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Suppression of literal meanings in L2 idiom processing: Does context help?

Anna B. Cieślicka
Texas A&M International University
anna.cieslicka@tamiu.edu

Abstract

Most current idiom processing models acknowledge, after Gernsbacher and Robertson (1999) that deriving an idiomatic meaning entails suppression of contextually inappropriate, literal meanings of idiom constituent words. While embedding idioms in the rich disambiguating context can promote earlier suppression of incompatible literal meanings, idioms embedded in the neutral context, favoring neither their literal nor figurative reading, are likely to become disambiguated much later in the course of their comprehension. The study reported in this paper investigates the role of context in suppressing irrelevant, literal meanings of idioms in the course of their processing by Polish proficient speakers of English. Ambiguous (literally plausible) English idioms were embedded in sentences which were either neutral (i.e., did not bias either the literal or figurative reading of the idiom, e.g., *There was no need to add fuel to the fire*) or figurative-biased (e.g., *The chairman is in a bad mood so do not say anything, as this will only add fuel to the fire*) and followed by targets related literally (e.g., HEAT) or figuratively (e.g., WORSE) to idiom meanings and displayed either immediately at idiom offset (0 ms) or after 300 ms. The self-paced reading paradigm was employed, in which participants first read the idiomatic sentences at their own pace and then made a lexical decision, i.e., decided if the displayed target string is a legitimate English word or not. Context was shown to play an important role in suppressing irrelevant meanings, but its effects were modulated by salience (prominence) of idioms' literal meanings as well as the time that elapsed from the end of the sentence to the display of the target stimulus.

Keywords: second language, idiom processing, context, salience, suppression

Suppression and Context in Figurative Language Processing

The mechanism of suppression has been postulated in many accounts of figurative language comprehension (cf. Coulson & Matlock, 2001; Giora, 1997, 1999, 2002, 2003; Titone & Connine, 1999) as crucial in inhibiting irrelevant literal meanings in the course of interpreting figurative expressions. Gernsbacher and Robertson (1999, p. 1619) define suppression as a "general, cognitive mechanism, the purpose of which is to attenuate the influence caused by the activation of extraneous, unnecessary, or inappropriate information". Suppression has been widely documented as essential in inhibiting irrelevant lexical- or concept-level information in processing ambiguous words, anaphoric and cataphoric reference or syntactic parsing (cf. Faust & Gernsbacher, 1996; Gernsbacher & Robertson, 1999; Gernsbacher et al., 2001). It has also been correlated with individual differences between more- and less-skilled language comprehenders, with the former group shown to be more efficient than the latter at suppressing the inappropriate meanings of ambiguous homonymic words (Gernsbacher, Varner, & Faust, 1990).

With regard to the role of suppression in comprehending metaphors, Gernsbacher et al. (2001) have demonstrated that interpreting metaphorical sentences consisting of a topic and a vehicle (e.g., *Lawyers are sharks*) entails enhancing attributes of the metaphor vehicle (*shark*) that are common to the topic (*lawyers*), such as "tenacity", "ferocity", and "aggressiveness", and suppressing those attributes that are irrelevant for a metaphorical interpretation, for example, "swimming", "having fins", or "living in the ocean". According to Keysar (1994), both literal and metaphorical interpretations are computed in parallel and selection of the appropriate interpretation depends on context. Context, according to Keysar, facilitates understanding by enhancing plausibility of the relevant interpretation and by eliminating (i.e., blocking or suppressing) the inappropriate alternative. Elimination thus operates via suppression, which is largely based on contextual constraints.

The mechanism of suppression is also central in the model of figurative language comprehension put forward by Giora (1997, 1999, 2003) and referred to as the *Graded Salience Hypothesis.* The hypothesis posits the priority of *salient* meanings, which are independent of context, always processed initially and accessed via direct look-up in the mental lexicon immediately upon encounter of the language stimulus. Salient meanings are lexicalized, i.e., "retrievable from the mental lexicon rather than from the context" (Giora, 1999, p. 919) and "enjoy prominence due to their conventionality, frequency, familiarity, or prototypicality" (Giora, 2002, p. 490). Even if lexical access favoring salient meanings is initially context-independent, context comes to play an

essential role in subsequent stages of figurative language comprehension. Depending on their contribution to the construction of the evolving interpretation of the phrase, contextually incompatible meanings accessed initially on account of their salience may, subsequently, be either maintained or suppressed (see the *retention hypothesis*, Giora, 2002).

Impairment of the suppression mechanism has been implicated as responsible for figurative language comprehension difficulties experienced by clinical populations (Papagno & Caporali, 2007; Papagno, Luccheli, Muggia, & Rizzo, 2003; Papagno, Tabossi, Colombo, & Zampeti, 2004). In general, impaired processing of figurative expressions has been related to lesions or dysfunctions of the prefrontal cortex and subsequent impairment of central executive skills which are needed to successfully inhibit contextually incompatible meanings (see, for example, Cacciari et al., 2006; Iakimova, Passerieux, & Hardy-Baylé, 2006; Papagno et al., 2003; Papagno, Curti, Rizzo, Crippa, & Colombo, 2006; Schettino et al., 2010; Titone, Holzman, & Levy, 2002).

