Reading Idioms: A Comparative Eye-Tracking Study of Native English Speakers and Native Korean Speakers

Sarah Lynne Miner
*Brigham Young University*

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Reading Idioms: A Comparative Eye-Tracking Study of

Native English Speakers and

Native Korean Speakers

Sarah Lynne Miner

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Arts

Grant Eckstein, Chair
Steven Luke
Dee Gardner
James Hartshorn

Department of Linguistics and English Language
Brigham Young University

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ABSTRACT

Reading Idioms: A Comparative Eye-Tracking Study of
Native English Speakers and
Native Korean Speakers

Sarah Lynne Miner
Department of Linguistics and English Language, BYU
Master of Arts

This quantitative study used eye-tracking technology to compare the attentional focus of 32 native English speakers and 26 native Korean speakers at the university level as they read idiomatic and literal phrases within well-formed sentences. Results revealed that native Korean speakers read both literal and idiomatic sentences slower than native English speakers. Additionally, native Korean speakers read idiomatic sentences slower than literal sentences, whereas native English speakers did not show a significant difference. Variables relating to language socialization, language development and idiom knowledge were also investigated to find which variables were correlated with reading measures. Of the variables tested, idiom knowledge was the only one that had significant effect on reading measures. These findings suggest that Korean speakers take longer to process English idioms as lexical units, though idiom familiarity seems to mitigate this effect.

Keywords: eye-tracking, L2 reading, L2 vocabulary, idioms, cognitive processing
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Introduction

Idioms such as “think outside the box” or “take a step in the right direction” are figures of speech frequently used in English, not only in casual conversation, but also in academic and professional settings (Wray, 2000). In a recently published study, a survey was conducted about teachers’ views on teaching idioms to students learning English as a second language (L2 learners). According to the survey, “raters who acknowledged a need for idioms in an academic setting cited the high frequency of idiomatic expressions and figurative language in academic lectures” (Ramonda, 2016, p. 136). In addition, idioms can serve a wide range of social functions in communication including transitioning between topics, summarizing main ideas, showing agreement or disagreement, and adding emphasis to a statement (Drew & Holt, 1998). This wide range of functions demonstrates the practical use of idioms in English and reflects the notion that interactions in a culture are inextricably connected to language (Jiang, 2000; Yagiz & Izadpanah, 2013). However, when it comes to the acquisition and processing of idioms by L2 learners, there are more questions than answers. How do L2 learners acquire and process idioms? Do L2 learners process idioms similarly to native speakers? What variables influence idiom processing? While some studies have addressed aspects of these questions (Cooper, 1998; Underwood, Schmitt, & Galpin, 2004; Conklin & Schmitt, 2008; Siyanova-Chanturia, Conklin, & Schmitt, 2011), there is still a need for further research to fully understand the complex processes of idiom acquisition.

Definition of Idioms

One reason why there are so many unanswered questions about how L2 students learn idiomatic expressions is that researchers use different definitions of idioms and other formulaic language (Myles & Cordier, 2017). Some researchers define idioms as any formulaic language,
including collocations and phrasal verbs (Siyanova-Chanturia & Martinez, 2015; Erman, 2007; Wray, 2000), while others define them as “[expressions] whose meaning cannot always be readily derived from the usual meaning of its constituent elements” (Cooper, 1999, p. 233). Still other researchers focus on the degree to which idioms are decomposable or not (Gibbs & Nayak, 1989) or the way phrases can be recalled as a single lexical unit (Vanderniet, 2015). These overlapping definitions are problematic because research that claims to analyze idioms may actually be examining a variety of constructs, making it difficult to generalize the results of one study to another (Vanderniet, 2015). For the purposes of this paper, idioms will be defined as multi-word units (see Martinez & Murphy, 2011) that have a possible figurative meaning, including phrasal verbs and collocations. While it is important to have a definition broad enough to encompass the wide range of phrases that can be idiomatic, it was also necessary to narrow the focus of the study for reasons of practicality. Thus, this study focuses exclusively on idioms that have both a possible literal meaning and a possible figurative meaning. As an example, the idiom *a piece of cake* can be used literally to describe food or figuratively to say that something is easy to do. Since this idiom has both a literal and figurative meaning for the same phrase, it fits the criteria of this study.

**Acquisition of Idioms**

Despite a lack of consensus on how to define idioms, researchers generally agree that idioms are difficult for L2 learners to acquire (Irujo, 1986; Cooper, 1998; Boers, 2003; Martinez & Murphy, 2011; Ramonda, 2016). Some researchers of idioms have even gone as far as to say that “Even though complete mastery of idioms may be nearly impossible, every language learner must be prepared to meet the challenge simply because idioms occur so frequently in spoken and written English” (Cooper, 1999, p. 233). Due to the frequency and socio-cultural value of
idioms, L2 learners cannot avoid them; yet mastering idioms also proves to be a daunting obstacle. The difficulty of learning idioms is partially accounted for by their figurative meaning. Even if a L2 learner knows all the words within an idiomatic phrase, he or she may not be able to infer the meaning from the individual words or even recognize that they are being used idiomatically (Martinez & Murphy, 2011).

