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How to *Save Your Skin* when Processing L2 Idioms: An Eye Movement Analysis of Idiom Transparency and Cross-language Similarity among Bilinguals

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ABSTRACT

The current study looks at whether bilinguals varying in language dominance show a processing advantage for idiomatic over non-idiomatic phrases and to what extent this effect is modulated by idiom transparency (i.e., the degree to which the idiom's figurative meaning can be inferred from its literal analysis) and cross-language similarity (i.e., the extent to which an idiom has an identical translation equivalent in another language). An eye tracking experiment was conducted in which Spanish-English bilinguals were presented with literally plausible (i.e., idioms that can be interpreted both figuratively and literally) transparent (e.g., *break the ice*, where the figurative meaning can be deduced from analyzing the idiom literally) and opaque idioms (e.g., *hit the sack,* where the meaning cannot be inferred from idiom constituents). Idioms varied along the dimension of cross-language similarity, with half the idioms having word for word translation equivalents in English and Spanish and another half being different, that is, having no similar counterpart in another language. Each idiom was used either in its literal (e.g., *get cold feet:* become cold) or figurative meaning (e.g., *get cold feet:* become afraid). In control phrases the last word of the idiom was replaced by a carefully matched control (e.g., *get cold hands).* Reading measures (fixation count, first pass/gaze reading time and total reading time) revealed that cross-language similarity interacts in an important way with idiom transparency, such that opaque idioms were more difficult to process than transparent ones, and different transparent idioms took faster to process than similar transparent idioms. Results are discussed with regard to the holistic vs. compositional views of idiom storage and the role of activated L1 (first language) knowledge in the course of L2 (second language) figurative processing.

Keywords: idioms, cross-language similarity; language dominance; transparency; eye tracking; bilingual; figurative language; holistic hypothesis

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Introduction

While a number of eye movement studies have been conducted in language processing in bilinguals (see Roberts & Siyanova-Chanturia, 2013 for overview), very few eye tracking studies to date have focused specifically on how bilinguals process figurative language (Carrol & Conklin, 2015; Carrol, Conklin, & Gyllstad, 2016; Cieślicka, Heredia, & Olivares, 2014; Siyanova-Chanturia, Conklin, & Schmitt, 2012; Siyanova-Chanturia, Conklin, & Van Heuven, 2011; Underwood, Schmitt, & Galpin, 2004). One strand of eye movement research in bilingual figurative processing has focused on the idea that idiomatic expressions might be stored and processed differently, depending on the status of the language (native, henceforth referred to as L1 vs. nonnative, henceforth referred to as L2). More specifically, since idioms are highly conventionalized formulaic sequences, it has been suggested that their processing is automatic for native language users and they should be retrieved as whole chunks from the mental lexicon, the view known as the *Holistic Hypothesis* (Jiang & Nekrasova, 2007, Wray, 2002). On the other hand, since idioms' figurative meanings are not necessarily directly related to or discernible from the analysis of their individual parts (Chomsky, 1980; Fraser, 1970; Katz, 1973; Weinreich, 1969), they have been shown to pose a challenge for nonnative language users (Cacciari, 1993; Fernando, 1996; Gairns & Redman, 1986; Kovecses & Szabo, 1996; Liontas, 2015; Moon, 1997). Thus, holistic retrieval might not be available for nonnative language speakers, who might instead rely on the word-for-word analysis of idiom constituents in the course of processing L2 idiomatic expressions.

Traditional monolingual idiom processing models (e.g., *Idiom List Hypothesis,* Bobrow & Bell, 1973*; Lexical Representation Hypothesis,* Swinney & Cutler, 1979*; Direct Access Model,* Gibbs, 1980, 1985) have indeed assumed that idioms are highly lexicalized (i.e., stored as a long word in the mental lexicon) and should therefore be easy to retrieve and processed faster than comparable literal phrases, which call for additional processing effort during the computation of meanings of their individual components. While these traditional, noncompositional idiom models have since been challenged, the most recent, *hybrid* approaches to idiom processing in native speakers such as the *Hybrid Model* (Caillies & Butcher, 2007; Cutting & Bock, 1997; Sprenger, Levelt, & Kempen, 2006) or *Constraint-Based Model* (Libben & Titone, 2008; Titone & Connine, 1999; Titone, Columbus, Whitford, Mercier, & Libben, 2015) also maintain the view that idioms can be retrieved holistically from the lexical store, in addition to being processed compositionally. The hybrid view of idiom processing is broadly consistent with the *Dual Route Model* of language use (Van Lancker Sidtis, 2004, 2012; Van Lancker Sidtis, Cameron, Bridges, & Sidtis, 2015), positing the parallel availability of two processing routes, namely, the direct route for holistic retrieval of highly automatized phrases and the compositional route for a word-by-word analysis of less familiar sequences (see Carrol & Conklin, 2014).

Only few theoretical accounts have been put forth to explain the acquisition, storage, and processing of idioms in nonnative language users. Gibbs (1995) has suggested that L2 speakers learn idioms in a rote manner, by establishing arbitrary links between idiom forms and their figurative meanings (cf. Glucksberg, 2001). A number of studies in L2 idiom processing suggest that L2 idiomatic expressions are more likely to undergo a full compositional analysis in the course of their processing by nonnative language users and for that reason the literal meaning of L2 idioms might enjoy a particular prominence. For example, Liontas' (2002) *Idiom Diffusion Model of Second Languages* assumes that lexical access of individual words is an obligatory step in idiom L2 processing. Similarly, Kecskes (2000) has suggested that nonnative language users whose metaphorical competence lags behind their overall language competence are more likely to rely on literal meanings of figurative utterances and on their L1 conceptual system when producing and comprehending figurative phrases. The strategy of reliance on literal meanings of idiom constituents is also apparent in the *Model of Dual L2 Idiom Representation* developed by Abel (2003) and in Cieślicka's (2006b) *Literal Salience Model* that assumes primacy (salience) of literal over

figurative senses of idiom constituents, assigning literal meaning a higher salience status in L2 idiom comprehension (cf. Giora, 2002, 2003). All in all, it is very likely that idiomatic expressions are processed differently by native and nonnative language speakers, although the literature to date is not consistent. Whereas some research points to the idea that L2 users are more likely to analyze idioms compositionally (e.g., Abel, 2003; Carrol & Conklin, 2014, 2015; Cieślicka, 2006b, 2007, 2010; Cieślicka & Heredia, 2011; Liontas, 2015; Siyanova-Chanturia et al., 2011; Underwood, Schmitt, & Galpin, 2004), other studies using idioms (e.g., Carrol et al., 2016; Conklin & Schmitt, 2008; McPartland-Fairman, 1989) or other types of formulaic sequences, such as phrasal verbs (Isobe, 2011; Paulmann, Ghareeb-Ali, & Felser, 2015) or collocations (Jiang & Nekrasova, 2007) have failed to demonstrate any processing differences between L1 and L2 users.

In general, studies conducted with the eye tracking methodology seem to support the view that native speakers process idiomatic expressions faster than matched novel phrases, whereas this advantage does not hold true for nonnative speakers (but see Carrol et al., 2016). For example, Underwood, Schmitt, and Galpin (2004) presented native and nonnative speakers of English with idioms (e.g., *honesty is the best* ***policy***) and novel phrases (*it seems that his* ***policy*** *of…).*The region of interest was the last word used in the idiom or in its control novel sequence, both of which contained the same lexical item (e.g., *policy*). Fixation count and fixation duration results for native speakers showed easier and faster processing for formulaic over non-formulaic control phrases; the last word of the idiom obtained fewer and shorter fixations than the same control word used in the non-formulaic sequence. Nonnative speakers, on the other hand, did not show any differences in fixation duration on the target words, regardless of whether the words were part of the idiom or a control novel sequence.

In a follow up study, Siyanova-Chanturia, Conklin, and Schmitt (2011) looked at how native and nonnative speakers of English processed idioms used figuratively (*at the end of the* ***day***: finally) and literally (*at the end of the* ***day***: in the evening). Non-formulaic control phrases were used as a baseline (*at the end of the* ***war***). The number and length of fixations were recorded for the whole idioms and their control phrases, as well as for idioms' last words (e.g., *day*) and their respective controls in non-formulaic phrases (e.g., *war*). A processing advantage was found for idioms over novel phrases, both when the idioms were used figuratively and literally, in the native speaker data. In contrast, the nonnative speaker data showed no differences between idioms and matched non-formulaic phrases (see also Carrol & Conklin, 2014, 2015).

Given these findings in the previous eye tracking research regarding the holistic processing of idiomatic over non-idiomatic expressions in native vs. nonnative speakers, the goal of the current study was to further address this issue. However, rather than looking at the differences between native vs. second language speakers, we focus on the dimension of bilingual language dominance which has been shown to affect figurative language processing (see Heredia & Cieślicka, 2014 for an extensive discussion). For example, in a study exploring processing differences for L2 formulaic sequences between early vs. late bilinguals, Matlock and Heredia (2002) asked monolingual English speakers and early or late Spanish-English bilinguals to determine if a paraphrase of either a literal or figurative interpretation of an English phrasal verb was accurate. Briefly, the term *early bilinguals* refers to individuals whose L2 is learned early in life (i.e., early childhood), whereas *late bilinguals* are those whose L2 is learned late in life (i.e., after childhood). Early bilinguals were faster in identifying the figurative than the literal interpretation of the phrasal verbs. In contrast, late bilinguals were generally slower and revealed no differences between the literal and figurative readings of the phrasal verbs. Based on these results, Matlock and Heredia suggested that, whereas late bilinguals who are dominant in their L1 might rely on a literal analysis of idiom constituent words in order to derive an idiom's figurative meaning, early and highly fluent bilinguals dominant in L2 could retrieve the idioms directly from the mental lexicon (see also Paulmann, et al., 2015 for similar results utilizing ERPs).

The role of language dominance was further examined in an eye-tracking study by Cieślicka et al. (2014) where Spanish-English bilinguals, dominant in Spanish or English, were presented with ambiguous (e.g., *a piece of cake*) English idioms that were used figuratively (*see the point:* understand) or literally (*see the point*: notice the dot), with disambiguating (i.e., figuratively or literally biasing) context either preceding (e.g., *Nowadays, to maintain a comprehensive Web site featuring fresh news and features is certainly not* ***a piece of cake*** *for smaller newspapers)* or following the idiom (e.g., *It's not* ***a piece of cake*** *but an apple tart, and I'd also appreciate it if you'd bring me the cappuccino I ordered ten minutes ago*). While the bilingual participants dominant in English showed a processing advantage for idioms used figuratively, Spanish-dominant bilinguals had shorter total reading time in sentences where the idioms were used literally, in line with the Literal Salience Model (Cieślicka, 2006b). Moreover, fixation data showed fewer fixations for the post-idiom (disambiguating) region in the figurative context for English-, as opposed to Spanish-dominant bilinguals, suggesting ease of retrieval of idioms' figurative meaning for bilinguals dominant in English. Regression data supported those differences, such that Spanish-dominant bilinguals showed a processing advantage for literal over figurative meanings, with significantly fewer regressions to the idiom region when the context biased the idiom's literal, as opposed to the figurative meaning. In light of these findings regarding differences in the activation of literal and figurative meanings of L2 idioms by early and late bilinguals, varying with regard to their dominance in the L2, the current study further explores whether and how the processing of idioms is modulated by language dominance.

