examined, however, a problem was encountered in that this index is based on participants' total scale scores. Participants' total sc ale scores on the Sound Symbolism Scale are not analogous to achievement test scores, as theoretically participants should score high on half of the items, the sound symbolic words, and low on the other half of the items, the non-sound symbolic words. As such, the item discrimination index could not be used in the way it was intended, to distinguish distractors that discriminated between high and low achievers.

To solve this problem a separate multiple-choice test of distractors was created to ensure that all distractors used in the subsequent Sound Symbolism Scales are seen as plausible definitions for stimulus words. In the first version of the Distractor Only Test the final list of stimuli, the 26 sound symbolic and 26 non-sound symbolic words resulting from the Study 1 and Study 2 psychometric analyses, were presented to 25 university undergraduates along with 4 distractor definitions. None of the distractor definitions were correct word definitions as theoretically, the correct definition for a sound symbolic word would draw participants to choose that definition for the test word. In the Distractor Only Test the correct word definition was eliminated to determine whether participants saw the incorrect distractor definitions as plausible definitions for the stimulus words. Thus, the Distractor Only Test was used to obtain distractors that received a proportion of the participants' responses at the level of chance or above. Only those distractors receiving chance or above chance level responding were used in future Sound Symbolism Scales, as participants saw these as plausible definitions for the stimulus words.

The first version of the Distractor Only Test resulted in 135 out of 208 (65%) plausible distractors. For some stimuli all distractors were seen as plausible and for others only one or two distractors were seen as plausible. As three distractors were needed for all stimuli words a second version of the Distractor Only Test was created. This version included the 27 stimuli words for which only 1 or 2 distractors received chance or above chance level responding in the first version of the test. These 27 words, 13 sound symbolic and 14 non-sound symbolic, were followed by 5 distractors, again, none of which were correct. Twenty undergraduate university students completed this second version of the Distractor Only Test, resulting in 93 out of 135 (69%) plausible distractors. The results of these two tests yielded three or more plausible distractors for all stimuli used in the subsequent Sound Symbolism Scales. Thus, the Distractor Only Test ensured that all distractors used in the multiple-choice phase of the subsequent studies would function as distractors.

Discussion

The results of Study 2 replicated those of Study 1. There was an effect of sound symbolism in both the guess and recognition phases. This effect of sound symbolism was strongest in the guess phase. This effect was found in the guess phase for words at both the partial and the full knowledge levels. This effect remained in both phases of the study even when the influence of sound association was controlled. Moreover, the scores on the Study 2 scale are more reliable than those from Study 1 because of improvements made from Study 1 to Study 2. These results are also generalizable to the larger universe of obsolete English sound symbolic and non-sound symbolic words. Thus, Study 2 supports a place for sound symbolism in the puzzle of word learning.

CHAPTER 4

STUDY 3

The results of the scale development analyses performed on the Study 2 data were used to revise the stimuli used in Study 3. Generalizability analysis revealed that 26 sound symbolic and 26 non-sound symbolic words were sufficient to generalize from this set of items to the larger universe of English sound symbolic and non-sound symbolic words, thus no more items were added to the Sound Symbolism Scale. The Distractor Only Test performed at the end of Study 2 helps assure that the distractors used in the recognition phase of Study 3 will function as distractors. As in the earlier revision, words that were rated at a knowledge level of two or more and were guessed or recognized correctly by two or more participants were removed from the Sound Symbolism Scale and replaced by other obsolete English words. In addition, 13 identifiable words were added to the Study 3 Sound Symbolism Scale to enhance the legitimacy of the task for participants. Finally, it was hypothesized that participants performing well on the Study 3 Sound Symbolism Scale might have better overall vocabulary knowledge than those not performing well on the scale. As such, participants were tested on their overall vocabulary knowledge and these results were correlated with their scores on the Sound Symbolic Scale. A relationship between overall vocabulary knowledge and the use of sound symbolic information would provide strong evidence for the utility of sound symbolism as a mechanism available to proficient word learners.

Method

Participants

One hundred and thirty nine, previously untested, undergraduates completed the Study 3 Sound Symbolism Scale and the Nelson Denny Vocabulary Test Version F for students at four-year universities. All university undergraduates were enrolled in introductory psychology classes, and their participation in this experiment fulfilled part of the requirements for their psychology class. All participants were native English speakers.

Stimuli

The same 13 initial sound symbols and non-sound symbols used in Study 2 were used in Study 3. These initial sounds remained balanced, two words per sound, for the sound symbolic and the non-sound symbolic words. As in Study 2, 26 sound symbolic and 26 non-sound symbolic words were used as stimuli. See Tables 5 and 6 for a list of the Study 3 stimuli. Any new sound symbolic or non-sound symbolic words were obtained in the same way as in the previous studies.

The most significant change in the scale from Study 2 to Study 3 was the addition of 13 identifiable words. In the previous studies participants were asked to define a great many words that were completely unfamiliar. The addition of these identifiable words was intended to enhance the legitimacy of the Study 3 Sound Symbolism Scale by giving participants several words for which they could knowingly generate a correct definition. It was also believed that being presented with some identifiable words would help keep participants on task. These 13 identifiable words added to the Study 3 Sound Symbolism

Table 5

Studies 3, 4 and 5 Sound Symbolic Stimuli

Sound Symbol	Stimulus	Definition
[fl-] "movement in air"	flotte	-to flow (cascade)
	fluce	- to flounce (bounce)
[gl-] "unmoving light"	glede	- a bright, burning coal
	glisk	- to sparkle
[sl-] "smoothly wet"	sleech	- to dip out water
	slive	- to slip (skid) down
[scr-] "grating impact	scranch	- to scratch (rub)
	scroop	- to squeak
[sn-] "creep"	snoke	- to poke one's nose where it has no business
	snoove	- to creep
[sw-] "swift movement"	swaib	- to move back and forth like a pendulum
	sweg	- to sway (wave) back and forth
[st-] "walking movement"	strake	- to walk around
	staffle	- to walk around in a weird way
[tr-] "effortful walking"	traik	- to wander without purpose
	trimple	- a wobbly walk
[dr-] "watery, wet"	drook	- to wet
	dreen	- to remove all water
[cr-] "noisy impact"	crunkle	- to squish

	craske	- to smash
[cl-] "a loud sound"	clicket	- a clinking (jingling) noise
	clammas	- a loud noise
[gr-] "an angry manner"	grame	- anger
	greme	- to bother
[tw-] "a twisting or pinching motion"	twage	- to pinch; to squeeze
	twight	- to twitch (jerk)

Note. Words enclosed in parentheses are synonyms used in the recognition phase of the study.