A few studies have identified variables that can influence the acquisition and usage of fixed expressions and figurative language (Boers, Demecheleer, & Eyckmans, 2004; Irujo, 1986; Martinez & Murphy, 2011; Vanderniet, 2015; Vanlancker-Sidits, 2003; Yagiz & Izadpanah, 2013). These studies have primarily focused on the ways that culture and proficiency affect idiom acquisition. For example, culture can influence the way that figurative language is recognized (Martinez & Murphy, 2011), produced (Irujo, 1986), and interpreted (Yagiz & Izadpanah, 2013). If cultures are different from each other, the themes used in figurative language can also differ (Boers, Demecheleer, & Eyckmans, 2004). For example, English has more idioms relating to sports and sailing, whereas French has a greater number of idioms related to food and cooking. For language learners crossing these cultural barriers, these differences can cause confusion, increasing the difficulty of learning the idiom. However, culture is only one part of a broader category of language socialization. Language socialization includes the interactions of language learners within the “local social, political, and cultural contexts in which language is learned and used” (Duff & Talmy, 2011, p. 96). This could include the language that L2 learners speak on a daily basis in their work and school interactions as well as the language used in interactions with friends. These interactional variables have not been studied in connection to idiom acquisition but will be addressed in this study.
The other main acquisition variable that has been addressed in current research is language proficiency. Two studies have examined the effects of proficiency on idiom acquisition. Vanlancker-Sidits (2003) showed that differences in proficiency between native speakers of American English, fluent non-native speakers of English, and ESL students contributed to their ability to recognize idioms in spoken English by using prosodic cues. A more recent study by Vanderniet (2015) further investigated the effects of proficiency on idiom acquisition, finding that the acquisition of idioms was more closely related to speaking proficiency than reading or writing proficiency. However, language proficiency at one point in time is simply one small piece of language development. Language learners come from a variety of background and learning situations. Some of the variables that could influence learners’ overall language development include the age they started learning English, the number of years they studied English, whether their instruction was in an ESL or EFL setting, and number of years living in a country where English is the medium of communication (Taguchi, 2008; Birdsong, 2018). Like the socialization variables mentioned above, none of these variables have been applied to the acquisition of idioms, but will be addressed in the current study.

**Idiom Processing**

Idiom processing refers to the physical and cognitive processes required to read and comprehend language, including vision, long-term, and short-term (working) memory. The two major theories of idiom processing focus on how idioms are stored and retrieved from long-term memory. The idiomatic key hypothesis by Cacciari & Tabossi (1988) states that each idiom has a certain point, referred to as the idiomatic key, when the mind will recognize the phrase as an idiom and reject a possible literal meaning. This recognition point varies for each idiom. According to this hypothesis, if the context is ambiguous, the literal meaning of an idiom will be
accessed first. However, if there is a biasing context, the figurative interpretation may be accessed earlier. In contrast, the lexical representation hypothesis (Swinney & Cutler, 1979) proposes that idioms are stored in the mental lexicon as a single lexical item, similar to morphologically complex words. Because these phrases are stored as a single lexical item, when they are retrieved from long-term memory, they are processed faster than if each word was individually processed. When the idiom is encountered, both literal and idiomatic meanings are activated in the mental lexicon. However, the more efficient processing of figurative language causes the idiomatic meaning to be accessed first. There has been support for both hypotheses (Swinney & Cutler, 1979; Cacciari & Tabossi, 1988; Cieślicka, 2006; Siyanova-Chanturia et al., 2011), but it should be noted here that these theories were intended to address L1 idiom processing. Research on L2 learners has shown mixed results on whether the literal or figurative meaning of idioms is accessed first. Some studies found that learners showed a processing advantage when reading idiomatic usages of a phrase rather than literal usages (Conklin & Schmitt, 2008; Underwood et al., 2004), but other studies did not show the same advantage (Siyanova-Chanturia et al., 2011; Cieslicka, 2006). Like other aspects of idiom research, this is an area that could use further study.

**Methods of studying idiom processing**

Several different methods have been used to study how idioms are processed. The main types include think-aloud procedures, self-paced reading studies, and studies that use eye-tracking. During think-aloud procedures, participants verbalize their thoughts to a researcher while completing a cognitive task such as problem solving or reading (Cooper, 1999; Ericsson & Simon, 1993; Bulut & Çelik-Yazici, 2004; Rohani, Ketabi, & Tavakoli, 2012). As the name suggests, self-paced reading studies allow readers to progress through a text at their own rate,
typically progressing one line at a time (Conklin & Schmitt, 2008). Eye-tracking studies use specialized eye-tracking technology to identify where participants are looking from moment to moment while reading texts containing idioms (Underwood et al., 2004; Siyanova-Chanturia et al., 2011; Conklin & Pellicer-Sanchez, 2016).

**Think-aloud procedures.** Up until the early 2000s, studies of idiom processing used think-aloud protocols to focus on learner reading strategies. One of the most important early studies was conducted by Cooper in 1999. During the study, participants were asked to verbalize their thoughts as they read and decoded the meanings of 20 different idioms in short contexts. The purpose of the study was to investigate the mental processes of L2 learners when they encounter a new idiom. Cooper successfully identified many strategies that L2 learners use when they encounter a new idiom – such as paraphrasing or referring to their native language. Later studies expanded on Cooper’s study by using think aloud procedures to evaluate how effective strategies were at helping learners deduce the correct meaning of an idiom (Bulut & Çelik-Yazici, 2004) and identifying differences in strategies depending on context (Rohani, Ketabi, & Tavakoli, 2012).

However, like all think-aloud studies, these studies were limited by the readers’ ability to clearly vocalize their thoughts as they complete a task. Cooke and Cuiddihy’s (2005) study of think-aloud procedures found that “participants tend to make more errors when thinking aloud and are less successful at completing tasks that are complex and require a great deal of concentration and focus” (p. 653). The same study also showed that even participants who have been trained to speak their thoughts aloud while performing tasks are not proficient at verbalizing their thoughts. This problem would naturally be compounded for students endeavoring to speak their thoughts in their second language.
Think-aloud procedures may also be affected by reactivity - the research method itself affecting the process and outcomes of the studies. Barkaoui (2011) found that participants who were required to think-aloud as they read and rated essays were affected in several ways, including reading comprehension and aspects of writing that they paid attention to. Out of 25 participants, 14 reported that thinking aloud caused them to slow down when performing the task. Additionally, 7 participants described their need to re-read parts of the essay due to a difficulty in focusing on the passage while thinking aloud. Others found that thinking aloud “drew their attention to some aspects of writing that they might not have attended to if they were rating silently” (Barkaoui, 2011, p. 65). Although these consequences may seem minimal, they are indications that think-aloud procedures cause participants to read differently than they would under normal circumstances. The implication is that oral protocols can affect the reliability of reading behavior measures, thus producing inaccurate results that do not reflect natural reading processes. This finding is especially important for studies in idiom processing where comprehension and attention to reading passages are central to the research. Rather than requiring participants to divide their attention between the tasks of reading and reporting their thoughts, more direct methods of measuring cognitive processes were needed to properly determine how readers interact with idioms.

