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Idioms in Context: Evidence from a Time Cloze-Response Study

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Summary: This article reports on two timed cloze-response experiments which examine the impact of context on idiom recognition. Study 1 presented participants with the beginnings of Polish VP idioms without any prior context. Cloze probabilities and response times for idiom continuations were measured to establish the idiom recognition point (IRP) for each idiom. In Study 2, we used the same idioms in two kinds of contexts: (i) supporting a figurative meaning and (ii) supporting a literal meaning. Cloze probability and response times were measured at the IRP and one word before and after it. The figurative meaning of idioms was automatically activated at the IRP independently of the type of context. Additionally, the figurative context did not move the IRP to an earlier position, whereas in the literal context the responses were significantly slower at the IRP as compared to the figurative context condition. Such a finding indicates that, irrespective of the literal context, the comprehenders automatically activated the figurative meaning of an idiom at the IRP, but they had to discard it later. The literal meaning was computed from the literal meanings of idiom constituents stored in idiom lexical representation, which was computationally costly.

Keywords: idioms, ambiguity, context, idiom recognition point (IRP), cloze probability

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1 Introduction

Evidence from studies using various psycho- and neurolinguistic methods suggests that context can facilitate lexical word production and recognition, even at the very early stages of processing. For instance, in lexical decision tasks, reaction times for words embedded in a supportive context are shortened (e.g., Rommers et al. 2013). In self-paced reading studies, subjects tend to increase their pace of reading on the target word, if the word can be deduced on the basis of sentential context (e.g., Van Berkum et al. 2005). Also, in the ERP studies, the facilitating role of context is well documented, and it can be associated with such phenomena as: the decreasing N400 amplitude elicited as a response for discourse-coherent words (see, e.g., Camblin et al. 2007; Federmeier & Kutas 1999; Van Berkum et al. 1999), late positivity elicited by unexpected information (e.g., Wlotko & Federmeier 2007), and the P300 component (and more specifically, its P3b subcomponent) appearing as a result of a highly expected item detection (e.g., Polich 2012; Roehm et al. 2007; Vespignani et al. 2010). Thus, one can assume that a highly constraining context provides a facilitation in language processing.

The role of context seems particularly relevant in the case of semantically ambiguous homonymous items. There is evidence that, in the case of such items, multiple possible meanings¹ are activated during lexical access, even if the sentential context strongly favors one of them. For instance, the word *port* (which is ambiguous between two unrelated meanings: ‘a type of alcoholic drink’ and ‘harbor’) was demonstrated to prime both *wine* and *ship* even when an earlier context supported only one of the meanings as in: *The guests drank vodka, sherry and port at the reception* (Seidenberg et al. 1982; Swinney 1979). Interestingly, when the same primes were presented 250 msec later (Swinney 1979: 655), only one of the meanings (the one supported by the previous context) was primed (see Marslen-Wilson & Zwitserlood 1989). This result is taken to indicate that both meanings of an ambiguous word are lexically activated independently of the earlier context, and the meaning supported by context is selected with a 250 msec delay (for further discussion, see also Pickering and Frisson 2001; Simpson 1994; Simpson & Burgess 1985).

In recent studies related to the role of context in resolving ambiguities, considerable attention has been paid to idioms, which are multiword expressions whose meaning cannot be computed from the meaning of their constituent parts. Some idiomatic strings are ambiguous in that they can be interpreted both figura-

1 We use the term *meaning* in the most intuitive sense (i.e., as a denotation of a linguistic form), and without any commitment to a particular linguistic theory or author.

tively and literally. For instance, such phrases as *to break the ice* or *to kick the bucket* would by default be interpreted as idiomatic (1a), but they could also be interpreted literally, especially when embedded in a supportive discourse or sentential context (1b).

- (1) a. John told Mary a funny joke and it *broke the ice*.
- b. The polar bear was so heavy that it *broke the ice*.

Unlike in the case of lexical ambiguities of single words, idiomatic strings have a lexically encoded figurative meaning, but their literal interpretation must be obtained compositionally from the meanings of their single constituents. An interesting question is whether in the case of ambiguous idioms their two potential interpretations: (i) figurative and (ii) literal, are equally easily available during processing, and what role context plays in the activation of the relevant interpretation of an idiom. Earlier models put forward by Bobrow & Bell (1973), Gibbs (1980) and Swinney & Cutler (1979) propose that the idiomatic and literal meanings of idioms are available simultaneously, but the figurative meaning is stored and retrieved directly from the mental lexicon, whereas the literal meaning is computed from the meanings of idiom components. Under these approaches, both idiom recognition and the computation of the literal meaning begin at the onset of the idiomatic string, but the retrieval of the idiomatic meaning from the mental lexicon takes less time than the computation of the literal meaning. In more recent approaches to idiom processing, it is postulated that idioms are processed literally until the parser accumulates enough information to conclude that the parsed string of words is an idiom (Cacciari & Tabossi 1988). This moment is called the idiom recognition point (IRP).