Table 6

Studies 3, 4 and 5 Non-Sound Symbolic Stimuli

Stimulus	Definition
reave	- to take away
rax	- to reach
targe	- a shield
tarne	- a girl
maups	- a silly girl
meazy	- dizzy (wobbly)
bourd	- a joke
busk	- to get ready
etyn	- a giant
ettle	- to try
hend	- gentle
henter	- a thief
kith	- to appear
kexy	- dry
wox	- to grow
wode	- mad
fay	- to clean up
fud	- a tail
goffram	- a clown
gome	- a man

nesp	- to bite
naye	- an egg
weth	- soft
welkin	- the sky
umgripe	- to catch
unco	- strange

Note. Words enclosed in parentheses are synonyms used in the recognition phase of the study.

Scale were low frequency adult words that were likely to be known by most undergraduate college students. See Table 7 for a list of these identifiable words. These words were not intended as a measure of any skill and as such were eliminated from all data analyses.

As in Study 2, synonyms were used to replace any words in the definition choices of the multiple-choice phase that contained the same sound symbols as the words to be defined. Also, the distractors used in this phase of the test were those that resulted from the Distractor Only Test performed at the end of Study 2. The choices in the multiple-choice phase of Study 3 consisted of: 1) the correct word definition, controlling for the influence of sound association, and 2) three equally distracting incorrect word definitions.

Procedure and Scoring

The procedures and scoring used in both the guess and recognition phases of Study 3 matched those used in Study 1. As in the previous studies, the primary researcher scored all of the guess phase data. In addition, a naive rater scored one-third of the guess phase data. A Cohen's Kappa was calculated for this data, and revealed an interrater reliability of 87%.

Psychometric Analyses and Validation

The scale development analyses conducted on the Study 1 and 2 Sound Symbolism Scales resulted in a final list of 26 sound symbolic and 26 non-sound symbolic obsolete English words. These words were unknown to the majority of the undergraduate participants, were neither too easy nor too difficult, and are generalizable to the larger universe of obsolete English sound symbolic and non-sound symbolic words. This scale development process also resulted in a scale that controls for the

Table 7

Low Frequency Identifiable Words Included in Studies 3, 4 and 5

Identifiable Word	Definition
agile	- quick and easy movement
delude	- to fool
elicit	- to draw out
eclectic	- selecting from various sources
hue	- a particular shade or tint of a color
deity	- a god or goddess
malice	- desire to harm another
nocturnal	- active during the night
inflate	- to expand
concave	- hollow and curved
benign	- good-natured
rendezvous	- a place designed for a meeting
glib	- done in a smooth off hand fashion

influence of sound association in the recognition phase and uses only quality diastactors in the recognition phase.

Study 3 continued this process of scale development by adding 13 known words to the Sound Symbolism Scale. In Study 3 both generalizability analysis and factor analysis were performed in an attempt to help validate the Sound Symbolism Scale scores. Also, the scores from Study 3 were correlated with a test of participants' overall vocabulary knowledge. The results of these analyses are discussed at the end of the following results section.

Results

As in the prior studies, words that were ranked at a knowledge level of two or more and for which the correct word definitions were either guessed or recognized were eliminated from analyses. This represented 5.8 % of the data in Study 3. Thus, as in the earlier studies the influence of prior word knowledge was controlled.

Guess Phase

A paired sample t-test comparing the average definition scores for the sound symbolic words to the average definition scores for the non-sound symbolic words showed a significant effect of word type, $t(138) = 12.01$, $p < .01$. A comparison of the means revealed that the sound symbolic words ($M = .18$) yielded 84% more accurate word definitions than the non-sound symbolic words ($M = .03$) when scored at both the partial and full knowledge levels.

This effect remained when scores were analyzed at the partiall and full knowledge levels separately. Frequency analysis revealed that 57% of knowledge displayed for the sound symbolic words was at the partially correct level and 85% of knowledge displayed for the non-sound symbolic words was at the partially correct knowledge level. A paired sample t-test comparing the partially correct sound symbolic word definition scores to the partially correct non-sound symbolic word definition scores revealed a significant effect of word type, $t(138) = 9.82$, $p < .01$, with the sound symbolic words yielding more partially correct word definitions. A paired sample t-test comparing the full knowledge level sound symbolic word definition scores to the full knowledge level non-sound symbolic word definition scores revealed a significant effect of word type, $t(138) = 10.19$, $p < .01$, with the sound symbolic words yielding more correct word definitions than the non-sound symbolic words. Thus, there was an effect of word type when word knowledge levels were combined and when the partial and full knowledge levels were analyzed separately.

Recognition Phase

A paired sample t-test comparing the definitions chosen by participants for the sound symbolic words to those chosen by participants for the non-sound symbolic words showed a significant effect of word type, $t(138) = 13.16$, $p < .01$. A comparison of the means revealed that the definitions of the sound symbolic words ($M = .33$) were 40% easier to recognize than the definitions of the non-sound symbolic words ($M = .20$). Thus, as in Study 2 an effect of sound symbolism was found in the recognition phase even when the influence of sound association was controlled.

Controlling for the Influence of Sound Association

Separate analysis was again performed on the guess phase data to control for the influence of sound association. Any definitions that may have been generated through sound association were removed from the data set. This was done for both the sound symbolic words and the non-sound symbolic words. This resulted in the removal of 48% of the sound symbolic word definitions and 26% of the non-sound symbolic word definitions. A paired sample t-test performed on the new data set containing only definitions not generated through sound association revealed a significant effect of sound symbolism, $t(138) = 9.73$, $p < .01$. A comparison of the means showed that without sound association the sound symbolic words ($M = .11$) still yielded more accurate word definitions than the non-sound symbolic words ($M = .03$). Thus, as in the previous studies the effect of sound symbolism cannot be viewed as a result of simple sound association.

Psychometric Analyses and Validation

The stimuli used in Study 3 is the final set of stimuli resulting from the scale development analyses performed on the Study 1 and Study 2 Sound Symbolism Scale scores. As such, how representative the words are as a sample of the universe of English sound symbolic and non-sound symbolic words is of great interest. Also, the establishment of a relationship between participants' sound symbolic word scores and their overall vocabulary knowledge would provide support for sound symbolism as a word property that leads to increased word learning. As such, generalizability analysis and factor analysis were conducted on the Study 3 Sound Symbolism Scale scores, and participants' scores on the sound symbolic words were correlated with their scores on the Nelson Denny Vocabulary Test.

Generalizability Analysis.