**Self-paced reading.** Conklin & Schmitt (2008) attempted a more direct measure of idiom processing through reading-pace research. Their study used self-paced reading to investigate the differences in reading speed between sentences containing idioms and matched literal equivalents. During the experiment, the readers were presented with one line of text at a time. When they finished, they pressed a button to progress to the next sentence. The results showed that both L1 and L2 readers read lines with idioms faster than matched lines containing a literal
equivalent, indicating faster mental processing times. Despite the success of this study, Conklin and Schmitt (2012) summarized idiom research and concluded that eye-tracking would be a more effective methodology to study the processing of idioms because it is more precise and minimizes variability.

**Eye-tracking.** Eye-tracking is an alternative to think-aloud procedures or self-paced reading that is frequently used in psychology and neuroscience. Modern systems typically track the pupil and light reflecting off the cornea to identify the direction of a participant’s gaze. When connected with stimulus shown at a fixed location (i.e. at a set location on a computer screen), this can provide accurate data about precisely where a person is looking at any given time. According to Rayner (1998), "eye movement data [reflects] moment-to-moment cognitive processes in...various tasks" (p. 372). Like self-paced reading, eye-tracking provides a more direct measure of idiom processing than think-aloud procedures. However, eye-tracking is an improvement on self-paced reading because it collects precise data not only on the total reading time, but on other reading measurements. According to Conklin and Pellicer-Sanchez (2016), “Eye-tracking is primarily used to detect and measure an eye’s movements (saccades) and stops (fixations), as well as movements back in a text when reading (regressions)” (p. 454). These additional measurements from eye-tracking tools provide valuable quantitative data on a reader’s attentional focus and allow greater insight into cognitive processing during reading tasks. The current study will focus on the durations of these measures and analyze dwell time (duration of fixations the first time a phrase is read), go-past time (dwell time plus the duration of all regressions, excluding re-reading time), and total time (total reading duration including dwell time, go-past time, and subsequent re-reading).
Eye-Tracking and Reading

Due to the small number of eye-tracking studies involving idiom processing, it seems prudent to first give an overview of eye-tracking in reading research. According to reader-response theory, reading can be seen as an interaction between the reader and the text (Hirvela, 1996). When there are changes to either of these components, it can affect the reading process. Eye-tracking studies on the effects of reader ability on overall text comprehension have shown that poor readers tend to make more regressions than good readers (Underwood et al., 2004). In addition, eye-tracking studies on the effects of text difficulty have shown that the number of regressions and saccades increase with text difficulty (Vitu & O'regan, 1995) and that total time tends to be longer, signaling an increase in the cognitive effort required to understand the text (Anson, Schwegler, & Horn, 2009). Clifton, Staub, & Rayner (2007) listed a number of variables both within the reader and within the text that could affect reading at the word level. These variables included word frequency, familiarity with the word, age of word acquisition, number of meanings, morphology, contextual constraint, and plausibility within context. If words are less frequent, less familiar, acquired at a later age, less plausible for a certain context, or have multiple meanings or complex morphology, then they will tend to elicit longer fixation durations. Essentially, if readers have difficulties with overall text comprehension (either because of reader ability or text difficulty), then this will show up in eye-tracking studies as more regressions, more saccades, and longer total time. If readers have difficulties comprehending single words, those words will show longer fixation durations. Comprehension of phrases is most similar to overall text comprehension, with increases in regressions, saccades, and total time.
Eye-Tracking and Idioms

While eye-tracking can be a highly effective way to research attentional focus, especially when paired with other study types, a review of the literature revealed only one study investigating how native English speakers read idioms and two eye-tracking studies focusing on how L2 learners of English read idioms.

Titone and Connine (1999) used eye-tracking to contrast L1 reading patterns of decomposable and non-decomposable idioms. Decomposable idioms are phrases in which the literal meaning of individual words in the phrase contributes to the figurative interpretation of the idiom (e.g., hit the jackpot). In contrast, non-decomposable idioms are phrases in which the literal meaning of individual words has little relation to the figurative meaning (e.g., kick the bucket). According to the results, reading rates differed according to the decomposability of the idioms. However, unlike more recent studies, the researchers did not include data on fixations, saccades, or regressions. Instead they tracked the reading rate per character during the idiomatic phrase. This method is not typically used because variables such as word frequency and word length can affect the reading process. Readers tend to read high frequency words and short words faster than low frequency words or longer words (Inhoff & Rayner, 1986). Depending on the frequency of the words and the amount of function words, the reading rate could change. Titone and Connine’s findings were contradicted by a later study that showed that the decomposability of idioms did not affect reading rates for L1 or L2 readers (Siyanova-Chanturia et al., 2011).

Underwood, Schmitt, & Galpin (2004) found that L1 readers had fewer fixations and shorter fixations than L2 readers, showing that it took L1 readers less time to process individual words. While this was a predictable result, it confirms the eye-tracking research that had previously been conducted on reading. More importantly, Underwood et al. found that both L1
readers and L2 readers showed a processing advantage for the final word of a phrase when it was part of a formulaic sequence instead of a non-formulaic context, possibly indicating that the beginning of a sequence helped readers predict the final words. However, it should be noted that the words used in the formulaic and non-formulaic phrases were not the same, so the two types of phrases could not be directly compared due to differences in the surrounding words (specifically length and frequency of words). Accordingly, their study focused primarily on fixations, but did not address other measurements such as total time. Regressions were briefly mentioned, but specific data was not included in their report. Although Underwood et al.’s study focused on a small number of measurements and did not balance the length and frequency of words in the phrases, it provided a valuable addition to idiom processing research as the first eye-tracking study to compare how L1 and L2 readers process idioms in English. This study paved the way for further research as it demonstrated that idiomatic phrases required more cognitive processing than literal phrases for both L1 and L2 readers.