Another factor shown to be critical in bilingual idiom processing, and the one that we directly address in this paper, concerns the degree of cross-language similarity or overlap between L1 and L2 idioms (Carrol et al., 2016; Cieślicka, 2006a; García, Cieślicka, Heredia, 2015; Irujo, 1986; Laufer, 2000; Liontas, 2002, 2015; Titone et al., 2015; Türker, 2016). Briefly, similar idioms have an identical meaning and a close word-for-word correspondence across languages, as in the Polish idiom *wziąć byka za rogi*, which, when translated literally into English, means *take the bull by the horns (wziąć=take, byka=the bull, za=by, rogi=the horns).* In contrast, different idioms vary in their semantic and syntactic structure, despite expressing the same concept, as in *curiosity killed the cat*, which is rendered in Polish as *ciekawość to pierwszy stopień do piekła (curiosity is the first step to hell)*. Previous research has shown that similar idioms are easier to comprehend than different ones, but similar idioms might be prone to negative transfer from L1 (e.g., Charteris-Black, 2002; Cieślicka, 2006a; Liontas, 2002, Irujo, 1986). It has also been argued that L2 users extensively employ knowledge of idioms in their native language when comprehending and producing L2 figurative expressions (e.g., Irujo, 1986; Singleton, 2007), provided the two languages are typologically close (Kellerman, 1983; Singleton, 1999).

In a recent study exploring the effect of cross-language similarity on idiom comprehension, Titone et al. (2015) conducted a meaningfulness judgment task, in which French-English bilinguals read English sentences with idioms and decided if the sentences were meaningful. The idioms were coded for their similarity to idioms in participants' L1 in such a way that they had identical meaning and structure, identical meanings but only one or two words overlapping across languages, identical meaning with no words overlapping across translations, or no equivalent meaning in L1. In addition, the presentation condition was manipulated so that the sentences either contained an intact English idiom (e.g., *He played with fire*) or a code-switched idiom, where the last idiom word was translated into French (e.g., *He played with feu* (*fire*).

Response times increased and accuracy of responses decreased for the code-switched condition, as compared to the intact condition, suggesting that changing the final word might have prevented the holistic retrieval of the idiom and hence slowed down the processing time. More importantly, similar English idioms with the highest degree of overlap with their French equivalents were the easiest to process, and this facilitation held both for the intact and code-switched conditions. Overall, Titone et al. (2015) conclude that cross-language similarity might be

one of the many facilitatory factors in the course of L2 idiom processing, in line with the *Constraint Based Model* (Libben & Titone, 2008), under which a number of variables modulate the availability of the holistic retrieval. The presence of a code switched L1 final word in similar idioms might be also facilitatory on account of its cross-language overlap, thus allowing faster retrieval of the corresponding L2 idiom.

In order to find out if the facilitatory effect of the activated L1 knowledge extends beyond the lexical-level (i.e., single word) and if idiom priming (i.e., faster recognition) can be obtained based on the conceptual-level activation of an entire phrase, Carrol and Conklin (2014) designed an ingenious study where Chinese-English bilinguals were presented with English idioms (e.g., *jump the gun*) and with Chinese idioms that have been translated into English (e.g., *draw a snake and add feet*, meaning "ruin with unnecessary detail"). Such translated idioms had no lexical or conceptual idiomatic counterparts in English, so any processing advantage obtained would be a strong indicator that L1 knowledge is automatically activated in the course of L2 processing. The task was a lexical decision on the last idiom word (e.g., *feet*), whereas the initial idiom fragment served as a prime (*e.g., draw a snake and add*…). Reaction times to English idioms and Chinese translated ones were compared to control phrases, where the last idiom word was replaced with a matched control (e.g., *draw a snake and add*….*hair*). While Chinese-English bilinguals showed no processing advantage for English idiomatic expressions, their lexical decisions following Chinese translated idioms were significantly faster than matched controls, suggesting the presence of cross-language priming and the possibility that the conceptual representation of L1 idiom meaning got activated through its component parts presented in L2.

Overall, given the important role demonstrated for L1 in L2 idiomatic processing, we look at whether the degree of cross-language idiom overlap will facilitate L2 idiom comprehension in bilinguals. Because the ease or difficulty of an L2 idiom is directly related to how transparent the idiom's figurative meaning is for the language user, idiom transparency is experimentally manipulated in the present study. Briefly, idiom transparency indicates the degree to which the original motivation of the figurative meaning can be directly inferred from the literal analysis of the idiom, as in "saw logs", where the figurative meaning can be deduced from analyzing the idiom literally and noticing a similarity between the sounds produced when someone saws logs to those produced by someone snoring (e.g., Cacciari & Glucksberg, 1991; Glucksberg 1993). The degree of idiom transparency can be influenced by a number of factors, such as the idiom's clear etymological origin (e.g., *bury the hatchet* referring to the symbolic act when making peace) or a common metaphorical theme, where one conceptual domain (e.g., *anger*) is expressed in terms of another (e.g., *heat*), as in he *blew his top* or he *let off steam* (Gibbs, 1993). Also, idioms can be transparent on account of overlap between literal meanings of idiom constituents and their figurative extensions in the idiomatic phrase, as in *pop the question*, where "question" stands for "marriage proposal" and "pop" refers to the act of uttering it (Glucksberg, 1993). Finally, idioms which are similar across languages are likely to perceived as transparent by nonnative language users and easier for them to process, as demonstrated in studies into L2 idiom learning that have shown a facilitating influence of idiom transparency on recognition and production (e.g., Irujo, 1986; 1993; Liontas, 2002, 2015; Steinel, Hulstijn, & Steinel, 2007; Yorio, 1989).

While dominance, cross-language overlap, and transparency have all been explored in previous L2 idiom studies, to the best of our knowledge, the joint effects of those three variables on L2 idiom comprehension have not yet been addressed with the eye-tracking paradigm. Our goal in the current study is therefore to look at these factors and investigate the extent to which idiom similarity and transparency affect the on-line comprehension of bilinguals who are either dominant or non-dominant in their L2. The study records eye movements of Spanish-English bilinguals as they read English sentences with idioms used figuratively and literally (e.g., *hit the sack*: go to sleep vs. *hit the sack:* punch the bag). The rationale behind including literally-biased

idioms is that obtaining a processing advantage for such idioms would strengthen even further support for the *holistic hypothesis* and indicate that automatic retrieval of an idiomatic phrase occurs regardless of the contextual bias and regardless of whether the idiom is used in its canonical (i.e., typical), or non-canonical meaning.

With regard to dominance, we assume that dominant bilinguals should show processing advantage for idioms over novel matched (control) phrases and retrieve them holistically (see Carrol & Conklin, 2014, 2015; Siyanova-Chanturia et al., 2011; Underwood et al., 2004). In relation to similarity, based on the limited on-line bilingual studies looking at the effect of cross-language overlap, we expect that similar idioms will be easier to process than different ones. Likewise, transparent idioms should be easier to process than opaque ones. How both transparency and similarity will interact to modulate this facilitatory effect, however, is at best speculative, since no eye tracking studies have explored the joint effects of both of these idiom characteristics in idiom processing. To sum up, the research questions can be summarized as follows: (1) Will language dominance affect a processing advantage for idioms over novel matched phrases for English-dominant vs. Spanish-dominant bilinguals? (2) Will cross-language similarity facilitate idiom processing? (3) Will there be differences between those effects for transparent vs. opaque idioms? (4) Will the processing advantage for idioms over control phrases differ as a function of whether the idiom is used figuratively or literally?

Method

Participants

Eighty-nine Spanish-English bilinguals from the psychology subject pool at Texas A&M International University participated in the experiment. Participants volunteered or received credit as a partial class requirement. Sixty-two participants were classified as English-dominant bilinguals, and 27 as Spanish- dominant. Dominance was determined using Dunn and Fox Tree's (2009) Bilingual Dominance Scale (BDS). Sixty-seven participants reported English as their L1 and 22 reported Spanish as their L1. Sixty-one participants learned English before the age of five and 75 participants learned Spanish before the age of five. The overwhelming majority (80 participants) reported residing in both English and Spanish-speaking region, with only four participants residing in the Spanish-speaking only and five in the English-speaking only region. Twenty-seven bilinguals rated themselves as more fluent speaking Spanish than English and twenty three as having better writing skills in Spanish than in English. Forty-eight participants considered themselves more fluent in English than Spanish, 18 reported feeling equally comfortable in both languages and 14 felt they were most comfortable speaking Spanglish, a code-switching variety of language typical of the border region where the study was conducted.

Materials

The stimuli consisted of 20 English literally plausible idioms (e.g., *have cold feet*), half of which were similar across languages and the other half different. Following Irujo (1986), Laufer (2000), Liontas (2002), and Cieślicka (2006a), English idioms (e.g., *point of view*) that have a direct translation and express the same meaning in Spanish (e.g., *punto de vista*) were classified as similar. Idioms classified as different were those lacking any written or spoken similarity but expressing the same concept (e.g., *to pull a leg* vs. *tomar el pelo*: *to take the hair*). All idioms conformed to the same syntactic structure: Verb + (Determiner/Adj) + Noun. Out of the 10 similar and 10 different idioms, half were transparent and half opaque (see Table 1). All stimuli were normed following Cieślicka's (2013) procedures.

Table 1
Examples of English Idioms and Their Spanish Translations

Idiom Type	English and Spanish Translation
Similar transparent	*Save your skin: Salvar el pellejo*
Similar Opaque	*Wear the pants: Llevar los pantalones*
Different Transparent	*Skate on thin ice: Ir pisando huevos*
Different Opaque	*Hit the sack: Planchar oreja*

Control novel phrases were prepared, closely matching the idiom structure, with the last word of the idiom replaced with a control word (e.g., *get cold feet*: *get cold hands*), matched on predictability, frequency, length, and concreteness (all *p*s >.05; see Table 2 for examples of stimuli). Word frequencies were taken from Brysbaert's (2009) American English word frequency counts. The adoption of the task, where the last idiom word was replaced with a matched control, was inspired by Siyanova-Chanturia et al, (2011) experiment.