Suppression is inextricably connected with context, whose role in language comprehension has been much debated. Although there seems to be a consensus among researchers about the instrumental role of context in determining the correct interpretation of an utterance, opinions differ about the exact point during processing at which context affects language comprehension. While the *modular*, or *context-independent* view, instantiated in *exhaustive access* models, holds that lexical access is automatic and uninfluenced by any extralexical factors (Forster, 1979; Holmes, 1979; Onifer & Swinney, 1981; Rayner, Carlson, & Frazier, 1983; Seidenberg, 1985; Seidenberg et al., 1982; Swinney, 1979), the *direct (selective) access* or *context-dependent* view assumes that the surrounding context primes the selection of the appropriate meaning of a lexically ambiguous word (Burgess, Tanenhaus, & Seidenberg, 1989; Paul et al., 1992; Tabossi, 1988; Tabossi, Colombo, & Job, 1987). Hybrid approaches, such as the *ordered access model* offer an intermediate explanation, by claiming that different meanings of an ambiguous word are accessed serially in order of their relative frequency of occurrence and are subsequently evaluated for their contextual fit (cf. Duffy, Morris, & Rayner, 1988; Hogaboam & Perfetti, 1975; Rayner & Frazier, 1989; Rayner & Morris, 1991; Sereno, Pacht, & Rayner, 1992; Simpson, 1981).

With regard to processing figurative language, some studies have yielded results consistent with the direct access view. For example, Gibbs (1981, 1984, 1986) found that indirect requests and sarcastic remarks embedded in the appropriate context took no longer to understand than either literal sentences or direct requests. In a study by Gildea and Glucksberg (1983) comprehension of metaphorical expressions was aided when a disambiguating

context was provided for less familiar metaphors such as *Some marriages are iceboxes* (see also Ortony et al., 1978; Shinjo & Myers, 1987). In yet another study Peterson and Burgess (1993) addressed the question of whether the literal meaning of an idiomatic expression is computed in the context biasing its figurative interpretation. They used a sentence-priming procedure in which participants were presented auditorily with sentence primes ending with incomplete idioms (e.g., *kick the* …). The sentences biased either a literal (*The soccer player slipped when he tried to kick the….*) or idiomatic (*The man was old and feeble and it was believed that he would soon kick the …*) interpretation. Following the final word of each incomplete sentence, a visual target was displayed which participants were instructed to name as quickly as possible. The target words displayed for naming were either appropriate or inappropriate completions to the preceding sentence. As expected, inappropriate targets were named significantly more slowly than appropriate ones but only for literal-biasing sentence primes. The effect did not obtain for figurative biasing sentences, which implies that the literal meaning of the idioms was not derived. Peterson and Burgess conclude that in contexts biasing the figurative interpretation of idioms, literal analysis of these idioms' constituent words is suppressed prior to the final word of the idiom.

On the other hand, a number of studies have shown support for the context-independent view and initial automatic and exhaustive activation of all the meanings of figurative expressions. In Hillert and Swinney's (2001) cross-modal priming experiment with German compounds as stimuli, literal meanings were found to be activated even in idiom compounds which only have idiomatic interpretations and which lack a plausible literal reading. In a similar vein, Colombo (1993) demonstrated that literal meanings of idiom constituents are always constructed in the course of idiom comprehension and remain active even in the figurative biasing context. In one experiment, Colombo had her participants listen to sentences containing idiomatic expressions and make lexical decisions on target words presented visually at the offset of the idiom string. For each idiomatic expression, two sentences were constructed, one biasing the literal meaning of the idiom and the other biasing its figurative meaning. The targets displayed visually at the offset of the idiom were either related to the literal meaning of the last word of the idiom or to the idiom's figurative interpretation. Irrespective of the context bias, priming (i.e., faster response) was found for targets related to both the literal and figurative meanings of the idiom string (see also Van de Voort & Vonk, 1995 for similar results).

Using a different methodology, Titone and Connine (1999) conducted an eye tracking study modeled on lexical ambiguity experiments investigating the role of context in resolving lexical ambiguities (cf. Rayner & Frazier, 1989).

They included in their study idioms embedded in sentence contexts biasing idioms' figurative or literal meanings. The biasing context disambiguating an idiom's interpretation either preceded the idiom (e.g., *After being ill for months, she finally kicked the bucket*), or followed the idiom (*She finally kicked the bucket, after being ill for months*). The sentences were displayed on the computer screen and participants' eye movements were recorded for the ambiguous idiom region and the disambiguating region. The results suggested that the activation of idiom literal and idiomatic meanings is obligatory, irrespective of whether context favors its literal or idiomatic interpretation.