Siyanova-Chanturia et al. (2011) built on Underwood et al.’s study by reporting a greater variety of measurements and comparing idiomatic and literal phrases with the exact same wording to allow for a better comparison. It also took another step toward reducing variation by asking participants to rate their comprehension of all of the idioms after they had finished reading. This helped control for participant knowledge of each idiom. Siyanova-Chanturia et al. found that L1 readers read more fluently than L2 readers, confirming Underwood et al.’s findings. Non-native speakers had longer first pass reading times, overall reading times, more saccades, and longer fixation durations, showing that it took more cognitive effort for them to process what they read. However, their results differed in that Siyanova-Chanturia et al. found that native speakers of English read both literal and figurative idioms faster than non-native
speakers of English, while non-native speakers processed the figurative meaning of idioms more slowly than literal versions.

Although both L2 eye-tracking studies made significant contributions to understanding idiom processing, the findings were conflicting. Underwood’s study found that both L2 readers and L1 readers showed a processing advantage when reading idioms, whereas Siyanova-Chanturia et al.’s study found that L2 readers did not show a processing advantage. As there are only two eye-tracking studies on L2 idiom processing at the current time, more research is needed to help support or refute their findings. With more studies on this topic, researchers will be able to more fully understand the complexities of L2 idiom processing.

Aims of the Current Study

The current study will build on the foundation of previous research by reducing participant variation and further exploring variables that can influence the processing of idioms. The research questions for this study are:

1. To what extent do L2 learners process idioms and non-idiomatic sentences differently from native speakers, as shown through dwell time, go-past time, and total time?

2. What individual variables among L2 learners correlate to processing time when reading idioms?
Methodology

Participants

The participants for this study consisted of 32 native speakers of English (L1 students) and 26 native speakers of Korean from South Korea who spoke English as a second language (L2 students). All of the participants were students at Brigham Young University. The L1 students included 4 graduate students and 28 undergraduate students. The L1 participants included 13 females and 18 males. The average age of the L1 students was 22. There were 5 L1 participants who considered themselves to be bilingual. Their L2s included Mandarin Chinese, German, and Spanish (3 participants). The L2 students included 4 graduate students and 22 undergraduate students. Half of the L2 participants (13) were female, and the other half (13) were male. The average age of the L1 students was 23. There were 3 L2 participants who considered themselves to be bilingual in English and Korean. These participants were included in the Korean population because they had lived in South Korea for the majority of their lives and used Korean more than English on a daily basis. On average the L2 participants began learning English at age 10 and had 10 years of formal English study in a classroom. In their daily interactions, 8 of the participants used mostly English, 8 used mostly Korean, and 10 used English and Korean equally. Each participant met or exceeded one of the following English proficiency requirements set by Brigham Young University: a TOEFL score of 80, IELTS score of 6.5, PTE score of 53, or an advanced or proficient Cambridge English rating. In order to participate in this study, participants were required to have normal or corrected-to-normal vision (glasses and contacts were acceptable).
Materials

Selection of sentences. To compare idioms and literal sentences two options were considered: comparing an idiomatic sentence with a paraphrased sentence, and comparing sentences where the same phrase is used literally and idiomatically (See Figure 1, compared phrases are underlined). In 1992, Gibbs studied native speakers of English and their perceptions of idioms versus paraphrased equivalents by having them read and respond to scenarios or stories. According to his study, native speakers viewed idioms as more complex than paraphrased equivalents. Because paraphrases may not be able to capture the nuances of an idiom (Gibbs, 1992), the decision was made not to use paraphrased versions of idioms for the current study. A more effective option (and one more frequently used in idiom research [Titone & Connine, 1999; Underwood et al., 2004; Siyanova-Chanturia et al., 2011]) involved comparing phrases that could be used in both an idiomatic and literal sense. This use of paired sentences with identical phrases also allowed a better comparison for eye-tracking. Because both the idiomatic and literal sentences contained a phrase with the same words, it was easier for the researcher to analyze how the phrases differed depending on whether they were being used literally or idiomatically.

<table>
<thead>
<tr>
<th>Paraphrase Comparison</th>
<th>Identical Phrase Comparison</th>
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<tr>
<td>This homework is a piece of cake.</td>
<td>This homework is a piece of cake.</td>
</tr>
<tr>
<td>This homework is easy to do.</td>
<td>For dessert I ate a piece of cake.</td>
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Figure 1. Paraphrase comparison vs. identical phrase comparison.

While creating the sentences, a few considerations were taken into account. It is possible that some phrases may be used primarily as an idiom, while others are used primarily in a literal sense. To ensure that both versions sounded natural, a pilot survey was given to ten native
speakers of English studying TESOL at the graduate level. The survey asked the native speakers to evaluate whether the proposed sentences seemed natural and if they could easily identify the phrase that could be used as an idiom. Any additional comments or suggestions were written below the survey questions. The items were revised based on their feedback and resulted in 30 pairs of idiomatic and literal sentences (60 sentences total). The sentences were then balanced so that idiomatic and literal versions were similar in length overall: 1640 characters for idioms, and 1623 characters for literal sentences. A paired t-test showed that this difference was not significant (p < .05). After adjusting the length, a lexical analysis was also conducted on the sentences to regulate the frequency of words. A large majority of the words (96.4%) were taken from the General Service List (GSL) of most frequent words. The remaining 3.6% included English-Korean cognates and words that college students could be reasonably expected to know (e.g. homework, interview, airport, wallet, etc.). A list of the final version of the sentences can be found in Appendix C.

Selection of AOIs. When creating an eye-tracking experiment, it is useful to set an area of interest (AOI) to collect reading behavior data on specific textual features. For reading experiments, AOIs can focus on individual morphemes, words, phrases, or sentences, according to the hypothesis of the experiment (Holmqvist, Nyström, Andersson, Dewhurst, Jarodzka, & Van de Weijer, 2011). Of the two eye-tracking studies on L2 processing of idioms, one study set each word as an AOI (Underwood et al., 2004), and the other focused on phrases (Siyanova-Chanturia et al., 2011). Underwood et al.’s study tested the processing of the final word within idiomatic phrases, so AOIs were set for single words. While a single word approach can provide rich data about that word, without evaluating the idiom as a unit, it is difficult to distinguish word processing from idiomatic processing. In contrast, Siyanova-Chanturia et al. (2011)
investigated the processing of phrases before and after a key point (the idiomatic key), so AOIs were set to collect data on a phrase level. According to the lexical representation hypothesis, idiomatic phrases are stored as a single lexical item, necessitating a phrase level approach to studying idiomatic processing (Swinney & Cutler, 1979). With that in mind, this study followed the example of Siyanova-Chanturia et al. (2011) in focusing on phrase level processing instead of single word processing.

