THE EFFECTS OF SENTENCE CONTEXT ON THE PROCESSING OF FIGURATIVE LANGUAGE IN AN ADULT POPULATION WITH NORMAL COGNITION

by

ROSEMARY MICHELLE MCPHEE
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Department of Audiology & Speech Sciences
The University of British Columbia
Vancouver, Canada

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The purpose of this study was to investigate how contextual information, prior to an idiomatic expression, affects the automatic processing of idiomatic expressions in an adult population with normal cognition. An on-line word-monitoring reaction-time task was used in which subjects were required to identify target words in spoken passages. The target words were final words from six idiomatic expressions. The idiomatic expressions were embedded in contexts biasing them to either a figurative interpretation, a literal interpretation, or an ambiguous context in which neither a figurative or a literal interpretation could be predicted from the contextual information preceding the idiomatic phrase. A filler condition was also presented in which target words were presented without the idiomatic expressions. It was found that subjects responded faster to target words in the idiomatic, literal, and ambiguous context conditions than to target words in the filler condition. Reaction times to target words in the literal context condition were faster than target words in the ambiguous context condition. Reaction times to target words in idiomatic context conditions were faster than ambiguous context conditions and slower than literal context conditions; however, this difference was not significant. These results support the Key Word Hypothesis which assumes that idiomatic expressions are processed literally until the key word is encountered. When the key word is encountered, the figurative interpretation is triggered.
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A. INTRODUCTION

The comprehension of idiomatic expressions (e.g., "smelled a rat") has been a challenging topic for researchers interested in figurative language processing. Recent evidence suggests that idioms are not homogeneous, as they differ by a number of variables which in turn affect the way they are processed (Janus and Bever, 1985; Mueller and Gibbs, 1987; Popiel and McRae, 1988; Gibbs, Nayak, and Cutting, 1989). There are currently four models under debate which propose how literal and figurative interpretations of idioms are processed (Swinney and Cutler, 1979; Estill and Kemper, 1982; Gibbs, 1986; Schweigert and Moates, 1988; Cacciari and Tabossi, 1988). This paper will discuss these topics in further detail with respect to the processing of idiomatic expression, but first we will turn to the clinical application of figurative language interpretation.

1. Definition and Characteristics of Alzheimer's Disease

Assessment of figurative language through the use of idiom, proverb, and metaphor interpretation is one area of standard diagnostic evaluation frequently included in the battery of tests used to assess the mental status of patients with Alzheimer's Disease (AD) and right hemisphere brain damage. AD is a progressive irreversible disease of the central nervous system, characterized by severe intellectual, sensory, and motor deterioration (Edwards, 1993; Kociol and Schiff, 1989). It affects the elderly population, with the initial symptoms often appearing at around age 55 (Edwards, 1993). People with AD and right hemisphere brain damage are known to have deficits in areas involving memory...
and word finding, semantic analysis, higher order mental processes, and relating meanings to situations (Bayles, 1986; Edwards, 1993; Kociol and Schiff, 1989). They are also known to give inappropriate interpretations of figurative language found in metaphors and idioms. For example, Van Lancker and Kempler (1987) and Kempler, Van Lancker, and Read (1988) investigated the comprehension of figurative language in adults with left hemisphere brain damage, right hemisphere brain damage, and AD using a picture-matching auditory comprehension task. Subjects were required to match familiar and novel phrases to line-drawing pictures. Results showed that subjects with AD and right hemisphere brain damage did significantly better on matching novel phrases requiring lexical-syntactic analysis (novel literal phrases) than matching familiar phrases (figurative phrases). Subjects with left hemisphere brain damage revealed an opposite pattern: they performed significantly better on familiar phrases than on novel phrases. On the basis of these results, Kempler, Van Lancker, and Read (1988) suggest that people with AD and right hemisphere brain damage have difficulty understanding the abstract language of idioms and proverbs. Subjects more often chose a concrete response, suggesting that AD patients fixate on single words from the idiom while interpreting the phrase and have difficulty processing the overall pattern and complex meaning of the idiom.

Tests such as the one used in the study by Van Lancker and Kempler (1987) and Kempler, Van Lancker, and Read (1988) are currently being used to diagnose patients with possible and probable AD and to assess patients with right hemisphere brain damage. These tests usually require the patient to give an interpretation of an idiom or familiar phrase either verbally, in writing, or in a multiple choice format (i.e., a phrase-picture identification task or a verbal multiple choice format). Because these tasks are an end-product of numerous cognitive
operations involved in language processing, or off-line tasks, it is difficult to identify where the source of breakdown occurs. These tasks do not reveal the nature of initial retrieval or initial comprehension of meaning, as they are distant in time and in terms of mental processes from initial comprehension. On the other hand, an on-line task requires a response to some aspect of input during the initial meaning activation and thus reflects the more automatic processes involved in language comprehension (Tompkins, Broada, and McGarry, 1992).

Very few researchers have investigated the on-line processing of idiomatic expression in subjects with right hemisphere brain damage or subjects diagnosed with probable or possible AD. The present study is intended as a pilot study to obtain normative data on the on-line processing of figurative language in an adult population with normal cognition. Following this study, a similar study will be carried out to examine the on-line processing of figurative language in an adult population diagnosed with possible or probable AD. This study incorporates an on-line word-monitoring reaction-time task which was patterned after the one used by Tompkins, Broada, and McGarry (1992) with brain-damaged and normal aging adults. The task requires subjects to listen for the presence of a target word in a spoken sentence. The target word is the last noun in an idiomatic phrase (i.e., "smelled a rat"). The idiomatic phrase is embedded in a sentence context which biases the interpretation of the idiom to either a figurative interpretation, a literal interpretation, or neither a figurative or literal interpretation. There is also a context condition in which the initial part of the idiom is included, but the target word is replaced with a word that is semantically and syntactically appropriate.

This study also examines the association between on-line and off-line processing of figurative language using an off-line picture identification task similar to the one used in the Familiar and Novel Language Comprehension Test (FANL-
(Kempler and Van Lancker, 1990). This task requires subjects to match a spoken idiomatic expression to one of four line drawings. In carrying out this study a better understanding of the automatic processing involved in idiomatic comprehension will be gained.

This thesis consists of four chapters. In Chapter One, the definition of and differences between idioms will be discussed, as well as how these differences affect the processing of idiomatic expressions. Next, a review of current theories on idiom storage and processing will be discussed. This chapter will end with hypotheses about figurative language comprehension in an adult population. Chapter Two will describe the apparatus and procedures for data collection and analysis. Chapter Three will present the results of the analysis and Chapter Four will discuss these results and how they relate to figurative language processing in an adult population.

B. LITERATURE REVIEW

1. Definition of and Differences between Idioms

Idioms are defined as accepted nonliteral phrases whose meanings cannot be derived from the meanings of their individual compositional parts (e.g., "smelled a rat" = "to become suspicious"; "spilled the beans" = "to tell a secret") (Chafe, 1970; Seidl and McMordie, 1988; Wood, 1986). Within the past decade, however, research has demonstrated that, for many idiomatic phrases, there is some overlap between the literal interpretation and the figurative interpretation (Gibbs and Nayak, 1989; Gibbs, Nayak, and Cutting, 1989) and that individual lexical items can contribute to the figurative interpretation of the idiomatic phrase (Gibbs, and Gonzales, 1985; Gibbs, Nayak, and Cutting, 1989). The extent to which these factors contribute to the figurative interpretation can vary and evidence
has shown that these factors affect the processing of idiomatic expressions (Gibbs and Nayak, 1989; Gibbs, Nayak, and Cutting, 1989; Popiel and McRae, 1988). For example, Gibbs and Nayak (1989) and Gibbs, Nayak, and Cutting (1989) examined how similarity between idioms' literal and figurative interpretations affects processing. They found that idioms whose literal interpretations were closer to their corresponding figurative interpretations were processed faster than idioms whose literal and figurative meanings were unrelated or idioms that did not have a literal interpretation. The researchers suggest that this is the result of assigning meanings to individual parts of the idiom as processing is taking place and integrating these meanings into the overall figurative meaning of the phrase.

These findings are similar to those found by Gibbs, Nayak, and Cutting (1989), who investigated the influence of idiom decomposition on idiom processing. They found that decomposable idioms (i.e., idioms whose individual parts contribute to the overall meaning of the idiomatic phrase) are processed faster than nondecomposable idioms. Gibbs, Nayak, and Cutting (1989) propose that decomposable idioms are easier to interpret because people can analyze individual parts of the idiomatic expression and combine them to form the idiomatic meaning. For example, in the phrase "lay down the law", "law" refers to the rules of conduct in certain situations and the "laying down" refers to the act of invoking the rules. On the other hand, nondecomposable idioms have to be learned and processed in their entirety, as in, for example, "shoot the breeze".

Gibbs and Gonzales (1985) investigated the effects of syntactic frozenness on idiom processing. Syntactic frozenness refers to the extent to which idiomatic expressions maintain their figurative interpretations in various syntactic forms. A syntactically frozen idiomatic expression appears to be quite restricted in the form it can take (e.g., "take under your wing"; "jump in the lake") whereas a more flexible
idiomatic expression is less restricted in the form it can take (e.g., "bury the hatchet" - "the hatchet was buried"). They found that syntactically frozen idioms are processed faster than idioms which are syntactically more flexible and that subjects have better recall for idioms that are syntactically flexible. The authors account for this by proposing that extra processing is required to interpret idioms which are syntactically more flexible, thus increasing their saliency and leading to better recall.

Other factors which have been found to influence the processing of idioms are: the number of meanings the idiom conveys (Mueller and Gibbs, 1987); the familiarity of their figurative interpretations (Schweigert and Moates, 1988); the familiarity of their literal meanings (Popiel and McRae, 1988); and their conventionality or novelty (Janus and Bever, 1985). Mueller and Gibbs (1987) found that idioms with more than one figurative meaning (e.g., "on the rocks" with its figurative meanings of "in trouble" and "over ice") are processed faster than idioms with only one figurative meaning. From these results, they suggest that idioms with multiple figurative meanings have multiple lexical entries corresponding to each meaning. Due to the multiple lexical entries, Mueller and Gibbs (1987) propose that idioms with multiple meanings are accessed faster than idioms with only one meaning because there is a higher probability of retrieving one of these entries during the search process.

Schweigert and Moates (1988) investigated whether or not the degree of idiom familiarity has an effect on idiom processing. Their results suggest that idioms which are familiar to subjects are processed with greater ease than idioms which are less familiar. They propose that these results suggest that idiomatic meanings are processed as discrete lexical units.

The familiarity of an idiom's literal meaning has also been found to affect the
processing of idiomatic expressions. Popiel and McRae (1988) had subjects rate literal and figurative meanings of idioms with respect to how familiar they are and how frequently they occur in the English language. Their results showed that idioms differed more on literal ratings than on figurative ratings. Based on these results, Popiel and McRae (1988) suggest that processing is most likely affected by this variable and that it may be a more important variable than the frequency with which an idiom is used figuratively.

The results from these studies suggest that idioms are not a homogeneous set. Different variables, including the degree of overlap between their literal and figurative meanings (Gibbs and Nayak, 1989; Gibbs, Nayak, and Cutting, 1989), whether or not the idiom has a literal interpretation (Gibbs, Nayak, and Cutting, 1989), the syntactic frozenness and the degree to which the idiom can decompose (Gibbs, and Gonzales, 1985; Gibbs, Nayak, and Cutting, 1989), the number of meanings the idiom conveys (Mueller and Gibbs, 1987), the familiarity of their figurative interpretations (Schweigert and Moates, 1988), the familiarity of their literal meanings (Popiel and McRae, 1988), and their conventionality or novelty (Janus and Bever, 1985) all affect the way idioms are retrieved and processed.

2. The Role of Contextual Information

Recent research focusing on the extent to which context contributes to the interpretation of idiomatic expressions suggests that context plays a crucial role in comprehension of idiomatic expressions (Gibbs, 1980; Schweigert and Moates, 1988; Nippold and Martin, 1989). For example, Nippold and Martin (1989) asked adolescent students to write the definition of idiomatic expressions presented in short contexts and in isolation. They found that idioms in contexts were defined more correctly than idioms in isolation. Gibbs (1980) and Schweigert and Moates
(1988) have also found evidence suggesting that context plays a crucial role in the comprehension of the interpretation on idiomatic expressions. Evidence from these studies will be discussed in further detail below in conjunction with the different models proposed for ways in which idioms are processed.

3. Theories of Idiom Storage and Processing
   a. Representation of Idioms in the Lexicon

   Differences within the idioms themselves, as well as the effect of context on idiom processing, have led to controversy among researchers with respect to storage, access, and retrieval of idiomatic expressions. The majority of recent evidence examining the processing of idioms supports the assumption that idioms are stored, accessed and retrieved as single lexical units (Ortony, Schallert, Reynolds, and Antos, 1978; Swinney and Cutler, 1979; Estill and Kemper, 1982; and Tompkins, Broada, and McGarry, 1992). This means that an idiomatic expression and its associated definition are stored in the lexicon as a unit. In order to access and retrieve the idiom from the lexicon, it must be processed as a unit.

   However, there are researchers who oppose this view. Cacciari and Tabossi (1988) suggest that idioms are encoded as strings of words whose figurative interpretation becomes available once sufficient input identifies the word pattern as an idiomatic string. They examined this hypothesis using an on-line lexical decision task in which subjects were presented with sentences that included an idiomatic phrase. The contextual information in the sentence did not bias the idiomatic phrase to either a figurative or literal interpretation. Each sentence was paired with three target words: one semantically associated with the idiomatic meaning of the phrase, one semantically associated with the literal meaning of the phrase, and a control target which was unrelated. Cacciari and Tabossi found that
when idioms were highly predictable (i.e., the idiomatic meaning is activated before the last word of the idiom is heard) the idiomatic interpretation was processed faster than the literal interpretation. However, when idioms were unpredictable (i.e., the idiomatic meaning is not available until the last word of the idiom is heard), the literal meaning was processed before the idiomatic meaning and 300 milliseconds later both meanings were activated. The experimenters interpret these results by suggesting that because the figurative interpretation of an idiom is made up of the same lexical items as its literal interpretation, when listeners encounter an idiom, they begin to process the word string literally until sufficient information is provided for the subject to recognize the word string as an idiom. When this occurs, Cacciari and Tabossi propose, the idiomatic word string is interpreted according to its figurative meaning.