Salience and Other Idiom Characteristics Affecting Figurative Processing

To account for the inconsistencies in the figurative language processing literature concerning the role of context, Giora (1997, 1999, 2002, 2003) has suggested that is not so much context but rather salience (i.e., frequency, familiarity, conventionality, and prototypicality of a figurative expression) that drives the initial processing of figurative language. With respect to the processing of idioms, the Graded Salience Hypothesis predicts that processing familiar idioms, whose idiomatic meanings are more salient than their literal meanings, will involve activating their figurative meanings in both figurative and literal biasing contexts. In the figurative biasing context, the idiomatic meaning should be evoked almost exclusively, because it is not only the more salient but also the intended meaning. In turn, in the literal biasing context, the idiomatic meaning will be activated initially, on account of its salience, but will subsequently give way to the contextually appropriate, less salient, literal interpretation. Support for the effect of salience in figurative processing has been demonstrated in a number of studies that looked into the comprehension of metaphorical meanings, such as irony (e.g., Giora & Fein, 1999a, b; Giora, Fein, & Schwartz, 1998; Peleg, Giora, & Fein, 2001) or idiomatic and metaphorical phrases (e.g., Blasko & Connine, 1993; Cronk, Lima, & Schweigert, 1993; Giora & Fein, 1999c; Laurent et al., 2006; Pynte et al., 1996).

The role of salience appears particularly crucial in second/foreign (henceforth L2) idiomatic langue processing. Since learners learning their L2 in a formal situation typically learn idioms well after they have acquired literal meanings of idiom constituents, literal meanings might enjoy a more salient status than figurative ones during their on-line processing by L2 users. The suggestion that literal meaning of L2 idioms might enjoy a particular prominence in the course of their processing by nonnative language users has been confirmed in a number of studies. For example, in a study by Liontas (2002) idioms with highly similar L1 equivalents presented in isolation were the ea-

siest and fastest to comprehend while idioms with no L1 equivalents the most difficult. In turn, the data obtained for idioms embedded in context showed a significant improvement in the comprehension level suggesting that context significantly facilitates idiom understanding. In addition, translation was the most common strategy employed by learners to interpret the meanings of the idiomatic phrases, which suggests a central role of the learners' native language in the comprehension and interpretation of L2 idioms. Given these results, Liontas concludes that L2 idioms are computed "in their literal sense until this is no longer possible" (2002, p. 179). Along similar lines, Kecskes (2000) has suggested that second language users are likely to rely on literal meanings of figurative utterances and on their L1 conceptual system when producing and comprehending figurative phrases (see also Abel, 2003; Matlock & Heredia, 2002).

The prominence of literal meanings of L2 idioms was further shown in a self-paced reading study combined with a naming task (Cieślicka, 2007). Polish and English idioms were embedded in sentences biasing their figurative reading and followed by targets related to their figurative or literal meanings and displayed either immediately at the end of the sentence or after 850 ms. Whereas in the Polish block, literal, contextually inappropriate meanings of idioms were activated at idiom offset but suppressed after 850 ms, the opposite pattern was shown in the English block, with literal targets actually increasing in activation, when moving from the 0 ms to 850 ms delay condition. Cieślicka accounts for those results by suggesting that the suppression mechanism might take longer to inhibit contextually inappropriate literal meanings of L2 idioms than L1 idioms because of the special salience status that they enjoy (see also, Cieślicka, 2006, 2010 for results suggesting literal salience in L2 idiomatic processing).

In addition to salience, the extent of literal and figurative activation in the course of idiom processing has been related to the various dimensions along which idioms can vary. One of such dimensions is predictability which refers to the likelihood of completing the idiomatic phrase figuratively, given the first few words of the idiom (such as *kick the…)*. Predictability has been shown to significantly determine idiomatic and literal activation in the course of processing idioms by native speakers (Cacciari & Tabossi, 1988). In their cross-modal study, Cacciari and Tabossi found that when processing high-predictable idioms (i.e., expressions that are quickly recognized as having a figurative meaning, even before reaching the end of the sentence, such as *to be in seventh…)*, only their figurative meanings were activated by the time the last word of an idiomatic string was encountered. On the other hand, with low-predictable idioms, which cannot be recognized as idiomatic before the

whole idiom string has been processed (e.g., *to carry the…*, where the language user would not very likely predict that the missing phrase is *torch)*, only the literal meaning was found to be active at the end of the idiomatic expression. This suggests that idiomatic meanings of high-predictable idioms may be accessed faster, obviating the need for further literal analysis of idiom constituents. On the other hand, for low-predictable idioms the language processing mechanism analyzes the whole string literally before its figurative interpretation may emerge (see also Tabossi & Zardon, 1993, 1995 and Titone & Connine, 1994a for similar results).

In addition, compositionality, i.e., the degree to which idiom components contribute to their overall figurative interpretation, has also been claimed to determine the processing patterns of idioms (Gibbs & Nayak, 1991; Gibbs, Nayak, & Cuting, 1989). In nondecomposable idioms, meanings of idiom component words do not coincide with the figurative interpretation of the idiom (e.g., *kick the bucket = die*). On the other hand, in decomposable idioms, meanings of individual components directly correspond to idioms' figurative senses (e.g., *pop the question,* where *pop = utter* and *question = marriage proposal*). Accordingly, Gibbs et al. (1989) suggested that figurative meanings of decomposable idioms might be available faster, since in such idioms meanings of their component words directly correspond to the idioms' figurative senses and so a compositional analysis of these idioms overlaps with an idiomatic interpretation, resulting in faster retrieval. On the other hand, with nondecomposable idioms, the attempt to assign independent meanings to the idioms' components fails to coincide with the figurative interpretation and so the figurative meaning will take longer to access. This view has been supported by empirical findings where figurative meanings of decomposable idioms were activated faster than those of nondecomposable ones (Caillies & Butcher, 2007; Titone & Connine, 1999; but see Cutting & Bock, 1997; Libben & Titone, 2008; Tabossi, Fanari, & Wolf, 2008 for results that have challenged the claim that decomposable idioms are processed faster than nondecomposable ones).