**Apparatus**

An SR Research Eyelink 1000 Plus system located at Brigham Young University was used to measure eye movements. The Eyelink 1000 Plus system uses a high-speed camera to capture an image of the pupil every millisecond (a sampling rate of 1000hz). Participants sat at a fixed distance of 65 cm from the computer monitor and used a chin and forehead rest to reduce head movements. Sentences were displayed on a monitor with a resolution of 1600 x 900. The table that the monitor was on was marked so that the monitor would be in exactly the same position for each participant. Text size was adjusted so that approximately 3 letters was equivalent to 1° of visual angle.

**Procedure**

All participants completed a questionnaire on their language learning background and personal information prior to beginning the eye-tracking portion of the study (Appendices A and B). After completing the background survey, the researcher adjusted the focus of the eye-tracker and conducted a 9-point calibration to ensure accurate tracking of the pupil. The calibration was repeated as necessary during the experiment. If calibration was not successfully completed, participants were excluded from the study.
Before beginning the tasks, participants read two test sentences to become familiar with the procedures and the equipment for the study. Following the practice sentences, participants read the sentences in a randomized order. Participants saw both the literal and idiomatic versions of sentences, but they never saw two versions of the same sentence right after each other.

After participants finished reading the sentences, they were given a list of all of the sentences in a randomized order on paper and asked to identify which sentences contained idioms. The researcher gave each participant a definition of an idiom and two example sentences: “The old man kicked the bucket.” – a stereotypical idiom with a possible figurative and literal meaning, and “The guy was hitting on the girl.” – a phrasal verb. Participants were given these examples to help them understand the definition for idioms that was used for this study, which included phrasal verbs. Participants were told to mark a sentence if it had a possible figurative meaning. All participants verbally confirmed that they understood the instructions and examples. None of the participants had questions about any of the words used in the sentences they saw during the eye-tracking portion of the experiment.

When participants finished marking the list of sentences, they were given a second survey on paper and asked to rate each idiom on a 4-point scale based on how well they knew the idiom (1 = I do not know this idiom, 2 = I have seen or heard this idiom before, but I don’t know what it means, 3 = I have heard this idiom before, and I think I know what it means, 4 = I know this idiom). A few L2 participants said that there was an idiom that they had never heard before, but they thought they knew what it meant. In this situation, they were instructed to mark 2 because they were guessing what the idiom meant. While this survey does not perfectly measure idiom knowledge, it can indicate that participants might know a given idiom.
Results

All data were analyzed by using SAS Proc Mixed to fit mixed models for repeated measures to determine the effects of native language (L1 or L2) on the dwell time, go-past time, and total time for target phrases in literal and idiomatic sentences. Dwell time is the sum of all fixation durations the first time the target phrase is read. This measure does not include the fixation times after regressions (re-reading time). Go-past time includes the dwell time plus the amount of time that a participant spends backtracking to re-read parts of the sentence before moving on. Total time is the total reading duration, including the dwell time, go-past time, and any re-reading time. All of these reading measures are reported in milliseconds.

Analysis of Dwell Time

The data were first analyzed to investigate the influence of native language and sentence type on dwell time. The effect for native language was statistically significant, $F(1, 50) = 15.71$, $p< .001$, $\eta_p^2 = .034$, indicating a shorter dwell time for native speakers of English ($M=586.66$, $SD=415.78$) compared to native speakers of Korean ($M=737.32$, $SD=492.25$). The effect for sentence type, $F(1, 50) = 0.07$, $p = .79$, $\eta_p^2 < .0001$, indicated that the effect was not significant for literal and idiomatic sentence types. The interaction effect was not significant, $F(1, 50) = 1.02$, $p = .32$, $\eta_p^2 = .003$.

Analysis of Go-Past Time

An analysis of the influence of native language and sentence type on go-past time found that the effect for native language was statistically significant, $F(1, 50) = 4.07$, $p = .049$, $\eta_p^2 = .013$, indicating a shorter go-past time for native speakers of English ($M=794.77$, $SD=764.92$) compared to native speakers of Korean ($M=967.69$, $SD=734.05$). The effect for sentence type, $F(1, 50) = 0.46$, $p = .50$, $\eta_p^2 = .0003$, indicated that the effect was not significant for literal and
idiomatic sentence types. The interaction effect was not significant, $F(1, 50) = 2.37, p = .13, \eta^2_p = .001$.

**Analysis of Total Time**

An analysis of the influence of native language and sentence type on the total time found that the effect for native language was statistically significant, $F(1, 50) = 10.25, p = .002, \eta^2_p = .044$, indicating a shorter total time for native speakers of English ($M=716.24, SD=523.81$) compared to native speakers of Korean ($M=937.73, SD=640.55$). The effect for sentence type, $F(1, 50) = 1.43, p = .24, \eta^2_p = .0004$, indicated that the effect was not significant for literal and idiomatic sentence types. The interaction effect was significant, $F(1, 50) = 10.33, p = .002, \eta^2_p = .004$. A post-hoc Tukey-Kramer test showed that there was a significant difference between Korean speakers reading idioms and literal sentences ($p = .001$) as seen in Figure 2. The mean total time for Korean speakers increased from 892.48 to 982.98. The mean total time for English speakers decreased slightly from 736.93 to 695.55 when reading idiomatic and literal sentences, but the difference was not significant ($p=0.15$).
Analysis of L2 Language Learning Variables

From the analysis of total time, it appeared that native Korean speakers read idioms and literal sentences differently. A follow-up analysis used SAS Proc Mixed to investigate which language learning variables moderated the differences in total reading time between idiomatic and literal sentences for native Korean speakers. The variables that were analyzed included variables related to language socialization (language used most frequently on a daily basis, language used most frequently with friends), language development (age that participants started learning English, years of formal English study, number of years in an English-speaking country, whether the participants learned English in an EFL or ESL context), and idiom knowledge. For each language variable the interaction of the variable was separately modeled with the factor sentence type.