Data for the Study 3 generalizability analysis was generated in the same way as in Studies 1 and 2. Analysis of the sound symbolic words resulted in a generalizability and reliability coefficient of .95. Analysis of the non-sound symbolic words resulted in a generalizabilty and reliability coefficient of .92. Thus, with 26 sound symbolic and 26 non-sound symbolic words and 139 adult participants the results of Study 3 are generalizable to the universe of obsolete English sound symbolic and non-sound symbolic words. This analysis, then, helps validate the scores from the Study 3 Sound Symbolism Scale, supporting the extension of these results to a more general set of obsolete English words.

Factor Analysis.

Factor analysis was also performed on the item data generated in Study 3. For this analysis the guess and recognition phase data for all stimuli words was combined to form one total word score for each word. These total word scores were combined into parcels based on the 26 initial sounds represented in the scale, resulting in 13 sound symbolic and 13 non-sound symbolic item parcels. Parcel scores ranged in value from 0-6. A two-factor model of confirmatory factor analysis was estimated using LISREL 8.14. Using maximum likelihood as an estimator this two-factor model resulted in acceptable goodness of fit measures: $\chi^2(299) = 353.89$; RMSEA = .04 (.02; .05); and GFI = .83. These model fit measures along with the non-correlated factors (r= -.067) support the validity of the internal structure of the Study 3 Sound Symbolism Scale, as all 13 sound symbolic item parcels factored together and all 13 non-sound symbolic item parcels factored together. Thus, the sound symbolic words presented in this scale were seen as distinct from the non-sound symbolic words.

Sound Symbolism and Vocabulary Knowledge.

Participants in Study 3 completed both the Study 3 Sound Symbolism Scale and the Nelson Denny Vocabulary Test Version F. Participants' scores on the Nelson Denny Vocabulary Test were correlated with their item totals for both the sound symbolic and the non-sound symbolic words. Given that the working hypothesis of this research is that vocabulary knowledge can be increased by the availability of sound symbolic information, it was also hypothesized that persons with high vocabulary skills might be more likely to capitalize on sound symbolic information. The Nelson Denny Vocabulary Test was intended as a means of establishing known groups for between group validation of the Study 3 Sound Symbolism Scale. Thus, if sound symbolism has the proposed relationship with vocabulary knowledge then participants' scores on the Nelson Denny Vocabulary Test should be positively correlated with their scores on the sound symbolic words and uncorrelated with their scores on the non-sound symbolic words in the Study 3 Sound Symbolism Scale.

Results of the correlation analysis, however, showed no significant relationship between participants' scores on the Nelson Denny Vocabulary Test and their scores on either the sound symbolic ($r^2 = .11$, $p > .05$) or the non-sound symbolic words ($r^2 = .10$, $p > .05$). It may be, then, that the above hypothesis is faulty and that the ability to capitalize on sound symbolic word information is not significantly related to overall vocabulary knowledge. Perhaps proficient vocabulary learners use other means more heavily to promote vocabulary growth.

It was originally hypothesized that the ability to capitalize on sound symbolic information would be related to phonological awareness. To date, however, there are no tests of phonological awareness for which most adults do not reach ceiling. Instead, it was reasoned that, for adults, the ability to capitalize on sound symbolic word information might be related to their overall vocabulary knowledge. This was a secondary hypothesis, and indeed, it may be faulty. One limitation of the above correlation, however, is the restricted range of scores resulting from the participants' completion of the Nelson Denny Vocabulary Test. The normative data for the Nelson Denny Vocabulary Test Version F for students at a four-year university shows that the normalized scores on this test range in value from 0 to 100, with a mean of 50. The scores resulting from my participants' completion of the Nelson Denny showed a range of 41 to 97, with one outlier of 22, and a mean of 72. In fact, 95 % of my participants scored above the standardized mean for this version of the test. As these participants' scores on the Nelson Denny Vocabulary Test are restricted to the high end of the scale the results of this analysis can only suggest that among persons with good vocabulary knowledge there is no difference in ability to capitalize on sound symbolic information.

Discussion

Using the finalized list of sound symbolic and non-sound symbolic stimuli the Study 3 Sound Symbolism Scale replicated the findings of the previous studies, lending more support to the idea that sound symbolism is a possible route to the learning of words. In Study 3 there was an effect of sound symbolism in both the guess and recognition phases of the study. This effect of sound symbolism was strongest in the guess phase. This effect was found in the guess phase at both the partial and the full knowledge levels, and this effect remained even when the influence of sound association was removed. The process of scale development that resulted in the Study 3 Sound

Symbolism Scale also lends support to sound symbolism's usefulness in word learning. The reliability and validity of the scores from the Sound Symbolism Scale 3 were found to be acceptable. The results of the correlational analysis with the Nelson Denny suggest only that for word learners with high vocabulary knowledge there is no difference in ability to capitalize on sound symbolism information. Sound symbolism's relationship to vocabulary knowledge when there is a variation in vocabulary knowledge has yet to be determined.

CHAPTER 5

STUDY 4

Study 3 finalized the list of stimuli used in the Sound Symbolism Scale resulting in the stimuli used for this and the subsequent study, see Tables 5 and 6. The purpose of Study 4 was to investigate whether the inclusion of partial word knowledge scoring for both test phases, guess and recognition, would provide a more sensitive measure of participants' ability to use sound symbolic information to infer the meaning of an unknown word. The only change from Study 3 was that the composition of the choices used in the recognition phase were changed to provide a contrast between partial and full word knowledge. This contrast served to clarify the level of receptive knowledge that participants had about the meanings of sound symbolic and non-sound symbolic obsolete words.

Method

Participants

As an effect for sound symbolism was found in all of the previous studies with out the inclusion of partial word knowledge scoring in the recognition phase of the study, Study 4 included a minimum number of participants. Thirty, previously untested, undergraduate college students completed the Study 4 Sound Symbolic Scale and the Nelson Denny Vocabulary Test Version F. All university undergraduates were enrolled in introductory psychology classes, and their participation in this experiment fulfilled part of the requirements for their psychology class. All participants were native English speakers.

Stimuli

The stimuli used in Study 4 were the same as those used in Study 3, including the 13 identifiable words. Again, the 13 identifiable words were not intended as a measure of any skill and were removed from all analyses. The only change between Study 3 and Study 4 was the inclusion of a partially correct word definition choice in the recognition phase of Study 4. Thus, the choices in the recognition phase of Study 4 included: 1) the actual word definition, controlling for the influence of sound association; 2) a definition, controlling for the influence of sound association, which shared domain features with the actual word definition but which violated some of the specific features of the words; 3) the definition of another obsolete word, that attained chance or above chance level responding in the Distractor Only Test; and 4) a definition which shared some features with the incorrect definition but not with either the correct or partially correct word definitions. The two distractor definitions were related to each other to preclude the possibility that test-wise participants could narrow down the meaning of the word to two semantically related definitions. With these four choices the recognition phase of Study 4 allowed for a distinction between participants who had only general word domain knowledge and those who had full word knowledge.