These contradicting assumptions, i.e., that idioms are stored as single lexical units and that idioms are encoded as word strings, underlie four current theories proposed to explain the processing of idiomatic expressions. The more popular assumption that idioms are stored, accessed, and processed as single lexical units lays the groundwork for the Literal Processing Model, the Simultaneous Processing Model, and the Idiom Processing Model. The assumption that idioms are encoded as word strings lays the groundwork for the Key Word Hypothesis proposed by Cacciari and Tabossi (1988). These theories and evidence supporting them will be discussed in some detail below.

b. Theories of Idiom Processing

i. Literal Processing Model/Idiom List Hypothesis

The Literal Processing Model is one of the earliest proposed models that describes how idioms are processed. It claims that when an idiom is encountered,
the literal interpretation is processed first. If the literal meaning does not coincide with the context, then the idiom's figurative meaning is assigned (see figure 1 below). Most of the evidence supporting this model comes from literature dating back to the late 1960's and early 1970's (Weinreich, 1969; Fraser, 1970; Bobrow and Bell, 1973).

Weinreich (1969) described the processing of idioms in terms of transformational grammar. He proposed that the lexical dictionary of each language is complemented by an idiom list. The idiom list contains idiomatic strings of morphemes, along with their corresponding phrase markers and figurative definitions. Weinreich suggested that when an idiom is encountered, each word in the idiomatic string is assigned its literal semantic feature from the lexical dictionary. The idiomatic verb phrase is then compared to the idiom list to determine if there is a match to any of the strings housed there. If there is a match and if the contextual requirements for the idiomatic phrase are satisfied, then the idiom comparison rule replaces the original semantic features with features that give the phrase its figurative interpretation. If the contextual requirements are not
satisfied, then the idiom comparison rule does not operate and the phrase retains its original literal semantic features.

Fraser (1970) also approached the processing of idioms using a framework based on transformational grammar. He claimed that the syntactic deep structure of an idiomatic expression is the same for both its literal and figurative interpretations. Fraser based this on the observations that (i) the phonological shape of both the literal and figurative interpretations of idioms are the same, thereby producing identical phonetic outputs and (ii) many idioms undergo some syntactic transformation, such as passivization or action nominalization. Fraser suggests that the figurative interpretation of idioms are represented in the lexicon in much the same way as a single word: they have a set of insertion restrictions and a set of semantic markers for each entry. The only difference between an idiomatic phrase and a word is that the idiomatic phrase has a string of complex symbols consisting of syntactic features and phonological representations, whereas a word has only one complex symbol.

Fraser went on to suggest that the figurative semantic representation of idiomatic phrases is accessed only when the literal representation of the phrase has been rejected due to a noncompatibility between its literal semantic representation and the context to which it is associated. Once the literal interpretation has been rejected, the lexical entry of the figurative interpretation is accessed and accepted based on compatibility with its corresponding context.

Weinreich (1969) and Fraser (1970) base their models of idiom representation and processing on the theory of transformational grammar. Weinreich and Fraser propose that when an idiomatic phrase is encountered the figurative interpretation is only accessed once the literal interpretation has been rejected due to noncompatible contextual information. This theory was not tested
by Weinreich and Fraser; it was only proposed. Bobrow and Bell (1973), however, carried out research which they claim supports the initial access of literal interpretations when idiomatic phrases are encountered.

Idiom List Hypothesis.

Bobrow and Bell (1973) proposed a hypothesis, known as the Idiom List Hypothesis, which is closely related to the Literal Processing Model. It claims that there are two distinct modes for processing idiomatic expressions. These modes enable people to process idiomatic ambiguities either literally or figuratively. For example, when a person is in a Literal Processing Mode, the idiomatic phrase is processed literally; when a person is in a Figurative Processing Mode, the idiomatic phrase is processed figuratively (see figure 2 below).

![Diagram of Idiom List Hypothesis]

Figure 2. Idiom List Hypothesis: Language is processed through a Literal Processing Mode until a figurative string of words is encountered and the literal meaning does not coincide with the context. At this point the person switches over to a Figurative Processing Mode.
Bobrow and Bell (1973) conducted a study on the processing of idiomatic expressions to test the Idiom List Hypothesis. An off-line phrase definition task was used in which subjects were biased to either a literal processing mode or an idiomatic processing mode before being presented with an ambiguous idiomatic sentence. Once the ambiguous sentence was read, subjects were required to think of two possible meanings that corresponded to the idiomatic sentence and indicate which meaning they came up with first.

Results indicated that when subjects were exposed to the literal set condition they would more often give the literal meaning of the idiomatic phrase before the figurative meaning. When the idiomatic set condition was presented, the subjects more often gave the figurative interpretation of the ambiguous sentence before the literal interpretation. Based on these results, Bobrow and Bell (1973) suggest that whether an idiomatic phrase is processed literally or figuratively depends on which mode the person is in. Therefore when a person is in a Literal Processing Mode and an ambiguous sentence is encountered, it will initially be processed using a literal processing strategy. If the person is in a Figurative Processing Mode, the ambiguous sentence will be processed using a figurative processing strategy.

Because the majority of English communication is literal, the Idiom List Hypothesis would claim that the Literal Processing Mode is the default processing mode. Hence, for the most part, people are in a Literal Processing Mode. When figurative speech is encountered, such as an idiomatic phrase, the literal interpretation will be processed first and then rejected because it does not "fit" the surrounding context. When this occurs one will switch into the Figurative Processing Mode and the idiomatic ambiguity will be processed figuratively.

Bobrow and Bell's Idiom List Hypothesis, which assumes that people
"switch" into a Figurative Processing Mode once they have encountered figurative language is a valid assumption, suggesting that once an idiomatic expression is heard in a conversation people are more inclined to interpret ambiguous speech as figurative. However, the task Bobrow and Bell chose to use in their experiment is a post-perceptual task. It measures the final, conscious access of material and does not necessarily examine perceptual processes or how the final interpretation was achieved. Furthermore, subsequent research concerning contextual information and idiom processing does not support this model. Other studies have found evidence suggesting that figurative interpretations of idioms are available just as fast, if not faster, than their corresponding literal interpretations (Ortony, Schallert, Reynolds, and Antos, 1978; Swinney and Cutler, 1979; Gibbs, 1980; Estill and Kemper, 1982). Work done by Swinney and Cutler (1979), Estill and Kemper (1982), and Tompkins, Broada, and McGarry (1992) shows that literal and figurative interpretations of idiomatic expressions are processed simultaneously, thus supporting a model called the Simultaneous Processing Model. This model will be discussed in greater detail below. Ortony, Schallert, Reynolds, and Antos (1978), Gibbs (1980,1986), and Schweigert and Moates (1988) have found evidence which is exactly opposite to that suggested by the Literal Processing Model. Their evidence suggests that figurative interpretations of idiomatic expressions are accessed, retrieved, and processed prior to their corresponding literal interpretations, thus supporting a model called the Idiomatic Processing Model. This model will be discussed following the discussion on the Simultaneous Process Model.

ii. Simultaneous Processing Model

The Simultaneous Processing Model claims that when an idiomatic phrase
is encountered, its literal and figurative meanings are accessed, processed, and retrieved simultaneously (Swinney and Cutler, 1979; Estill and Kemper, 1982; and Tompkins, Broada and McGarry, 1992). Once the meanings are drawn from the lexicon, both are examined with respect to the surrounding contextual information. Based on this information, one interpretation will be accepted and integrated into the text, while the other interpretation will be rejected (see figure 3 below). Evidence to support the Simultaneous Processing Model has been documented in several studies, some of which will be discussed below (Swinney and Cutler, 1979; Estill and Kemper, 1982; and Tompkins, Broada and McGarry, 1992).

Figure 3. Simultaneous Processing Model: States that when an idiomatic expression is encountered, its literal and figurative meanings are processed simultaneously regardless of the surrounding contextual information.

Swinney and Cutler (1979) conducted a study to determine how people access, store, and comprehend idiomatic expressions using a phrase classification task. Subjects were required to judge whether short strings of words were natural meaningful phrases in English. This judgement was to be carried out as quickly as
possible. The word strings consisted of idiomatic and literal phrases. The literal phrases were created by replacing one word from the idiom with another word while maintaining a grammatically correct phrase.

Results indicated that subjects judged idioms as acceptable faster than their matched controls. Based on these results Swinney and Cutler (1979) suggest that idiomatic phrases are accessed and comprehended both literally and figuratively at the same time. They argue that if idiomatic expressions are initially processed literally, then no significant difference would be found between the judgement ratings of the idiomatic phrases and their matched control phrases. This would also be the case if idiomatic expressions were computed from their individual lexical items. Because subjects judged the idiomatic expressions as grammatically correct faster than the matched controls, Swinney and Cutler (1979) claim that idiomatic phrases are accessed, retrieved, and processed using the Simultaneous Processing Model and are stored as discrete lexical units.

Estill and Kemper (1982) used a reaction-time task to investigate the automatic processing involved in interpreting idiomatic expressions. Subjects were presented with cue words which corresponded to target words in one of three ways: (i) by being identical to the target word, (ii) by rhyming with the target word, or (iii) by being within the same semantic category as the target word. For example, "walls" from the idiomatic expression "climbing the walls" was cued with either "walls", "falls" or "part of a building". The target words were always the last words in the idiomatic expressions. Idiomatic phrases were embedded in sentences which biased the listener to either a literal interpretation, a figurative interpretation, or an ambiguous interpretation. A control context was also presented in which the target word was in a nonidiomatic expression. Subjects were required to identify target words that corresponded to the cue words by
pressing a response button as quickly as possible upon hearing them in the sentence.

Results indicated that subjects detected target words faster in idiomatic expressions than in control nonidiomatic expressions. No significant reaction-time differences were exhibited among idiom target words presented in literal contexts and figurative contexts. Estill and Kemper (1982) explained these results based on the notion that idioms are stored, accessed, and processed as discrete lexical units regardless of surrounding contextual information. They claimed that interpretations of idiomatic phrases, whether figurative or literal, are retrieved faster than interpretations of nonidiomatic phrases because in the latter, interpretations must be derived by taking each word's individual meaning and constructing a meaning via that route. Estill and Kemper (1982) state that all meanings of idiomatic phrases are accessed and retrieved using the Simultaneous Processing Model. The proper meaning (literal or figurative) is then determined by examining the surrounding contextual information.

A more recent study, carried out by Tompkins, Broada, and McGarry (1992), investigated the automatic on-line processing of idiomatic expressions in unilateral right and left brain-damaged and normal aging adults. Subjects were required to identify target nouns from familiar idiomatic phrases that were embedded in different sentence contexts. The sentence contexts biased the interpretation of the idiomatic phrases to either a figurative or literal interpretation. A control context was also used in which the target noun was embedded in a sentence without its corresponding idiomatic phrase.

Results from this study are similar to those found by Estill and Kemper (1982). Tompkins et al. (1992) found that subjects responded faster to target words in idiomatic phrases with both figurative and literal contexts than to target words in
nonidiomatic phrases. There was no significant reaction-time difference on target word identification when the idiomatic phrase was embedded in either a literal biasing context and a figurative biasing context. These results support their argument that idiomatic phrases are recognized as discrete lexical units regardless of the surrounding context and that only a certain portion of the idiomatic phrase is required to access the idiomatic phrase. They also argue that the similarity in reaction-times for the target word embedded in both literal and figurative contexts supports the Simultaneous Processing Model.

Results from these three studies (Swinney and Cutler, 1979; Estill and Kemper, 1982; and Tompkins, Broada and McGarry, 1992) support the Simultaneous Processing Theory, which proposes that the literal and figurative meanings of idiomatic expressions are accessed, retrieved, and processed simultaneously. Gibbs (1985), however, has disputed evidence supporting the Simultaneous Processing Model. He pointed out that Swinney and Cutler's (1979) research did not control for familiarity of their idiomatic expressions used in testing. This factor must be taken into account as it has been found to influence the processing of idiomatic expressions (Popiel and McRae, 1985; Schweigert and Moates, 1988). Gibbs also states that the results from Estill and Kemper (1982) may be affected by subjects examining the meanings of the target words without actually combining the additional words in the sentence to come up with a literal interpretation. If this occurred, the figurative and literal meanings of the idiom would not have been processed simultaneously.

Tompkins, Broada, and McGarry's (1992) results are also suspect. The idioms in their study were embedded in contexts which biased the expressions either figuratively or literally. When one examines the stimuli text for the figurative context condition, it can be seen that the text prior to the idiomatic phrases did not
consistently bias the idiomatic phrases to their figurative interpretations, as can be seen in the example: "My lawyer was studying my contracts. When he smelled a rat, he warned me". Here the initial sentence is ambiguous to the interpretation of the idiom. It is not until the text after the idiomatic expression is stated that a figurative interpretation is construed. This is also apparent in Estill and Kemper's (1982) on-line study. For example, in the sentence: "By the fourth day in the hospital, Orville was climbing the walls to go home" the figurative interpretation is not evident until the entire sentence is heard. As both these studies involve on-line tasks, it is crucial for the context prior to the idiomatic phrase to bias the interpretation either literally or figuratively.