The language socialization variables were related to the language that the participants used most frequently. These variables included language (English or Korean) used most
frequently in daily interactions and language used most frequently with friends. Analysis showed a non-significant effect for both language used on a daily basis, $F(2, 1413) = 0.62, p = .26, \eta^2_p = .0007$, and language used with friends, $F(2, 1413) = 0.59, p = .56, \eta^2_p = .0008$.

The language development variables related to when and where the native Korean speakers learned English. The analysis showed a non-significant effect for the age that participants started learning English, $F(1, 1413) = 0.07, p = .79, \eta^2_p < .0001$, years of formal study, $F(1, 1355) = 0.12, p = .73, \eta^2_p = .0001$, number of years in an English-speaking country, $F(1, 1414) = 0.11, p = .74, \eta^2_p = .0001$, and whether the participants learned English in an EFL or ESL context, $F(2, 1413) = 1.37, p = .26, \eta^2_p = .0019$.

The final variable that was tested was idiom knowledge. Idiom knowledge was the only variable among the language learning variables analyzed that showed a significant interaction with total time, $F(1, 1413) = 9.37, p = .002, \eta^2_p = .007$, indicating a significant difference between Korean speakers who self-reported a higher knowledge of the idioms and Korean speakers who self-reported a lower knowledge of the idioms.
Discussion

The purpose of this study was to investigate differences in the way native Korean and native English speakers processed idiomatic and literal sentences differently and to further examine language learning variables that might influence L2 reading. To answer the first research question, overall reading durations for native Korean and native English speakers were collected and compared and will be discussed below followed by a more specific discussion of main and interactional effects of language background and sentence for type dwell time, go-past time, and total time. Finally, the post-hoc analysis of language learning variables among the native Korean speakers will be addressed.

Reading Differences for English and Korean Speakers

Overall there was a difference between the way native Korean and native English speakers read idioms. In all reading measures – dwell time, go-past time, and total time – Korean speakers spent longer in both idiomatic and literal phrases than their counterparts. As noted before, when dwell time, go-past time, and total time increase, it reflects an increase in the cognitive effort required to understand the text (Anson et al., 2009). In the current study, native Korean speakers had longer reading times in all of these measures. This was an expected result, considering that previous research found that language background and proficiency affects the recognition and processing of idioms (Martinez & Murphy, 2011; Vanlancker-Sidits, 2003). Similar patterns were noted in previous eye-tracking studies by Siyanova Chanturia et al. (2011) and Underwood, Schmitt, & Galpin (2004), reflecting differences in proficiency and reading fluency between native English speakers and non-native English speakers. Likewise, the data from the current study reflects the increased cognitive processing time required for participants reading in their second language through an increase in dwell time, go-past time, and total time.
The main effects and interaction effects of L1 (English or Korean) and sentence type (idiomatic or literal) on dwell time, go-past time, and total time will be discussed in greater detail below, along with follow-up analyses of language learning variables.

**Reading Differences by Language and Sentence Type**

An analysis of dwell time revealed a significant main effect for L1, showing that native Korean speakers had significantly longer dwell times than native English speakers. Dwell time refers to the sum of fixation durations the first time a participant reads the target phrase or AOI. This measure excludes any re-reading time, and thus is typically associated with early reading processes such as word recognition and decoding (Conklin & Pellicer-Sánchez, 2016). This indicates that native Korean speakers spent more time on word recognition and decoding in the early stages of processing the idiom. There was not a significant main effect for sentence type or a significant interaction between L1 and sentence type for dwell time. This means that although there were differences in word recognition and decoding between native English and native Korean speakers, those differences were not contingent on whether a sentence was literal or idiomatic. Instead, those differences may primarily reflect the difference in language proficiency between the two groups.

The analysis of go-past time also showed a significant main effect for L1, indicating that native Korean speakers spent more time re-reading the sentence than native English speakers in order to understand the phrase. Go-past time includes the dwell time plus the amount of time that a participant backtracks to re-read parts of the sentence before moving on. Longer go-past times can be associated with later reading measures such as text comprehension (Conklin & Pellicer-Sánchez, 2016). The mean go-past time for native Korean speakers was 967.69 milliseconds, as opposed to 794.77 milliseconds for native English speakers. This amounts to approximately 22%
longer go-past times for native Korean speakers. Like dwell time, this measure shows that it took more time and effort for native Korean speakers to read and understand phrases than native English speakers. There was not a significant main effect for sentence type or a significant interaction between L1 and sentence type for go-past time. The lack of a significant interaction effect between L1 and sentence type for go-past time indicates that the differences in go-past time for native English and native Korean speakers did not depend on whether the sentence was literal or idiomatic. As with dwell time, differences in go-past time between native English speakers and native Korean speakers may reflect the proficiency of the groups.

The analysis of total time showed a significant main effect for L1, indicating that native Korean speakers took more time to cognitively process phrases than native English speakers. There was also a significant main effect for sentence type, meaning that there was a significant difference in the amount of time required to read literal and idiomatic sentences. However, unlike dwell time and go-past time, there was a significant interaction between L1 and sentence type for total time. As seen in Figure 2, the reading speed for native English speakers increased when reading idiomatic phrases while the reading speed of native Korean speakers decreased. Total time reflects the total amount of time that participants look at words within the target phrase, including the initial dwell time and re-reading time. Total time is associated with later reading processes that include both the time spent decoding words and the time needed to process the meaning of the words in the context of the sentence (Anson et al., 2009).