In fact, there is ERP evidence (Molinaro & Carreiras 2010; Molinaro et al. 2012; Molinaro et al. 2013; Siyanova-Chanturia et al. 2011; Vespignani et al. 2010) lending credibility to the idea that idioms are recognized as such not at the onset of an idiomatic string but later at the IRP. More specifically, a P300 component is elicited on the word immediately following the IRP because the IRP prompts the recognition of the whole idiom as a template, and the confirmation of this predicted template triggers the P300. The presence of this component suggests that the idiomatic meaning of a given string of words is retrieved from the mental lexicon at the IRP. Additional support for this assumption comes from the observation that the replacement of an element of an idiom coinciding with its recognition point with another unrelated element is reflected in the modulation of the N400 amplitude, “as a function of cloze-probability differences” (Vespignani et al. 2010: 1685), which is consistent with the literal (compositional) interpretation.

Importantly, even after the activation of an idiomatic meaning, the comprehenders have access to the literal meanings of idiom constituents, as shown in the studies of Cacciari & Tabossi (1988), Cutting & Bock (1997), Sprenger et al. (2006) or Holsinger (2013). Based on this observation, Cutting & Bock (1997) and Sprenger et al. (2006) developed a *hybrid model* of idiom lexical representation which assumes that at one level, idioms have unitary entries corresponding to their non-literal meanings, but at another level, they are represented by simple lemmas of their single constituents. This most probably means that only the figurative meaning of an idiomatic configuration is stored and activated at the moment of idiom recognition, whereas its potential literal meaning is to be computed compositionally in the context supporting such a literal interpretation. The interaction of the literal and figurative meaning of an idiom with context has been studied by Cacciari & Corradini (2015) who used predictable idioms (i.e., idioms whose IRPs are located before the last word of the string) and unpredictable idioms (i.e., idioms for which the IRP is located at the end of the string) and embedded them in literal and idiomatic stories of the type presented in (2) and (3) respectively (ibid.: 802).

(2) *Literal story*

- a. Predictable idioms: rimboccarsi le maniche ‘to roll up one’s sleeves’
La mamma ha visto che / Ada si era rimboccata le maniche / per potersi infilare i guanti di gomma / e fare le pulizie. (Mom saw that / Ada had rolled up her sleeves / to shove the rubber gloves / and do the cleaning.)
- b. Unpredictable idioms: tagliare la corda ‘to cut the rope, to snake off’
La signora disse che / Sergio aveva tagliato la corda / per poter aprire il delicato pacchetto / proveniente dalla sua città. (The lady said that / Sergio had cut the rope / to open the delicate package / coming from his hometown.)

(3) *Idiomatic story*

- a. Predictable idioms: rimboccarsi le maniche ‘to roll up one’s sleeves’
La mamma ha visto che / Ada si era rimboccata le maniche / per poter terminare la tesi di laurea / entro tre settimane. (Mom saw that / Ada had rolled up her sleeves / to finish the dissertation / within three weeks.)
- b. Unpredictable idioms: tagliare la corda ‘to cut the rope, to snake off’
La signora disse che / Sergio aveva tagliato la corda / per sfuggire alla volante della polizia / arrivata dopo la rapina. (The lady said that / Sergio had cut the rope / to escape the police car / arrived after the robbery.)

Cacciari & Corradini (2015) predicted that the interplay between the composition of the literal meanings of idioms and the activation of their figurative meaning should depend on idiom predictability. Their prediction was confirmed. More spe-

cifically, the literal continuations of contexts with unpredictable idioms were read faster than idiomatic continuations, and idiomatic continuations of contexts with predictable idioms were read faster than literal continuations. This observation indicates that, because the recognition point of unpredictable idioms was at the end of the string, their literal interpretation was fully composed, and it was easy to integrate it with the upcoming literal context. By contrast, the dominant figurative meaning of predictable idioms was strongly activated, and hence easy to integrate with the idiomatic continuations. Additionally, it was difficult to integrate predictable idioms with literal continuations – probably because their idiomatic meaning was activated before the end of the idioms. Encountering the literal continuation probably led to the revision of the initial figurative interpretation, which in turn triggered the computation of the literal meaning of the idiomatic string. This revision process, together with the process of building the literal meaning of idioms compositionally in the working memory, led to very long reading times.

Summing up, Cacciari & Corradini (2015) showed that the time when an idiom is recognized as such affects its integration with the later idiomatic or literal continuation. What is still unresolved is whether an earlier context can influence the choice between the literal and the idiomatic interpretation of an idiomatic string, and whether it can prevent the parser from considering the literal or idiomatic meanings of idiomatic strings. We wanted to test whether – upon the recognition of an idiomatic configuration – its figurative meaning is accessed automatically, independently of the preceding context. If so, we might expect that the composition of the literal meaning of the whole idiomatic expression should be delayed, when the idiom is supported by literal context. The goal of the present paper is to investigate these questions, and more precisely, to better understand the interaction between the context and the literal and figurative meanings of idiomatic expressions. Before we present our study, in the following section, we will provide more background information about different types of idioms and the role of context in their processing. All of this will serve as the basis for motivating the present experimental design and the choice of experimental material.