Table 2
Idioms and Matched Control Phrases Used in the Experiment

Experimental	Control
paint the town (247)	paint the door (292)
carry a torch (4.98)	carry a ribbon (5.06)
hit the sack (12.92)	hit the clerk (12.90)
kick the bucket (10.02)	kick the pistol (10.06)
wear the pants (58.75)	wear the cross (55.04)
spill the beans (14.43)	spill the soup (25.20)
bite the dust (23.84)	bite the tail (23.90)
break the ice (79.55)	break the seat (78.78)

Each idiom was embedded in two context types: (1) Context biasing the idiom's literal meaning (e.g., *Grandpa was told by the doctor that his circulation problems are the reason why he often* ***gets cold feet*** *and becomes tired quickly)*; (2) context biasing the idiom's figurative meaning (e.g., *Even though he is a seasoned conference speaker, every time he is about to get on stage he* ***gets cold feet*** *and fears a panic attack*). In addition, a novel, idiom's control phrase was constructed in which the last word of the idiom was replaced with the matched control (e.g., *Grandpa was told by the doctor that his circulation problems are the reason why he often* ***gets cold hands*** *and becomes tired quickly*). Examples of the three types of stimuli (literal, figurative, and novel) are provided in Table 3 below. So that each participant saw each idiom only once, three experimental lists were prepared. Each list included 20 idiomatic sentences (10 used literally and 10 figuratively), 10 novel matched controls, and 30 filler, non-idiomatic sentences.

Table 3
Experimental Stimuli Used in the Experiment

Phrase Type	Sentence
Literal	*As part of our stress-release seminar, we all had to fight each other, scream at the top of our lungs, hit the sack, and practice cry therapy, just as Steve Jobs did.*
Figurative	*I worked all night, I am fatigued, sleepy and ready to hit the sack, but I still need to read for a few minutes before I turn off the light.*
Novel Matched	*After being ignored for over 20 minutes, Roger became so frustrated that he finally hit the clerk who had been on his android smart phone texting his significant other.*

Design

The critical eye movements measured were *first pass reading time* (defined as the sum of all fixation durations made prior to exiting the region), *gaze duration* (defined as the sum of the duration of all fixations made on the word prior to exiting the word region), *total reading time* (the sum of all fixation durations made within a region of interest), and *fixation count* (the number of all fixations made within a region of interest), both for the whole idiom (*gets cold feet*) and its matched novel phrase (*gets cold hands*) and for the final word of an idiomatic phrase (*feet*) and the final word (*hands*) embedded in a matched novel phrase. The design conformed to a 3(Type of Phrase: Figurative vs. Literal vs. Novel) x 2(Idiom Similarity: Similar vs. Different) x 2(Transparency: Transparent vs. Opaque) x 2(Language Dominance: Spanish-dominant vs. English-dominant) mixed factorial design, with Type of Phrase, Idiom Similarity, and Transparency as within subjects factors, and Language Dominance as a between-subjects variable.

Procedure

Eye movements were recorded using the Eye-Link 1000 eye-tracker and SR Research Experiment Builder Software. Participants were assigned to one of the three experimental lists based on a Latin Square counterbalancing. They were seated approximately 55 cm from the monitor, with their head supported by a chin rest to minimize head movements. Following the calibration, the instructions were displayed on the computer screen. Participants were asked to read the sentences shown on the screen and to answer the comprehension questions that followed. Comprehension questions were of the YES/NO type and were randomly displayed after every few sentences to ensure that participants read with understanding. Following the calibration, participants were provided with a few practice trials to familiarize them with the procedure. Each trial started with a black fixation point appearing on the left of the screen where the first word of the sentence would be shown. Participants were asked to focus their eyes on the fixation point and to press the designated button on a Microsoft SideWinder Plug and Play Game Pad (Model GP5) game controller device in order to trigger the sentence display. After reading the sentence, they pressed the game controller button to advance to the next trial. Sentences were displayed in black Times New Roman 20 font against a white background. The eye monitoring session lasted approximately 20 minutes. Following the experiment, participants completed Dunn and Fox Tree's BDS language questionnaire and further rated the idiomatic expressions used in the experiment for familiarity. Idioms were rated on a 1-5 point Likert scale (ranging from 1 = totally unfamiliar to 5 = completely familiar). Only idioms with a mean rating of 4.0 or higher than 4.0 were included in the data analysis for a given participant. Given this criterion, .7% of the data were removed. The experimental protocol was approved by the Texas A&M International University Institutional Review Board.

Results

Participants' responses to comprehension questions were first analyzed for accuracy. Since all the participants answered the comprehension questions with the accuracy at or above 90%, no data were removed. Next, fixations shorter than 100ms or longer than 800ms were removed from the data. The data were analyzed using linear mixed effects models (LME) using IBM SPSS V. 20 mixed linear model procedure. Analyses were conducted on the first pass reading time, gaze duration, total reading time, and fixation count for both the idiom (and matched novel) phrase region and the last word of the idiom (and last word of the control phrase) region with fixed (Language Dominance, Type of Phrase, Idiom Similarity, and Idiom Transparency) and random effects (items and participants).

First-Pass Reading Time: Whole Phrase

LME analyses revealed a marginally significant main effect of Type of Phrase, $F(1, 973) = 2.77$, $p = .06$, suggesting that reading times for literal ($M = 588$ ms, $SE = 44$) were similar to novel phrases ($M = 582$ ms, $SE = 44$), but faster than figurative ($M = 644$ ms, $SE = 45$). The two-way interaction between Language Dominance and Type of Phrase, $F(2, 971) = 2.36$, $p = .09$, was marginally significant. Follow up simple effects using least significant differences (LSDs) for the interaction between Language Dominance and Type of Phrase showed that for Spanish-dominant bilinguals literally used idioms had significantly shorter first pass reading time (595 ms) than figuratively used idioms (671 ms; $p<0.01$), which lends support to the idea that literal meanings are more salient than figurative ones for late bilinguals who are not dominant in the language. The two-way interaction between Transparency and Type of Phrase, $F(2, 977) = 4.82$, $p < .01$, was reliable, as well as the interaction between Idiom Similarity and Type of Phrase, $F(2, 973) = 5.99$, $p < .005$. The three-way interaction between Similarity, Transparency and Type of Phrase was also reliable, $F(2, 982) = 3.85$, $p < .05$. Follow up simple effects using least significant differences (LSDs) for the interaction between Transparency and Type of Phrase (see Table 4 below) showed that opaque idioms used figuratively elicited significantly longer first pass reading time (653ms) than idioms used literally (559ms; $p<.05$) and than novel matched phrases (503ms; $p<.001$).

Table 4
Mean and Standard Error (SE) for Eye Movements (First Pass Reading Time, Gaze Duration, Total Reading Time, Fixation Count) for Idiom Whole Phrase and Last Word as a Function of Phrase Type (Figurative, Literal, Novel) and Idiom Transparency (Opaque, Transparent)

	Opaque			Transparent		
	Figurative	**Literal**	**Novel**	**Figurative**	**Literal**	**Novel**
First Pass Reading						
Whole Phrase	653 (60)	559 (59)*	503 (59)***	635 (59)	617 (59)	662 (59)
Gaze Duration						
Last Word	167 (18)	193 (18)	144 (18)**	137 (18)	167 (18)	163 (18)
Total Reading						
Whole Phrase	1046 (104)	853 (102)***	796 (102)	937 (102)	1010 (102)	1010 (102)
Last Word	330 (31)	306 (31)*	236 (31)***	249 (31)*	279 (31)	282 (31)
Fixation Count						
Whole Phrase	ns	ns	ns	ns	ns	ns
Last Word	4.9 (2.6)	3.9 (.25)**	3.7 (.25)***	3.7 (.62)	4.9 (.62)	4.2 (.62)

Note: *$p < .05$; **$p < .01$; ***$p < .001$

The three-way interaction of Idiom Similarity, Idiom Transparency, and Type of Phrase is summarized in Table 5.

Table 5
Mean and Standard Error (SE) for Eye Movements (First Pass Reading Time, Gaze Duration, Total Reading Time, Fixation Count) for Idiom Whole Phrase and Last Word as a Function of Phrase Type (Figurative, Literal, Novel), Idiom Transparency (Opaque, Transparent), and Similarity (Different, Similar)

	Opaque-Different			Opaque-Similar			Transparent-Different			Transparent-Similar		
	Fig	**Lit**	**Nov**	**Fig**	**Lit**	**Nov**	**Fig**	**Lit**	**Nov**	**Fig**	**Lit**	**Nov**
First Pass Reading												
Whole Phrase	543(84)	572(82)	513(81)	763 (80)	547 (80)***	492 (80)***	649 (82)	599 (80)***	753 (81)	621 (80)	635 (80)	571 (79)
Gaze Duration												
Last Word	137 (23)***	224 (23)	108 (23)	192 (23)	162 (23)*	179 (23)	161 (23)	157 (23)*	194 (23)	113 (23)***	177 (23)**	132 (23)
Total Reading												
Whole Phrase	976 (144)	868 (140)	725 (139)*	1115 (138)	838 (138)*	867 (139)** **	927 (138)	902 (138) *	1087 (139)	948 (139)	1118 (138)	933 (138) *
Last Word	238 (41)***	354 (42)**	185 (41)	422 (41)	257 (41)***	287 (41)**	318 (41)	258 (41)	329 (42)	181 (41)***	300 (41)	235 (41)
Fixation Count												
Whole Phrase	ns	ns	ns	ns	ns	ns	ns	ns	ns	3 ns	Ns	ns
Last Word	4.6 (.35)	4.0 (.33)	3.5 (.32)*	5.3 (.31)	3.9 (.32)**	4.0 (.32)**	3.7(.94)	5.1 (.94)	4.4 (.71)	3.8 (.71)*	4.7 (.71)	4.0 (.94)

Idiom similarity significantly affected reading times. Specifically, for similar opaque idioms, figuratively used idiomatic phrases had significantly longer reading times (763 ms) than both literally used idioms (M = 547 ms, $p < .001$) and novel phrases (M = 492 ms, $p < .001$). The opposite was found for different transparent idioms, which both when used figuratively (M = 649 ms, $p = .07$) and literally (M = 599 ms, $p < .001$), had significantly shorter first pass reading times than their matched novel phrases (M = 753 ms). It seems that different idioms, unlike similar ones, do not activate cross-language equivalents, which makes them easier to comprehend, by obviating the need to suppress the unwanted cross-language alternative. In addition, transparency also contributes to this ease of processing, as literal analysis of idioms constituents in such idioms helps in deriving the figurative interpretation.

Gaze Duration: Last Word

A significant main effect of Type of Phrase was found, $F(2, 1259) = 3.85$, $p < 05$. The main effect reveals that gaze duration for figurative (M = 151 ms, SE: 14) and novel (M = 153 ms, SE: 14) phrases was larger than for literal ones (M = 108 ms, SE: 14). Figurative and novel phrases were read equally fast. The interaction between Transparency and Type of Phrase was marginally significant, $F(2, 1264) = 2.64$, $p = .07$. The 3-way interaction between Similarity, Transparency and Type of Phrase was statistically reliable, $F(2, 1271) = 12.27$, $p < .001$.