Procedure and Scoring

The procedures used in Study 4, for both the guess and the recognition phases, matched those used in the earlier studies. Scoring of the Study 4 guess phase match those used in the earlier studies. The scoring of the recognition phase was changed to reflect the inclusion of the partially correct word definition choice. This phase of Study 4 was scored on a 0-2 scale. A score of 2 was given when participants choose the completely correct word definition, a score of 1 was given when participants choose the partially correct word definition, and a score of 0 was given when participants choosing either of the incorrect distractor definitions.

As in the previous studies, the primary researcher scored all of the guess phase data. In addition, a naive rater scored one-third of the guess phase data. A Cohen's Kappa was calculated for this data, and revealed an interrater reliability of 87%.

Results

As in the prior studies words that participants ranked at a knowledge level of two or more and for which the correct word definition was either guessed or recognized were eliminated from analyses. This represented 8.7 % of the data. This number increased from Study 3 to Study 4 as the inclusion of both partially correct and correct word definitions in the recognition phase of the study gave participants a 50% chance of choosing, by chance, a correct definition for any word labeled at a knowledge level of two or above. Thus, participants were just as likely to choose one of the correct word definitions as one of the incorrect word definitions and this is likely to have resulted in more instances of word knowledge being displayed for words that had been erroneously ranked as known.

Guess Phase

A paired sample t-test comparing the definition scores for the sound symbolic words to the definition scores for the non-sound symbolic words showed a significant effect of word type, $t(29) = 5.49$, $p < .01$. A comparison of the means revealed that the sound symbolic words (*M* = .22) yielded 89% more accurate word definitions than the non-sound symbolic words (*M* = .02) when scored at both the partial and full knowledge levels.

This effect was also found when the two knowledge levels were analyzed separately. Frequency analysis revealed that 55% of knowledge displayed for the sound symbolic words was at the partially correct level and 81% of knowledge displayed for the non-sound symbolic words was at the partially correct level. A paired sample t-test comparing the partially correct definition scores for the sound symbolic words to the partially correct definition scores for the non-sound symbolic words revealed a significant effect of word type, $t(29) = 5.45$, $p < .01$, with the sound symbolic word yielding more partially correct word definitions than the non-sound symbolic words. A paired sample t-test comparing the full knowledge level definition scores for the sound symbolic words to the full knowledge level definition scores for the non-sound symbolic words revealed a significant effect of word type, $t(29) = 4.65$, $p < .01$, with the sound symbolic words yielded more correct word definitions than the non-sound symbolic words. Thus, there was an effect of word type when knowledge levels were analyzed together and when they were analyzed separately.

Recognition Phase

A paired sample t-test comparing the definitions chosen by participants for the sound symbolic words to those chosen by participants for the non-sound symbolic words revealed a significant effect of word type, $t(29) = 5.99$, $p < .01$. The definitions of the sound symbolic words (*M* = .88) were 32% easier to recognize than the definitions of the non-sound symbolic words (*M* = .59). This effect of word type remained when the knowledge levels were analyzed separately. A paired sample t-test comparing the partially correct word definitions chosen by participants for the sound symbolic words to the partially correct word definitions chosen by participants for the non-sound symbolic words revealed a significant effect of word type, $t(29) = 3.98$, $p < .01$. A comparison of the means revealed that the partially correct sound symbolic word definitions were easier to recognize than the partially correct non-sound symbolic word definitions. A paired sample t-test comparing the full knowledge level word definitions chosen by participants for the sound symbolic words to the full knowledge level definitions chosen by participants for the non-sound symbolic words revealed a significant effect of word type, $t(29) = 4.70$, $p < .01$. Again, the sound symbolic words definitions were easier to recognize than the non-sound symbolic word definitions. Thus, in the recognition phase, as in the guess phase, there was an effect of word type when knowledge levels were analyzed together and separately. This, again, was with the influence of sound association controlled.

Controlling for the Influence of Sound Association

Analysis was again performed on the guess phase data to control for the influence of sound association. For this analysis 53% of the sound symbolic word definitions and 35% of the non-sound symbolic word definitions were eliminated from analyses as they may have been generated through sound association. A paired sample t-test analysis performed on the data containing only definitions not generated through sound association revealed a significant effect of sound symbolism, $t(29) = 5.59$, $p < .01$. A comparison of the means revealed that, without sound association, the sound symbolic words ($M = .13$) still yielded more accurate word definitions than the non-sound symbolic words (M = .02). Thus, as in the three previous studies the effect of sound symbolism cannot be viewed as a result of simple sound association.

Generalizability Analysis

Generalizability analysis of the sound symbolic words resulted in a generalizability coefficient of .78 and a reliability coefficient of .77. Analysis of the non-sound symbolic words resulted in a generalizabilty and reliability coefficient of .78. Thus, with 26 sound symbolic and 26 non-sound symbolic words and 30 adult participants the results of Study 4 are generalizable to the universe of obsolete English sound symbolic and non-sound symbolic words.

Sound Symbolism and Vocabulary Knowledge

As in Study 3, participants in Study 4 completed both the Study 4 Sound Symbolism Scale and the Nelson Denny Vocabulary Test Version F. Scores from the Nelson Denny Vocabulary Test were again correlated with participants' totals for both the sound symbolic and the non-sound symbolic words. As in Study 3, the results of this correlation analysis showed no significant correlations between participants' scores on the Nelson Denny and either their scores the sound symbolic (r^2 = .26, p > .05) or non-sound symbolic words (r^2 = .001, p > .05). Again, however, the range of scores on the Nelson Denny Vocabulary Test were fairly restricted with 100% of participants scoring above the normative data's standardized mean. Participants' scores range between of 50 to 93, and had a mean of 71.

Discussion

Using the final list of sound symbolic and non-sound symbolic words Study 4 replicated the findings of Studies 1 through 3, lending more support to the idea that sound symbolism is a possible route to the learning of words. In Study 4 there was again an effect of sound symbolism in both the guess and recognition phases of the study. This effect was found for words at both the partial and the full knowledge levels in both the guess and recognition phases, and this effect remained when the influence of sound association was controlled.

CHAPTER 6

STUDY 5

The purpose of Study 5 was to determine whether the combination of information from context and sound symbolism would yield greater word learning than either alone. The clue to a word's meaning gained from sound symbolism may enable vocabulary learners to narrow down which features of context are most relevant to the meaning of the unknown word. To examine this possibility Study 5 compared sound symbolic words presented in context to sound symbolic words presented in isolation. If the combination of sound symbolism and context can help college students both guess and recognize the meanings of unknown words, then they should show larger benefits from the sound symbolic information presented in context than from either the sound symbolic information alone or context alone. Study 5 used the sound symbolic and the non-sound symbolic words resulting from the two revisions of the Sound Symbolism Scale 3. Study 5 examined half of these words in isolation and half in context, counterbalancing this across participants.