2 Different Types of Idioms and the Role of Context in the Processing of Idioms

Idioms do not constitute a uniform class: for instance, it is possible to distinguish between idioms which are ambiguous between the literal and figurative meaning (e.g., *to break the ice*) and idioms which possess only the figurative meaning (e.g., *to pop the question*). Additionally, for some literal idioms, the literal interpretation

is isomorphic with the figurative interpretation (e.g., *to hit below the belt* indicates an unfair action both when meant figuratively and literally) (see Dobrovolskij 1982, 2004; Mueller & Gibbs 1987). Although early work on idioms had suggested that idioms are represented uniformly in the mental lexicon (Swinney & Cutler 1979), later studies showed that idioms may differ with regard to the processing load (Gibbs & Gonzales 1985). Mueller & Gibbs (1987) have demonstrated that subjects spent significantly less time reading and paraphrasing idioms with two or more possible meanings compared with items which had only one, conventional meaning. Moreover, they have shown that phrase classification judgments were faster in the case of non-isomorphic as opposed to isomorphic idioms. These observations led to the conclusion that idioms with isomorphic literal and idiomatic meanings have essentially a single entry in the mental lexicon. The same seems to be true for idioms with no literal meaning as they have only a figurative entry. Idioms with distinct literal and idiomatic meanings, however, have two different entries in the mental lexicon and are, therefore, accessed faster.

The above observations point to the conclusion that the choice of idioms can crucially affect the experimental results. For that reason, the idioms used in our study were carefully selected: they all had the same syntactic structure, they all had an idiomatic and a literal interpretation, they all were isomorphic and familiar (more on that in section “Material”). Furthermore, we followed Giora (1997, 2003) in her observation (formulated as a Graded Salience Hypothesis) that the figurative meaning of an idiomatic expression is the dominant one (i.e., the *salient* one) in the case of native speakers (see also Cieřlicka & Heredia 2011; Cieřlicka et al. 2009; Filik et al. 2014; Laurent et al. 2006). If, along with Giora’s Graded Salience Hypothesis, it is so that the idiomatic meaning of a fixed expression is activated automatically, one could expect that it should be more difficult to arrive at its literal interpretation as it has to be triggered by context. By contrast, the figurative interpretation should be easily available for the parser or even facilitated by a supporting context. In order to verify these predictions, we used two types of context in the reported study on the processing and production of Polish idioms, as exemplified in (4).

(4) a. FIGURATIVE² CONTEXT

Byliśmy na skraju bankructwa, ale
 be.PST.1PL on verge.SG.LOC bankruptcy.SG.GEN but
miałem jeszcze asa w rękawie.
 have.PST.1SG.M still ace.SG.ACC in sleeve.SG.LOC
 ‘We were about to go bankrupt but I still had an ace up my sleeve.’

b. LITERAL CONTEXT

Gdy graliśmy w karty, cały czas
 when play.PST.1PFV.1PL in card.PL.ACC [whole time].SG.ACC
miałem asa w rękawie.
 have.PST.1SG.M ace.SG.ACC in sleeve.SG.LOC
 ‘While we played cards, I had an ace up my sleeve all the time.’

Given Giora’s (1997, 2003) assumptions, an idiom such as *mieć asa w rękawie* ‘to have an ace up one’s sleeve’ would also be recognized as an idiom when presented in a context suggesting its non-idiomatic meaning, as in (4b). This is so because the salient reading of an idiom occupies the more prominent position in the mental lexicon. The figurative interpretation should then always be activated, even in the context biasing the literal meaning of an expression. The role of contextual cues would then be considered secondary in the view of the Graded Salience Hypothesis. In reference to the observation that a supportive context facilitates language processing, the figurative context (4a), which supports the more salient meaning of an idiom, would be expected to facilitate the processing of idioms to a greater extent when compared with the literal context (4b). One particularly puzzling question, however, concerns the exact nature of such a facilitation. As mentioned in the Introduction, in the literature, one finds the view that the comprehenders process the idiomatic expressions literally until they encounter the so-called idiom recognition point (IRP). Then the idiomatic processing begins (Cacciari & Tabossi 1988). Idiom recognition point can be defined as the moment at which an expression is recognized as idiomatic, and it is associated with a certain cloze probability (or expectancy) threshold, usually estimated in paper-and-pencil cloze tasks. The subjects in such tasks have to write down or utter (see

² The terms ‘figurative context’ and ‘literal context’ refer to the types of context which promote, respectively, the expression’s figurative and literal meanings. Quite significantly, the context preceding the idiom did never contain any other figurative expressions. Also – what is crucial in the case of isomorphic idioms used in the study – the idioms presented in the literal context could be interpreted in the figurative and literal sense at the same time (for a more detailed discussion of the nature of idiom semantic analysability see Dobrovol’skij 2004).

Staub et al. 2015) the first sentence ending which would come to their minds (see (5a) and (5b)).

- (5) *John told Jenny that he was in the seventh ____.*
 a. **a word of high cloze probability:** *heaven*
 b. **a word of low cloze probability:** *building*

Thus, one could assume that the IRP would be located after the word *seventh* in the case of the idiom presented in (5). Importantly, idiom recognition may take place either before the offset of an idiom (in the case of *predictable* idiom continuations), or after the offset (in the case of *nonpredictable* idiom continuations). According to *the Configuration Hypothesis* (Cacciari et al. 2007; Cacciari & Tabossi 1988; Vespignani et al. 2010), the fact that an idiom is only processed literally up to an IRP is reflected in faster lexical decisions for literally-related as opposed to idiom-related probes (Cacciari & Tabossi 1988: 676). After the IRP has been reached, the comprehenders retrieve the specific configuration associated with the processed idiom from semantic memory, and they match the actual input (i.e., the idiom fragment) to the stored template (i.e., the whole idiom). The idea receives support from the results of the already mentioned ERP study by Vespignani et al. (2010), whose subjects were presented with sentences in an idiomatic condition (in which idioms were presented in an unchanged form; see (6a)), a substitution condition (in which some parts of idioms were substituted with literal phrases *before* the IRP was reached; see (6b)), and a violation condition (in which the word incompatible with the idiomatic meanings was introduced *after* the IRP; see (6c)).