Tompkins et al. (1992) also advised caution in the interpretation of their results, stating that only a small number of experimental stimuli were used repeatedly and that the results may have been due to the familiarity of the expression rather than the fact that the idioms were idiomatic. Tompkins et al. suggested that similar results may have been obtained using nonidiomatic familiar phrases, such as "cup of coffee." Although evidence from their study supports the Simultaneous Processing Model, there is not sufficient evidence to conclude that both literal and figurative interpretations of the idiomatic expression are always available simultaneously.

iii. Idiomatic Processing Model

Evidence has been cited to support the Idiomatic Processing Model, which claims that when an idiomatic expression is encountered, the figurative interpretation of the idiom is accessed, retrieved, and processed before the literal interpretation. If, and only if, the figurative interpretation is inappropriate for the surrounding context, will the literal interpretation of the idiom be activated (Ortony,
Schallert, Reynolds, and Antos, 1978; Gibbs, 1980, 1986; Schweigert and Moates, 1988). Thus, when a person encounters an idiom, it will automatically be interpreted using the figurative meaning. If the context is appropriate for this meaning then processing will continue to take place. If the context is inappropriate for this meaning, then the figurative meaning will be rejected and the literal meaning adopted (see figure 4 below). Based on this hypothesis, one can assume that idiomatic expressions will be processed faster when they are in a figurative context than when they are in a literal context.

![Diagram](image)

**Figure 4.** Idiomatic Processing Model: Idiom is processed initially by its figurative interpretation. If the figurative interpretation does not fit the context, then it is processed literally.

Ortony et al. (1978) investigated the effects of contextual information on idiomatic expressions using a reaction time task. Undergraduate students were presented with short paragraphs on a computer screen. The contexts of the paragraphs biased the interpretation of idiomatic expressions to either literal or figurative interpretations. Subjects were instructed to read the paragraph as it showed up on the computer screen. The amount of time it took for subjects to read each idiomatic expression was measured. It was assumed that this measurement reflected subjects' ability to understand the idiomatic phrase. A control context was used in which the idiomatic expressions were replaced by literal paraphrases (e.g.,...
"let the cat out of the bag" was replaced with "revealed a secret").

Ortony et al. found that subjects understood idiomatic phrases faster in figurative contexts than in literal contexts. They suggested two explanations for this difference. The first explanation is the familiarity of idiomatic expressions. Ortony et al. claim that because idiomatic expressions are familiar strings of words, their common figurative interpretation will be processed faster than their literal interpretation. Thus, idiomatic expressions will be interpreted figuratively before being interpreted literally regardless of the surrounding context.

Ortony et al. also argued that figurative interpretations of idiomatic phrases are processed faster than literal interpretations because they have fewer processing demands. This argument is based on the assumption that idioms are stored as discrete lexical units. Therefore, an idiomatic expression with a literal interpretation will require more processing time than one with a figurative interpretation because each word's meaning must be accessed and retrieved individually in order to extract a coherent meaning. Ortony et al. thus claim that figurative interpretations of idioms are processed before literal interpretations of the same idioms regardless of the surrounding context.

Gibbs (1980) investigated the comprehension and recollection of idiomatic expressions using a paraphrase judgement task. Subjects were required to read a short story ending with an idiomatic phrase and then paraphrase the idiomatic phrase. The story biased the idiomatic expression to either a literal or figurative interpretation. The amount of time required to read the story and the amount of time required to make a paraphrase judgement was examined.

Results showed that subjects took less time to understand and make paraphrase judgements for idiomatic expressions in figurative contexts than for the same idiomatic expressions in literal contexts. These results suggest that literal
interpretations of idiomatic expressions take longer to process than figurative interpretations. Gibbs suggests that the additional time required to process literal interpretations of idioms may be due to the degree of conventionality, rather than how literal or metaphoric a sentence is. Hence, the more conventional an utterance is, the easier it will be to interpret in the appropriate context. The more unconventional an utterance is (i.e., literal use of an idiomatic expression), the more processing time will be required by a person to locate and verify some schemata of the sentence in memory and, thus, the greater amount of time will be required for the sentence to make sense in its context.

Based on his results, Gibbs (1980) predicted that if a person engages in extra processing to understand unconventional uses of idioms (literal uses), then on a recall test a person should have a greater recollection for idioms used in unconventional contexts than for idioms used conventionally. Gibbs suggested that the additional processing required in unconventional contexts makes the idiomatic expressions more distinctive. He investigated this prediction using a recall task in which subjects were required to recall the idiomatic phrase in stories which biased the interpretation of the phrase either literally or figuratively. Results indicated that subjects recalled the idiomatic phrase in the literal context with more accuracy than in the idiomatic context. There was no significant difference between the literal or idiomatic interpretation when paraphrases were substituted for the idiom. These results confirm Gibbs' prediction that people have better memory for unconventional uses of nonliteral language than for conventional uses.

Based on the above findings, Gibbs (1980) claims that when an idiomatic expression is encountered in an unconventional context (i.e., a literal context), it is analyzed automatically with respect to its conventional meaning and then at some point after, the literal, unconventional meaning is verified as appropriate based on
the context. The extra steps required to process idioms used unconventionally make the expression more distinctive in memory and, therefore facilitate recall. The conventional use of idioms is harder to recall, but easier to understand and incorporate into context than unconventional uses of the same idioms.

Gibbs’ reasoning is based on a theory of “levels of processing” developed by Craik and Lockhart (1972 in Lockhart and Craik, 1990) proposing that memory performance is enhanced as the analysis of information increases to deeper levels. For example, an "early sensory analysis" is carried out relatively automatically for the purpose of perception whereas a "deeper semantic analysis" requires more attention and yields information that is more memorable (Lockhart and Craik, 1990).

In a second study, Gibbs (1986) examined the role of the literal meaning of idiomatic expressions with respect to understanding idioms. Subjects were required to read stories which ended with an idiomatic expression. The story context biased the interpretation of the idiomatic phrase to either an idiomatic interpretation or a literal interpretation. After reading the stories, subjects were required to decide whether or not the story was meaningful. The time it took subjects to make the judgement decision was measured. The target word strings at the end of the stories were: (i) a literal interpretation of the idiomatic phrase, (ii) an idiomatic interpretation of the idiomatic phrase, (iii) an unrelated sentence, and (iv) a string of words that was not a meaningful English sentence.

Subjects took less time to make judgement decisions on contexts which biased idiomatic interpretations than about contexts which biased literal interpretations. Based on these results, Gibbs (1986) claims that it is not necessary to understand literal interpretations of idiomatic expressions before understanding their figurative interpretations. His subjects’ responses to the figurative targets
were facilitated when the conventional use of the idiom was used, whereas the responses to the literal targets were not facilitated. Gibbs suggests that the results from this study support the notion that when an idiomatic expression is encountered in a context that biases the literal interpretation, the nonliteral meaning of the idiom is interpreted automatically, before the literal meaning is derived.

More recently, Schweigert and Moates (1988) investigated the processing of idiomatic expressions in sentences which biased the idiomatic interpretation either literally or figuratively. They used a brief serial presentation task in which sentences were presented repeatedly for 100 msec at a rate of 1 presentation per second. The number of presentations required to read the whole sentence was measured. Subjects were also required to do a cued recall task.

Subjects required more presentations when the idiom had a literal interpretation than when the idiom had a figurative interpretation. There was no difference in the number of presentations required for the idioms in the figurative context and for the control condition which consisted of a sentence not containing the idiom. According to Schweigert and Moates, these results suggest that the figurative meaning of the idiom was retrieved and processed prior to the literal meaning. If the figurative interpretation was inappropriate for the context then the literal meaning was accessed and processed later. Schweigert and Moates interpreted the extra presentations required to read the sentence in a literal context as a reflection of the extra time the subjects needed to process the idiom literally.

Schweigert and Moates (1988) suggest that their results support the Idiomatic Processing Model. To rule out the Simultaneous Processing Model, Schweigert and Moates (1988) suggest that if the figurative and literal interpretations were processed simultaneously one would expect the sentences in
the control condition and the literal context to be processed with equal amounts of time because both of their meanings would be constructed by the individual words. This was not the case, as the literal context was processed slower than the control condition, suggesting that the idiom was processed figuratively before the literal meaning was retrieved, thus supporting the Idiomatic Processing Model. Subjects were also able to recall idioms in literal contexts with more ease than idioms in figurative contexts. These results suggest that the extra processing required to interpret an idiomatic phrase literally makes the idiom more distinct in a person's memory. Schweigert and Moates (1988) propose that these results best support the Idiomatic Processing Model.

Ortony, Schallert, Reynolds, and Antos (1978), Gibbs (1980, 1986), and Schweigert and Moates (1988) provide strong evidence supporting the Idiomatic Processing Model. Ortony et al.'s results, however, can be disputed as they did not actively control for the familiarity of the idiomatic expressions used in their test. However, Ortony et al. had subjects rate stimuli on the basis of the appropriateness of the context associated with the idiomatic expressions and only those stimuli rated highly appropriate were chosen. Thus, if an idiom was somewhat less familiar to a subject, contextual information may have aided in the interpretation. However, one would still expect processing to take longer for less familiar idiomatic expressions than for the familiar idiomatic expression. Schweigert and Moates (1988) controlled for the familiarity of the idiomatic expressions used in their study by using idioms that were rated as being very familiar in a pilot study carried out prior to their main study. The results from these four studies strongly suggest that the figurative interpretation of an idiomatic expression is processed prior to its corresponding literal interpretation, at least if the idiomatic expression is highly familiar.
iv. Key Word Hypothesis

The last model to be discussed in this paper was recently proposed by Cacciari and Tabossi (1988). It is called the Key Word Hypothesis. This model claims that when an idiomatic expression is encountered, it is processed literally until sufficient input from the idiomatic string triggers an idiomatic interpretation. Thus, the idiomatic phrase will only be recognized and interpreted as an idiom once key input has been accessed. Cacciari and Tabossi further claim that idioms are not encoded as separate entities in the mental lexicon and that access and processing of idioms will only take place once sufficient information renders a phrase idiomatic.

Cacciari and Tabossi (1988) carried out three experiments that examined how idioms are accessed and processed during comprehension. In the first experiment, subjects were presented with sentences that included a familiar idiomatic phrase that could be completed literally until the last word of the idiom was heard (e.g., "After the excellent performance, the tennis player was in seventh heaven." - "After the excellent performance, the tennis player was in seventh position."). The sentences did not bias the idiomatic phrase to either a literal or idiomatic interpretation. In other words, no contextual information biased the reader to the presence of an idiomatic phrase. Each sentence was paired with three target words: a target word semantically related to the idiomatic interpretation (e.g., HAPPY), a target word semantically related to the literal interpretation (e.g., SAINT), and an unrelated control target word (e.g., UMBRELLA).

Subjects were required to make a lexical decision task by responding to words presented on a computer screen after the last word of the idiomatic string was presented. Subjects were to indicate by pressing the space bar on the
computer when the stimulus was an actual word and to do nothing when it was a non-word. Filler sentences and words were presented so that subjects would not recognize a pattern.

Subjects responded faster to idiomatically related targets than to literally related targets. These results appear to support the Idiom Processing Model. However, Cacciari and Tabossi (1988) suggest that subjects may have been biased toward an idiomatic interpretation by some portion of the initial fragment of the idiomatic expression. Thus, the phrase would be identified as an idiomatic expression before the final word in the phrase was encountered. Because of this, a second experiment was carried out. In this second experiment, Cacciari and Tabossi (1988) looked at the interpretation of idiomatic strings that were not predictable until the final word of the string was heard. To determine the predictability of an idiom, Cacciari and Tabossi ran a pilot test in which subjects were given idiomatic strings which were cut off at either the third or second word from the end (e.g, "To be in..." or "To be in seventh..."). Subjects were then asked to complete each string. From this pilot test, Cacciari and Tabossi chose only those idioms which were not predictable until the final word of the string was present. In doing this, they ensured that the idiomatic phrase could not be processed figuratively until the last word of the string was heard. The idiomatic phrases were presented in sentences with their corresponding target words as in the first experiment and the same lexical decision task was carried out.

In the second experiment, however results opposite to those of the first experiment were found. Subjects responded faster to literal target words than to idiomatically related target words. These results contradict both the Idiomatic Processing Model and the Simultaneous Processing Model. Cacciari and Tabossi (1988) claim that these results reflect that unpredictable idioms (i.e., idioms that are
not recognized as idioms until the last word is given) presented in the absence of context are processed initially using the Literal Processing Model.

In a third experiment, Cacciari and Tabossi (1988) delayed the subjects' response by presenting the target word 300 milliseconds after the last word in the idiomatic expressions. This was done in order to examine if the idiomatic and literal interpretations would both be available after a short delay. They used the same stimuli as in experiment two and the same lexical decision task was carried out. Cacciari and Tabossi found that when a delay was imposed, subjects responded faster to both literal and idiomatic targets than to the control targets. There was no significant difference between the literal and idiomatic targets. Cacciari and Tabossi claim that, when idioms are presented in the absence of biasing information, it takes some time before the idiomatic interpretation is also accessed.

Overall Cacciari and Tabossi (1988) found that when idioms are highly predictable (i.e., the idiomatic meaning is activated before the last word of the idiom is heard) then the idiomatic interpretation is processed faster than the literal interpretation, which seems to support the Idiomatic Processing Model. When unpredictable idioms are processed without any contextual cues, the literal meaning is processed before the idiomatic meaning until some time later (300 milliseconds) when the idiomatic meaning is also activated. These results are not predicted by either the Idiomatic Processing Model or the Simultaneous Processing Model.

Based on these results, Cacciari and Tabossi (1988) propose an alternate hypothesis: the Key Word Hypothesis. They suggest that idioms are not encoded as separate entities in the mental lexicon, but as strings of words that become available once key input identifies the word pattern as an idiomatic string.
Because the idiomatic interpretation of an idiom is made up of the same lexical items as its literal interpretation, when listeners encounter an idiom, they begin to process the idiom literally until sufficient information is provided for the subject to recognize the idiomatic configuration. When this occurs, the idiomatic string is interpreted figuratively.