Table 4 above summarizes gaze duration data for idiom last words and control last words as a function of Type of Phrase and Transparency. As can be seen from Table 4, the last word of the phrase was recognized faster when opaque idioms were used figuratively M = 167 ms) than literally (M = 193 ms); however, the effect was marginally significant, ($p = .08$). The same effect was obtained for transparent idioms, which took shorter reading times when they were used in their figurative (M = 137 ms) than their literal (M = 167 ms) meaning. However, the simple effects were marginally significant ($p = .07$). Though marginally significant, these results suggest that figurative meanings were more salient and easier to retrieve than non-salient literal readings

of these idioms. This suggestion is further supported by the finding that the last word in opaque idioms took significantly more time to read when the idioms were used in their literal (M = 193 ms) meaning than for matched control word in novel phrases (M = 144 ms, $p < .01$).

The three-way interaction of idiom Similarity, Idiom Transparency, and Type of Phrase is summarized in Table 5. For different opaque idioms, the last word was read significantly faster (M = 137 ms) when the idiom was used figuratively than literally (M = 224 ms, $p < .001$), and significantly longer when the idiom was used literally (M = 224 ms) than its matched control in novel phrases (M = 108 ms, $p < .001$). In addition, similar transparent idioms turned out very fast to process figuratively, as the last word took shorter to read (M = 113 ms) than when those idioms were meant literally (M = 177 ms, $p < .01$)

Total Reading Time: Whole Phrase

Similar to the results obtained for the first pass/gaze duration reading time data, the total reading time analysis revealed a significant two-way interaction between Transparency and Type of Phrase, $F(2, 1154) = 6.71$, $p < .001$, a significant three-way interaction between Similarity, Transparency and Type of Phrase, $F(2, 1157) = 4.48$, $p < .05$, and a marginally significant four-way interaction between Language Dominance, Similarity, Transparency and Type of Phrase, $F(2, 1155) = 2.42$, $p = .09$. As shown in Table 4, the two-way interaction of idiom Transparency and Type of Phrase significantly affected total reading time, in that opaque idioms used figuratively had significantly longer total reading time (M = 1046 ms) than opaque idioms used literally (M = 853 ms, $p < .01$) and novel matched phrases (M = 796 ms, $p < .001$). This finding directly replicates results from the first pass reading time and strengthens the suggestion that idioms are automatically analyzed compositionally. Since such a compositional analysis fails to retrieve the correct meaning for opaque idioms, it incurs an extra processing cost as the language comprehension mechanism must reject the literal interpretation as inappropriate and retrieve the figurative meaning of the idiom.

Transparency also interacted with Similarity in affecting total reading time for idioms, as was the case for the first pass reading time data. Table 5 summarizes the three-way interaction of Similarity, Transparency and Type of Phrase. Specifically, different opaque idioms used figuratively had significantly longer total reading time (M = 976 ms) than novel phrases (M = 725 ms, $p < .05$); whereas the reverse was true for different transparent idioms which, when used figuratively, had marginally significantly shorter total reading time (M = 927 ms) than novel phrases (M = 1087 ms, $p = .08$). This suggests that different opaque idioms pose processing difficulty as compared to transparent idioms. Not only were transparent idioms faster to read than novel phrases when used figuratively, but also when used literally ($p < .05$). The ease of processing different transparent idioms might stem from the fact that different idioms did not activate cross-language equivalents that could potentially slow down their processing. In addition, transparency as such might make them easier to comprehend as for such idioms literal analysis of their components transparently overlaps with their figurative interpretation. On the other hand, the presence of an identical cross-language translation slowed down the processing of similar idioms. Figuratively used similar opaque idioms had significantly longer total reading time (M = 1115 ms) than both literally used idioms (M = 838 ms, $p < .05$) and control novel phrases (M = 867 ms, $p < .01$). Again, these findings extend the results obtained in the first pass reading data, suggesting that the presence of cross-language competition from Spanish might have led to the slowing down in the processing of similar, as compared to different idioms. Finally, another significant new finding in this 3-way interaction was that similar transparent idioms used literally took significantly longer to read (M = 1118 ms) than matched novel phrases (M = 933 ms, $p < .05$) and marginally significantly longer than when used figuratively (M = 948 ms, $p = .06$). These results might mean that the presence of an identical cross-language translation equivalent might slow

down idiom processing when it is meant literally, as literal counterparts activated from another language interfere with the literal rendering of the idiomatic phrase.

Table 6 and Figure 1 summarize the four-way interaction between Type of Phrase, Transparency, Similarity and Language Dominance. Although marginally significant, we go ahead and interpret the results. For English-dominant bilinguals, transparency seems to have significantly affected the processing of idioms used figuratively and literally. In the opaque idiom data, for both similar and different idioms, figuratively used idioms were read significantly slower (similar, M = 1141 ms vs. different, M = 1034 ms) than literally used idioms (similar, M = 915 ms, $p < .05$ vs. different: 771 ms, $p < .05$) than matched novel phrases (similar, M = 890 ms, $p < .01$ vs. different, M = 764ms, $p < .01$). There was no difference in total reading time between opaque idioms used literally and matched novel phrases. Transparent idioms behaved differently than opaque ones and were additionally affected by whether they were similar or different across languages. Whereas there were no significant differences between similar transparent idioms, whether they were used figuratively or literally or their matched novel phrases, different transparent idioms were recognized significantly faster than matched control phrases (M = 1121 ms), both when used figuratively (M = 822 ms, $p < .01$) and literally (M = 900 ms, $p < .05$).

Table 6
Mean and Standard Error (SE) for Total Reading Time (in ms) for the Whole Phrase as a Function of Phrase Type, Idiom Transparency, Similarity and Language Dominance

Similarity	Transparency	Type of Phrase		
		Figurative	Literal	Novel
English-dominant bilinguals				
Different	Opaque	1034 (147)	771 (142)*	764 (141)**
	Transparent	822 (142)**	900 (141)*	1121 (141)
Similar	Opaque	1141 (142)	915 (142)*	890 (143)**
	Transparent	932 (141)	1021 (141)	938 (141)
Spanish-dominant bilinguals				
Different	Opaque	917 (183)	965 (176)	686 (175)
	Transparent	1032 (173)	904 (171)	1054 (175)
Similar	Opaque	1089 (171)	762(173)*	845 (173)
	Transparent	963 (174)	1216 (174)	882 (170)*

Note: *$p < .05$; **$p < .01$; ***$p < .001$

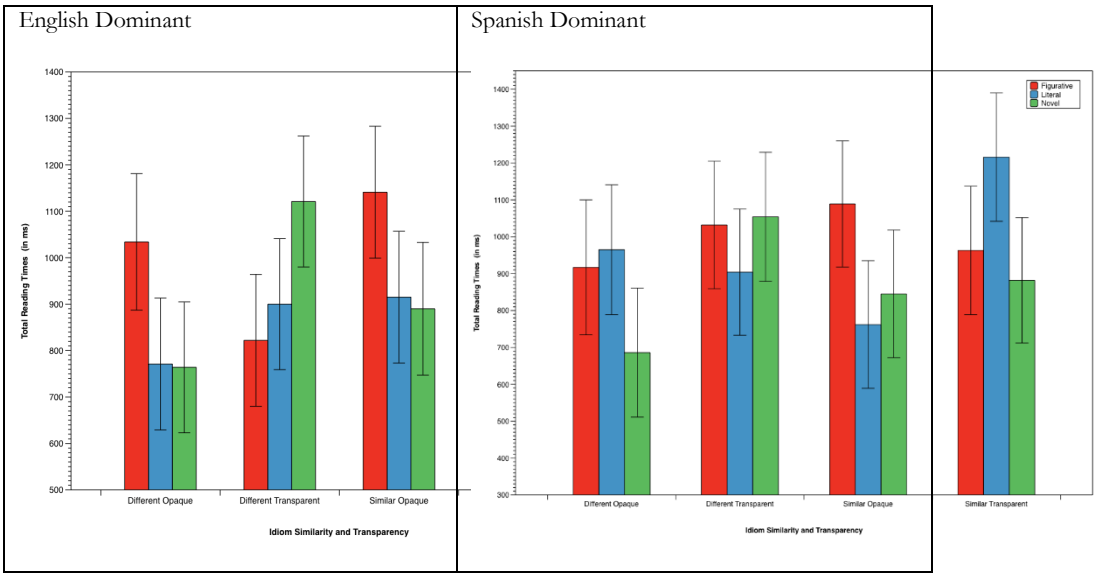

Figure 1. Total reading time for the whole phrase as a function of Type of Phrase, Idiom Similarity and Transparency for English-dominant (top panel) and Spanish-dominant (bottom panel) bilinguals

The data for Spanish-dominant bilinguals showed mostly no processing advantage for idioms over novel phrases, which can be taken to suggest that figurative meaning of English idiomatic expressions is less well established in the mental lexicon of bilinguals not dominant in the L2 or English, or at least, that L2 is not as readily accessible. In addition, literal meaning turned out to be more salient than figurative meaning for similar opaque idioms. These idioms when used literally took significantly shorter to read (762 ms) than when used figuratively (M = 1089 ms, p < .05). In turn, similar transparent idioms were read significantly slower when used literally (M = 1216 ms) than their matched controls (M = 882 ms, p < .05).

Total Reading Time: Last Word

In the total reading time analysis for the last word, results showed a significant two-way interaction between Similarity and Transparency $F(1, 18.28) = 4.37$, $p = .051$, and between Transparency and Type of Phrase, $F(2, 1267) = 4.56$, $p < .05$, as well a significant three-way interaction between Similarity, Transparency and Type of Phrase, $F(2, 1275) = 15.60$, $p < .001$. Table 4 above summarizes the Transparency by Type of Phrase interaction. There were no significant differences for the total reading time of the last word in transparent idioms, as compared to novel matched phrases, irrespective of whether the idioms were used figuratively or literally. In contrast, opaque idioms were more difficult to understand than novel matched phrases, as demonstrated by the significantly longer total reading of the last word in opaque figurative (M = 330 ms) vs. control word in novel matched phrases (M = 236 ms, p < .001), as well as significantly longer total reading time for the last word of opaque idioms used literally (306 ms) vs. control word in novel matched phrases (M = 236 ms, p < .05). Again, as was true for the

first pass reading time data, also here, idiom similarity significantly interacted with transparency in affecting total reading time for the last word of idioms and novel matched phrases (see Table 4).