- (6) a. an idiomatic condition:
Giorgio aveva un buco (IRP) nello (IRP+1) stomaco
 George have.PST.3SG a hole in stomach
quella mattina.
 that morning
 Lit. 'George had a hole in the stomach that morning'; intended meaning: 'George was hungry that morning.'
- b. a substitution condition:
Giorgio aveva un dolore (IRP) nello (IRP+1) stomaco (...)
 George have.PST.3SG a pain in stomach (...).
 'George had a pain in the stomach that morning.'
- c. a violation condition:
Giorgio aveva un buco (IRP) sulla (IRP+1) camicia (...).
 George have.PST.3SG a hole on shirt (...).
 'George had a hole in his shirt that morning.'

Vespignani et al. (2010) found two distinct ERP effects associated with idiom processing. In the idiomatic condition (compared with the violation condition), the P3b component, which is usually associated with the occurrence of a highly expected ending (Roehm et al. 2007), was elicited at the IRP+1 (in the case of (6a): at the word *nello*). This finding was interpreted as evidence that the idiom has already been recognized at this point, making the subsequent word of an idiom highly expected. The effect observed at the IRP in the idiomatic (when compared with the substitution) condition was the N400. Thus, in accordance with the Configuration Hypothesis, the timing and topographical distribution of the two observed components differed, depending on whether the word at which a given component was observed was presented *before* or *after* the previously established IRPs. In the first case, the outcome of the manipulation was a centrally distributed negativity peaking at around 400 milliseconds after the stimulus (and thus associated with an N400 component), and in the latter case, it was a posterior positivity with a peak at around 300 milliseconds after the target (interpreted as a P3b component). Importantly, the contexts used both in Cacciari & Tabossi's (1988) study as well as in the one of Vespignani et al. (2010) were fairly short and neutral. Thus, they did not support the expressions' figurative meanings (for instance, the expression *to go to the devil* was presented in the sentence *He told him to go to the devil*) (Cacciari & Tabossi 1988: 675).

Yet another study supporting the hybrid model of idiom representation was an eye-tracking experiment conducted by Holsinger (2013) who used idioms embedded in context biasing either the figurative or the literal associations. Having taken into account the proportion of looks to the idiom associates (e.g., *to kick the bucket – death*) as opposed to the literal associates (e.g., *to kick the bucket – foot*), the author of the study revealed that, in spite of a strong contextual effect, the participants tended to show literal considerations even in the context supporting an expression's figurative meaning. Importantly, Holsinger (2013) observed no figurative considerations under the literal bias. This finding would support hybrid as opposed to the parallel interpretation models of idiom processing, as the latter ones assume that the two meanings of an ambiguous expression are always computed in parallel (e.g., Swinney & Cutler 1979).

3 Aims of the Present Study

Taking into account both the potential facilitating role of context in general and the possible differences between the two context types (i.e., figurative and literal context), the aim of our study was to examine the impact of two types of context (literal and figurative) on idiom recognition. In order to achieve this goal, we con-

ducted two cloze probability experiments (Study 1 and Study 2) in which we investigated the role of context in the recognition of Polish idioms of similar syntactic structure (i.e., verb phrases headed by transitive verbs followed by a complement and a prepositional phrase). In the first cloze-task (Study 1), which served as a baseline condition, we presented the idioms without any context. In the second part of the study (Study 2), we embedded the idioms in two types of context: figurative (i.e., supporting the salient meanings of the idioms we used) and literal (i.e., supporting the less salient meanings of the idioms used in this study). In both experiments, we used the online (i.e., timed) version of the cloze-task, which, as opposed to the standard paper-and-pencil version of the method, enables the researcher to measure not only cloze probability but also response times.

Regarding the expected results of the present study, the lack of research incorporating the timed cloze probability method and the variety of theoretical views on idioms preclude any strong hypotheses concerning the present research question. However, given the number of studies whose results provide support for the facilitating role of context in general (e.g., Federmeier & Kutas 1999; Rommers et al. 2013; Van Berkum et al. 2005; Vespignani et al. 2010), it can be assumed that the preceding constraining context should facilitate the access to an idiomatic phrase. In accordance with the Configuration Hypothesis (Cacciari & Tabossi 1988), such a facilitation could be manifested by the change of the IRP. That is, in the context supporting the expression's figurative meaning, a given idiom should be recognized at an earlier prompt position than in the case of no context. When it comes to the expected differences between the contexts supporting the figurative and literal meanings of the expressions, one could refer to the Graded Salience Hypothesis (Giora 1997), which assumes that the idiomatic meaning of an ambiguous expression is the more salient meaning and, at least in the case of one's native language, is always activated first. This regularity has been observed in many psycholinguistic studies investigating the nature of idioms and is usually reflected in slower reading/response times for the less salient (i.e., literal) meanings of the expressions (among many others, Cacciari & Corradini 2015; Cieśllicka et al. 2009; Holsinger 2013; Laurent et al. 2006). Thus, one could expect that also in the case of this study, the response times in the literal context would be significantly longer when compared with the figurative context. One cannot exclude, however, that the preceding context supporting the literal meaning of an idiomatic string will affect the strength of idiom recognition which would be reflected in lower cloze probabilities (possibly in addition to slower response times) for the literal context condition as compared with the figurative context condition. It might even be the case that the literal sentential context would bias the parser so strongly towards the literal meaning of an ambiguous expression that the com-