Method

Participants

Seventy-nine, previously untested, undergraduates completed the Study 5 Sound Symbolism Scale and the Nelson Denny Vocabulary Test Version F. All university undergraduates were enrolled in introductory psychology classes, and their participation in this experiment fulfilled part of the requirements for their psychology class. In addition, 23 undergraduate college students completed a Contextual Helpfulness Task. These participants were recruited from an introductory education class. All participants were native English speakers.

Stimuli

To control for the helpfulness of context across word types, 23 adult participants completed a fill-in-the-blank Contextual Helpfulness Task. Synonyms for the stimuli word definitions were used to obtain naturally occurring contexts from a survey of *Collins COBUILD English Dictionary* (1995) and *The World Book Dictionary* (1992). Through this survey a list of 112 sentences, two for each stimuli word, were obtained. Participants were presented with this list of sentences containing blanks in place of the stimuli word synonyms. Participants were instructed to "write up to three separate words or phrases that could fit into the blank." The meanings participants attributed to the context were scored on a 0 – 2 scale. A score of 2 was given for the definition of the stimulus word or a direct synonym (a word appearing in *Roget's A-Z Thesaurus* as a synonym for the stimulus word's definition) for the stimulus word. A score of 1 was given for an indirect synonym (a word appearing in *Roget's A-Z Thesaurus* as a synonym for a direct synonym of the stimulus word's definition). All other generated meanings were given a score of 0. The scores for each of the 112 sentences were totaled and used as a rating of contextual helpfulness. If participants generated more than one meaning that was a synonym for the stimulus word's definition the highest scoring meaning was included in the contextual helpfulness rating.

The contextual helpfulness ratings for the individual sentence ranged in value from 0 – 44. Using these ratings the context in which the sound symbolic and the non-sound symbolic words were embedded were balanced. For example, if a sentence with a contextual helpfulness rating of 10 was used as context for a sound symbolic word a sentence with a contextual helpfulness rating of 10 – 12 was used as context for a non-sound symbolic word. The helpfulness rating for the contexts included in the Study 5 Sound Symbolism Scale ranged in value from 0 – 29 (M = 14.7) for the sound symbolic words, and 1 – 31 (M = 15.8) for the non-sound symbolic words. Thus, there was a range of contexts represented in the Study 5 Sound Symbolism Scale from non-helpful to helpful.

The words used as stimuli in Study 5 were the same as those used in the previous studies. The only change between Study 3 and Study 5 was that half of the participants received half of the words in context and half of the words in isolation. This was counterbalanced across participants.

Procedure and Scoring

The Study 5 Sound Symbolism Scale consisted of a guess phase only. This was done because many of the distractor definitions used in the previous studies did not fit appropriately when words were embedded in context. In Study 5 participants were presented with stimulus words, half in context and half in isolation, and asked to fit the words into one of Dale et al.'s (1986) four levels of word knowledge. The participants were then asked to generate a definition for the stimulus words. Words presented in context were underlined in order to assure that participants both ranked their knowledge level and generated a definition for the correct words.

The scoring of the guess phase of Study 5 matched those used in the earlier studies. Again, the primary researcher scored all of the guess phase data. In addition, a naive rater scored one third of the guess phase data. A Cohen's Kappa was calculated for this data, and revealed an interrater reliability of 92%.

Results

As in the prior studies, words that participants ranked at a knowledge level of two or more and for which the correct word definition was guessed were eliminated from analyses. This represented 4.8 % of the data. Thus, as in the earlier studies the influence of prior word knowledge was controlled.

Data analysis consisted of a 2 x 2 repeated measures ANOVA comparing the two context types (context and isolation) and the two word types (sound symbolic and non-sound symbolic). Results showed an effect of context type, $F(1,73) = 165.88$, $p < .01$, $\eta^2 = .69$, with the words in context yielding more correct word definition scores ($M = .64$) than the words in isolation ($M = .15$). Results also showed an effect of word type, $F(1,73) = 111.51$, $p < .01$, $\eta^2 = .60$, with the symbolic words yielding more correct word definition scores ($M = .50$) than the non-sound symbolic words ($M = .29$). The interaction between context and word type, however, was not significant, $F(1,73) = .95$, $p > .05$. Upon examination of the means it seems as though participants were able to combine the information available in context with the sound symbolic information to produce greater word learning as the sound symbolic words in context ($M = .76$) yielded the most accurate word definitions, followed by the non-sound symbolic words in context ($M = .53$), than the sound symbolic words in isolation ($M = .24$), and lastly the non-sound symbolic word in isolation (M = .05). Thus, I began to question why the interaction between sound symbolism and context did not reach significance.

An examination of the frequency data revealed a problem with the use of the Dale et al.(1986) knowledge level checklist in context. As in the previous studies, words participants ranked at a knowledge level of two or more and for which word knowledge could be displayed were eliminated from analyses. This represented 4.8 % of the data in this study. An examination of the data eliminated from each condition (word type x context type) revealed that 55% of the eliminated data came from one condition, sound symbolic words within context. In a comparison of the amount of data eliminated from the sound symbolic words within context condition to the sound symbolic words in isolation condition, a condition containing the same words, a chi-squared analyses revealed a significant difference, $\chi^2(1) = 45.125$, $p < .01$. It seems, then, that the inclusion of both contextual information and sound symbolic information in the Dale et al. checklist influenced the number of words participants ranked as known and for which they were able to display knowledge. The use of this checklist, then, unduly influenced the sound symbolic word within context condition. As such, a separate 2 x 2 ANOVA comparing the two text types (context and isolation) and the two word types (sound symbolic and non-sound symbolic) was conducted on the Study 5 data without eliminating words scores based on the Dale et al. checklist. Without the Dale et al. checklist one can view this second analysis as a less conservative estimate of sound symbolism's effect. In reviewing the findings from this analysis, one must keep in mind that the means will be somewhat inflated, compared to the previous studies, as no words with prior knowledge have been eliminated.

This second ANOVA, done on the data set containing all word scores, resulted in an effect of context type, $F(1,73) = 349.60$, $p < .01$, $\eta^2 = .83$, with the words presented in context yielding more correct word definition scores ($M = .77$) than the words presented in isolation ($M = .17$). Results also showed an effect of word type, $F(1,73) = 187.93$, $p < .01$, $\eta^2 = .72$, with the sound symbolic words yielding more correct word definition scores ($M = .61$) than the non-sound symbolic words ($M = .33$). Lastly, a significant interaction between context type and word type was found, $F(1,73) = 10.16$, $p<.01$, $\eta^2 = .12$. An examination of the means showed that definition scores for the sound symbolic words presented in context ($M = .94$) were greater than the definition scores for the sound symbolic words presented in isolation ($M =. 28$), the non-sound symbolic words in context ($M = .60$), and the non-sound symbolic words in isolation ($M = .06$). Thus, it does seem as though participants were able to combine the information from context with sound symbolic information to yield greater word learning.