Cacciari and Tabossi (1988) propose that idiomatic phrases with both literal and figurative interpretations are initially interpreted literally until the key word, which assigns an idiomatic configuration to the phrase, has been accessed. If the key word occurs early in the phrase then by the end of the phrase only a figurative interpretation should be available. If the key word occurs at the end of the string (i.e., the last word), then the literal interpretation should be available before the figurative interpretation emerges.

Cacciari and Tabossi mention a number of unresolved questions with respect to with their model. The first concerns the identification of the key word in the idiomatic expression. The authors suggest that there may be some idioms in which the key word is difficult to identify or where the key element may be the co-occurrence of two or more words. The other problem deals with location of the key word if the idiomatic expression is syntactically altered (e.g., "the hatchet was buried by John"). Does the key word stay the same or does it change? Cacciari and Tabossi also did not take into account the influence of context on the recognition of an idiom, as the effect of context has been shown elsewhere to be significant.

SUMMARY

It has been shown that there is considerable controversy about the ways in which idioms are stored, accessed, retrieved and processed. While the majority of
researchers offer evidence which supports idiomatic phrases being represented in the lexicon as single lexical units, there is some evidence to support idiomatic phrases being encoded as word strings (Cacciari and Tabossi, 1988). There is also strong evidence supporting four theories proposed to explain ways in which idioms are processed: the Literal Processing Model which has the least recent evidence to support it; the Simultaneous Processing Model, the Idiom Processing Model, and the Key Word Hypothesis. This controversy surrounding idiom storage, access, retrieval, and processing is in part due to the differences within the idioms themselves (i.e., familiarity, frequency of use, degree of compositionality, etc.) and in part due to the effects of contextual information which both affect processing.

The Literal Processing Model has been rejected by most recent researchers who have found that the figurative interpretation of an idiomatic expression is processed just as fast if not faster than the literal interpretation (Swinney and Cutler, 1979; Gibbs, 1980; Tompkins, Broada and McGarry, 1992). The more recent Key Word Hypothesis has strong evidence supporting it, but identification of the key words for specific idioms is not clear. This hypothesis has also not yet accounted for the effects of context.

The Simultaneous Processing Model has more evidence in support of it than does the Literal Processing Model or the Key Word Hypothesis. However, Estill and Kemper (1982) and Tompkins et al. (1992) failed to control for the contextual information presented prior to the presentation of the idiomatic phrase. In many cases the contextual information biasing the idiomatic phrase to a figurative interpretation was ambiguous until the context after the idiomatic phrase was read. In both these studies it was crucial that the contextual information presented before the idiomatic expression biased the idiom either figuratively or literally. The research by Swinney and Cutler (1979) and Estill and Kemper (1982) also did not
control for the familiarity of idiomatic expressions. As mentioned above, familiarity affects the comprehension and processing of idiomatic expressions and should be controlled for in studies examining the access, retrieval, and processing of idiomatic expressions.

There is strong evidence supporting the Idiomatic Processing Model. Ortony, Schallert, Reynolds, and Antos (1978), Gibbs (1980, 1986), and Schweigert and Moates (1988) in some ways all controlled for the familiarity of the idiomatic expressions and used contextual information that was appropriate for their tasks. However, the majority of experimental evidence comes from off-line tasks. If this model is correct it should also hold for on-line processing tasks.

HYPOTHESES

The main purpose of this study is to investigate how contextual information, prior to an idiomatic expression, affects the on-line processing of idiomatic expressions in an adult population with normal cognition. An on-line word-monitoring reaction-time task in which subjects identify a given noun has been employed. The target word is the final word from one of six idiomatic expressions. The idiomatic expressions are embedded in contexts biasing them to either a figurative interpretation, a literal interpretation, or an ambiguous context in which neither a figurative or a literal interpretation can be predicted from the contextual information preceding the idiomatic phrase. In carrying out this study, a better understanding of the automatic processing involved in idiomatic comprehension will be gained.

A secondary issue in this study is to examine the association between on-line and off-line processing of figurative language using an off-line picture identification task. This task involves subjects matching a spoken idiomatic
Based on the Idiomatic Processing Model, which claims that the figurative interpretation of an idiomatic expression is processed before the literal interpretation, the following hypotheses are proposed:

1. Subjects will respond faster to target words in the ambiguous, literal, and idiomatic context conditions than to target words in the filler condition. This will occur because the ambiguous, literal, and idiomatic context conditions contain the idiomatic phrase whereas the filler condition only contains the target word. Based on the assumption that idiomatic phrases are stored, accessed, and processed as single lexical units, one would expect the reaction time for these three context conditions to be faster because access and processing will take place before the target word is heard. This prediction can also be made based on the assumption that idiomatic expressions are familiar strings of words. One would expect reaction times to be faster for target words in familiar word strings because there is more predictability of the target words being present than in unfamiliar word strings.

2. Subjects will respond faster to target words in contexts which bias idiomatic phrases to idiomatic interpretations than to the contexts which bias idiomatic phrases to literal interpretations and ambiguous contexts. This will occur because, based on the Idiomatic Processing Model, the figurative interpretation of an idiomatic expression will be processed prior to the literal and therefore subjects should respond faster.

3. Subjects will respond faster to target words in contexts biasing the literal interpretation of the idiomatic expression than to ambiguous contexts. This hypothesis is based on the assumption that the literal contextual information prior to the idiomatic expression will cue the subject to expect the target noun. In the
ambiguous context, subjects have no priming from the preceding context to facilitate processing.
CHAPTER TWO

METHOD

A. DESIGN

The on-line processing of six familiar idiomatic expressions in a normal aging population was examined using a word-monitoring reaction-time task. Subjects were required to listen for the presence of a specified target word in a short two sentence passage. When they heard the target word, they were to press a response button as quickly as possible. The target words were concrete nouns in final position of idiomatic phrases (e.g., "leaf" in "turned over a new leaf"). Each target word was presented visually and read aloud by the subjects.

Three experimental contexts (idiomatic, literal, and ambiguous with respect to the target word) were created in which the target words were presented in their respective idiomatic phrases. A fourth experimental context containing the target word without the idiomatic phrase was also presented. The four experimental context conditions were similar in length, position of the target word (if present), and syntactic structure and complexity in order to control for variability in the stimuli. Each presentation consisted of two sentences with the target noun embedded in the second sentence. Reaction-time data were recorded in the four experimental contexts which contained the target word. False responses for the ambiguous context without the target word were also recorded.

The subjects also participated in an off-line picture identification task which required them to match a spoken idiomatic expression to one of four line drawings. This task was administered to examine the association between off-line and on-line processing of figurative language.
B. SUBJECTS

Eighteen normal adults volunteered in this study. In view of the possibility of extending this study to one involving cognitively-impaired adults, all subjects were recruited from normal adults accompanying cognitively-impaired patients to the Clinic for Alzheimer Disease and Related Disorders at University Hospital in Vancouver, British Columbia. Initial contact was made by either the clinic coordinator or a nurse clinician inviting them to participate in the study. Once potential candidates agreed to participate, a formal introduction to the experimenter was given. The experimenter then gave a brief written and oral explanation of the study and what would be required of them. All potential subjects were then asked to sign a consent form (see Appendix A for consent form).

Subjects included in this study were from Vancouver and the surrounding areas. They were between the ages of 37 years, one month and 76 years, one month, with a mean age of 64 years, 5 months (see Appendix B for subject information). Their educational background ranged from nine years to 18 years of schooling. All of the subjects were female with the exception of one male. Two subjects were left-handed; however, one left-handed subject preferred to respond with the right hand. The remainder of the subjects were right-handed. Fourteen subjects spoke English as a first language. The remaining four spoke the following languages as their first language: Ukranian until age two, French until age seven, Dutch until age seven, and Norwegian until age 12. All subjects had the majority of their schooling in the English language and used English as their dominant language for communication. No subjects exhibited any signs of an accent being carried over into the English language.

To rule out any previous episodes of neurological problems and/or substance abuse, potential subjects were required to fill out a short questionnaire
(see Appendix C for questionnaire). Subjects' cognitive well-being was also evaluated through administration of the Standardized Mini-Mental State Examination (SMMSE). Subjects who obtained a score of 23 or lower on the SMMSE were eliminated from the study. This score was chosen as per guidelines from the SMMSE, which suggests that subjects scoring above 23 have normal cognition. Because stimuli were being presented auditorally, subjects were required to pass a pure-tone air-conduction hearing screening (40 dB at 500, 1000, 2000, and 4000 Hz in the better ear). Exclusions were based on: not meeting the requirements mentioned above; any lesion to the brain from a previous stroke or head injury; or any focal motor, sensory, cerebellar, or cranial nerve damage. Out of the 23 subjects contacted for this study, 23 voluntarily participated and five were screened out for various reasons mentioned above.

C. MATERIALS

1. On-Line Word-Monitoring Task

   The on-line word monitoring task consisted of six sets of presentations each containing ten short two sentence passages. Of these ten passages, six were experimental stimuli and four were non-experimental stimuli. The four non-experimental stimuli were included for warm-up and fatigue effects. In the section to follow the experimental and non-experimental stimulus materials will be discussed in further detail.

   a. Selection of Experimental Stimulus Materials

   Stimulus materials used in this study were modeled after those used by Tompkins, Broada, and McGarry (1992). Tompkins et al. (1992) chose target nouns from six idiomatic expressions and embedded them in contexts containing two sentences. The contexts they used biased the interpretation of the idiom either
figuratively or literally. They also included a control context, in which the target noun was presented in the absence of the idiomatic expression, and a filler in which the target noun’s position in the sentence was varied. The target noun was always in the second sentence.

There was a total of six idiomatic expressions used in the present study. Four of the idiomatic expressions were selected from the study by Tompkins et al. (1992). Originally all six idiomatic phrases from their study were included, but two were eliminated because the target word could not be replaced with an alternate noun without the sentence sounding awkward. Tompkins et al. selected their idioms from two idiom dictionaries. Idioms chosen were required to end in a noun and to be capable of being interpreted both literally and figuratively. This original set of idiomatic expressions was then rated by normal elderly volunteers as to degree of familiarity. Only those idioms which were rated as very familiar were chosen for their study.

Two additional idiomatic phrases were selected from the Familiar and Novel Language Comprehension Test (FANL-C) (Kempler and Van Lancker, 1990). These idiomatic phrases were chosen because they filled the requirements set out by Tompkins et al. (1992), i.e., they were highly familiar idiomatic expressions, ending in a concrete noun, and they could be interpreted both literally and figuratively. As in Tompkins et al. (1992), the target word was always the final word in the idiomatic expressions (e.g., "rat" in "smelled a rat").

For each idiomatic expression, six two-sentence passages were constructed for the following context conditions which related to the interpretation of the idiomatic phrase:

(i) idiomatic context condition, in which the text preceding the idiomatic phrase biased the interpretation of the phrase to its figurative meaning. This was
carried out by including words based on the figurative definition of the idiom in the sentence preceding the idiomatic phrase (e.g., "getting suspicious" for "smelled a rat"). Definitions were selected from three idiom dictionaries (Long, 1979; Wood, 1964; Gullard and Hinds-Howell, 1986).

(ii) literal context condition, in which the text preceding the idiomatic phrase biased the interpretation of the phrase to its literal meaning. This was carried out by including text that was semantically related to the literal meaning of the phrase (e.g., "my cat was hunting" for "smelled a rat").

(iii) ambiguous context condition with the idiomatic phrase containing the target word (hereafter referred to as ambiguous with target word), in which the text prior to the idiomatic phrase biased the listener to neither a literal interpretation nor a figurative interpretation of the idiomatic phrase. However, the text following the idiomatic expression gave the idiomatic phrase a figurative interpretation.

(iv) ambiguous context condition with the idiomatic phrase not ending in the target word (hereafter referred to as ambiguous without target word), in which the beginning of the idiomatic phrase was present and the text prior to the idiomatic phrase biased the listener to neither a literal interpretation nor a figurative interpretation of the idiomatic phrase. The final word (target word) was replaced with a different noun and the text was written semantically and syntactically around this.

(v) filler context condition with the target word present (hereafter referred to as filler with target word), in which the passage did not contain the idiomatic phrase, however, the target word was present.

(vi) filler context condition without the target word present (hereafter referred to as filler without target word), in which the idiomatic phrase was not included in the passage and the target noun was a noun that was semantically
similar to the target word.

The position of the idiomatic phrase and the length and syntactic complexity of the passages in the idiomatic, literal, ambiguous with target word, and ambiguous without target word context conditions were similar and the target noun never appeared at the end of the passage. The two filler contexts were included to decrease the chances of subjects noticing any pattern in the stimuli. As in the four context conditions mentioned above, the filler contexts consisted of two sentences; however, the length and syntactic features of the sentences, as well as the position of the target word, varied in the filler context conditions (see Appendix D for stimuli used in this experiment).

Once the idiomatic phrases were chosen and the six passages were created (four based on the interpretation of the idiomatic phrase and two fillers), the predictability of the target word in each context was examined to ensure that the context strongly biased the appropriate interpretation of the idiomatic phrase relative to its context condition. This was carried out by having 20 volunteers read the sentences with the target word missing. They were asked to write in a single word which they thought would best complete the sentence. Each subject was given a maximum of eleven sentences with no more than two stimulus contexts for the same target word. The sentences were presented in a semi-random order so that the position of the same context type and the same target noun were maximized. In other words, same target nouns or same context types were only repeated once all others were presented.