prehenders would never be able to reach the idiom recognition point, and as a consequence, the figurative meaning would not be accessed in this case. Such an outcome would be in line with Holsinger's (2013) findings, and namely, with the fact that no figurative considerations were observed under the literal bias.

The study consisted of two experiments, referred to as Study 1 and Study 2, which will be described separately in Sections **Study 1** and **Study 2**. Both experiments were conducted using the same experimental method: a timed cloze probability test. The goal of Study 1 was to determine IRPs for the idioms presented without any context. Then, in Study 2, the role of two context types (i.e., contexts supporting an idiom's figurative and literal meaning) was estimated.

4 Study 1

The goal of Study 1 was to determine IRPs for the selected set of idioms, when presented without any context (i.e., in the form of infinitive phrases).

4.1 Method

The method used in the study was a cloze probability test, based on the paradigm proposed by Staub et al. (2015). Standard paper-and-pencil cloze probability tests, though often used to determine the IRPs, are believed to possess a number of drawbacks when compared with their timed equivalents, which enable the researchers to measure the reaction time accurately (Staub et al. 2015: 2), and which we used in the reported study. In contrast with the offline version of the paradigm, the subjects' responses are uttered (and recorded) instead of being written. Thus, it is possible to estimate which completion of a given phrase is indeed the most expected and automatic by measuring how much time elapses between the moment in which the prompt to provide a continuation appeared on the computer screen and the onset of the first word uttered by a participant. Importantly, in contrast to the more common psycholinguistic methods used in research related to the figurative language (e.g., the semantic priming), the method of timed cloze probability test combines the elements of both idiom comprehension and production tasks.

4.2 Material

Fifty idioms of similar syntactic structure were initially selected to be used in the study. All the idioms were verb phrases headed by transitive verbs followed by a direct object and a prepositional phrase (V+DP_{OBJ}+P+DP_{PREP_OBJ}³). All idioms had the same degree of literality, i.e., they had two possible meanings: the figurative one (7a) and the literal one (7b).

- (7) a. *W pierwszych dniach nowy pracownik*
 in first.PL.LOC day.PL.LOC new.SG.NOM employee.SG.NOM
był zagubiony, więc trzeba go było
 be.PST.3SG.M lost.SG.NOM so need 3SG.M.ACC be.PST.3SG.N
prowadzić za rączkę.
 lead.INF by [little hand].SG.ACC
 ‘During the first days, the new employee felt lost so one had to lead him by the hand.’
- b. *W czasie spaceru nie chciałem stracić*
 in time.SG.LOC walk.SG.GEN NEG want.PST.1SG.M lose.INF
synka z oczu, więc cały
 son.SG.GEN from eye.PL.GEN so whole.SG.ACC
czas prowadziłem go za rączkę.
 time.SG.ACC lead.PST.IPFV.1SG.M 3SG.M.ACC by [little-hand].SG.ACC
 ‘While we had a walk, I did not want to lose sight of my son so I led him by the hand all the time.’

Also, all the idioms used in the study were well-formed (i.e., formed according to the rules of grammar) and controlled for familiarity, saliency and isomorphism in the form of three off-line pre-tests. The aim of the first pretest was to estimate the idioms’ familiarity. 36 university students (none of whom participated in the main study) assessed their knowledge of the expressions presented to them on a 7-point Likert scale (where 1 meant “I have never heard this expression” and 7 meant “I hear the expression very often, and I am sure I know its meaning very well”). Only 22 idioms whose familiarity was assessed as at least 6.5 were selected to be used in the study. In addition, we conducted a saliency pre-test: the set of 30 highly familiar idioms was presented to 60 university students (none of whom partici-

³ The abbreviation DP_{PREP_OBJ} stands for a DP which serves as a complement to a preposition. Being aware that the precise structure of nominal phrases is especially difficult to determine in article-less languages such as Polish, we decided to use the general term “Determiner Phrase” (DP) for the ease of reference.

pated in the main study). Their task was to provide all possible definitions of the presented expressions, in the exact order in which the definitions came to their mind. The subjects' answers were categorized as *figurative*, *literal* or *others*. In most cases, the definitions provided by the participants involved only the figurative interpretation of the target (e.g., *chwycić byka za rogi* 'to take the bull by the horns' was defined as "to be courageous" or "to take risk," etc.). Sometimes, the definitions involved the literal interpretation of an idiom, though (for instance, *kłaść kogoś na łopatki* 'to pin somebody down' defined as "to knock somebody down"). Incorrect answers were classified as *others*. For all idioms, it was the figurative meaning which was revealed to be the more salient one, i.e., the one which was provided first by the vast majority of subjects. Finally, the isomorphism pre-test was conducted. 77 college students (none of whom participated in the main study) were provided examples of isomorphic and non-isomorphic idioms (defined in accordance with the definition proposed by Mueller & Gibbs 1987), and were asked to assess whether a given idiom is isomorphic or not (in the form of a yes-no question): "using your own judgements try to determine whether the following Polish idioms have similar or different figurative and literal meanings." Only idioms which were judged to be isomorphic by at least 70 % of the respondents were selected to be used in the main study. As the vast majority of idioms satisfying all the other criteria (concerning syntactic structure, length, familiarity, salience, etc.) were isomorphic, it was not possible to divide the experimental material into two groups according to the degree of isomorphism. On the basis of the third pre-test results, it can be stated that isomorphism is one of the properties associated with most Polish idioms taken into account in this study (for a more detailed discussion of the role of familiarity and decomposability in idiom comprehension, see Libben & Titone 2008).