Finally, some studies seem to imply that the dimension of idiom opacity/transparency, i.e., whether or not the figurative meaning of the idiom can be inferred (Glucksberg, 1993), might be a crucial variable affecting the activation of idiom literal and figurative meanings. For example, transparent idioms (e.g., *play with fire*) have been shown to be more difficult to interpret for aphasic patients than opaque idioms (e.g., *trip the light fantastic*) (Papagno et al., 2004; Papagno & Caporali, 2007). This is so because idiom opacity provides an important pragmatic clue for the language processing system, suggesting the need to suppress the irrelevant literal meaning. However, research into this dimension of idiom variability is not unanimous, with some studies failing

to show any effect of transparency (e.g., Papagno & Genoni, 2004; Papagno et al., 2006; Schettino et al., 2010)

Given the inconsistencies in the previous literature concerning the role of context in figurative processing and the relevance of salience demonstrated in previous L2 idiom processing studies, the major goal of the research reported here was to investigate how context affects the suppression of irrelevant, literal meanings in the course of processing idioms by second language users, as well as to see how this effect would vary over time. In addition, the study was motivated by paucity of research into on-line aspects of L2 idiom processing. While abundant literature exists concerning the processing of figurative language by native language speakers, psycholinguistic research into on-line processing of idiomatic expressions by second language users is very limited. In the study, English idioms were embedded in sentences which were either neutral (i.e., did not bias either the literal or figurative reading of the idiom) or figurative-biased and followed by targets related literally or figuratively to idiom meanings and displayed either immediately at idiom offset (0 ms) or after 300 ms. If context triggers the activation of idioms' figurative meanings and ensures suppression of contextually irrelevant literal meanings then no activation should be found for literally related targets in the figurative context condition compared to the neutral context condition. If, however, salience takes prominence over context and, given that literal meanings of L2 idioms are more salient than their figurative meanings, then substantial activation is likely to be found for literal meanings, even if they are contextually inappropriate. In addition, those patterns of literal and figurative activation are likely to vary over time, with suppression of contextually incompatible literal meanings more likely to be in effect after 300 ms than immediately at idiom offset. Those predictions can be formulated as the following research questions: (1) How will activation of literal and figurative meanings of idioms vary as a function of context? Will the strongly biasing figurative context ensure faster activation of idiomatic meanings and suppression of incompatible literal meanings than the neutral context? (2) Will there be a difference in the amount of suppression between the 0 ms and 300 ms display conditions? (3) Will literal meanings of L2 idioms be overall more strongly activated than figurative meanings on account of their special salience status?

The Present Study

The study employed self-paced reading with a lexical decision task. In the self-paced reading task, participants are presented with sentences and instructed to press the key as soon as they have read the sentence. Pressing the

key triggers the display of the consecutive stimulus. In the self-paced reading technique combined with a lexical decision task, pressing the key triggers the display of the stimulus target to which participants react by making a lexical decision, i.e., decide whether the displayed target is a meaningful word or a nonword. The sentence may act as a prime, in that it may influence the speed with which readers make a lexical decision on the following target word. Varying the relationship between the priming sentence and the stimulus target and comparing reaction times to different target words allows assessing the degree of activation of various aspects of meaning of the preceding sentence. For example, comparing reaction times to the stimulus targets ALMOST and MOUTH, following the sentence *He passed the exam by the skin of his teeth*, allows estimating the degree of activation of figurative and literal meanings of the idiom *by the skin of his teeth.* The target ALMOST is related to the figurative interpretation of the idiomatic phrase, whereas the target MOUTH is a semantic associate of the literal meaning of the last word of the sentence (*teeth*).

In the experiment described here, idiomatic expressions were embedded in sentences and followed by three types of target stimuli: idiomatic (related to the figurative meaning of the idiom), literal (related to the literal meaning of the last word of the idiom), and unrelated in any way, which served as a baseline condition. An additional variable was the time (Inter Stimulus Interval, ISI) that elapsed from the moment the subject pressed the key upon the completion of sentence reading and the display of the target stimulus. Whereas for half of the participants the ISI was 0 ms, for the remaining ones it was 300 ms. This variable was introduced to investigate the varying availability of literal and idiomatic meanings over time and to explore the time course of suppression of incompatible literal meanings in the process of idiom comprehension. The idioms used in the study were controlled for predictability, compositionality, and transparency to ensure that only context and salience were responsible for the obtained patterns of literal and idiomatic facilitation.