Controlling for the Influence of Sound Association

Definitions for both the sound symbolic words and the non-sound symbols words that contained sound associations were removed from the data set used in the second ANOVA, the data set including all word scores. This was done for both the sound symbolic words and the non-sound symbolic words in context and in isolation. This resulted in the removal of 36% of the sound symbolic words within context definitions, 56 % of the sound symbolic words in isolation definitions, 7.1% of the non-sound symbolic words within context definitions and 2% of the non-sound symbolic words in isolation definitions.

A 2 x 2 repeated measures ANOVA comparing the two context types and the two word types was performed on the data containing no sound association. The results showed a significant effect of context type, $F(1,73) = 498.02$, $p < .01$, $\eta^2 = .87$, with the words presented in context yielding more correct word definition scores ($M = .56$) than the words presented in isolation ($M = .09$). A marginal effect of word type was found, $F(1,73) = 3.14$, $p < .10$, $\eta^2 = .04$, with the sound symbolic words yielding more correct word definition scores ($M = .35$) than non-sound symbolic words ($M = .30$). This analysis, however, showed no interaction between context type and word type, $F(1,73) = 2.12$, $p > .05$. Thus, when a large proportion of the sound symbolic word definition scores are removed from analysis the interaction between context and sound symbolism disappears and the effect of sound symbolism is minimized. The results of all four previous studies, however, show robust effects for sound symbolism even when sound association is controlled. This suggests that sound symbolism's effect is not a result of simple sound association and that our inability to find this in Study 5 may simply be a result of the inclusion of contextual variance.

Generalizability Analysis

Generalizability analysis was repeated for Study 5 and showed that the results of Study 5 are generalizable to the larger domain of English sound symbolic and non-sound symbolic words. Analysis of the sound symbolic words resulted in a generalizability coefficient of .91 and a reliability coefficient of .90. Analysis of the non-sound symbolic words resulted in a generalizabilty and reliability coefficient of .87. Thus, with 26 sound symbolic and 26 non-sound symbolic words and 76 adult participants the scores from the

Study 5 Sound Symbolism Scale are generalizable to the universe of obsolete English sound symbolic and non-sound symbolic words.

Sound Symbolism and Vocabulary Knowledge

As in the two prior studies, participants in this study completed both the Study 5 Sound Symbolism Scale and the Nelson Denny Vocabulary Test Version F. As before, the range of scores obtained from the Nelson Denny were restricted to those in the moderate to high vocabulary skill range (M = .71, range 41-94). Results from the Nelson Denny Vocabulary Test were correlated with both participants' sound sym bolic and non-sound symbolic word totals for words presented in context and words presented in isolation. This analysis was done on the data set not eliminating word scores based on the knowledge level checklist.

Results of this correlational analysis showed no significant relationship between the participants' scores on the Nelson Denny and participants' scores on either the sound symbolic words ($r^2 = -.21$, $p > .05$) or the non-sound symbolic words ($r^2 = -.08$, $p > .05$) presented in isolation. This replicates the findings from the previous two studies. However, when these words were presented in context, a different pattern of relationships between vocabulary skill and vocabulary learning emerged. There was a significant correlation between the Nelson Denny scores and scores on the non-sound symbolic words presented in context ($r^2 = .30$, $p < .05$), but not for the sound symbolic words presented in context ($r^2 = .18$, $p > .05$).

The findings for the non-sound symbolic words within context replicates the findings from other studies by showing that, for non-sound symbolic words, persons with high verbal ability are better able to extract meaning from context (McKeown, 1985).

However, the lack of such a relationship in the sound symbolic case may have been due to the presence of sound symbolism allowing persons of moderate vocabulary skill (those at the bottom of the distribution in this study) to abstract out relevant context clues. To test this, I divided the participants into moderate and high vocabulary skill based on the Nelson Denny scores and examined their word scores for the non-sound symbolic and sound symbolic words in context using a 2 x 2 (vocabulary skill x word type) ANOVA. Unfortunately, the word type by vocabulary skill interaction was not significant, F (1,37) = .249, $p > .10$. In fact, this analysis revealed an overall effect of skill, $F(1,37) = 3.0$, $p < .10$. Consequently, it is unclear why participants of high vocabulary skill were not better able than participants of moderate vocabulary skill to capitalize on context for sound symbolic words.

Discussion

Using the final list of sound symbolic and non-sound symbolic words the Study 5 Sound Symbolism Scale examined the combination of sound symbolic information and contextual information, and found an effect for both context and word type, when controlling for prior knowledge. A problem with this control, however, resulted in a non-significant interaction between context and word type. In retrospect, it may have made more sense to control for prior word knowledge by conducting the Dale et al. (1986) with all words in isolation before displaying words in context. In an attempt to eliminate this problem a second analysis was performed on data containing all word scores. This analysis showed that participants were able to combine sound symbolic information with contextual information to attain greater word learning than when either sound symbolic or contextual information were presented alone. Thus, sound symbolism has an effect in a more natural word learning situation and indeed, may add to word learners ability to attain word knowledge from context. When general vocabulary knowledge was examined, however, participants with high vocabulary skill were not more able to capitalize on this contextual information when sound symbolic words were targeted, although they were more able to do so when non-sound symbolic words were targeted. Unfortunately, I was unable to isolate the cause of this discrepancy.

CHAPTER 7

GENERAL DISCUSSION

The present research examined the ability of adult word learners to both generate and recognize the meanings of two types of unknown words, those containing a sound symbol and those lacking a sound symbol. The overall purpose of this research was to determine if sound symbolic information provided a clue to word learners as to the meaning of an unknown word. A secondary purpose was to examine the effects of sound symbolic information on word learning within context, as the general consensus among researchers of vocabulary growth is that the majority of words are learned within context.

With regards to the overall objective, the results of all five studies showed that sound symbolic words consistently yielded more accurate word knowledge than non-sound symbolic words. Participants in these studies were able to generate more correct definitions for the sound symbolic words when compared to the non-sound symbolic words. They were also able to choose, in a multiple-choice format more correct word definitions for the sound symbolic word. Sound symbolism, then, does seem to be providing adult word learners with a clue to understanding the meaning of an unknown word.