4.3 Participants

Twenty native speakers of Polish (14 females; mean age 19.7, age range from 19 to 23), all of them college students and with reported normal or corrected-to-normal vision participated in the study for a partial course credit. None of them took part in Study 2, nor in any of the three pre-tests.

4.4 Stimuli and lists

Thirty idioms selected in the pre-tests were presented to the subjects. As all the idioms consisted of four words, it was necessary to present each idiom in three versions, bearing in mind that the recognition point of predictable idioms might be located in one of the three positions: after the verb, after the object, or after the preposition (see Table 1). All idioms were presented in the form of infinitive phrases.

Table 1: Experimental design: Study 1

Prompt location 1	Prompt location 2	Prompt location 3
<i>verb.INF</i> _____ e.g., <i>take</i>	<i>verb.INF + DP_{object}</i> _____ e.g., <i>take the bull</i>	<i>verb.INF + DP_{object} + preposition</i> _____ e.g., <i>take the bull by</i>

Thus, three experimental lists, to which the subjects were later assigned, were created with the use of Latin-square design. Each of the lists contained only one version of the same idiom: consequently, each participant saw every idiom in only one version. In addition, each list contained a set of 173 filler items whose aim was to divert the subjects’ attention from the focus of the research, that is, idiom processing and production. Various kinds of fillers were used in the study, for instance: long similes (e.g., *rozpaść się jak domek z kart* lit. ‘to collapse like a house of cards’), short similes (e.g., *biały jak ściana* lit. ‘white as a wall’), idioms whose familiarity was assessed as low (e.g., *mieć piasek w rękawach* lit. ‘to have sand in the sleeves’), common transitive verbs (e.g., *obejrzeć* ‘to watch’), transitive verbs followed by a preposition (e.g., *krzyczeć na* ‘to shout at’), transitive verbs followed by a noun and a preposition (e.g., *podkreślać coś z* ‘to underline/emphasize something with’). Long similes were presented in three versions (see (8)) in order to establish the idiom recognition points (IRPs) for them as well. Short similes were presented in two versions for the same reason (see (9)). As in the case of idioms, one participant did not see the same simile in more than one version.

- (8) a. LIST A: rozpaść się jak
collapse.INF REFL like
- b. LIST B: rozpaść się jak domek
collapse.INF REFL like little_house.SG.NOM
- c. LIST C: rozpaść się jak domek z
collapse.INF REFL like little_house.SG.NOM of

- (9) a. LIST A: *biały*
white
b. LIST B⁴: *biały jak*
white like

The items on each list were pseudo-randomized so that the target items were separated by at least three filler items. Half of the participants assigned to each list saw the items appearing in the reverse order to avoid the situation in which the participants' tiredness would affect the recognition of the stimuli presented in the final block.

4.5 Procedure

The participants were tested individually in a quiet room. All experimental stimuli were presented on a computer screen (see Figure 1) with the aid of PsychoPy software, version 1.83.04 (Peirce 2007, 2009).

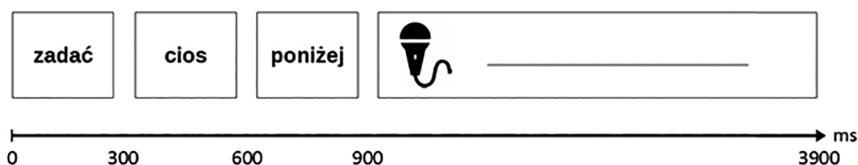


Figure 1: The procedure in Study 1 for the idiom *zadać cios poniżej pasa* ‘to punch somebody below the belt’

The instructions for the subjects were presented on the computer screen: “Please say aloud the first word (or words) that, in your opinion, could be a possible completion of the presented expression.” Every word constituting either an idiom or a filler fragment was visible for 300 milliseconds. Then, a horizontal line appeared on the screen, which was a signal for the participants to provide a continuation. In order to elicit maximally rapid responses, the next trial began after 3 seconds. A fixation cross appeared on the screen at the beginning of a new trial. The whole experiment was divided into four experimental blocks: after the completion of

⁴ More transitive verbs were included in LIST C to compensate for the lack of short similes on this list.

each block the subjects had an opportunity to take a break. One experimental session lasted approximately 20 minutes. During the trials, the PsychoPy (1.84.2) software generated .wav files containing the subjects' oral responses.