Different opaque idioms were easier to process in their figurative meaning (total reading time for the last word, M = 238 ms) than in their literal meaning (M = 354 ms, $p < .01$). For one thing, different idioms have no corresponding counterparts in the bilingual's first language and so there is no boost in activating literal meanings of idiom constituents coming from the presence of cross-language translations. For another, they have opaque meaning, where literal analysis of such idioms does not help in rendering their figurative interpretation. Consequently, when opaque idioms are meant literally, their processing is slowed down, both as compared to when they are used figuratively and also to control matched phrases (M = 185 ms, $p < .001$). On the other hand, for different transparent idioms, where there is a transparent contribution of literal meanings of idiom components to the idiom meaning, the last word of such idioms was read marginally significantly faster when they were used literally (M = 258 ms) than matched controls (M = 329 ms, $p = .09$) and than the last word in figuratively used transparent idioms (M = 318 ms, p =0.1). Where different opaque idioms were easier to comprehend figuratively than literally, the reverse was found for similar opaque idioms for which the last word took significantly longer to process (M = 422 ms) in figurative than in literal phrases (M = 257 ms, $p < .001$) and than in matched controls (M = 287 ms, $p < .01$). Finally, similar transparent idioms were easier to understand when used figuratively (the total reading time for the last word, M = 181 ms) than when used literally (300 ms, $p < .01$).

Fixation Count: Whole Phrase

In the fixation count analysis for the whole phrase, the only significant main effect was found for similarity, $F(1, 2068) = 26.59$; $p < .001$. Similar idioms had significantly more fixations (M = 4.3) than different idioms (M = 3.5, $p < .05$). The increased number of fixations on similar, as compared to different idioms, might indicate the presence of cross-language interference and the resulting extra time needed to suppress the translation equivalent. No other significant main effects or interactions were found on the fixation count data for the whole phrase. *Fixation Count: Last word*

In the analysis of the fixation count data on the last word, the only significant main effect was reported for Transparency, $F(1, 1160) = 5.04$, $p < .05$. On average, opaque idioms (M = 4.22, SE = .19) exhibited fewer fixations than transparent idioms (M = 4.28, SE = .42) In addition, there was a significant two-way interaction between Transparency and Type of Phrase, $F(1, 1166) = 6.28$, $p < .005$, and a significant three-way interaction between Similarity, Transparency, and Type of Phrase, $F(1, 1170) = 3.07$, $p < .005$. However, the four-way interaction between Language Dominance, Similarity, Transparency, and Type of Phrase did not reach significance, $F(2, 1170) = 2.32$, $p = .10$. As reported for the remaining eye measures, the fixation count data for the last word revealed that idiom transparency is a major determinant in the ease or difficulty of idiom processing. Table 4 provides a summary of the fixation counts on the last word in idioms and matched controls in transparent and opaque idioms.

Overall, opaque idioms, again, turned out to be more difficult, a pattern consistent with the remaining eye measures. Specifically, when used figuratively opaque idioms had marginally significantly more fixations (M = 4.9) than transparent ones (M = 3.7, $p = .06$). In addition, opaque idioms had significantly more fixations when used figuratively than literally (M = 3.9, $p < .01$) and than their control words in matched novel phrases (M = 3.7, $p < .001$).

Whether the idiom was similar or different across English and Spanish also affected fixation counts on the last idiom word, as summarized by the three-way interaction of Phrase Type,

Transparency, and Similarity on Table 5. Different opaque idioms used figuratively had significantly more fixations on last word (M = 4.6) than matched novel phrases (M = 3.5; $p < .05$); this finding is consistent with the previous eye measures suggesting that idioms are automatically analyzed word by word. With different opaque idioms, such analysis incurs an extra processing cost as it fails to overlap with the idiom's figurative interpretation. Moreover, different opaque idioms used figuratively had marginally significantly fewer fixations on the last word (M = 4.6) than similar opaque idioms used figuratively (M = 5.3, p = .08). As shown by the other eye measures, also, the fixation count data point to the possibility that the presence of an identical counterpart in another language slows down the processing of idioms. Similar opaque idioms used figuratively had significantly more fixations on the last word (M = 5.3) than both matched controls (M = 4.0; $p < .01$) and similar opaque idioms used literally (M = 3.9, $p < .01$), suggesting that opaque idioms pose more difficulty with accessing their figurative meaning. Similarly, last words in opaque idioms (M = 5.3) were more difficult to process than last words in transparent idioms (M = 3.8, p < .05).

General Discussion and Conclusion

In this study, we looked at how bilinguals varying in dominance process idiomatic expressions, by recording their eye movements as they read English idioms used figuratively and literally, as well as control non-idiomatic phrases in which the last idiom word was replaced with its matched control. The reading measures recorded were the first pass reading time, total reading time, and number of fixations on the whole idiom or non-idiomatic phrase, and gaze duration, total reading time, and fixation count on the last word of the idiom or the last word of the control non-idiomatic phrase. We asked the following research questions: (1) Will language dominance affect a processing advantage for idioms over novel matched phrases for English-dominant vs. Spanish-dominant bilinguals? (2) Will cross-language similarity facilitate idiom processing? (3) Will there be differences between those effects for transparent vs. opaque idioms? (4) Will the processing advantage for idioms over control phrases differ as a function of whether the idiom is used figuratively or literally?

In general, the study did indeed demonstrate differences between the processing of idiomatic vs. non-idiomatic novel phrases and, as predicted, those differences were modulated by language dominance and type of idiom. More specifically, Spanish-dominant bilinguals had overall longer reading times for idioms used figuratively than for idioms used literally or novel matched phrases. These data are suggestive of the possibility that the figurative meanings of English idioms were less strongly coded and not available for a holistic retrieval for Spanish-dominant bilinguals. With the figurative meaning not immediately available, the Spanish-dominant speakers instead resorted to a compositional analysis, in line with the previous eye tracking research indicating that literal meanings of L2 figurative expressions might be faster to process for non-native language users (Carrol & Conklin, 2015; Cieślicka et al., 2014; Siyanova-Chanturia et al., 2011; Underwood et al., 2004). The current results extend those findings and allow drawing an analogy, whereby dominant bilinguals process L2 idiomatic expressions like native speakers, whereas non-dominant bilinguals behave like non-native language users (see Matlock & Heredia, 2002; Paulmann et al., 2015). This points to the crucial role of language proficiency as a highly constraining factor determining the nature of figurative processing. While language dominance should not be conflated with proficiency only, the two are highly correlated, in that bilinguals dominant in a given language are, by default, highly proficient in this language as well. The role of L2 proficiency as an important factor modulating a processing advantage for idiomatic over non-idiomatic expressions has been demonstrated in an eye tracking study by Carrol et al. (2016). Highly proficient Swedish learners of English read short sentences which contained one of the three idiom types: L2-only idioms,

that is, English idioms which had no Swedish equivalents, L1-only idioms, that is Swedish idioms that were translated to English but had no English counterparts, or congruent idioms, that is idioms with a high degree of cross-language overlap between English and Swedish. The results suggested that Swedish-English bilinguals showed a processing advantage for all three idiom types, as compared to the non-idiomatic control phrases, which was taken to imply that highly proficient L2 speakers can process L2 idiomatic expressions in a holistic manner compatible to that demonstrated for native language users.

In the current study, dominance interacted with idiom type in affecting whether idioms had a processing advantage over non-idiomatic phrases also in late measures of processing (i.e., total reading time). For English-dominant bilinguals, opaque idioms had significantly shorter total reading time when used figuratively than when used literally and as compared to matched novel phrases. For different transparent idioms, both when used figuratively and literally, total reading time was significantly faster than for matched controls. In contrast, similar transparent idioms did not differ significantly in total reading time from novel phrases, regardless of whether they were used figuratively or literally.

The whole phrase total reading time data for Spanish-dominant bilinguals showed no processing advantage for idioms over novel phrases, and shorter reading time for similar opaque idioms used literally than figuratively, suggesting that literal meanings are processed faster for Spanish-dominant bilinguals than figurative meanings. This literal over figurative advantage, however, held true only for similar opaque idioms, as in similar transparent idioms the reverse was found to be the case, with literally used idioms taking longer to read than matched controls. Overall, these results suggest that there are indeed differences between the processing of idiomatic expressions and novel matched phrases, but these differences are significantly affected by such idiom characteristics as idiom transparency and similarity, as well as by whether the idiom is used figuratively or literally, and the bilingual participant's language dominance.

Indeed, both similarity and transparency significantly affected idiom processing, as manifested in all the reading measures reported. Opaque idioms were generally shown to pose more processing difficulty than transparent ones. In addition, opaque, but not transparent, idioms took longer to understand in their figurative meaning than in their literal meaning. This suggests the possibility that idioms automatically undergo a full compositional analysis, in line with the *Idiom Decomposition Model* (Gibbs & Nayak, 1989; Gibbs Nayak, & Cutting, 1989). Briefly, the model states that, depending on the degree of their decomposability, or the extent to which literal meanings of idiom constituents contribute to the figurative interpretation, idioms differ with regard to their storage and language processing strategies. Using a phrase classification task, Gibbs et al., (1989) found that nondecomposable idioms (e.g., *kick the bucket*) took significantly more time to process than decomposable ones (e.g., *spill the beans*). To account for these findings, Gibbs et al. suggested that such idioms might take longer to comprehend because, in the course of their processing, the attempt to assign independent meanings to the idiom's components, which is obligatory, fails to coincide with the figurative interpretation of the idiom. In contrast, with decomposable idioms, meanings of individual components directly correspond to these idioms' figurative senses (where *spill=reveal*, and *beans=secrets*), and so compositional analysis of these phrases overlaps with an idiomatic interpretation. If, as the Idiom Decomposition Hypothesis suggests, compositional analysis of idiomatic phrases is undertaken automatically, then the outcome of such an analysis will differ for opaque and transparent idioms. While the dimension of idiom transparency is not identical to that of decomposability (e.g., Cieślicka, 2013, 2015), all the opaque idioms used in the current study were nondecomposable, and all the transparent idioms were decomposable. Since in opaque non-decomposable idioms there is no overlap between literal and figurative meanings, compositional analysis slows down their processing when the idioms are meant figuratively, as the meaning emerging from analyzing the idiom components literally does not overlap with the figurative interpretation. In contrast, transparent decomposable idioms are easier to process

because, regardless of their intended meaning- figurative or literal, both meanings are highly overlapping, and so analyzing the idiom literally helps retrieve its figurative interpretation.