Materials and Methods

Participants

Thirty-six fluent Polish learners of English volunteered to participate in the experiment. Twenty five participants were female and 11 were male; their average age was 22.5 years (range 21-25.5). They were all graduate students enrolled in the second year of their M.A. English Studies program at the School of English, Adam Mickiewicz University in Poznan, Poland. All the participants were dominant in Polish and proficient in English, as determined by their self-

rating language background questionnaire and by their successful performance on the general proficiency examination which they took four months before the experiment and which is compatible in terms of the required language skills level with Cambridge Proficiency in English Examination.

Stimuli

Idiomatic sentences.

A norming study was conducted prior to the experiment in order to select idioms which are ambiguous, i.e., with a literally plausible meaning (e.g., *play with fire*). In addition, idioms were normed on a number of different characteristics, such as familiarity (how well known the idiom is), predictability (probability of completing an incomplete phrase idiomatically), compositionality (the degree to which the individual meanings of an idiom contribute to its overall nonliteral interpretation) and transparency/opaqueness (the degree to which the meaning of the idiom can be derived from the phrase). Even though norms are available for a large number of English idioms (cf. Titone & Connine, 1994b), such norms reflect native speaker judgments, which may vary from intuitions of nonnative English language users. Therefore, a list of 154 idioms, taken from the norms developed by Titone and Connine (1994b) and from *Longman Idiom Dictionary* (1998) was prepared and administered to 42 graduate students of English at the School of English, Adam Mickiewicz University. None of the norming study participants took part in the experiment and they were highly comparable in terms of their language experience and proficiency to the experimental group.

For familiarity judgment, participants were asked to rate the idiom on a scale of 1 to 7, where 1 indicated that they did not know what the idiom meant and 7 that they were familiar with the idiom and could use it in a sentence. In the literal plausibility rating task, participants were first given examples of idioms with plausible literal interpretations (e.g., *skate on thin ice*) and those which could only be interpreted figuratively (e.g., *rack one's brains*). They were next instructed to decide if there is a possible literal interpretation for each of the idioms, and if so, how plausible it was on a 7-point scale, with 1 indicating that the idiom definitely does not have any plausible literal interpretation and 7 that the idiom definitely has a clear and well-formed literal interpretation that is very plausible. In the predictability rating task, idioms were rated according to how likely it was for an idiom to be completed figuratively, given its beginning word(s). Participants were first provided with examples of high- and low-predictable idioms and then asked to rate predictability of all

the idiom stimuli on a scale of 1-7, where 1 = low-predictable and of 7 = high-predictable. In the compositionality rating task, the rating of 1 indicated that an idiom is nondecomposable and the rating of 7 meant that the idiom is decomposable and that literal meanings of its constituents are semantically close to their corresponding figurative senses (e.g., *save your skin*). Finally, participants also rated idioms for their transparency, on a scale from 1 to 7, where 1 meant that the idiom is opaque and its meaning cannot be guessed (e.g., *chew the fat*), whereas 7 meant that the idiom's figurative meaning can be inferred from the analysis of its constituents (e.g., *skate on thin ice).*

The 18 idioms selected for the experiment were highly familiar, with familiarity ratings ranging from 6.0 to 7.0 (*M* = 6.4) and ambiguous (literally plausible), with the mean literality score *M* = 6.5 (range 5.5-7.0). The idioms were matched on predictability, with mean rating *M* = 3.7 (range from 3.0 to 4.5), compositionality (*M* = 3.5; range 2.9-4.3), and transparency (*M* = 3.3; range 3.1 to 4.4). Two types of context sentences were next created for each idiom. The neutral context sentences did not provide any bias towards either a literal or a figurative reading of the upcoming idiom string (e.g., *There was no need to add fuel to the fire*). The second context type provided a figurative bias (e.g., *The chairman is in a bad mood so do not say anything, as this will only add fuel to the fire).*

Visual targets for the Lexical Decision Task.

Each idiom was paired with three target types: an idiomatic target (a word related figuratively to the meaning of the idiomatic phrase, e.g., *skate on thin ice – RISK*), a literal target (a word related to the literal meaning of the last word of an idiom, e.g., *skate on thin ice – COLD*), and an unrelated target, matched in length and frequency (*British National Corpus*). The target words were obtained from the same Polish speakers of English who participated in the norming study. After the norming task, the participants were asked to study each idiom and 1) think of and write down the word that best captures the figurative meaning of the idiom, 2) write down the word that they first thought of when reading the last word of the idiom. Word association responses provided by the participants were next analyzed in search of the most common associates. The words finally selected as idiomatic and literal targets were those provided by over 60% of the respondents (see Table 1 for examples of the three types of stimulus words matched with idiomatic phrases). In addition to the idiomatic sentences, 36 nonidiomatic filler sentences were created and paired with target words for the lexical decision. For 9 of the filler sentences, word targets for the lexical decision task were created, unrelated in

any way to the meaning of those sentences. For the remaining 27 filler sentences, pronounceable nonword targets were created (e.g., *SLAGS*). Each experimental list included all the 18 idiomatic sentences and 36 nonidiomatic filler sentences, whose presentation order was randomized for each subject. To ensure that each participant saw a given idiom only once, six lists were created counterbalanced with respect to the type of target (idiomatic, literal, or unrelated) paired with the sentence. The design was a mixed 2 x 3 x 2 (Context x Target Type x ISI) ANOVA, with two within-subject factors: 1) Context (Neutral vs. Figurative), 2) Target Type (Literal vs. Idiomatic vs. Unrelated), and one between-subject factor: ISI (0 ms vs. 300 ms).