4.6 Results

On the basis of the data obtained in Study 1, it was possible not only to determine the IRP but also to measure the response times for each idiom (i.e., the time interval between the moment in which the prompt appeared on the computer screen until the onset of the first uttered word). The first stage of the results' analysis involved preparing the transcriptions of the subjects' responses in order to count the number of idiomatic endings provided in response to each idiom after the verb, after the noun, and after the preposition. In the cases in which two responses were produced within the three-second-long time limit, only the first response was taken into account. Another problematic response involved the subjects skipping the verb's nominal complement (e.g., *walić w mur* 'to beat against the wall' instead of *walić głową w mur* 'to beat one's head against the wall') – such answers were not considered as idiomatic given that the idiomatic meaning of the expression was lost. Also, it was sometimes the case that the subjects produced the full correct idiomatic ending followed by some other phrase (e.g., *policzyć coś na palcach... jednej ręki* 'to count something on the fingers... of one hand'). As such responses mostly involved other (i.e., longer) variants of the investigated idioms, they were classified as idiomatic. Then, mean response latencies (for idiomatic completions only) were calculated on the basis of waveforms generated and interpreted with the aid of the Praat software (see Staub et al. 2015). To assume that an idiom's recognition point is located in a certain position, the number of idiomatic completions in this position by at least 65%⁵ of the participants was required. 19 idioms presented in Study 1 were revealed to be predictable, i.e., in their case, the threshold was exceeded before the idiom's last word. And more specifically, 14 idioms had their IRPs after the first noun and 5 idioms had their IRPs located behind the preposition. In the case of the remaining 3 unpredictable idioms the IRP was determined to be behind the second noun (i.e., the expression's last word) (see Table 2).

⁵ Though arbitrary, the .65 cloze probability threshold seems in accord with that used in similar studies (see, for instance, Vespignani et al. 2010; Federmeier & Kutas 1999; Cacciari & Corradini 2015; Romero-Rivas et al. 2016).

Table 2: The location of the IRP for idioms used in Study 1 and Study 2

IRP	After the first noun	After the preposition	After the second noun
Number of idioms	14	5	3

5 Study 2

The goal of Study 2 was to investigate the role of two CONTEXT TYPES (the one supporting an idiom’s more salient figurative meaning and the one promoting its less salient literal meaning), with the two measures (that is, idiom cloze probability and idiom response time) taken into account.

5.1 Predictions

As already mentioned above, the lack of research incorporating the timed cloze probability method and the variety of theoretical views on idioms preclude any strong hypotheses. However, relying on the previous literature, the following can be expected as to the potential impact of figurative and literal context on idiom recognition:

- i) Figurative context should facilitate idiom recognition in comparison to idiomatic strings used without a context (based on Cacciari & Tabossi 1988). This facilitation can be reflected either: i) in the shift of the IRP to an earlier position, or ii) in higher cloze probabilities in the figurative context condition.
- ii) Literal context should hinder the processing of the idiomatic strings in comparison to the same strings used in figurative context. This difficulty can be reflected either, i) in slower response times on critical words (words processed at the IRP) due to the revision of the stronger initially retrieved idiomatic meaning (based on Cacciari & Corradini 2015; Giora 1997, 2003), or ii) in lower cloze probabilities in the literal context condition (based on Holsinger 2013).

5.2 Method

The experimental method used in Study 2 was identical with the method used in Study 1 (a timed cloze probability study). The only difference between the two

studies involved the length of the presented stimuli. In Study 1, infinitival phrases were presented to the participants, while in Study 2, the subjects read the whole sentences.

5.3 Participants

Thirty native speakers of Polish (25 females; mean age 21, age range from 19 to 25), all of them college students and with reported normal or corrected-to-normal vision participated in the study for a partial course credit. None of them took part in Study 1, nor in any of the three pre-tests.

5.4 Stimuli and lists

Like in Study 1, the prompt appeared in three different locations (see Table 1). Additionally, the idiom fragment was preceded by either literal or figurative context. Two independent variables were then considered in the design: CONTEXT TYPE and PROMPT LOCATION. First, 22 idioms were embedded in two types of CONTEXT: one supporting their FIGURATIVE (i.e., salient; at least in the case of the expressions used in our study) meaning (see (10a)), and the other one supporting their LITERAL (i.e., less salient) meaning (see (10b)).

- (10) a. *Tuż przed spotkaniem wszystko było*
 right before meeting.SG.INS all be.PST.3.SG.N
już prawie gotowe i pozostało
 already almost ready.SG.N and remain.PST.3SG.N
tylko postawić kropkę nad i.
 only put.INF dot.SG.ACC above 'i'
 'Right before the meeting everything was almost ready so the only thing we had to do was to dot our I's.'
- b. *W czasie dyktanda starałem się*
 in time.SG.LOC dictation.SG.GEN try.PST.1SG.M REFL
pisać jak najładniej, więc szczególnie starannie
 write.INF as most.nicely so particularly attentively
postawiłem kropkę nad i.
 put.PST.1SG.M dot.SG.ACC above 'i'.
 'During the dictation I tried to write as nicely as I could so I paid attention to dot my I's.'