These conclusions are further supported by the data obtained for the last word in opaque and transparent idioms. In the gaze duration data, the last word of different opaque idioms took longer to read than the last word of transparent idioms when the idioms were used literally. While transparent idioms lend themselves to being processed compositionally on account of the contribution of literal meanings of idiom components to their overall figurative interpretation, in opaque idioms no such contribution exists, and so when opaque idioms are meant literally, the language processing mechanism is slowed down. Furthermore, for different opaque idioms, the last word was read significantly faster when the idiom was used figuratively than literally and significantly longer when the idiom was used literally than its matched control in novel phrases. Clearly, literal interpretation of opaque idioms poses more challenge than literal interpretation of transparent idioms. The gaze duration data on the last word of similar idioms also showed that opaque idioms were more difficult to understand than transparent ones. Specifically, in similar idioms used figuratively, the last word of opaque idioms took significantly longer to read than the last word of transparent idioms. These findings were extended in the total reading time data on the last word, where last words of opaque idioms elicited significantly longer total reading time than last words of transparent idioms, and in fixation count data, where opaque idioms used figuratively had more fixations on the last word than did transparent idioms, and opaque idioms had more fixations when used figuratively than literally. These data converge on the idea that, in line with the *Idiom Decomposition Hypothesis,* the language processing system undertakes an automatic compositional analysis of idiomatic phrases (see Abel, 2003). Since for opaque idioms used figuratively, there is no contribution of idiom components to their meaning, opaque idioms take more fixations on component words when they are used figuratively than when used literally or when compared to control phrases.

The ease of transparent over opaque idioms demonstrated in the current study is consistent with findings from first language acquisition and the development of metaphorical competence in children, which show that transparent idioms are easier to comprehend and acquire by children than opaque ones (Cain, Towse, & Knight, 2009; Levorato, Cacciari, 1999; Nippold & Duthie, 2003; Nippold & Rudzinski, 1993; Nippold & Taylor, 1995; Spector, 1996). In addition, transparent idioms seem to be easier to comprehend, even if they are unfamiliar to L2 learners. Skoufaki (2008) had advanced learners of English guess at the meaning of unknown English idioms varying along the dimension of transparency. High-transparent idioms had significantly more correct guesses than low-transparent ones, suggesting the presence of idiom inherent properties, such as the constraining conceptual metaphors motivating the meaning of transparent idioms, which makes them easier to understand for non-native language users (see also Boers & Webb, 2015; Boers & Demecheleer, 2001).

Like transparency, idiom similarity significantly affected the eye reading data, both for the whole phrase and last word analysis. In the first pass reading time data for the whole phrase, similar idioms took significantly longer to read than different ones. Likewise, in the total reading time data, not only did transparent idioms behave differently than opaque ones, but they were additionally affected by whether they were similar or different across languages, with different, but not similar idioms demonstrating a processing advantage over novel matched phrases. Consistent with those findings, similar idioms had significantly more fixations than different ones in the whole phrase analysis. These results suggest that an idiom's translation equivalent is automatically activated and its constituent L1 lexical items accessed in the course of L2 idiom processing. The activated L1 lexical items need to be eventually suppressed, which slows down the processing time for similar, as compared to different idioms, where no competing lexical items from L1 get activated. The extra time needed for the suppression of linguistically inappropriate lexical items

obliterates any processing advantage the idiom might otherwise have over a non-idiomatic novel phrase (see Gernsbacher & Robertson, 1999). That is why no processing advantage was found in the current data for similar transparent idioms over novel phrases, regardless of idiom usage (figurative or literal). However, when no direct L1 counterpart exists, as in different idioms, they are more likely to be processed faster than their matched control phrases, as the processing mechanism is not slowed down by the necessity to suppress the activated cross-language translation equivalents. This explains the demonstrated advantage for different transparent idioms, both literal and figurative, over novel matched phrases in the total reading time data.

The importance of similarity in idiom processing was also shown in the eye data reported in the last word analysis, where it had a different effect on transparent vs. opaque idioms. In the total reading time data for opaque idioms used figuratively, the last word took significantly longer to read in similar than in different idioms. The reverse was shown for transparent idioms, where the last word took significantly longer to read in different than in similar idioms. Moreover, different opaque idioms used figuratively had fewer fixations on the last word than similar opaque idioms. In sum, the data recorded for last words are consistent with the findings from the whole phrase analysis and point to the possibility that the presence of an identical counterpart in another language slows down idiom processing.

Overall, the present results extend previous research which showed a significant role that L1 plays in L2 idiom processing (see Carrol & Conklin, 2014, 2015; Carrol et al., 2016; Liontas, 2002, 2015; Titone, 2015). Consistent with previous studies, the current results do demonstrate a strong modulating effect of L1 on L2 figurative processing; however, they seem to challenge the assumption that similar idioms with a high degree of cross-language overlap are easier to process. As discussed earlier, similar idioms turned out more difficult to process than different ones, the finding directly opposite to those reported by Liontas (2002, 2015) and Titone et al. (2015), where English idioms similar to their L1 counterparts were processed faster and more accurately than different ones. Liontas (2002; 2015) presented L2 learners with L2 idioms, either in isolation or embedded in context, and asked them to write down their reading strategies, thought processes and image creation during the processing of each idiom. In line with the Liontas' predictions, lexical level (i.e., transparent) idioms were the easiest and fastest to comprehend, while idioms with no L1 equivalents (i.e., opaque) were the most difficult. Analysis of participants' metacognitive protocols further revealed that translation was the most common strategy employed by learners to interpret the meanings of the idiomatic phrases, which suggests that L2 learners made frequent recourse to their L1 knowledge for L2 idiom interpretation.

One reason for this discrepancy between the current results and those reported earlier might be the task effect, which is considered one of the multiple factors modulating the ease or difficulty of L2 idiom processing in the Constraint-Based Model (Libben &Titone, 2008; see also Liontas, 2015). In Liontas' (2002) study, participants performed one of the three tasks: (1) an Idiom Detection Task, which consisted of detecting an idiom that was part of a text presented on the computer screen; (2) a Zero Context Task, where an idiom was presented in isolation and the task was to interpret its meaning; (3) a Full Context Task, where the idiom was embedded in rich context and the goal again to interpret what the idiom meant. All three required participants to type their responses after they had read the stimulus materials. In turn, Titone et al. (2015) used a grammaticality/meaningfulness judgment task. Both studies hence employed the methodology that primarily reflects late stages of language processing, whereas the current experiment used eye tracking, with both early (first fixation duration/gaze duration) and late (total reading time, fixation count) processing measures. While the presence of a similar L1 counterpart might be conducive to L2 idiom processing in a post-lexical access task like interpreting the idiom's meaning or meaningfulness judgment, early stages of lexical activation might be delayed by the automatic activation of the idiom's translation equivalent, since the activated L1 phrase needs to be suppressed as incompatible with the evolving interpretation of the sentence.

The fact that idiom similarity might both facilitate and hinder L2 idiom processing, depending on the nature of the task, has indeed been demonstrated in the previous literature. In general, studies employing off-line measures have shown dissociation between the effect of idiom similarity on language receptive tasks on the one hand and language productive tasks, on the other. Typically, off-line studies concerning idiom comprehension show facilitative effects of cross-language similarity, but the effect does not hold for production tasks. For example, Irujo (1986) examined comprehension and production of English idioms by native Spanish learners of English. The idioms were either identical or similar in form and meaning to their Spanish equivalents or different from the corresponding Spanish expressions. Idioms that were simple in terms of vocabulary and structure, transparent, and identical or similar across languages were comprehended much better than different ones. In a production test, identical idioms were produced more correctly in significantly more cases than similar or different idioms, whereas similar idioms showed interference from the participants' native language. Other studies also support the finding that cross-language similarity might lead to interference from L1 in production tasks (e.g., Yorio, 1989).

Further demonstration of a dissociation between the facilitatory and inhibitory effects of L1 idiom similarity on L2 idiom processing was shown in Steinel et al.'s (2007) paired associate learning study. The study had Dutch university students learn English idioms in L1-L2 or L2-L1 pairs. In addition to the direction of learning, idiom imageability (i.e., how easy it is to create a mental image of an idiom) and transparency were manipulated. It was hypothesized that transparency should be particularly facilitative for participants' performance on the recognition test, as the overlap between literal and figurative meanings would provide the learners with sufficient clues to deduce the figurative interpretation of the idiom. In addition, the literal meaning of a transparent idiom might constitute an extra memory aid boosting performance. In line with those predictions, transparency facilitated the comprehension of L2 idioms, but high transparent idioms did not differ much from low transparent ones on the production test.

In parallel to those task effects demonstrated in off-line L2 idiom studies, the importance of task type seems equally relevant in on-line measures of bilingual idiomatic processing, as documented in Cieślicka et al.'s (2017) recent idiom comprehension study with Spanish-English bilinguals. While the experiment did not manipulate the dimension of idiom similarity *per se*, it clearly showed how the nature of the task can affect the extent to which idioms are either retrieved holistically or analyzed compositionally. In the study, Spanish-English bilinguals varying in terms of their dominance in English were presented with sentences including English idioms (e.g., *I was feeling nervous about going up on stage, but my fellow actors all told me to take a deep breath and break a leg)* and either asked to make a lexical decision on a target word related literally (e.g., DAMAGE) or figuratively (e.g., LUCK) to the preceding idiomatic sentence (Experiment 1) or perform a meaningfulness judgment task and decide if the presented target word (e.g., DAMAGE or LUCK) was congruent with the preceding sentence (Experiment 2). Results showed a clear dissociation for the RT data obtained for figurative- and literal-related targets in the lexical decision task, which is implicit (automatic) and an index of early semantic processing, and a meaningfulness judgement task, which reflects late stages of processing and as such constitutes a conscious, explicit task. Specifically, while the lexical decision task showed faster processing for idioms, used both figuratively and literally, over control phrases for English-dominant bilinguals, Spanish-dominant bilinguals showed preference for analyzing the idioms literally. This difference disappeared in the explicit meaningfulness judgment task, where both Spanish- and English-dominant bilinguals recognized congruent idiom targets faster than incongruent ones, regardless of whether the idioms were used figuratively or literally.

Task differences can likewise be evoked to explain the discrepancy between the results reported here and those of Carrol and Conklin (2015). In their experiment, eye data were recorded while

native speakers of English and Chinese learners of English read English idioms and Chinese idioms translated into English. The Chinese idioms had no congruent counterpart in English; for example, the Chinese idiom *add oil to vinegar* (meaning "to embellish a story") does not correspond to any existing English idiomatic expression. The idioms were presented in sentences biasing their literal or figurative meaning and control phrases were created, in which the last word of the idiom was replaced with a matched control (e.g., *spill the beans/chips; draw a snake and add feet/hair*). The results supported the previously demonstrated advantage for idiomatic over control phrases for native speakers, in that native speakers of English processed idiomatic expressions significantly faster than control phrases, regardless of whether the idioms were used literally or figuratively. In contrast, Chinese learners of English read literally used English idioms faster than figuratively used ones, supporting the view that nonnative language users are more likely to process idioms compositionally. More importantly, Chinese speakers also processed Chinese-translated idioms significantly faster than controls, although this priming was only present when the Chinese translated idioms were used in the literal context. The results clearly support the view that L1 knowledge is automatically activated in the course of L2 processing. Without activating L1 translation equivalents of lexical items making up an otherwise non-existing L2 idiom, Chinese participants would not be able to process the Chinese-based English idioms faster than controls. Interestingly, the lexical-level priming, which allowed faster recognition of Chinese-translated idioms used in the literal context, did not extend all the way up the phrase-level and did not facilitate the processing of those idioms in the figurative context.