The degree of predictability in the figurative context condition for the idiomatic expressions selected as experimental stimuli was 97%. This was expected as the sentence preceding the idiomatic expression was based on its definition. In the literal context the degree of predictability was 88% for the target
noun. Again this was expected due to the contextual information in the sentence preceding the idiomatic expression. For the ambiguous with target word context, one would expect a high degree of predictability due to the figurative information following the idiomatic phrase. For this context condition 70% of the volunteers wrote down the target word. The predictability for the ambiguous context without the target word was only 29% for the target word. This was expected because there were no cues at all in the context for the presence of the target word. For both the filler contexts, 52% of the respondents wrote down the target word. Predictability characteristics were judged to be adequate for this study.

b. Selection of Non-experimental Stimulus Materials

Six completely different target words and idiomatic phrases were used for the non-experimental stimuli (see Appendix E for non-experimental stimuli). The contexts in which the idiomatic phrases were embedded were similar to the experimental contexts. However, only four contextual environments were used: idiomatic, filler without the target word, ambiguous without the target word, and literal.

c. Stimulus preparation.

Stimulus preparation consisted of recording the stimuli onto a NeXTstation computer, editing it through the computer, and dubbing it onto experimental tapes. Before the stimuli were recorded, they were arranged into six presentation files. Each presentation file contained ten passages or trials; six of which were experimental stimuli and four of which were non-experimental stimuli. The non-experimental stimuli were distributed so that two were presented at the beginning of each file and two were presented at the end of each file. The two at the beginning allowed for warm-up effects and the two at the end allowed for fatigue effects. The first trial on each file always contained the idiomatic non-experimental
item. The second trial on each file always contained the filler without the target word non-experimental item. The ninth and tenth trial on each file always contained the ambiguous context without the target word and literal non-experimental item respectively. Trials three through eight were the experimental stimuli. Each of the ten trials per file had a different target word.

The passages from each experimental target word set were arranged on the files A:1 through C:2 in a counter balanced order so that for each word set: (i) no two ambiguous contexts occurred in succession; (ii) no two filler contexts occurred in succession; and (iii) no two idiomatic expressions with figurative interpretations (i.e., idiomatic context or ambiguous with idiomatic phrase) occurred in succession. Thus the following order was used across target word sets: idiomatic, filler with target word, ambiguous without target word, literal, ambiguous with target word, and filler without target word. Each target word started with a different context on each file, but the order above was maintained across sets (see Appendix F for word and context order).

Once the experimental target words and their respective contexts were assigned to a file, the six experimental stimuli on each file were arranged in a counter balanced order so that: (i) each trial per file had a different context; (ii) each trial per file had a different target word; (iii) no context of the same type (i.e. idiomatic, literal, filler, etc) occurred in the same position on any file; and (iv) no target word occurred in the same position on any file. Randomizing within the files was done to reduce the possibility of subjects recognizing a pattern and predicting the presence or absence of the target word.

Once the target word order and the experimental context order of the stimuli were achieved, a master list of the six presentation files was constructed and recorded. The master list was read in a sound proof room by a practiced female
speaker at a slow, normal rate with natural intonation. A handgrip powering microphone (Sennheiser module K3U), placed six inches from the speaker, was used to record the stimuli onto a NeXTstation computer using Soundworks 3.0 (version 2) application at a sampling rate of 32 kHz mono left. The high quality audio bandwidth analog to digital signal conversion was accomplished using a stereo audio/DSP port interface (Proport Model 656 dual-channel analog I/O module).

The beginning of each file was identified by a letter and a number corresponding to the file name. Following this, the stimulus passages were read and recorded onto the tape. Each passage was introduced by an alerting number, followed by a six second pause and then the passage.

Acoustic characteristics were controlled for by splicing one exemplar of the idiomatic phrase and target word from a given context and inserting them into phrase and target word position in the other contexts of the same set. This was carried out by manipulating visual (i.e., sound waveform display on Soundworks) and auditory playback of the digital speech signal using Soundworks 3.0 (version 2) application on the NeXTstation computer. The idiomatic phrases and the target words were taken equally from the original idiomatic, literal, and ambiguous with target word passages. There were no perceivable discontinuities or interruptions in the final revised presentations.

Pausing between presentations was also carried out using Soundworks 3.0 (version 2) application on the NeXTstation computer. A six second pause was inserted between each trial number and corresponding passage to allow time for the subject to read the target word and the experimenter to reinstruct if required. A four second pause was inserted after the tape identifier and after each trial presentation. This allowed time for the experimenter to remove the target word
card before the next presentation.

After the stimuli were recorded and edited on the NeXTstation computer, the presentation files were paired to create three sets, based on presentation order, and converted back into analog signals. The speech signals were recorded onto both channels of three high quality metal alloy cassette tapes (TDK MA110) using a portable professional quality audiocassette recorder (Marantz PMD 420). Each tape contained two presentation files. The tapes were presented in counterbalanced order to control for order effects.

2. Baseline Reaction-Time Task

A baseline reaction-time task was used as a covariate for the analysis of the word-monitoring reaction-times. The baseline task consisted of two practice items, used to familiarize the subjects with the task, followed by twenty test items. Each trial started with an alerting number followed by one of four words: 'ties', 'hang', 'strap', and 'rod'. These words were chosen because they were similar in length and phonemic structure to the target words used in the experiment. The stimuli were recorded using the same procedure and equipment as were used for the word-monitoring task. A one and a half second pause was placed between each trial number and word and a two second pause was placed between each trial.

3. Off-Line Picture Identification Task

a. Selection of Stimulus Materials

The off-line picture identification task was a text-to-picture matching task modelled after the Familiar and Novel Language Comprehension Test (FANL-C) by Kempler and Van Lancker (1990). The task required the subject to match an idiomatic phrase to one of four line-drawings which best depicted the figurative
interpretation. Eight idiomatic phrases were used in this experiment: two practice stimuli and six experimental stimuli. The experimental idiomatic phrases were the same phrases used in the on-line word-monitoring reaction time task.

The response sheets corresponding to the idiomatic phrases consisted of four line drawings. The drawings for the two practice stimuli and two experimental stimuli ("he's turning over a new leaf" and "she has him eating out of her hand") were taken directly from the FANL-C. The remaining drawings corresponding to the four other idiomatic phrases were produced by the experimenter in a similar style. These drawings were administered to ten normal volunteers to ensure the desired figurative response was apparent.

The set of four line drawings going with each idiomatic phrase consisted of one picture depicting the idiomatic meaning of the phrase and three foils: one depicted a concrete response corresponding to one word in the stimulus; one depicted the meaning opposite to the figurative meaning, and one was unrelated to the idiomatic phrase (see Appendix G for stimuli). Each drawing was framed in a five inch by seven inch outline approximately 1 mm thick. The four drawings associated with each idiomatic phrase were presented on two pieces of eight and a half by eleven inch white paper (two drawings per page). The two sheets of white paper were presented long side together. The positioning of the drawings was randomly ordered.

Literal foils were not included because all idiomatic expressions used in this study could be interpreted literally. Thus, if a subject chose a picture depicting the literal interpretation of the idiomatic expressions she or he could not be marked incorrect as the interpretation would be acceptable, although not the figurative interpretation.
D. TEST APPARATUS AND PROCEDURES

This study was conducted by the experimenter in a quiet office at the Clinic for Alzheimer and Related Disorders at University Hospital (UBC site). The subject sat at a desk opposite to the experimenter. It took approximately 45 to 60 minutes to complete an entire session. This included the questionnaire, hearing screening, SMMSE, baseline reaction task, on-line word monitoring task and off-line picture identification task.

A typical session began with the experimenter being introduced followed by a brief discussion about the experiment, including the time required by the subject and the subject's task in the experiment. The subject was then given 2 consent forms, one for him/her to take home and one to be signed and given back to the experimenter. A questionnaire was then filled out. Next the subject's hearing was screened using a portable audiometer (Maico Instruments Inc. Model MA-21). This was followed by the administration of the baseline reaction-time task, the practice word-monitoring items, and the three word-monitoring reaction-time tasks. In between each word-monitoring tape, section 1 and section 2 of the SMMSE were administered, respectively. The final task performed by the subjects was an idiom picture identification task. The session closed with the experimenter debriefing the subject (see Appendix H for debriefing).

The baseline reaction-time tapes and the word monitoring reaction-time tapes were played on a professional quality stereo audiocassette recorder (Marantz PMD 420). The subjects listened to the stimuli through high quality headphones (Seinnheiser HD 420 SL). The volume was adjusted using the volume control knob to a loudness level that was comfortable for each subject.

The speech signal from the audiocassette recorder was routed from the left output channel to the left input channel on the stereo cassette deck (Yamaha...
natural Sound KX-500U). A red Jelly Bean switch (Able Net Inc.), approximately two and a half inches in diameter was placed on the table in front of the subject. The switch was routed to a white noise source (CURTIS AM.FM portable radio RS-22), which was, itself, routed into the right input switch on the stereo cassette deck (Yamaha Natural Sound KX-500U). The stereo cassette recorder recorded the running speech stimuli onto the left channel of a normal cassette tape (Maxell UR 90 IEC) and the noise burst from the switch onto the right channel of the tape (see figure 5 for diagram of setup)

Subjects responded to the stimuli with their dominant hand. While waiting to respond, subjects were instructed to rest their hand on a yellow square card, approximately three inches by three inches. This was identified as the start box and was taped on the desk approximately one inch from the edge of the desk and two inches in front of the Jelly Bean switch.
1. Baseline Reaction-Time Task

The baseline reaction-time task consisted of a "go/no-go" procedure similar to that used by Tompkins, Broada, and McGarry (1991). Subjects were presented with a four-by-six inch index card with the word "rod" on it in black three-quarter inch upper-case letters. The stimulus word was printed from a Macintosh Plus computer using MacWrite II (version 1.0) word processing in Helvetica 72 point font with a QMS-PS810 laser printer and pasted in the middle of the index card. The card was placed above the response button and left there for the entire baseline task.

Subjects were instructed to read the word aloud. They were then told that they were going to hear some words through the headphones. As soon as they heard the target word they were to press the response button as quickly as possible and then return their hand to the start box. They were instructed only to press the button when they heard the target word and do nothing when they heard the other words (see Appendix I for baseline reaction-time instructions).

Eight of the twenty trials contained the target word. This procedure took about three minutes to complete. The median was taken from these eight trials to obtain the subject's baseline reaction-time. Reaction-times were measured from the onset of the target word to the subject's response.

2. On-Line Word-Monitoring Task

The on-line word-monitoring reaction time task was similar to the baseline task except that the target words were presented in sentences instead of in isolation. The target words were printed from a Macintosh Plus computer using MacWrite II (version 1.0) word processing in Helvetica 72 point font with a QMS-
PS810 laser printer and pasted in the middle of a four by six inch blank white index card.

Subjects were presented with a target word following each trial number. The target word card was placed above the response button and left there for the entire trial. Subjects were instructed to read each word aloud and listen for the word in the passage. When they heard the word in the passage they were to press the response button as fast as possible. While waiting for the target word they were instructed to rest their hand on the start box placed two inches below the switch (see Appendix J for on-line word monitoring instructions).

Before starting the six experimental files, subjects listened to four preliminary practice items to familiarize them with the task (see Appendix K for stimuli for practice items). A different target noun was presented with each practice item. Of the four practice items two contained a target word in its idiomatic phrase with a figurative interpretation, one contained a target word that did not correspond to an idiomatic expression (e.g., "cake" for "chocolate cake"), and one did not contain the target word. During the practice session, subjects were reminded to return their hand to the start box after responding and to react as quickly as possible when they hear the target word.

After subjects were familiarized with the task, the three word-monitoring tapes were presented. Before each of the six files, subjects were re-instructed to listen for the target word and to press the button as quickly as possible after they heard it. A five to ten minute break was provided between each tape presentation, at which time parts of the SMMSE were administered and a short conversation took place. Each word monitoring tape took approximately six minutes to present.

a. Reaction-Time Measurements

Subjects' response tapes were converted back from analog to digital using
the stereo audio/DSP port interface (Proport Model 656 dual-channel analog I/O module). The speech stimuli and the subjects’ responses were recorded onto the NeXTstation computer using Soundworks 3.0 (version 2) application at a sampling rate of 16 kHz in stereo. Subjects' reaction times to the target words were measured from target word onset to the noise burst created by the response button. Measurements were carried out using the visual (i.e., sound waveform display in Soundworks) and auditory playback of the digital signal using the NeXTstation computer.

The onset of the target word measurement was identified by first creating a file on the computer which contained a recording of each target word. Then a marker was placed in the wave form as close to word onset as possible. The wave forms from the target words of the subjects' tapes were compared and the marker point was identified. The measurement was then taken from the marker onset in the wave form to the onset of the noise burst. Measurements were taken to the nearest millisecond. Twenty percent of the data was checked by a second individual for interjudge reliability rating of 96 percent.

3. Off-Line Picture Identification Task

The picture identification task was presented at the end of the session. It took approximately five minutes to administer. Two practice items were presented first followed by the six experimental items. The subject was instructed to listen to the idiomatic phrase read aloud by the experimenter, and point to the picture that best showed the figurative meaning of the phrase. With the two practice items, if the subjects chose the wrong picture they were reminded that they were to look for a picture of the idiomatic meaning. If they still did not choose the correct picture, they were asked for a verbal definition of the idiomatic phrase. If the verbal
definition was incorrect, the examiner gave them the correct definition and showed them the correct picture (see Appendix L for picture-identification instructions).

The same procedure was followed for the experimental items except, if the incorrect picture was chosen, the subjects were asked to give a verbal definition. After the verbal definition was given they proceeded to the next item regardless of whether the definition was correct or incorrect. The examiner noted the subject's response to the pictures using a score sheet and verbatim recordings when a verbal definition was required.
CHAPTER THREE
RESULTS

A. ON-LINE WORD-MONITORING TASK

After reaction times were collected and scored, the raw data was transformed by taking the median baseline reaction time scores for each subject and subtracting them from that obtained for the same subjects in the experimental test items (i.e., reaction time (subject 1, target word "rat", literal context) - baseline = transformed time). These scores were used to eliminate variability due to some subjects having faster reaction times than others as a result of different sensory or motor abilities. The median transformed reaction times were obtained for each context (i.e., literal, idiomatic, filler, and ambiguous with target word) across the six target words for each subject. This was done to eliminate outlying data points that might have resulted, for example, from a subject’s occasional lapse of attention.