In the first four studies the effect of sound symbolic information on participants' word learning ability was found to be quite robust. When asked to generate a word definition, the presence of sound symbolic information was likely to coincide with a participants' ability to display both partial and full knowledge of the presented word. When participants were asked to choose a word definition, the presence of sound symbolic information was likely to coincide with their ability to choose both partially correct and correct word definitions. The effect of sound symbolism, then, remained even when analyses were split by knowledge level. Thus, sound symbolic information resulted in both partial and complete word learning.

The findings from the first four studies provide great support for the claim that the link between word sounds and word meaning is not completely arbitrary for all words. In these studies, all words were presented to participants in isolation, with no surrounding context. Participants were asked to simply read the word and both generate and choose a definition for the word. In this situation participants had nothing except information present in the word itself from which to draw a conclusion about what the unknown word might have meant. In the guess phase of these studies there were countless possible meanings for the unknown word. In this situation the likelihood that a participant would be able to generate a correct word definition by chance was rather remote. An examination of the means for the non-sound symbolic words in the guess phases of the first four studies suggests that there is a less than 4% chance of generating, by chance, a correct word definition for a random unknown word presented in isolation. For the sound symbolic words in this research, however, there was an overall 18% chance that participants would generate a correct word definition. As the words in these studies were presented in isolation, this difference can only be attributed to the sound symbolic information present in the sound symbolic words. These findings support not only the idea that sound symbolic information present in words is a possible route to word learning, but also provide evidence for the presence of sound symbolism in the English language.

The process of scale development implemented in this research adds further support to sound symbolism's usefulness in word learning. Through scale development the influence of prior word knowledge was controlled by eliminating words from Studies 1 and 2 that were known by two or more participants. The item analyses conducted on the stimuli used in Studies 1 and 2 helped eliminate the confound of word difficulty that could have influenced scale scores. Through these analyses, sound symbolic and non-sound symbolic words that were either too easy or too difficult were eliminated. The Distractor Only Test assured that an effect for sound symbolism found in the recognition phases of Studies 3 and 4 was not a result of ineffective distractors. Factor analysis conducted on the Study 3 scale scores supports the internal validity of the Study 3 scale. Participants' scores on the Study 3 Sound Symbolism Scale reflected the two distinct types of words used in the scale. Lastly, the generalizabiltiy analyses conducted on the scores from all studies supports the generalization of these scale scores to other obsolete English sound symbolic and non-sound symbolic words. Thus, the ability of participants to use sound symbolic word information to yield greater word learning should not be restricted to the items used in any of these particular Sound Symbolism Scales and is not likely to be a result of any particular scale factors.

The only results questioning the validity of the Sound Symbolism Scales are the results of the correlational analyses between the participants' total scores on the sound symbolic words and the participants' scores on the Nelson Denny Vocabulary Test Version F. Unfortunately, given the population from which participants were drawn, there was a somewhat limited range of scores on this vocabulary skill test. It may be that once adults have attained a certain amount of vocabulary skill the ability to distinguish differing abilities in the use of sound symbolic information is undetectable. Thus, the correlations between the Nelson Denny Vocabulary Test scores and the Study 3, 4 and 5 Sound Symbolism Scale sound symbolic word totals were not really a sensitive test for the psychologically reality of sound symbolism because of the limited range on the Nelson Denny. Furthermore, the Nelson Denny is a general test of vocabulary knowledge. This research is suggesting only that sound symbolism is one of many potential sources of vocabulary knowledge. Context, experience, morphology, part of speech, and lexical concreteness have also been shown to influence vocabulary knowledge. Indeed, in Study 5 context was positively correlated with the Nelson Denny Vocabulary Test. Given such a multifaceted skill, it is perhaps not surprising that sound symbolism did not relate to the Nelson Denny. Moreover, if sound symbolism is a basic feature of human cognition, as might be expected if the feature is universal in human languages, individual differences as assessed by the Nelson Denny might be the exception rather than the rule. The lack of a correlation between participants sound symbolic word totals and the Nelson Denny, then, suggests only that the ability to use sound symbolic information is not related to highly skilled adults overall vocabulary knowledge.

Another issue addressed in this research was the idea that sound symbols do not carry meaning but that sound symbols lead to word association emanating from the initial word sounds, as a type of "sound association." To rule out this possibility separate analyses were done on all studies examining only generated definitions not containing the sound symbol present in targeted words. In all of these analyses the effect of sound symbolism remained, even if only marginally in Study 5. This effect also remained in the recognition phases of Studies, 2, 3, and 4 when correct choices did not contain sound associations. Thus, the effect of sound symbolism cannot be dismissed as a result of simple sound association.

Another possible explanation for an effect of sound symbolism might be orthographic neighborhood effects. A neighborhood effect is any processing benefit or problem that might be caused from having words in the lexicon that share a large number of letters with the target word (Andrews, 1997). By definition, sound symbolic words share letters with other words bearing the same meaning. Although the sound symbolic words used in this study did not have any a priori neighbors because they were obsolete, participants may have been able to use their orthographic knowledge to guess at the word's neighborhood in the lexicon and make guesses based on lexical ne ighbors. I do not think that neighborhood effects could totally account of the sound symbolism effect found in these studies as such an orthographic mechanism was also available for the non-sound symbolic words. Further, responses based on the first two letters of the word were removed from both word types and sound symbolic words were still guessed better.

In this research, then, I have tried to control for all possible variables, except sound symbolism, that could result in participants scoring higher on sound symbolic words verses non-sound symbolic words. Indeed, one control implemented in Studies 1 through 4, the use of the Dale et al. (1986) knowledge level checklist, may have inadvertently controlled away a portion of the overall experimental effect for sound symbolism. In an effort to be conservative, and control for any possible prior word knowledge, any word ranked by participants at a knowledge level of two or more (any word knowledge at all) and for which participants displayed knowledge in either the guess or recognition phases were eliminated from analyses. In Study 5 this control, eliminated the interaction between sound symbolism and context because it unduly influenced the sound symbolic words within context condition. In Studies 1 through 4, however, this knowledge control was not eliminated. After analysis of the Study 5 data I reviewed the frequency data from Studies 1 through 4 to determine if the Dale et al. checklist control may have been unduly influencing the sound symbolic conditions of those studies. I examined the number of sound symbolic words removed from analyses in Studies 1 through 4 and compared this number to the number of non-sound symbolic words removed from analyses. I found that in Study 2 the number of sound symbolic words removed from analyses (59%), based on the Dale et al. checklist, was significantly greater than the number of non-sound symbolic words removed, $\chi^2(1) = 9.24$, $p < .05$. I also found that in Study 3 the number of sound symbolic words removed from analyses (59%) was significantly greater than the number of non-sound symbolic words removed, $\chi^2(1) = 10.06$, $p < .05$. It seems then that in Studies 2 and 3 the effect of sound symbolism was influencing either participants' rankings of word in the Dale et al. checklist, or more likely, their ability to display knowledge of a word they had erroneously rated at a knowledge level greater than one. Thus, in Studies 2 and 3 the effect of sound symbolism is likely to have been minimized by the use of the Dale et al. checklist. Despite this, an effect of sound symbolism was still found in both Study 2 and Study 3.