Several important differences can be identified between Carrol and Conklin's study and the experiment reported here. For one thing, the materials employed were fundamentally different. While our study included L2 (English) idioms varying with regard to cross-language overlap with L1 (Spanish), Carrol and Conklin's study had L1-transliterated idioms non-existent in the participants' L2. It is therefore very likely that, as participants were reading a translated L1 idiom, which did not correspond to anything they were familiar with in L2, they might have treated the novel phrase as a classic problem solving task that an L2 learner encounters on a regular basis whenever faced with an unfamiliar L2 lexical/phrasal item. As demonstrated in the L2 acquisition literature (see Cieślicka, 2015 for extensive discussion), whenever L2 learners come across an unknown expression in L2, they are likely to resort to the *parasitic strategy*, whereby they rely on their L1 to look for possible cues and figure out the meaning of the novel phrase (see also Liontas, 2002). The activation of L1 might therefore be part of the conscious strategy where a learner is trying to deal with the unfamiliar L2 expression at hand. The level of familiarity might thus be very crucial in determining the results. While our study only included highly familiar L2 idioms that were known to the bilingual participants, Carrol and Conklin's study included transliterated L1-based idioms which, by default, were not familiar in their L2 format to the nonnative speakers.

Another important factor is that Carrol and Conklin's transliterated idioms were all incongruent between participants' L1 and L2, in the sense they had no lexically and conceptually matching translation equivalents at the phrasal level. On the other hand, all the idioms employed in our study had conceptual counterparts in the participants' L1 and, in addition, half of them were lexically congruent, in that they had a word-for-word translation equivalent in the bilinguals' L1. It is very likely that processing a translated L1 phrase in one's L2 calls for a different strategy than processing a legitimate L2 phrase which overlaps with a corresponding L1 translation equivalent, although this suggestion seems challenged by the recent eye-tracking study by Carrol et al. (2016) summarized earlier. In the study, Swedish learners of English saw translated Swedish idioms which had no English counterpart, English-only idioms with no Swedish counterpart, or congruent idioms which had a high degree of cross-language overlap. Importantly, there was no difference in terms of processing between Swedish-based and congruent idioms, suggesting that L1 knowledge is the main driver in L2 idiom processing. The overwhelming role of L1 was further demonstrated by the fact that the speed of congruent L2 idiom processing was not so

much dependent on participants' familiarity with the idioms in L2, but rather on their familiarity with those idioms' corresponding forms in L1. However, a crucial difference between our study and Carrol et al.'s (2016) experiment is that their idioms were presented in neutral context (e.g., *It was hard for him to break the ice when he was at the party last week*), whereas our participants saw idioms embedded in rich literal- or figurative-biasing context. While congruent L2 idioms presented in isolation might indeed benefit from having their L1 counterparts automatically activated, with active lexical translation equivalents aiding the retrieval of the L2 conceptual representation, this might not be the case when L2 idioms are embedded in a specific context and have to be interpreted either literally or figuratively, in accordance with the contextual bias. In such cases, where not only lexical-level but also phrasal-level activation is called for, in order to successfully incorporate the retrieved L2 idiom into the developing interpretation of the sentence, the activated L1 lexical and phrasal equivalents might be more of an obstacle than a help.

Our results showing no facilitatory effect of idiom similarity are actually consistent with those of Carrol et al. (2016), where no processing advantage was found for congruent (similar) over Swedish-translated or English-only idioms in the total reading time data. Those data seem to imply that is not cross-language idiom similarity *per se*, but rather the mere activation of the L1 task-relevant knowledge that enhances L2 processing. In addition, as G. Carrol (personal communication June 09, 2016) has noticed, the observed discrepancy between our data might be due to the relative knowledge of the L2 between the participants in our respective studies. While all of our participants were highly fluent in English and residing in an English-speaking country, participants in Carrol and Conklin (2015) and Carrol et al.'s (2016) studies were either intermediate or advanced learners of English, who spent most of their lives residing in the county where English was a foreign language.

Finally, it should be noted that the L2 idioms employed in our study differed not only with regard to their L1-L2 congruency, but also with regard to their transparency, and that the observed processing differences were not so much caused by similarity alone, but by the interaction of similarity with transparency, such that the effect was different for transparent vs. opaque similar and different idioms. Overall, it seems that considerably more research with the use of eye tracking methodology and other sensitive on-line measures is needed in order to fully explain all the factors contributing to the processing of idiomatic expressions by nonnative language users.

References

Abel, B. (2003). English idioms in the first language and second language lexicon: A dual representation approach. *Second Language Research, 19*(4), 329-358.

Bobrow, S. A., & Bell, S. M. (1973). On catching on to idiomatic expressions. *Memory & Cognition, 1*, 342-346.

Boers, F., & Demecheleer, M. (2001). Measuring the impact of cross-cultural differences on learners' comprehension of imageable idioms. *ELT Journal, 55*(3), 255-262.

Boers, F., & Webb, S. (2015). Gauging semantic transparency of idioms: Do natives and learners see eye to eye? In R. R. Heredia & A. B. Cieślicka (Eds.), *Bilingual figurative language processing* (pp. 368-392). New York, NY: Cambridge University Press

Cacciari, C. (1993). The place of idioms in literal and metaphorical world. In C. Cacciari & P. Tabossi (Eds.), *Idioms: Processing, structure, and interpretation* (pp. 27-56). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cacciari, C., & Glucksberg, S. (1991). Understanding idiomatic expressions: The contribution of word meanings. In G. B. Simpson (Ed.), *Understanding word and sentence* (pp. 217-240). Amsterdam, Netherlands: Elsevier.

Caillies, S., & Butcher, K. (2007). Processing of idiomatic expressions: Evidence for a new hybrid view. *Metaphor and Symbol, 22(1),* 79-108.

Cain, K., Towse, A. S., & Knight, R. S. (2009). The development of idiom comprehension: An investigation of semantic and contextual processing skills. *Journal of Experimental Child Psychology, 102*(3), 280-298.

Carrol, G., & Conklin, K. (2014). Getting your wires crossed: Evidence for fast processing of L1 idioms in an L2. *Bilingualism: Language and Cognition,* 17, 784-797. doi:10.1017/S1366728913000795

Carrol, G., & Conklin, K. (2015). Cross language lexical priming extends to formulaic units: Evidence from eye tracking suggests that this idea 'has legs'. *Bilingualism: Language and Cognition*, *20*(2), 299–317. doi:10.1017/S1366728915000103.

Carrol, G., Conklin, K., & Gyllstad, H. (2016). Found in translation: The influence of L1 on the processing of idioms in L2. *Studies in Second Language Acquisition*, *(38)*3, 403-443. doi: 10.1017/S0272263115000492.

Charteris-Black, J. (2002). Second language figurative proficiency: A comparative study of Malay and English. *Applied Linguistics, 23*, 104-133.

Chomsky, N. (1980). *Rules and representations*. New York, NY: Columbia University Press.

Cieślicka, A. (2006a). On building castles on the sand, or exploring the issue of transfer in the interpretation and production of L2 fixed expressions. In J. Arabski (Ed.), *Cross-linguistic influences in the second language lexicon* (pp. 226-245). Clevedon, New Zealand: Multilingual Matters.

Cieślicka, A. (2006b). Literal salience in on-line processing of idiomatic expressions by L2 speakers. *Second Language Research, 22,*115-144.

Cieślicka, A. (2007). Language experience and fixed expressions: Differences in the salience status of literal and figurative meanings of L1 and L2 idioms. In M. Nenonen & S. Niemi (Eds.), *Collocations and Idioms 1: Papers from the First Nordic Conference on Syntactic Freezes, Joensuu, Finland, May 19-20* (pp. 55-70). Joensuu: Joensuu University Press.

Cieślicka, A. (2010). Formulaic language in L2: Storage, retrieval and production of idioms by second language learners. In M. Pütz & L. Sicola (Eds.), *Cognitive processing in second language acquisition: Inside the learner's mind* (pp. 149-168). Amsterdam/Philadelphia: John Benjamins.

Cieślicka, A. B. (2013). Do nonnative language speakers *chew the fat* and *spill the beans* with different brain hemispheres?: Investigating idiom decomposability with the divided visual field paradigm. *Journal of Psycholinguistic Research, 42(6),* 475-503.

Cieślicka, A. B. (2015). Idiom acquisition and processing by second/foreign language learners. In R. R. Heredia & A. B. Cieślicka (Eds.), *Bilingual figurative language processing* (pp. 208-244). New York, NY: Cambridge University Press.

Cieślicka, A. B., & Heredia, R. R. (2011). Hemispheric asymmetries in processing L1 and L2 idioms: Effects of salience and context. *Brain and Language, 116,* 136-150.

Cieślicka, A. B., Heredia, R. R., & Olivares, M. (2014). The eyes have it: How language dominance, salience, and context affect eye movements during idiomatic language processing. In L. Aronin & M. Pawlak (Eds.), *Essential topics in applied linguistics and multilingualism. Studies in honor of David Singleton* (pp. 21-42). Springer.

Cieślicka, A. B., Heredia, R. R., & García, T. (2017). Task effects in bilingual idiom comprehension. *Poznań Studies in Contemporary Linguistics, 53*(1), *95–117*.doi: 10.1515/psicl-2017-0005

Conklin, K., & Schmitt, N. (2008). Formulaic sequences: Are they processed more quickly than nonformulaic language by native and non-native speakers? *Applied Linguistics*, *29*, 72-89.

Conklin, K., & Schmitt, N. (2012). The processing of formulaic language. *Annual Review of Applied Linguistics, 32,* 45-61. doi: 10.1017/S0267190512000074.

Cutting, J. C., & Bock, K. (1997). That's the way the cookie bounces: Syntactic and semantic components of experimentally elicited idiom blends. *Memory & Cognition, 25*, 57-71.

Deignan, A., Gabryś, D., & Solska, A. (1997). Teaching English metaphors using cross-linguistic awareness-rasing activities. *ELT Journal, 51*, 352-360.

Dunn, A. L., & Fox Tree, J. E. (2009). A quick, gradient Bilingual Dominance Scale. *Bilingualism: Language and Cognition, 12*(3), 273-289.

Fernando, C. (1996). *Idioms and idiomaticity*. Oxford, England: Oxford University Press.

Fraser, B. (1970). Idioms within a transformational grammar. *Foundations of Language, 6*(1), 22-42.