The implications of this result are twofold. First, native English speakers processed idiomatic phrases slightly faster than literal phrases, possibly reflecting the tendency for native English speakers to process idiomatic phrases as a single lexical item or language chunk (Swinney & Cutler, 1979; Underwood et al., 2004). Second, native Korean speakers processed
idiomatic phrases slower than literal phrases, reflecting an increase in the cognitive processing required to understand the meaning of the idioms in the context of the sentences. These results support the findings of Siyanova-Chanturia et al. (2011) and Cieslicka (2006) showing that non-native speakers of English did not have a cognitive processing advantage when reading idioms as compared to literal sentences. However, it should be noted that the interaction between L1 and sentence type for native Korean speakers was only significant in the late reading measure of total time. The two groups are similar in the earlier reading measures (word recognition, re-reading), but differ in the late reading measures involving comprehension as the participants integrate the meaning of the idiomatic phrases in the sentence. This suggests that native Korean speakers may initially process idioms word-by-word instead of recognizing them as single lexical items the way native English speakers are thought to, although they recognize the difference at a later stage. According to the idiomatic key hypothesis (Cacciari & Tabossi, 1988), there is a point where readers recognize that a phrase is idiomatic. After that point, the idiom is processed faster. The difference in total time between native Korean speakers and native English speakers implies that the idiomatic key or recognition point may vary depending on language background.

**Discussion of Language Learning Variables**

While some of the differences in total time between native English speakers and native Korean speakers can be attributed to language background, follow-up analyses tested if other variables affected the reading behavior of native Korean speakers. Three categories of variables were chosen for analysis based on previous language acquisition research: socialization variables, language development variables, and idiom knowledge.

The socialization variables included the language that participants used most frequently on a daily basis (English or Korean) and the language they used most frequently with friends.
These were included as variables because the language that the participants use and are exposed to could influence their knowledge of the English language. If participants use English more on a daily basis, there is a higher chance that they will be exposed to more idiomatic language. Likewise if participants have more friends who speak English, they will likely develop more receptive vocabulary knowledge than participants who speak mostly Korean. Unexpectedly, neither of these variables had a significant effect on total time. While it is possible that these variables are not connected to idiomatic processing, it is also possible that the long-term effects of these variables are not visible in the acquisition of discrete vocabulary items.

The language development variables were related to the time and place where English was learned. These variables included the age that participants started learning English, years of formal study, number of years in an English-speaking country, and whether the participants learned English in an EFL or ESL context. These variables could also affect the amount of English that participants are exposed to. It was anticipated that participants who learned English earlier, longer, or in settings with a lot of English exposure would be more familiar with idioms, resulting in a reduced cognitive load when reading idioms. Similar to the socialization variables, none of these variables had a significant effect on total time. This suggests that ESL/EFL settings may not be as different as one might expect in terms of idiom acquisition. It is possible that both settings may not provide an idiom-rich environment for students learning English. Teachers in EFL settings often focus on vocabulary that is necessary for standardized tests, which may not include idioms. Other EFL teachers, as Ramonda (2016) found, may not see a reason to teach idioms or not find it practical for the situations where their students would use English. It is possible that instruction in ESL settings is equally idiom-impoverished, but further research
investigating the extent to which idioms are taught in ESL programs is necessary to confirm or deny this possibility.

The final variable that was tested was idiom knowledge. Idiom knowledge was included as a separate category to represent the necessary knowledge of each idiom as a lexical item, as discussed by the lexical representation hypothesis (Swinney & Cutler, 1979), which states that idioms are stored in the mental lexicon as a single lexical item or language chunk. Idiom knowledge had a significant effect on total time, with native Korean speakers who were more familiar with the idioms exhibiting shorter reading times than native Korean speakers who were less familiar with the idioms. This suggests that the cognitive processing time for idioms is reduced for native Korean speakers who are familiar with the idioms. In applying the concept of an idiomatic key to this research (Cacciari & Tabossi, 1988), it may mean that the idiomatic key or recognition point has greater variability among second language learners than in native English speakers, depending on their familiarity with the idiom. Learners who are more familiar with a given idiom may recognize the phrase earlier, contributing to their effectiveness in integrating the meaning of the idiomatic phrase into the sentence.
Conclusion

The analyses of the native English and native Korean reading measures for idiomatic and literal sentences reveal several findings. First, native Korean speakers in this study processed both idiomatic and literal sentences slower than native English speakers. Second, the native Korean speakers processed idiomatic sentences slower than literal sentences, but only in later reading measures. Finally, out of the language acquisition variables that were investigated, idiom knowledge was the only variable that significantly affected the reading measures of the native Korean speakers. As long as the native Korean speakers had knowledge of the idiom as a lexical item, then they read it faster. While language socialization and development variables may contribute to proficiency or idiom knowledge, they are not the most important variables in idiom processing.

The findings of this study suggest that both the lexical representation hypothesis and the idiomatic key may apply to L2 idiom acquisition. Like native English speakers, native Korean speakers may store idioms as a single lexical unit. However, whether the idioms are retrieved as multi-word lexical units or a single lexical unit may differ by language background (L1/L2) and the reader’s idiom knowledge. Likewise, the idiomatic key or recognition point of an idiom may vary according to language background and the reader’s idiom knowledge.

Future Research

As with many aspects of idiom acquisition and processing research, more research is needed in a number of areas. First, it should be noted that this study was intended as a study of attention. While participants were asked to self-rate their familiarity with each idiom, their comprehension was not tested in other ways. Participants were also not directly asked about their thoughts or cognitive processes. While conducting a think-aloud study may influence the reading
process, future researchers may want to consider conducting interviews after the reading is completed or including more direct measures of idiom comprehension.

A second aspect of this study that deserves more attention is the location of regressions within idiomatic sentences. Both groups of participants in this study spent similar amounts of time re-reading the text. However, participants could have spent more time re-reading the figurative language used in the idiomatic phrase, or they could have spent more time re-reading the rest of the sentence to understand the context. Future research could investigate which parts of idiomatic sentences were re-read the most following regressions and how that differs according to language background (L1/L2). This would give greater insight into the processing differences of L1 and L2 readers. It would also be informative to see how cognitive processing changes if readers are unable to reread the idiom. This could be examined through a moving window eye-tracking study. Would this equalize the language proficiency variable or exacerbate it? If both groups showed longer reading times or reduced comprehension of the idioms, it would suggest that re-reading idioms is a necessary component of idiom recognition.