Overall, then, Studies 1 through 4 established an effect of sound symbolism with words presented in isolation. This goal having been achieved sound symbolism needed to be examined in a more natural word learning situation. A secondary purpose of this research, then, was to examine the effects of sound symbolism on word learning within context, as context is generally agreed upon to be a major source of vocabulary growth. The purpose of Study 5 was to determine whether the combination of information from context and sound symbolism would yield greater word learning than either alone. Study 5 examined sound symbolic and non-sound symbolic words presented in context and in isolation. The main finding of this study was that having both sources of information was better than the additive effect of having either context or sound symbolism alone. Study 5, then, showed that the presence of a sound symbolic word allowed participants to capitalize on the relevant features of context to more efficiently infer the meaning of an unknown word.

Having established that sound symbolism is a word feature that people can use for word learning, how big an effect this clue to word learning will have in the real world is of importance. Or more specifically, what portion of the English language is sound symbolic? The answer to this second question, to date, has not been determined. Unfortunately, there is no exhaustive list of English sound symbols. However, I attempted to estimate the importance of the effect for sound symbolism in English, by surveying the 5,000 most frequent English words listed in Carroll, Davies and Richman's *Word Frequency Book* (1971) for words containing the 13 initial sound symbols used in this research (words with the same morphological base were counted as a single word). Of these words, 213 contained the 13 initial sound symbols used in this research, and 51 or 24% were sound symbolic. With this large of a proportion of sound symbolic words in English sound symbolism could indeed be a key player in vocabulary growth, especially when considering that the number of possible meanings are infinite.

In this research I have discussed sound symbols as units of sound (phonemes) that carry meaning. Traditionally, however, morphemes have been considered the smallest units of language that carry meaning. For example, in the word "unwrap" both "un" and "wrap" would be considered morphemes as each part contributes distinct elements of meaning to the word. The question, then, is whether sound symbolism is really a subset of phonology, morphology or something entirely different? This is a running question in the area of sound symbolism with advocates of all three positions. Most researchers examining assonance (initial consonants or consonant clusters) and rime (a vowel and the final consonants) have not called their analyses morphology, but instead have decided to use a distinctive term such as *phonestheme* (Bolinger, 1950). Others have suggested that these sounds that carry meaning are submorphemes (McCune, 1985). Still, others (Rhodes and Lawler, 1981) are of the opinion that assonance-rime is simply a case of derivational morphology. Bolinger suggests that

> No sharp line could be drawn between those collocations of phonemes which, through relative uniqueness of one sort or another (unique context, unique content, unique position, etc., or combinations), show comparatively little deviation in meaning, and those which are shared by so many occurrences under such varied conditions that we must either admit extensive homonymy or not consider them as morphemes at all, in the sense that a morpheme depends on consistency of meaning. . . If we can show enough regularity in use, a rime or an assonance should be, or come very near to being, a morpheme. (p. 131).

Bolinger then proceeded to examine words beginning with the [gl-] sound to demonstrate that only half of the English words containing the [gl-] sound have meanings corresponding to 'visual phenomena.' As my analysis of the 13 sound symbols focused on in this study suggest, that this figure may be closer to a quarter of the words sharing sound-meaning relations. Bolinger concluded that "where such u nrelated rimes and assonances occur, and intersect others that are related and meaningful, we have sub-morpheme differentials" (p. 133). Sound symbolism, then, seems to be more than phonology, as it carries meaning, but less than morphology because the one-to-one relationship between sound and meaning is not as strong or as stable

Whether sound symbols are processed and stored in the lexicon more like phonemes, morphemes or something separate is another question. Some have begun to examine how sound symbolism influences lexical processing. Research has suggested that the presence of sound symbolism speeds reaction times. Sereno (1994) examined a type of sound symbolism that suggests that specific phonological features are linked to different syntactic categories. Specifically Sereno examined the sound symbolic phenomenon that nouns more often contain back vowels and verbs more often contain front vowels. This distribution is only true in high-frequency words, however. Using 12 university students and 32 nouns and verbs of high and low frequency, Sereno found that for both high and low frequency words nouns that had back vowels were categorized faster than nouns that had front vowels, and verbs that had front vowels were categorized faster than verbs that had back vowels. Thus, sound symbolic information available in words seems to influence word processing. As this type of research has just begun to be examined, I am limited in the kinds of conclusions I can draw regarding the role that sound symbolism and its relationship to morphology might play in lexical processing. I believe that this question cannot be answered until we have not only examined more in depth how sound symbolism effects lexical representations and processing but have also come to a conclusion as to how morphology effects lexical representations and processing.

Sound symbolism then seems to be a word property that affects word learning. Concreteness, word difficulty and morphological transparency are others. The question of where sound symbolism fits within these other word properties is of concern. Sound symbols tend to be concrete. Most of the sound symbols that I have encountered in my research have referred to concrete referents. As stated by Ciccosto (1991) "sound carries meaning insofar as it references motor sequences within the hearer's mind, iconically representative of expressed behavior and activity" (p.104). Overall, then, sound symbolisms may lead to decreased word difficulty as they not only provide a clue as to the meaning of a word but are also likely to signify a concrete referent. Sound symbols are also similar to morphemes in that they carry meaning, and allow for word learning in the absence of contextual information, as demonstrated in Studies 1 through 4 of this research. Sound symbolism, then, is a complex phenomenon encompassing many aspects of language; exactly how it fits into the structure of language is a question still to be answered.

Based on these compelling results sound symbolism and its effect on word learning warrant further investigation. In the near future I would like to revise the Sound Symbolism Scale for use with children in order to examine, developmentally, children's ability to use sound symbolic information to learn the meanings of unknown words. The use of sound symbolic information to acquire word meaning may only emerge when the child possesses enough phonological awareness to be able to make explicit use of the phonological information inherent within words. Further, given that the relationship between sound symbolism and context was not fully clear in Study 5, a more thorough examination of sound symbolism's effect within different levels of context, directive, generally directive and nondirective, is in order.

I believe that research in this area will lead to new and exciting information about the process of word learning. I also believe that sound symbolism may be a strategy like morphological analysis that teachers can instruct children to use. Moreover, there are questions regarding the ability of sound symbolism to serve as a vehicle in semantic priming. The question of sound symbolism place in puzzle of word learning is vast and open and there are countless studies left to be done.

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