1. Preliminary Analysis

A preliminary analysis was conducted to determine if the order of presentation influenced performance. An analysis of variance (ANOVA) indicated that a significant difference occurred across the six orders of presentation \[ F (5,60) = 13.34; \ p < .05 \]. A Student-Newman-Keuls test indicated that reaction time performance for presentation order BCA was significantly faster than BAC and these two orders were significantly faster than reaction times for orders CAB, ABC, ACB, CBA. There was no significant difference in reaction time between orders CAB, ABC, ACB, CBA. An analysis of variance (ANOVA) was then run to determine if order of presentation influenced reaction times for the four context conditions. No
significant interaction of order and context was found \[F(15,48) = .04; \ p < .05\]. Therefore, order of presentation was not considered in the primary analysis.

Numerous errors were made by subjects in this task. Two subjects (Ss 1 and 18) did not respond to one target word (rat:literal and hand:literal respectively), presumably due to their thoughts wandering from the task. This did not affect the results as it was the median reaction time for each context condition which was used across target words for each subject. Twelve subjects responded when the target word was not present. Of these twelve subjects, one responded with two false positives and one with three false positives. The other ten responded with only one false positive. Fourteen of the 15 false positives occurred in the ambiguous without target word context condition for the non-experimental stimuli and one occurred in the ambiguous without target word context condition for the experimental stimulus (target word: leaf “The gambler looked at the dealer. He had turned over a new card since they brought him a drink.”). The false positive responses did not affect the results as they occurred in a context which was not included in the measurement under investigation.

2. Primary Analysis:

The primary analysis in this study assessed the effects of context type on reaction time in the word-monitoring task. Median transformed reaction times for idiomatic, literal, ambiguous, and filler contexts served as the dependent measures. The results indicated that subjects responded faster to target words in idiomatic, literal, and ambiguous contexts than in filler contexts. Reaction times to target words in the literal context conditions were faster than target words in the ambiguous context conditions. Reaction times to target words in idiomatic context conditions were faster than ambiguous context conditions and slower than literal
context conditions (refer to table 1 and figure 6 in text). A one-way within subject ANOVA using a general linear model confirmed that there was a significant effect of context type on word-monitoring performance \( [F (3,51) = 14.74; \ p < .05] \). Furthermore, a post hoc analysis using a Student-Newman-Keuls test confirmed that subjects responded significantly faster to target words in idiomatic, literal, and ambiguous contexts than in filler contexts \( (p < .05) \). Reaction times to target words in literal context conditions were significantly faster than target words in ambiguous context conditions. There was no significant difference between reaction times of target words in the idiomatic context condition and target words in the ambiguous context condition nor between reaction times to target words in the idiomatic context condition and the literal context condition.

<table>
<thead>
<tr>
<th>Context Condition</th>
<th>Transformed Mean (seconds)</th>
<th>Adjusted Mean* (Tr. Mean + 1 second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literal</td>
<td>-.301</td>
<td>.699</td>
</tr>
<tr>
<td>Idiomatic</td>
<td>-.286</td>
<td>.714</td>
</tr>
<tr>
<td>Ambiguous</td>
<td>-.269</td>
<td>.731</td>
</tr>
<tr>
<td>Filler</td>
<td>-.220</td>
<td>.780</td>
</tr>
</tbody>
</table>

*Transformed reaction times were obtained by subtracting the baseline reaction times scores from the experimental test item reaction time scores, resulting in a negative transformed reaction time score. In order to make the reaction time scores easier to interpret one second was added to the mean of the transformed reaction time scores, resulting in a positive reaction time value. These adjusted means were used only to display data, not in analysis.
Means of Adjusted Reaction Time Scores in Four Context Conditions.

Figure 6: Means of Adjusted Reaction Times (transformed reaction times + one second) in Four Context Conditions.
B. OFF-LINE PICTURE IDENTIFICATION TASK

Responses to the picture identification task were marked correct or incorrect. Incorrect responses were categorized as concrete, opposite to the figurative meaning, or unrelated to the idiomatic phrase. Idiom definitions, which were given when subjects chose an incorrect picture, were categorized as correct (figurative), literal, or unrelated. Overall, 44.5% (8/18) of the subjects responded without error, 33.3% (6/18) responded with one error, and 22.2% (4/18) responded with two errors. Of the errors, 36% (5/14) were concrete responses, 36% (5/14) were opposite responses, and 28% (4/14) were unrelated. When asked to verbally define the idiomatic phrase 72% (10/14) defined the idiomatic phrase with its appropriate figurative meaning and 28% (4/14) with a meaning unrelated to the figurative or literal meaning. Only one unrelated verbal definition corresponded to one unrelated picture identification response. The three remaining unrelated verbal definitions corresponded to opposite picture identification responses (see table 2 for off-line task response types).
TABLE 2: Types of responses for the off-line picture identification task.

<table>
<thead>
<tr>
<th>Subject</th>
<th># correct</th>
<th>type of error</th>
<th>#correct including definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>opposite</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>concrete &amp; unrelated</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>opposite</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>unrelated</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>4</td>
<td>opposite &amp; opposite</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>5</td>
<td>opposite</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>6</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>5</td>
<td>unrelated</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>4</td>
<td>concrete &amp; opposite</td>
<td>5</td>
</tr>
<tr>
<td>19</td>
<td>4</td>
<td>opposite &amp; concrete</td>
<td>5</td>
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<td>6</td>
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</tr>
<tr>
<td>23</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER FOUR
DISCUSSION

This study investigated the effects of contextual information on the on-line processing of idiomatic expressions in an adult population with normal cognition. An on-line word-monitoring reaction-time task was used in which subjects identified the presence of a given target noun in a short passage. The target noun was the final word from one of six idiomatic expressions. The idiomatic expressions were embedded in contexts biasing them to either a figurative interpretation, a literal interpretation, or an ambiguous context in which neither a figurative or a literal interpretation could be predicted from the contextual information preceding the idiomatic phrase. There was also a filler condition in which the target noun was placed in a sentence in the absence of its idiomatic phrase.

Based on the Idiomatic Processing Model which claims that the figurative interpretation of an idiomatic expression is processed before the literal interpretation, it was anticipated that: (i) subjects would respond faster to target words in the ambiguous, literal, and idiomatic context conditions than to target words in the filler condition, (ii) subjects would respond faster to target words in contexts which biased idiomatic phrases to idiomatic interpretations than to the contexts which biased idiomatic phrases to literal interpretations or ambiguous contexts, and (iii) subjects would respond faster to target words in contexts which biased the literal interpretation of the idiomatic expression than to target words in ambiguous contexts.

To further investigate the processing of figurative language, the association between on-line and off-line processing of figurative language was investigated.
using an off-line picture identification task. Subjects matched a spoken idiomatic expression to one of four line drawings. There were three foils included with each set of drawings: one depicting a concrete interpretation based on one noun in the phrase, one depicting an interpretation opposite to the idiomatic meaning, and one picture which was not related to the idiomatic expression. It was anticipated that subjects would perform without error on the off-line picture identification task because it was assumed that adults with normal cognition would have no difficulty matching a spoken idiomatic phrase to a picture corresponding to its figurative meaning if the idiomatic phrase was familiar to them.

The results of both the on-line word monitoring reaction time task and the off-line picture identification task will be discussed below as well as the relationship between the two tasks.

A. ON-LINE WORD-MONITORING TASK

The results from the on-line word monitoring reaction-time task failed to support all but one hypothesis stated at the onset of this study. In this study the results showed that (i) subjects responded significantly faster to target words in the ambiguous, idiomatic, and literal context conditions than to target words in the filler context condition and (ii) subjects' response times to target words were faster in the following respective order: ambiguous context condition, idiomatic context condition, and literal context condition. However, only the reaction time difference between the literal context condition and the ambiguous context condition was significant.

Before the results are discussed further, one must be cautioned as the interpretations are limited by the small number of experimental stimuli used in this study and the small sample of subjects who participated in this study. A larger and
more precise effect may have been achieved with a larger population size and more stimuli.

1. Difference between Filler Condition and other Context Conditions

Subjects responded significantly faster to target words in the ambiguous, idiomatic, and literal context conditions than to target words in the filler context condition, suggesting that the embedding of target words in idiomatic expressions facilitates processing. It appears that the presence of the initial portion of the idiomatic phrase may give the subject enough information to anticipate the last word of the idiom. Although in itself this finding shows only that context supports word identification, it is also consistent with the claim that idiomatic expressions are stored as single lexical units (Ortony, Schallert, Reynolds, and Antos, 1978; Swinney and Cutler, 1979; Estill and Kemper, 1982; and Tompkins, Broada, and McGarry, 1992). In an alternate interpretation, Tompkins, Broada, and McGarry (1992) suggest that this finding may also be a result of the "familiarity and lexicalized" nature of the idiomatic expression, rather than the fact that they are idioms" (p. 634). For example, familiar nonidiomatic phrases, such as "sleep in a bed" and "cup of coffee", may render results similar to those found in this study. This would be interesting to examine in the future.

Another factor which may have contributed to subjects responding faster to passages containing the target word and the idiomatic phrase than to passages containing only the target word is that the idiomatic phrases were repeated four times each over the sixty trials. The co-occurrence of the idiomatic phrase and the small number of stimulus passages may have made the idiomatic expressions more salient in the subjects' memory, thus contributing to the faster reaction times for those context conditions in which the entire idiomatic phrase was present.
2. Difference between Context Conditions with the Idiomatic Phrase

The second set of findings for the on-line word monitoring task, i.e., that (i) reaction times were slower for the ambiguous context condition than for the idiomatic and literal context conditions, (ii) reaction times for the idiomatic context conditions were faster than for the ambiguous context condition but slower than for the literal context conditions and (iii) reaction times were faster for the literal context condition than for both the idiomatic and ambiguous context conditions, were not predicted by the hypotheses of this study. Before these results are discussed, it must be stated again that only the reaction time difference between the literal and ambiguous context conditions was significant. The idiomatic context condition was not significantly different from either the literal or the ambiguous context condition. The general pattern of the results, however, will be considered for the purposes of discussion.

There are two conclusions that can be drawn from the results obtained in this study. The first is that context facilitates the processing of idiomatic expressions. This assumption has been supported in numerous studies (Gibbs, 1980; Schweigert and Moates, 1988; Nippold and Martin, 1989) and is evidenced in this study by the finding that reaction times for target words in the ambiguous context condition, which contained little context that would predict the presence of the target word, were slower than reaction times for target words in idiomatic and literal context conditions. The idiomatic and literal context conditions contained information which facilitated the identification of the target word prior to its presentation. The second conclusion that can be drawn from the results of this study is that because the reaction times for target words in the literal context condition were fastest, people may process the literal interpretation of an idiomatic
These results do not support the Idiomatic Processing Model, which was initially used to predict outcome in this study. The Idiomatic Processing Model predicts that idiomatic expressions should be processed figuratively unless context conditions suggest otherwise and that only then are they processed literally. If this model were true then one would expect reaction times to the idiomatic context condition to be fastest. This was not the case as reaction times in this study were fastest for the literal context condition, suggesting that idiomatic expressions are initially processed literally and thereby supporting the Literal Processing Model. However, there is only weak evidence from this study supporting the Literal Processing Model. As mentioned earlier, there was no significant difference between the reaction times for target words in the literal and in the idiomatic context condition. One would expect the difference to be significant if idiomatic expressions were being processed according to the Literal Processing Model.

It appears that the best model to explain the results obtained in this study is the Key Word Hypothesis proposed by Cacciari and Tabossi (1988). If one recalls from the literature review at the beginning of this paper, the Key Word Hypothesis proposes that there is a key word at some point in an idiomatic expression which triggers the idiomatic interpretation. The idiom is processed literally until the key word is triggered. Cacciari and Tabossi (1988) claim that when idiomatic expressions are predictable (i.e., the key word comes at the beginning of the expression), idiomatic interpretations are processed faster than literal interpretations because the key word triggers the idiomatic interpretation before the whole phrase is heard. If the idiomatic expression is unpredictable (i.e., the key word is the final word in the phrase) then the literal interpretation is processed faster than the figurative interpretation because the figurative interpretation is not
triggered until the final word is heard.

Cacciari and Tabossi (1988) did not incorporate the effects of contextual information in their study. All of their sentences could be completed figuratively or literally; however, their idiomatic phrases had no literal interpretations so once the final word in the idiom was heard the idiomatic phrase was processed figuratively. This present study, however, examined the effects of contextual information on the processing of idioms with both literal and figurative interpretations. Evidence from this study and others (Gibbs, 1980; Schweigert and Moates, 1988; Nippold and Martin, 1989) suggests that context facilitates comprehension of idiomatic expressions. Therefore, the assumption can be made that context increases the predictability of an idiomatic expression being present when contextual cues suggest it. Based on the Key Word Hypothesis, one would predict that in this study the idiomatic context condition would be faster than the literal and ambiguous context conditions because contextual cues make the idiomatic expressions in the passages predictable.

However, there is also a variable in this study which adds an unpredictable component to the idiomatic expressions. This variable is the doubt created by replacing the target word or last word in the idiomatic expression with another noun (e.g., "pull some strings/pull some toys"; "gave him the green light/gave him the green jar"). Subjects were aware that on some presentations the target word would not be present in the passage. This made the idiomatic expressions to some degree unpredictable and the subjects more cautious because they might not have wanted to make an error.