Table 1 Examples of idiomatic and literal targets paired with idioms embedded in the neutral and figurative-biasing context

Neutral Context sentence	Idiomatic Target	Literal Target
There was no need to add fuel to the fire.	WORSE	HEAT
Peter has unnecessarily let the cat out of the bag.	TELL	SHOP
Figurative-Biasing Context sentence		
The chairman is in a bad mood so do not say anything, as this will only add fuel to the fire.	WORSE	HEAT
Since he could never keep the secret, Peter let the cat out of the bag.	TELL	SHOP

Apparatus and Procedure

The experiment was run with the E-Prime (1.1) program which controlled presentation of the stimulus sentences and targets in the following way. At the beginning of each trial a fixation point appeared in the center of the computer screen. After 1500 ms the fixation point was replaced with the sentence, which appeared in black print (Verdana, 18 pts) against a white background. The sentence disappeared from the screen when the participant pressed the key. Participants could press any key to terminate the display of the sentence and were instructed to do it as soon as they have read the sentence. In the 0 ms ISI condition, immediately after the sentence disappeared, a visual target was displayed in the center of the screen in black capital letters, whereas in the 300 ms ISI condition the target appeared after 300 ms. The target remained on the screen until the participant made the lexical decision, i.e., pressed “0” for a nonword decision and “1” for a word decision. If no response was provided within 2000 ms, the target disappeared from the screen and the response was counted as error.

Participants were tested individually in a session that lasted approximately 15 minutes. They first went through a practice block consisting of 20 trials to familiarize them with the nature of the experiment. After the 20 trials there was a break during which the experimenter ensured that the participants understood the instructions and felt comfortable with the keyboard and the distance from the monitor. When the session was over, participants were given a comprehension test to complete. The test consisted of 36 sentences, half of which had been presented during the experimental session. Participants' task was to check the sentences they thought they had just read. In addition, they were asked to underline any idiomatic expressions whose meaning they did not understand.

Results

First, participants' performance on the recognition test was examined. Data pertaining to idioms unknown to participants (1% overall) were removed from the subsequent analysis. The recognition error criterion of 66% correct was set (cf. Blasko & Connine, 1993). The mean of correct recognitions was 83% and none of the participants had a performance below 66% correct identification. Error rates for each person were next examined for evidence of a speed-accuracy trade-off. The lexical decision criterion of 85% correct was set (cf. Titone & Connine, 1994a). None of the participants failed to reach the 85% threshold, and the majority of participants actually reached the rate of over 95% of accurate responses. Since the error rate was low and highly comparable for all target types (4.2% errors on idiomatic targets, 4.1% errors on literal targets, 3.9% errors on nonwords in the 0ms ISI condition; 3.9% errors on idiomatic targets, 4.0% errors on literal targets, 3.8% errors on nonwords in the 300 ms ISI condition), no further analysis was performed on the error data. Reaction times exceeding two times the standard deviation from the subject means counted as outliers and were excluded from the set of valid responses. Outliers accounted for 2.3% of all the responses and they were approximately equally distributed across conditions. The remaining data were entered into the SPSS (15.0) program for statistical analysis.

A mixed three-way ANOVA was performed on the data. The only significant major effect was that of Target Type by subjects ($F1$ (2, 33) = 3.39; $p < 0.05$; $\eta = 0.44$). The three-way interaction between Target, Context and ISI turned out marginally significant as well, by both subjects and items ($F1$ (2, 33) = 1.64; $p < 0.1$; $\eta = 0.32$; $F2$ (1, 49) = 1.90; $p < 0.1$; $\eta = 0.29$). Table 2 summarizes mean RTs and priming effects obtained for literal and idiomatic targets in the lexical decision task.

Table 2 Mean RTs, SDs (in parentheses) and priming effects obtained for Literal and Idiomatic Targets in both ISIs and in both context types

Target Type	Mean RT (ms)	Priming effect
Literal	781.55 (138)	61.92**
Idiomatic	813.72 (137)	29.76

Note: *p < .05, ** p < .01; two-tailed.

Overall, literal targets were recognized significantly faster than unrelated control targets (t (35) = -2.93; p < 0.005) and obtained the priming effect almost twice as substantial as idiomatic targets, which did not differ significantly from their controls. The priming patters varied over time, as summarized in Table 3, which shows activation of literal and idiomatic meanings in the two ISI conditions.

Table 3 Mean RTs, SDs (in parentheses) and priming effects for Literal and Idiomatic Targets at 0 ms ISI and at 300 ms ISIs

ISI	Literal Targets Mean	Priming effect	Idiomatic Targets Mean	Priming effect
0 ms	776.90 (138)	72.25**	825.59 (170)	23.56
300 ms	786.21 (151)	51.60*	801.86 (160)	35.96

Note: *p < .05, ** p < .01; two-tailed.