A good follow-up study might also address word-level processing during idiom recognition and comprehension. Coding each word of an idiom as an AOI in addition to each idiom would enable researchers to identify the idiomatic keys for idioms and compare if there were differences according to language proficiency. This type of study could allow researchers to see if the idiomatic key hypothesis applies equally to L1 and L2 readers of different proficiencies.

Given the significance of idioms in the English language, the acquisition and processing of idioms by English language learners is a topic worthy of further study. While there are two major theories of L1 idiom processing (processing as a single lexical item vs. initial processing...
as independent words), the applications of these theories to L2 idiom processing have shown mixed results. Findings from this study show that L2 learners process idiomatic sentences slower than literal sentences. This effect was moderated by idiom knowledge, suggesting that it is familiarity with the meaning of specific idioms that contributes to idiom processing speed. It is possible that English language learners may initially read idioms as individual words, but progress to processing idioms as single lexical items as their familiarity with idioms increases. Future research will continue to illuminate the processes by which learners acquire idiomatic language and the connections between idiom knowledge and cognitive processing.
References


Appendix A: Background Information Survey for Native English Speakers

- Name:
- Age:
- What country are you from?
- What is your first language?
- Did you grow up bilingual? If so, which other language(s) do you speak fluently?
- Are you an undergraduate student? If so, how many years have you studied at BYU?
- Have you studied at any other universities? If so, how long did you study there?
- Do you have normal vision? If you wear glasses or contacts to correct your vision, answer “Yes”.
- Do you have any disabilities that affect your ability to read or understand written sentences?
Appendix B: Background Information Survey for Native Korean Speakers

General Background Questions

- Name:
- Age:
- What country are you from?
- What is your first language?
- Did you grow up bilingual? If so, which other language(s) do you speak fluently?
- Are you an undergraduate student? If so, how many years have you studied at BYU?
- Have you studied at any other universities? If so, how long did you study there?
- Do you have normal vision? If you wear glasses or contacts to correct your vision, answer “Yes”.
- Do you have any disabilities that affect your ability to read or understand written sentences?

Language Learning Background

- What age did you start studying English?
- How long did you study English in a classroom setting with a teacher?
- Did you primarily learn English in an English speaking country?
- How long have you lived in an English-speaking country (including your current stay in America)?
- In your daily interactions, do you primarily speak English or another language?
- What parts of learning English are the most difficult for you?
- Do most of your friends speak Korean, or English?

Self-report of English proficiency:
Rate your proficiency in the following categories (Circle one):
<p>| | | | |</p>
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</thead>
<tbody>
<tr>
<td>1. Reading in English</td>
<td>Beginner/Novice</td>
<td>Intermediate</td>
<td>Advanced</td>
</tr>
<tr>
<td>2. Speaking in English</td>
<td>Beginner/Novice</td>
<td>Intermediate</td>
<td>Advanced</td>
</tr>
<tr>
<td>3. Listening to English</td>
<td>Beginner/Novice</td>
<td>Intermediate</td>
<td>Advanced</td>
</tr>
<tr>
<td>4. Writing in English</td>
<td>Beginner/Novice</td>
<td>Intermediate</td>
<td>Advanced</td>
</tr>
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Appendix C: Idiomatic and Literal Sentences with the Target Phrase Underlined

1. Going to college was a step in the right direction for him.
2. After looking at a map, he took a step in the right direction.
3. I know I shouldn’t have hit him, but he was asking for it.
4. I gave him a pencil because he was asking for it.
5. His promotion was up in the air.
6. The balloon was up in the air.
7. The bad news was hard for him to swallow.
8. The big piece of meat was hard for him to swallow.
9. The company still has a long way to go before it is out of debt.
10. We have a long way to go before we arrive at the airport.
11. After losing his job, he quickly got back on his feet.
12. The runner got back on his feet after he tripped.
13. You need to get your hands dirty to be a successful businessman.
14. If you play outside, you might get your hands dirty.
15. My efforts went down the drain.
16. The water went down the drain.
17. His hopes for college went out the window when he saw his test results.
18. The child threw a ball that bounced off the wall and went out the window.
19. Ever since the new baby was born, they have a lot on their plates.
20. When people eat at a buffet, they usually have a lot on their plates.
21. He hit below the belt when he mentioned John’s divorce.
22. In boxing it is illegal to hit below the belt.
23. Annie was careful to keep her eyes open for good sales at the store.
24. She couldn’t keep her eyes open because of the strong wind.
25. This assignment is a piece of cake.
26. After dinner I ate a piece of cake for dessert.
27. He had the job in the bag after he did well on his interview.
28. The woman put the groceries in the bag.
29. My manager let me off the hook for my mistake.
30. The man took his coat off the hook and went outside.
31. Congress is still on the fence about the new bill.
32. There was a warning sign on the fence by the construction site.
33. The businessman smelled a rat when he was offered a deal that seemed too good.
34. The cat smelled a rat that was hiding in the kitchen cupboard.
35. The businessman pulled the plug on the deal.
36. The mother pulled the plug in the bath.
37. The way the waiter treated him left a bad taste in his mouth.
38. The bitter drink left a bad taste in his mouth.
39. Our research barely scratched the surface of the topic.
40. I accidentally scratched the surface of the table.
41. His history homework was so easy that he could do it with his eyes closed.
42. Everyone was surprised when the player scored after shooting the ball with his eyes closed.
43. I stood by my friends when they were in trouble.
44. I stood by the door so I could be first in line when the store opened.
45. The politician’s supporters turned on him when they realized he was lying.
46. I turned on the light before I sat down at my desk.
47. His guesses are usually spot on.
48. I got a spot on my shirt.
49. He has been on the street since he lost his job.
50. I found five dollars on the street yesterday.
51. The student fell apart from the constant stress.
52. My shoes fell apart after I used them for three years.
53. This interview could be my ticket to success.
54. I bought a ticket to the new movie.
55. His name is on the tip of my tongue, but I can’t remember it.
56. I burned the tip of my tongue on my hot chocolate.
57. I’m still waiting for the bad news to sink in.
58. I have a sink in my kitchen but not in my bathroom.
59. She yelled at her boyfriend last week, but that’s water under the bridge now.
60. After the storm, the water under the bridge near my house was higher than ever.