The idiomatic expressions in this present study have been classified as "unpredictable" because it appears that the degree of doubt created by the target word not being present all the time out-weighs the benefits that could be derived
from contextual information. This is not to say that context does not play a role in this study. It plays a crucial role, however not as big as the role played by the doubt created by possibility of the word not being presented. Based on the assumption that the idiomatic expressions in this study are unpredictable, the Key Word Hypothesis would predict that the idiomatic expressions in the literal context condition would be processed faster than the idiomatic expressions in the idiomatic and ambiguous context conditions, as the expression would be processed literally until the last word in the idiomatic expression was heard. This appears to be the case. The literal context condition was processed faster than both the ambiguous and idiomatic context conditions suggesting that the idiomatic expression was initially processed literally and since the literal interpretation was appropriate for the contextual information, the key word did not trigger the idiomatic interpretation.

The Key Word Hypothesis would suggest that the reason why the ambiguous context condition was processed slower than both the literal and idiomatic context conditions was because the idiomatic expression was processed literally first and when the contextual information was not appropriate for the last word in the idiomatic expression the idiomatic interpretation was triggered. The ambiguous context condition had a strong degree of unpredictability as there was no contextual information biasing the idiomatic expression to a figurative interpretation and once again there was a sense of doubt that the target word might not have been present. The idiomatic context condition, on the other hand, had contextual cues which increased the probability of the key word occurring.

To summarize, the results from this study best support the Key Word Hypothesis proposed by Cacciari and Tabossi (1988). The contextual information provided in the idiomatic context condition may improve the predictability of the entire idiomatic expression being present, however, the doubt created by
occasional absence of the target word may make the idiomatic expressions in this study unpredictable. Thus the idiomatic expression is processed literally until the key word in the expression triggers the idiomatic interpretation. Because the idiomatic expressions in this study could be interpreted either literally or figuratively, contextual information facilitated the idiomatic interpretation being triggered once the key word was heard. These results suggest that idiomatic phrases are not stored as single lexical units, but, as Cacciari and Tabossi propose, as strings of words whose idiomatic interpretation is triggered by a key word in the phrase. The idiomatic interpretation is processed literally until this time.

The results from the on-line word monitoring task used in this study are different from the results obtained in the Tompkins, Broada, and McGarry's (1992) study after which this study was modeled. This, however, was expected as Tompkins et al. did not have a deliberately ambiguous context condition and their idiomatic context condition was somewhat ambiguous prior to the presentation of the idiomatic expression. The target word was also included in every passage so their target words were more predictable than the ones in this study.

Tompkins et al. obtained the following results: (i) reaction times for passages which contained the idiomatic expressions (idiomatic and literal) were faster than reaction times for passages with only the target noun (control) and (ii) reaction times for the idiomatic context condition were faster than reaction times for the literal context condition, although this difference was not significant. Because the idiomatic expressions in the Tompkins et al. study were always complete, subjects could more reliably predict that they would end in the target word. Thus, the Key Word Hypothesis would predict that reaction times for the idiomatic context condition would be faster than reaction times for the literal context condition. This result was found by Tompkins et al.
Reaction times for literal and idiomatic context conditions in Tompkins et al.'s study may have been insignificant because the contextual information may not have been strong enough to trigger the idiomatic interpretation early enough to make the difference significant. Therefore, although the idiomatic interpretation was triggered by the key word sometime before the subject finished processing the literal interpretation, the "triggering" was not fast enough. If contextual information were stronger in biasing the idiomatic phrase figuratively, the key word may have been triggered earlier in the idiomatic phrase, hence the reaction time difference between the idiomatic and literal context conditions may have been significant.

The results of the present study best support the Key Word Hypothesis. However there are limitations to this hypothesis. First of all, the key word is not in the same place in all idiomatic expressions and second, the key word is also affected by variables such as contextual information and the occurrence of recent or frequent exposure to other idiomatic expressions with idiomatic interpretations. Research needs to be carried out to look at the degree to which these variables may affect the function served by the key word and how much these variables may affect different key words in varying degrees.

One must also be cautioned in interpreting the results from this study as the extent to which the idiomatic expressions literal and figurative meanings overlap was not controlled for. According to assumptions made by the Key Word Hypothesis, one would predict that the greater the overlap between the literal and figurative interpretations of an idiomatic expression the faster the figurative interpretation would be retrieved once the key word was triggered as the literal component of the figurative meaning would already be accessed. It would be interesting to carry out a study similar to this with idiomatic expressions that had different degrees of overlap between their literal and figurative interpretations.
As mentioned at the beginning of this section, these interpretations are also limited by the small number of experimental stimuli used in this study and the small sample of subjects who participated in this study.

B. OFF-LINE PICTURE IDENTIFICATION TASK

As predicted at the beginning of this paper, subjects responded with little or no error on the off-line picture identification task. This was anticipated because adults with normal cognition should have no difficulty matching a spoken idiomatic phrase to a picture corresponding to its figurative meaning if they are familiar with the idiomatic phrase. These results do not support or refute any one of the four models proposed to explain how idiomatic expressions are processed, as this task examined the subjects' knowledge of the figurative interpretation of the idiomatic expression. These findings are similar to the findings in Tompkins, Broada, and McGarry's (1992) study with normal adults on their idiom definition task.

C. RELATIONSHIP BETWEEN ON-LINE AND OFF-LINE TASKS

The on-line word-monitoring reaction time task and the off-line picture identification task used in this study are not directly comparable as there are no direct relations between the tasks. However, subjects' familiarity to idiomatic phrases can be investigated in respect to their response on both the on-line and the off-line tasks. Subjects who are not familiar with a certain idiomatic expression will likely respond slower to a target word in that idiomatic phrase than to a target word in a familiar idiomatic phrase. They will also likely respond in error to an idiomatic picture matching task or idiom definition task, as did four subjects in this study.

In order to control for familiarity entirely in an experiment one of two
procedures would need to be carried out. The first would be to test every subject using an idiom definition task, or something similar, and then rate the accuracy of subjects' definitions to determine how familiar they were with the idiomatic expression. The second procedure would be to use a large enough subject population that subjects who were unfamiliar with an idiomatic expression would be a small minority and therefore would not affect the results.

D. CONCLUSION AND CLINICAL IMPLICATIONS

Results of this paper indicate that idiomatic expressions are interpreted based on the degree of their predictability from sentence context which depends on the location of a key word in the idiomatic phrase that triggers the idiomatic interpretation. The idiomatic expression is interpreted literally until such a key word is presented. The results also suggest that the location of the key word is not the same for each idiom and that certain variables can change which word is the key word in an idiomatic expression. Some of these variables are contextual information, familiarity of the listener with the idiomatic expression, and the recent or frequent exposure to other idiomatic expressions with idiomatic interpretations. These variables, as well as many others, must be remembered when idiomatic expressions are used in future research and in the clinic.

It is also important to recognize the difference between an on-line task and an off-line task when figurative language processing is examined. Most, if not all, figurative language tests in the clinic use an off-line task. Further research must be done to examine the on-line processing of idiomatic expressions in clinical populations, such as patients with right hemisphere damage and Alzheimer's Disease.
BIBLIOGRAPHY


APPENDIX A

LETTER OF CONSENT

THE UNIVERSITY OF BRITISH COLUMBIA

CONSENT FORM

THE PROCESSING OF FIGURATIVE LANGUAGE
(Graduate Thesis Research)

Investigators: Michelle McPhee, M.Sc. candidate (Speech/Language Pathology), U.B.C.,
Phone number: 822-5591
Barbara Purves, M.Sc., Phone number: 822-7185
Holly Tuokko, Ph.D., Phone number: 822-7031

A research project conducted at the Clinic for Alzheimer Disease and Related Disorders at University
Hospital is investigating the comprehension of familiar phrases. In studying this, a better understanding of the
source of breakdown for individuals with difficulties understanding figurative language meaning will be gained.
Such an understanding can assist in developing appropriate communication strategies.

As a participant in this study you will be required to complete the attached questionnaire and have a hearing
screening (approximately five minutes). If selected for the remainder of the study, you will be required to: (i)
listen to a sentence and identify when you hear a specific word and (ii) listen to a sentence and point to a picture
which best corresponds to the sentence. This will take approximately 90 minutes, in one session to be held at
University Hospital-UBC Site.

Your participation in this project will be up to you. You may refuse to participate in the project. At any
time after agreeing to participate in it, you may withdraw from the project without jeopardizing any aspect of your
involvement with the clinic.

All information gathered during the project will be identified by a code known only to the experimenter.
Your identity and name will not be known to anyone except the experimenter.

If you have any questions, the researcher will be pleased to provide further information to be sure that you
fully understand this project and what you are being asked to do.

In signing below I acknowledge that:
(1) a copy of the consent form has been given to me
(2) I have read it and received a thorough explanation of the project
(3) I, _______________________________, consent to participate in the research project.

Date: _______________________________
Signature of Subject: _______________________________
Printed Name of Subject: _______________________________
APPENDIX B
SUBJECT INFORMATION
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APPENDIX C

QUESTIONNAIRE
QUESTIONNAIRE
THE PROCESSING OF FIGURATIVE LANGUAGE
(Graduate Thesis Research)

Name: ____________________________
Date of Birth: ______________________
Address: __________________________
Phone: ____________________________

Please circle YES or NO below:

A. Within the past year, have you suffered from:
1. Headaches .................................................. YES ........... NO
2. Seizures ..................................................... YES ........... NO
3. Blackouts ................................................... YES ........... NO
4. Memory Impairment ................................. YES ........... NO
5. Confusion...................................................... YES ........... NO
6. Trouble with vision (not improved by glasses).... YES ........... NO
7. Numbness, pins and needles or loss of sensation...... YES ........... NO
8. Weakness, slowness of movement or incoordination.... YES ........... NO
9. Difficulty with speech ..................................... YES ........... NO
10. Difficulty with swallowing ............................ YES ........... NO
11. Difficulty walking ........................................ YES ........... NO
12. Difficulty with control of bladder or bowels ......... YES ........... NO

B. 1. Have you ever suffered a major head injury?.............. YES ........... NO
2. Have you ever had surgery on the head?.................... YES ........... NO
3. Have you ever had a stroke?................................. YES ........... NO
4. Have you ever been depressed?............................. YES ........... NO
5. Have you ever had any other psychiatric diagnosis or treatment? Comment if you wish............ YES ........... NO
QUESTIONNAIRE cont.

C. 1. Are you on any medications? (if yes, please list) ........ YES. ........ NO
   A. Prescription
   B. Over-the-Counter

2. What is your usual alcohol intake?
   A. Not at all
   B. Less than 5 drinks/week
   C. 5 to 10 drinks/week
   D. More than 10 drinks/week

3. Please list other medical problems that you have had (if any).

D. What is your first language? ____________________________

E. What was the last grade you completed in school? ________________
APPENDIX D
EXPERIMENTAL TEST STIMULI
APPENDIX D

EXPERIMENTAL TEST STIMULI

WORD MONITORING TASK
SENTENCE CONTEXTS FOR SIX TARGET WORDS

Set 1. RAT
Idiomatic: The lawyer was getting suspicious. He smelled a rat so he prosecuted further.
Literal: My cat was hunting one night. He smelled a rat and he attacked it.
Ambig. w/: My husband was working in the garden. He smelled a rat when he saw a strange man.
Ambig. w/o: My dog was playing outside. He smelled a rat, so he ran to it.
Filler 1: My basement was very dark. I thought I heard a rat run up the steps.
Filler 2: The man was walking down a dark alley. When he looked toward a garbage can, he saw a big skunk.

Set 2. STRINGS
Idiomatic: Sue knows how to use her influence. She can pull some strings and make things happen.
Literal: Mary has several wooden puppets. She can pull some strings and make them dance.
Ambig. w/: Stan is coming home tomorrow. He can pull some strings with people he knows.
Ambig. w/o: John is a very clever fellow. He can pull some toys while he toddles.
Filler 1: Paul found an old violin. It needed some new strings.
Filler 2: Paul was tying up his boat. He needed some ropes to make it stable.

Set 3. TONGUE
Idiomatic: Steve's teacher told him to stop talking. He held his tongue when she looked in his direction.
Literal: John's dentist looked in his mouth. He held his tongue away from his sore tooth.
Ambig. w/: Scott's mother told him to keep scrubbing. He held his tongue after she told him not to talk back.
Ambig. w/o: Bill's mom told him to come close. He held his jacket in front of the stain.
Filler 1: The coffee was too hot to drink. My tongue got burnt when I tasted it.
Filler 2: The doctor examined my mouth. He told me to open wide and not move my jaw.

Set 4. LIGHT
Idiomatic: Tom was waiting for the company's approval. His boss gave him the green light to start the project.
Literal: George was repairing the traffic signal. His assistant gave him the green light to install.
Ambig. w/: Tim was standing by the door. His aunt gave him the green light to take the car.
Ambig w/o: Jim was reading the Saturday cartoons. His mother gave him the green jar to open.
Filler 1: Bob was doing home repairs. The light in the hallway needed replacing.
Filler 2: Samantha was trying to sleep. She told her brother to turn off the music.
Set 5. LEAF

Idiomatic: The delinquent reformed his behavior. He had turned over a new leaf since his last encounter with the law.

Literal: The gardener examined the rosebush. He had turned over a new leaf to check for aphids.

Ambig. w/: The student opened the envelope. He had turned over a new leaf since his last report card from school.

Ambig. w/o: The gambler looked at the dealer. He had turned over a new card since they brought him a drink.

Filler 1: John was raking the lawn. He found a beautiful orange leaf under the apple tree.

Filler 2: Joanne had thought the tree was dead. However, when she looked at it this morning, she saw a new bud starting to grow.

Set 6. HAND

Idiomatic: Sarah's boyfriend would do anything Sarah wanted. He was eating out of her hand ever since she met him.

Literal: Susan's raven was at last tame. He was eating out of her hand after only two weeks.

Ambig. w/: Mary sat with her uncle at dinner. He was eating out of her hand in response to her charm.

Ambig. w/o: Jill's brother loved ice cream. He was eating out of her bowl as soon as she left the room.

Filler 1: Sarah and Bill were painting the fence. Sarah fell back and stuck her hand in the can of paint.