As can be seen from the table, literal targets were more activated than idiomatic targets at both 0 ms and 300 ms. At 0 ms ISI literal targets were recognized significantly faster than their controls (the priming effect of 72.25 ms; t (17) = -2.23; p < 0.01). After 300 ms, literal activation became slightly suppressed, but the obtained priming effect of 51.60 ms was still statistically significant (t (17) = -0.93; p < 0.05). In turn, idiomatic targets failed to be significantly primed either at 0 ms or 300 ms later. Table 4 and Figure 1 summarize the effect of both context and ISI on literal and figurative meaning activation.

Table 4 Mean RTs, SDs (in parentheses) and priming effects for Literal and Idiomatic Targets as a function of Context (Neutral or Figurative) and Delay (0 ms and 300 ms)

Target Type	Neutral Context				Figurative Context			
	0 ms ISI		300 ms ISI		0 ms ISI		300 ms ISI	
	Mean	Priming effect	Mean	Priming effect	Mean	Priming effect	Mean	Priming effect
Literal	777.77(138)	87.06**	755.28(147)	76.85**	766.65(141)	8.43	770.61(160)	46.44
Idiomatic	816.24(162)	48.59	814.25(148)	17.88	828.49(171)	-13.40	787.08(151)	29.96

Note: *p < .05, ** p < .01; two-tailed.

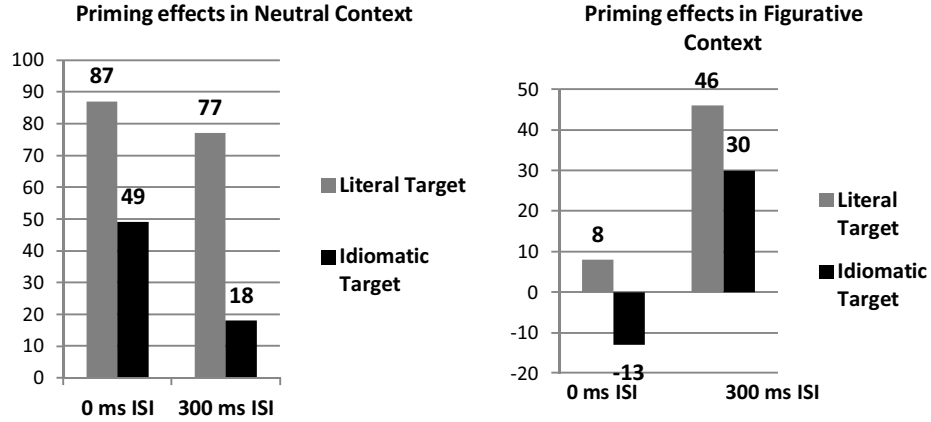

Figure 1 Priming effects (in milliseconds) obtained for Literal and Idiomatic Targets at 0 ms and 300 ms ISIs in the Neutral (left panel) and Figurative (right panel) Context

The data in the table and the figure clearly show the dynamic nature of literal and figurative meaning activation on-line and the role of context. Beginning with the neutral context, immediately at the end of the idiomatic sentences, only literal meanings were significantly activated (the priming effect of 87 ms; t (17) = -1.70; p < 0.01) and this activation persisted until after 300 ms (the priming effect of 77 ms, t (17) = -1.67; p < 0.01). Idiomatic targets were not significantly primed at either 0 ms or 300 ms ISI. In contrast, in the figurative context, neither literal nor idiomatic meanings were activated at 0 ms. After 300 ms, both literal and figurative meanings slightly increased in activation, with literal targets recognized 46 ms faster than controls and idiomatic targets

recognized 30 ms faster than the control targets, but neither literal nor idiomatic facilitation achieved statistical significance.

Discussion

All in all, the obtained results point to the competition between literal and figurative meanings of idioms in the course of their processing by second language speakers and they do indeed seem to imply that context modulates suppression of irrelevant meanings. Research Question (1) specifically concerned the effect that the strongly biasing figurative context would have on the suppression of literal meanings of idioms. The latency data obtained for literal and idiomatic targets displayed at the end of idioms embedded in the neutral vs. figurative-biasing context clearly confirm this effect. More specifically, while only literal meanings were significantly facilitated (i.e., recognized faster than their controls) when idioms were embedded in the neutral context, the same literal meanings were suppressed when idioms were embedded in the context biasing their figurative interpretation. This suppression of contextually incompatible literal meanings was not, however, accompanied by the simultaneous retrieval of the idioms' figurative interpretations. Idiomatic targets were recognized 30 ms faster than their controls when displayed with the figurative-biasing context, but this slight priming effect only obtained in the 300 ms ISI condition and it failed to be statistically significant. It seems then that while the strongly biasing figurative context did indeed ensure suppression of incompatible literal meanings of the English idioms, it did not manage to help boost idioms' figurative meanings sufficiently enough to result in significant facilitation.