García, O., Cieślicka, A. B, & Heredia, R. R. (2015). Figurative language processing and methodological considerations. In R. R. Heredia & A. B. Cieślicka (Eds.), *Bilingual figurative language processing* (pp. 117-170). New York, NY: Cambridge University Press.

Gairns, R., & Redman, S. (1986). *Working with words: A guide to teaching and learning vocabulary*. Cambridge: Cambridge University Press.

Gernsbacher, A. M., & Robertson, R. R. (1999). The role of suppression in figurative language comprehension. *J. Pragmat., 31,* 1619–1630. doi: 10.1016/S0378-2166(99)00007-7

Gibbs, R. W. (1980). Spilling the beans on understanding and memory for idioms in conversation. *Memory & Cognition, 8*, 149-156.

Gibbs, R. W. (1985). On the process of understanding idioms. *Journal of Psycholinguistic Research, 14*, 465-472.

Gibbs, R. W. (1993). Why idioms are not dead metaphors. In C. Cacciari & P. Tabossi (Eds.), *Idioms: Processing, structure, and interpretation* (pp. 57-77). Hillsdale, NJ: Lawrence Erlbaum Associates.

Gibbs, R. W. (1995). Idiomaticity and human cognition. In M. Everaert, E.-J. v. d. Linden, A. Schenk & R. Schreuder (Eds.), *Idioms: Structural and psychological perspectives* (pp. 97-116). Hillsdale, NJ: Lawrence Erlbaum Associates.

Gibbs, R. W., & Nayak, N. P. (1989). Psycholinguistic studies on the syntactic behavior of idioms. *Cognitive Psychology*, *21,* 100-138.

Gibbs, R.W., Nayak, N. P., & Cutting, C. (1989). How to kick the bucket and not decompose: Analyzability and idiom processing. *Journal of Memory and Language, 28,* 576-593.

Giora, R. (2002). Literal vs. figurative language: Different or equal? *Journal of Pragmatics, 34,* 487-506.

Giora, R. (2003). *On our mind: Salience, context, and figurative language*. Oxford, England: Oxford University Press.

Glucksberg, S. (1993). Idiom meanings and allusional content. In C. Cacciari & P. Tabossi (Eds.), *Idioms: Processing, structure, and interpretation* (pp. 3-26). Hillsdale, NJ: Lawrence Erlbaum Associates.

Glucksberg, S. (2001). *Understanding figurative language: From metaphors to idioms*. New York, NY: Oxford University Press.

Heredia, R. R. & Cieślicka, A. B. (2014). Bilingual storage: Compound-coordinate and derivates. In R. R. Heredia & J. Altarriba (Eds.), *Foundations of bilingual memory* (pp. 11-40). Springer.

Irujo, S. (1986). Don't put your leg in your mouth: Transfer in the acquisition of idioms in a second language. *TESOL Quarterly, 20,* 287-304.

Irujo, S. (1993). Steering clear: Avoidance in the production of idioms. *International Review of Applied Linguistics, 21*, 205-219.

Isobe, Y. (2011). Representation and processing of formulaic sequences in L2 mental lexicon: How do Japanese EFL learners process multi-word expressions? *JACET 関西紀要*, *13,* 38-49.

Jiang, N., & Nekrasova, T. M. (2007). The processing of formulaic sequences by second language speakers. *Modern Language Journal*, *91*, 433-445. DOI: 10.1111/j.1540-4781.2007.00589.x

Katz, J. J. (1973). Compositionality, idiomaticity and lexical substitution. In S. R. Anderson & P. Kiparsky (Eds.), *A Festschrift for Morris Halle* (pp. 357-376). New York, NY: Holt, Reinhart and Winston.

Kecskes, I. (2000). A cognitive-pragmatic approach to situation-bound utterances. *Journal of Pragmatics, 32,* 605-625.

Kellerman, E. (1983). Now you see it, now you don't. In S. Gass & L. Selinker (Eds.), *Language transfer in language learning* (pp. 112-134). Rowley, MA: Newbury House.

Kövecses, Z., & Szabo, P. (1996). Idioms: A view from cognitive semantics. *Applied Linguistics, 17*, 326-355.

Laufer, B. (2000). Avoidance of idioms in a second language: The effect of L1-L2 degree of similarity. *Studia Linguistica, 54,* 186-196.

Levorato, M. C., & Cacciari, C. (1999). Idiom comprehension in children: Are the effects of semantic analyzability and context separable? *European Journal of Cognitive Psychology, 11*(1), 51-66.

Libben, M. R., & Titone, D. A. (2008). The multidetermined nature of idiom processing. *Memory & Cognition, 36*, 1103-1121.

Liontas, J. I. (2002). Context and idiom understanding in second languages. In S. H. Foster-Cohen, T. Ruthenberg, & M.-L. Poschen (Eds.), *EUROSLA Yearbook: Annual conference of the European Second Language Association* (pp. 155-185). Amsterdam/Philadelphia: John Benjamins Publishing Company.

Liontas, J. I. (2015). Straight from the horse's mouth: Idiomaticity revisited. In R. R. Heredia & A. B. Cieślicka (Eds.), *Bilingual figurative language processing* (pp. 301-340). New York, NY: Cambridge University Press.

Matlock, T., & Heredia, R.R. (2002). Understanding phrasal verbs in monolinguals and bilinguals. In R. R. Heredia & J. Altarriba (Eds.), *Bilingual sentence processing* (pp. 251-274). Amsterdam, Netherlands: Elsevier.

McPartland-Fairman, P. (1989). The processing of phrasal verbs by native and nonnative speakers of English. (Unpublished doctoral dissertation). The City University of New York, NY..

Moon, R. (1997). Vocabulary connections: Multi-word items in English. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition and pedagogy* (pp. 40-63). Cambridge, England: Cambridge University Press.

Nippold, M. A., & Rudzinski, M. (1993). Familiarity and transparency in idiom explanation: A developmental study of children and adolescents. *Journal of Speech and Hearing Research, 36*, 728-737.

Nippold, M. A., & Taylor, C. L. (1995). Idiom understanding in youth: Further examination of familiarity and transparency. *Journal of Speech and Hearing Research, 38*, 426-433.

Nippold, M. A., & Duthie, J. K. (2003). Mental imagery and idiom comprehension: A comparison of school-age children and adults. *Journal of Speech and Hearing Research, 46*, 788-799.

Paulmann, S., Ghareeb-Ali,Z., & Felser, C. (2015). Neurophysiological markers of phrasal verb processing: Evidence from L1 and L2 speakers. In R. R. Heredia, & A. B. Cieślicka (Eds.), *Bilingual figurative language processing* (pp. 245-267). New York, NY: Cambridge University Press.

Roberts, L., & Siyanova-Chanturia, A. (2013). Using eye-tracking to investigate topics in L2 acquisition and L2 processing. *Studies in Second Language Acquisition*, *35*(2), 213-235.

Singleton, D. (1999). *Exploring the second language mental lexicon*. Cambridge, England: Cambridge University Press.

Singleton, D. (2007). How integrated is the integrated mental lexicon? In Z. Lengyel & J. Navracsics (Eds.), *Second language lexical processes: Applied linguistic and psycholinguistic perspectives* (pp. 3-16). Clevedon, New Zealand: Multilingual Matters.

Siyanova-Chanturia, A., Conklin, K., & Schmitt, N. (2011). Adding more fuel to the fire: An eye-tracking study of idiom processing by native and nonnative speakers. *Second Language Research*, *27,* 251-272.

Siyanova-Chanturia, A., Conklin, K., & van Heuven, W. (2011). Seeing a phrase 'time and again' matters: The role of phrasal frequency in the processing of multi-word sequences. *Journal of Experimental Psychology: Language, Memory and Cognition, 37,* 776–784.

Skoufaki, S. (2008). Investigating the source of idiom transparency intuitions. *Metaphor and Symbol, 24*(1), 20-41.

Spector, C. C. (1996). Children's comprehension of idioms in the context of humor. *Language, Speech, and Hearing Services in Schools, 27*, 307-313.

Sprenger, S. A., Levelt, W. J. M., & Kempen, G. (2006). Lexical access during the production of idiomatic phrases. *Journal of Memory and Language, 54*, 161-184.

Steinel, M. P., Hulstijn, J. H., & Steinel, W. (2007). Second language learning in a paired-associate paradigm: Effects of direction of learning, direction of testing, idiom imageability, and idiom transparency. *Studies in Second Language Acquisition, 29*, 449-484.

Swinney, D. W., & Cutler, A. (1979). The access of idiomatic expressions. *Journal of Verbal Behavior and Verbal Learning, 18,* 523-534.

Titone, D. A., & Connine, C. M. (1999). On the compositional and noncompositional nature of idiomatic expressions. *Journal of Pragmatics, 31*, 1655-1674.

Titone, D., Columbus, G., Whitford, V., Mercier, J., & Libben. M. (2015). Contrasting bilingual and monolingual idiom processing. In R. R. Heredia & A. B. Cieślicka (Eds.), *Bilingual figurative language processing* (pp. 171-207). New York, NY: Cambridge University Press.

Türker, E. (2016). The role of L1 conceptual and linguistic knowledge and frequency in the acquisition of L2 metaphorical expressions. *Second Language Research, 32*(1), 25-48.

Underwood, G., Schmitt, N., & Galpin, A. (2004). The eyes have it: An eye-movement study into the processing of formulaic sequences. In N. Schmitt (Ed.), *Formulaic sequences: Acquisition, processing, and use* (pp. 153-172). Amsterdam/Philadelphia: John Benjamins Publishing Company.

Van Lancker Sidtis, D. (2004). When novel sentences spoken or heard for the first time in the history of the universe are not enough (Cf. Pinker, 1995, p. 22): Toward a dual-process model of language. *International Journal of Language Communication Disorders, 39*(1), 1–44.

Van Lancker Sidtis, D. (2012). Two-track mind: Formulaic and novel language support a dual-process model. In M. Faust (Ed.), *The handbook of the neuropsychology of language* (pp. 342–367). Chichester, England: Wiley-Blackwell.

Van Lancker Sidtis, D., Cameron, K., Bridges, K., & Sidtis, J. J. (2015). The formulaic schema in the minds of two generations of native speakers. *Ampersand, 2*, 39–48.

Weinreich, U. (1969). Problems in the analysis of idioms. In J. Puhvel (Ed.), *Substance and structure of language* (pp. 23-81). Los Angeles, CA: University of California Press.

Wray, A. (2002). *Formulaic language and the lexicon*. Cambridge, England: Cambridge University Press.

Yorio, C. A. (1989). Idiomaticity as an indicator of second language proficiency. In K. Hyltenstam & L. K. Obler (Eds.), *Bilingualism across lifespan: Aspects of acquisition, maturity, and loss* (pp. 55-72). Cambridge, England: Cambridge University Press.

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