Filler 2: Natalie and her baby sister, Colleen, were mixing some cookie dough. Colleen got bored and started squishing the dough with her fingers.
APPENDIX E

NON-EXPERIMENTAL TEST STIMULI
APPENDIX E
NON-EXPERIMENTAL TEST STIMULI

WORD MONITORING TASK
SENTENCE CONTEXTS FOR NON-EXPERIMENTAL TEST STIMULI

Practice 1: HEAD
Idiomatic: Fred was an accurate newspaper-reporter. He hit the nail on the head every time he wrote about issues.
Filler w/o: Sally was a beginning tumbler. When she went to gym class, she stood on her hands for a short time.
Ambig. w/o: Henry was hanging a picture. He hit the nail on the thumb of his injured hand.
Literal: Steve was an excellent carpenter. He hit the nail on the head every time he hammered boards.

Practice 2: WATER
Idiomatic: Mark was in serious trouble at school. His principal said he would get in hot water if he skipped class again.
Filler w/o: The soccer team was hot and thirsty after the game. The coach gave them some cold oranges and lemonade to rehydrate them.
Ambig w/o: Karen complained of the frigid winter climate. Her husband said she would get in hot weather if she went south with him.
Literal: Sam lifted too many weights at the gym. His wife said he should get in hot water if he wanted to loosen up.

Practice 3: BEANS
Idiomatic: Jenny could never keep a secret. She spilled the beans every time she was told one.
Filler w/o: Ben was almost finished dinner. His mother said he had to eat all his carrots before he got dessert.
Ambig. w/o: Mary was wiping the counter. She had spilled the milk when she tried to pour herself a glass.
Literal: Jeff was sweeping the floor. He had spilled the beans when he took them out of the freezer.

Practice 4: ICE
Idiomatic: John was taking a big risk. He was skating on thin ice when he used his mother's car without her permission.
Filler w/o: Kathy was sitting in the hot sun. She was drinking cold Perrier water with lemon in it.
Ambig w/o: The twins were outside playing. They were skating on thin boards with their new roller blades.
Literal: Lisa was wet and cold. She was skating on thin ice when it cracked and she fell through.
Practice 5: RIDE
Idiomatic: Trevor didn't trust the stock broker. He felt she was going to take him for a ride on the next stock sale.
Filler w/o: Jill missed her neighbour's pony. She used to walk him every day after school.
Ambig w/o: John was excited about visiting his aunt's farm. She had promised to take him for a walk to the swimming hole.
Literal: Jim's sister just bought a brand new car. She was going to take him for a ride later that afternoon.

Practice 6: HOOK
Idiomatic: John was no longer held responsible for the accident. He got notice that he was off the hook from the car insurance representative.
Filler w/o: Jill was at the beach with her uncle. She caught her first fish with his new net.
Ambig w/o: Karen was in the kitchen. She got off the phone with her best friend Marsha.
Literal: Mike was very upset. When he took the fish off the hook, it jumped back into the water.
APPENDIX F

WORD AND CONTEXT TAPE ORDER
## APPENDIX F

**WORD AND CONTEXT ORDER**

<table>
<thead>
<tr>
<th>Target Word</th>
<th>File A:1</th>
<th>File A:2</th>
<th>File B:1</th>
<th>File B:2</th>
<th>File C:1</th>
<th>File C:2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAT</td>
<td>5: Idiomatic</td>
<td>2: Filler w/</td>
<td>3: Amb. w/o</td>
<td>5: Literal</td>
<td>5: Amb. w/</td>
<td>3: Filler w/o</td>
</tr>
<tr>
<td>STRINGS</td>
<td>4: Filler w/o</td>
<td>6: Idiomatic</td>
<td>1: Filler w/</td>
<td>4: Amb. w/o</td>
<td>2: Literal</td>
<td>1: Amb. w/</td>
</tr>
<tr>
<td>TONGUE</td>
<td>2: Amb. w/</td>
<td>1: Filler w/o</td>
<td>2: Idiomatic</td>
<td>6: Filler w/</td>
<td>1: Amb. w/o</td>
<td>6: Literal</td>
</tr>
<tr>
<td>LIGHT</td>
<td>1: Literal</td>
<td>4: Amb. w/</td>
<td>5: Filler w/o</td>
<td>1: Idiomatic</td>
<td>4: Filler w/</td>
<td>2: Amb. w/o</td>
</tr>
<tr>
<td>LEAF</td>
<td>6: Amb. w/o</td>
<td>3: Literal</td>
<td>6: Amb. w/</td>
<td>2: Filler w/o</td>
<td>3: Idiomatic</td>
<td>5: Filler w/</td>
</tr>
<tr>
<td>HAND</td>
<td>3: Filler w/</td>
<td>5: Amb. w/o</td>
<td>4: Literal</td>
<td>3: Amb. w/</td>
<td>6: Filler w/o</td>
<td>4: Idiomatic</td>
</tr>
</tbody>
</table>

**FOR EXAMPLE:**

<table>
<thead>
<tr>
<th>File A:1</th>
<th>File A:2</th>
<th>File B:2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. LIGHT:Literal</td>
<td>TONGUE:Filler w/o</td>
<td>STRINGS:Filler w/</td>
</tr>
<tr>
<td>2. TONGUE:Amb. w/</td>
<td>RAT:Filler w/</td>
<td>TONGUE:Idiomatic</td>
</tr>
<tr>
<td>3. HAND:Filler</td>
<td>LEAF:Literal</td>
<td>RAT:Amb. w/o</td>
</tr>
<tr>
<td>4. STRINGS:Filler w/o</td>
<td>LIGHT:Amb. w/</td>
<td>HAND:Literal</td>
</tr>
<tr>
<td>5. RAT:Idiomatic</td>
<td>HAND:Amb w/o</td>
<td>LIGHT:Filler w/o</td>
</tr>
<tr>
<td>6. LEAF:Amb. w/o</td>
<td>STRINGS:Idiomatic</td>
<td>LEAF:Amb. w/</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>File B:3</th>
<th>File C:1</th>
<th>File C:2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. LIGHT:Idiomatic</td>
<td>TONGUE:Amb. w/o</td>
<td>STRINGS:Amb. w/</td>
</tr>
<tr>
<td>2. LEAF:Filler w/o</td>
<td>STRINGS:Literal</td>
<td>LIGHT:Amb. w/o</td>
</tr>
<tr>
<td>3. HAND:Amb. w/</td>
<td>LEAF:Idiomatic</td>
<td>RAT:Filler w/o</td>
</tr>
<tr>
<td>4. STRINGS:Amb. w/o</td>
<td>LIGHT:Filler w/</td>
<td>HAND:Idiomatic</td>
</tr>
<tr>
<td>5. RAT:Literal</td>
<td>RAT:Amb. w/</td>
<td>LEAF:Filler w/</td>
</tr>
<tr>
<td>6. TONGUE:Filler w/</td>
<td>HAND:Filler w/o</td>
<td>TONGUE:Literal</td>
</tr>
</tbody>
</table>
APPENDIX G
OFF-LINE PICTURE IDENTIFICATION STIMULI
She'll pull some strings
He held his tongue.

She gave him the green light.
He smelled a rat.

*See Familiar and Novel Language Test (FANL-C) by Kempler and Van Lancker (1990) for the picture stimuli to the following idiomatic phrases:

- He's got his head in the clouds.
- The coast is clear.
- He's turning over a new leaf.
- She's got him eating out of her hand.
FAMILIAR PHRASES
page 1

A. He's got his head in the clouds. 1 *2
   3 4

B. The coast is clear. 1 2
   *3 4

1. She's got him eating out of her hand. 1 2
   3 *4

2. She'll pull some strings. 1 2
   *3 4

3. He held his tongue. *1 2
   3 4

4. She gave him the green light. 1 *2
   3 4

5. He smelled a rat. 1 2
   3 *4

6. He's turning over a new leaf. 1 *2
   3 4

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This experiment here (pointing to experiment), where I had you listen for certain words, examined the automatic processing of idiomatic expressions. It measured how you processed the information as it was going into your brain to - in other words, before you've had time to think about it because you had to react right away.

This last part you did: finding the picture that went with the idiomatic phrase, measures your processing after the information had gone in. So you've had time to process and think about your response.

If you noticed while you were listening to the tapes there were a number of idioms like *smelted a rat, pull some strings, eating out of her hand.*

These idioms were embedded in different contexts, for example with the idiom *smelted a rat* there was an idiomatic context: "The lawyer was getting suspicious, he smelled a rat so he prosecuted further" and there was a literal context: "My cat was hunting one. He smelled a rat and he attacked it".

What I'm going to do now is see how fast you reacted to the target word in the different contexts and see if there is a difference.

If there is a difference then I hope to do the same experiment with people with Alzheimer's Disease to see if the same difference appears.

We know that people with Alzheimer's Disease find the picture identification task quite difficult and they often choose the incorrect picture.

So there is some breakdown in the processing of idioms, but we don't know where because that task occurs after you've had time to think about your response.

By doing the word monitoring task with Alzheimer's patients and comparing their results with yours, I'll be able to see whether or not the breakdown occurs during the initial stages of processing or if it occurs sometime after.

Is that clear?
APPENDIX I

BASELINE REACTION TIME INSTRUCTIONS
APPENDIX I

BASELINE REACTION TIME INSTRUCTIONS

Subject sitting across from examiner with headphones on.

EXAMINER: "I'm going to show you a word and I want you to read the word out loud."

SUBJECT: subject says word.

Examiner leaves card positioned above the response button for the entire session.

EXAMINER: "Okay, now you are going to hear some words through the headphones. Each time you hear this word (pointing to the index card) I want you to press the button as quickly as possible and then return your hand to the yellow square. Only press the button when you hear the word 'rod' and try to press it as fast as possible."

"Okay, we'll start with some practice ones"

Turn the tape on. Subject listens to two practice items, the second one being the word 'rod'.

EXAMINER: If subject presses the button and returns hand to start box then:

"Good, now you will hear some more words. Remember each time you hear the word 'rod' press the button as quickly as possible and then return your hand to the yellow square. It's really important that you press the button as fast as you can when you hear the word 'rod'."

If subject doesn't press button or return hand to start box then:

"Remember, each time you hear the word 'rod' I want you to press the button as fast as possible"

"Remember to return your hand to the yellow box."

Rewind tape and start again until subject presses button and returns hand to start box.

At any time during the baseline task, if subject doesn't respond or doesn't return hand to start box, pause the tape and re-instruct.
APPENDIX J

ON-LINE WORD MONITORING INSTRUCTIONS
APPENDIX J

ON-LINE WORD MONITORING INSTRUCTIONS

EXAMINER: "This next part is almost the same as what you just did, but this time you'll hear a sentence instead of a word. So, I'm going to show you a word again and I want you to read it out loud. Then, you will hear a sentence. When you hear the word on the card in the sentence I want you to press the button as quickly as possible. Some of the sentences may not contain the word. Only press the button when you hear the word. Do you understand?"

SUBJECT: If subject states that he doesn't understand re-instruct one more time, then go on.

EXAMINER: "Okay, so I will show you a word on a card. You will read it out loud. Then you will listen to a sentence. As soon as you hear the word in the sentence press the button. You can then return your hand to the yellow box. Are you ready? Remember to try and press the button as fast as you can"

EXAMINER: "These first four are for practice."

Turn the tape on and have subject do four practice items separate from Set A, B, or C.

Instruct the subject step-by-step if s/he does not seem to understand the instructions.

BEFORE EACH NEW FILE:

EXAMINER: "Once again, I just want to remind you to press the button as soon as you hear the word. Try and go as fast as possible."
APPENDIX K

WORD MONITORING PRACTICE STIMULI
APPENDIX K
WORD MONITORING PRACTICE STIMULI

WORD MONITORING TASK
SENTENCE CONTEXTS FOR PRACTICE ITEMS

1. CAKE
   Jan was baking in the kitchen.
   She was making a chocolate cake for her niece.

2. CLOUDS
   John's sister was a daydreamer.
   She had her head in the clouds all day long.

3. BATH
   Kevin was playing in the garden.
   His mother called him to come in for dinner.

4. WALL
   Tom never listens to me when he's reading the newspaper.
   It's like talking to a brick wall.
APPENDIX L

OFF-LINE PICTURE IDENTIFICATION INSTRUCTIONS
APPENDIX L

OFF-LINE PICTURE IDENTIFICATION INSTRUCTIONS

Instructions from D. Kempler and D. Van Lancker's *Familiar and Novel Language Comprehension Test (FANL-C)* (1990) with slight modifications.

Examiner: "For this next task I'm going to say a sentence, and I'd like you to point to a picture which best matches the sentence I say. I also may get you to give me the definition of one or two of the sentences. These sentences are kind of funny. They're called idioms, which means the sentences don't mean exactly what they say, like 'he has his head in the clouds.'"

(Show pictures for practice item #1).

Examiner: "Which picture is best for 'he has his head in the clouds?''

Subject: selects picture

Examiner:

*If CHOICE is CORRECT:*

"Yes, the boy is daydreaming, and it is true to say that 'he has his head in the clouds.'"

*If CHOICE is INCORRECT:*

"Do you know the meaning of 'he has his head in the clouds'?"
"Tell me the meaning of 'he has his head in the clouds.'"

*If DEFINITION is CORRECT:*

"Now, can you show me a picture of that"

*If DEFINITION is INCORRECT:*

"No, it actually means; the boy is daydreaming, and so we would say that 'he has his head in the clouds.'" (Examiner points to the correct picture.)

Show pictures for practice item #2 and instructs the same was as for item #1.

Examiner: "Okay, now I'll show you some more pictures. Once again I'd like you to match the picture which is best for the sentence. Try to guess at an answer even if you're not sure. Are you ready?"

If subject chooses wrong picture ask them for a verbal definition.

"Do you know the meaning of '..................................................'?"
"Tell me the meaning of '..................................................'."