Whereas the suppression of literal meanings reported for idioms embedded in the strong figurative-biasing context is consistent with the direct access (context-dependent) view of figurative language processing, lack of significant facilitation for idiomatic targets following idioms embedded in the figurative-biasing context provides support for ordered access accounts of language processing and for the *graded salience* approach (Giora, 1997), under which both salience and context interact in modulating literal and figurative meaning activation. The overall higher activation of literal than idiomatic meanings obtained in the study confirms the prediction formulated as Research Question (3) and adds further support for the literal salience proposal (cf. Cieślicka, 2006), under which literal meanings of idiomatic phrases are more salient than figurative ones for L2 users. Latencies reported for literal targets indicate that literal meanings were more highly activated than idiomatic ones in both the neutral and figurative-bias contexts, even if in the latter neither literal nor idiomatic facilitation turned out to be significantly different

from the control condition. Presence of literal facilitation at the offset of idioms is consistent with those studies which have shown that literal analysis of idiom constituents is not terminated upon retrieval of the idiom's figurative interpretation (e.g., Colombo, 1993; Hillert & Swinney, 2001; Titone & Connine, 1999; Van de Voort & Vonk, 1995).

With regard to Research Question (2) and the time course of literal and figurative meaning activation, the priming patterns obtained in the study do indeed show varying availability of literal and figurative senses depending on the time of target display. There was robust activation of literal meanings at idiom offset which persisted until 300 ms after the end of neutral sentences, whereas in the figuratively biased context the activation of literal meanings, even if insignificant at either ISI, actually increased from the small value of 8 ms at idiom offset to 46 ms at the ISI of 300 ms. The time of target display has also affected the availability of idiomatic meanings, causing an increase in their activation following the figurative-biasing context from no priming effect recorded at 0 ms ISI to a slight, but insignificant priming of 30 ms at 300 ms ISI. In the neutral context, idiomatic meanings were recognized 49 ms faster than the controls at idiom offset, but this facilitation failed to reach significance and it further decreased to only 18 ms after 300 ms. This decrease in the activation of idiomatic meanings following neutral sentences probably reflects the ongoing competition between literal meanings of idiom constituent words, initially highly activated on account of their salience, and the evolving figurative interpretation of the idiom. Since in the neutral context literal meanings of ambiguous idioms are plausible and potentially useful for the evolving interpretation of the sentence, even 300 ms after the end of such sentences, literal meanings were still facilitated and their activation significantly exceeded that of idiomatic meanings. On the other hand, in the figurative-biasing context, where literal meanings are less useful for the construction of the utterance's interpretation, 300 ms after the end of such sentences, the activation of literal meanings was much lower. Those patterns of results are consistent with the *retention hypothesis* (Giora, 2002), under which contextually incompatible meanings which are potentially conducive to the emerging figurative interpretation are retained, whereas those incompatible meanings which conflict with the overall interpretation are discarded. Since literal meanings may contribute to the construction of figurative interpretations, in the neutral context, where the literal sense of the literally plausible idiom is not blatantly incompatible with context, it may remain active even after the sentence has been processed. Most probably, for the complete suppression of literal meanings and the construction of a figurative interpretation of an L2 idiom, more time needs to elapse. Further research, with even longer ISIs is needed to address this issue.

The study has certain limitations and implications for future research. Given the presence of a dynamic competition between literal and figurative meaning activation, longer delays should be employed in addition to the short ISI of 0 ms and 300 ms. Tracking the presence or absence of literal and figurative priming over various time-windows would provide a more complete picture of the time-course of idiom processing by L2 learners. The idioms used in the present study were controlled for predictability, compositionality, and transparency, all of which have been shown to significantly affect idiom processing. Future studies should be conducted looking more closely at how these various dimensions of idioms affect their processing by second language users and interact with both context and salience.

Conclusions

To sum up, the study reported here provides support for the role of salience and context in determining the patterns of activation of literal and figurative meanings of L2 idioms during their on-line processing. Context was shown to be helpful in suppressing inappropriate literal meanings when idioms were embedded in sentences that provided a strong bias towards their figurative interpretation. Salience was also shown to affect idiom processing, in that more salient, literal meanings of L2 idioms were activated throughout the time course of their processing. The results of the current research expand our knowledge of the complex processes of L2 idiomatic processing and carry potential implications for L2 pedagogy concerning the development of L2 figurative competence, whose importance has been repeatedly stressed by second language researchers (e.g., Danesi, 1992; Jones & Haywood, 2004; Littlemore & Low, 2006; Low, 1988; Schmitt & Carter, 2004). For example, results showing an obligatory activation of literal meanings of idiomatic phrases in the course of their processing by second language learners might imply a potentially beneficial role of employing teaching techniques capitalizing on a literal analysis of idiomatic expressions. Rather than avoiding literal translations in teaching figurative language, such techniques might actually encourage L2 learners to analyze an L2 idiom literally, so as to help them see the incompatibility of literally-based and arbitrarily stipulated figurative interpretations. Such techniques capitalizing on a literal analysis of idiomatic phrases might potentially serve as a useful mnemonic (i.e., mental imagery), promoting the meaningfulness of the vocabulary learning activity and enhancing the depth of processing which is essential in ensuring successful vocabulary retention (e.g., Nation, 1990, 2001).

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