The contexts used were roughly matched with respect to their length (from 10 to 15 words) and sentence structure as they all started with temporal or place adverbials followed by a (coordinated or subordinated) complex sentence. Also, all idioms were presented in three versions, i.e., with the prompt to provide a continuation appearing one word before the previously established IRP, at the IRP, or one word after the IRP. As in the case of Study 1, we employed a Latin-square design during the stimuli division, and we distributed evenly all items across six experimental lists so that each idiom was presented to each participant in one version only. Taking into account that only 14 out of the 22 idioms used in the study had their IRP located after the object, and none of them was recognized already after the verb in Study 1, only 14 idioms could be presented in all three versions. The group of 5 idioms recognized after the preposition was presented in two versions: one word before the IRP and at the IRP. These idioms could not be displayed in the version with the prompt appearing one word after the IRP as that would result in a necessity to present the whole idiom to the participants. For the same reason, 3 idioms whose continuations turned out to be impossible to predict could not be displayed with the prompt presented at the IRP and after the IRP, and they were shown only in one version (i.e., one word before the IRP). To compensate for the lack of some idioms in some versions, substitutes (additional transitive verbs) were introduced in their place. Altogether, each list contained 120 sentences (including 22 targets and 98 fillers), out of which: 12 were similes, 36 were sentences with the prompt located after the verb (including targets and transitive verbs), 36 were sentences with the prompt placed after the object or part of the object (including targets and transitive verbs followed by a preposition), 36 were sentences with the prompt after the preposition (including targets and transitive verbs followed by an object and a preposition). The lists were pseudo-randomized so that target items were separated by at least two filler items. As in the case of Study 1, half of the participants assigned to each list saw the items appearing in the reverse order.

5.5 Procedure

The procedure of Study 2 was almost identical with the one of Study 1. The only exception was that this time the idioms were embedded in sentences supporting either their literal or figurative interpretations, as illustrated in Figure 2.

Before the start of the training session the participants were asked to provide their e-mail addresses, and they were informed that the researchers would send them a short online questionnaire after the end of the study. When all the data had been collected, a survey checking the knowledge of 22 idioms used in the study was sent to all the subjects. The form of the questionnaire was identical to the one

of the familiarity pre-test, and its aim was to make sure that the participants indeed knew the expressions which we presented to them. Every participant filled the questionnaire and sent it back. The mean result of the survey was 6.62 (out of 7.0), with the vast majority of test scores (96.67 %) ranging between 6.16 and 7.0. The response coding was identical with the one of Study 1: first, transcriptions of all the answers provided by the participants were prepared. Then, first word onset latencies were measured (for idiomatic completions only) with the use of Praat software (Boersma 2001) and finally, idiom response times were estimated.

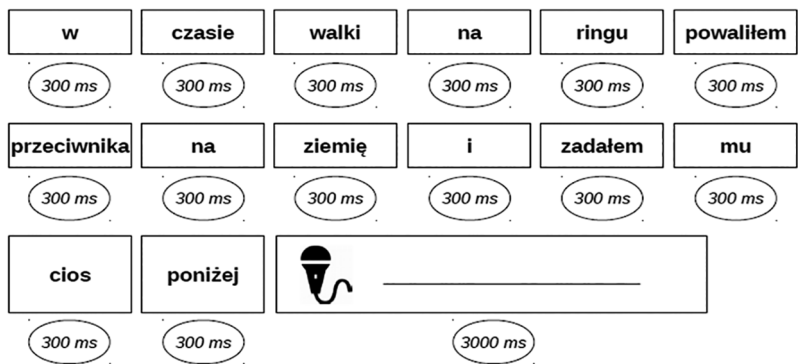


Figure 2: The procedure in Study 2 for the idiom *zadać cios poniżej pasa* ‘to punch somebody below the belt’ (embedded in a literal context: “During the fight in a boxing ring I knocked my opponent out and punched him below_”).

5.6 Descriptive Results

To determine if the size of stimulus and context cue influence the rate at which idioms were correctly recognized, a loglinear analysis using the *loglm* function from *MASS package* (Ripley et al. 2017) was carried out. The complete model consisted of frequencies for the correct idiom recognition distributed across three levels of the PROMPT LOCATION condition: IRP-1, IRP and IRP+1 and three levels of the CONTEXT condition: NO CONTEXT, LITERAL CONTEXT and FIGURATIVE CONTEXT. The significance of the main effects of PROMPT LOCATION and CONTEXT, and interaction effect was estimated with log-likelihood on model comparison. We determined the significance of main effects and interaction effect by subtracting the effect of interest from a model and comparing this model to the model with all main and interaction effects. Pairwise comparisons were estimated on the basis of

standardized residuals calculated for 3 x 3 contingency table for the PROMPT LOCATION and CONTEXT conditions. Table 3 below presents the counts, proportions and standardized residuals for correct idiom recognition across the PROMPT LOCATION and CONTEXT conditions.

Table 3: Raw counts, proportions and standardized residuals for correct idiom recognition (Study 1 and Study 2)

<u>Prompt location</u>	<u>Context type</u>		
	No context	Literal context	Figurative context
IRP-1	count: 27 percentage: 22.31% cloze probability: .19 st. resid: -2.693	count: 43 percentage: 35.54 % cloze probability: .41 st. resid: 1.130	count: 51 percentage: 42.15 % cloze probability: .48 st. resid: 1.775
IRP	count: 110 percentage: 40.74 % cloze probability: .89 st. resid: 0.957	count: 78 percentage: 28.89 % cloze probability: .84 st. resid: -0.309	count: 82 percentage: 30.37 % cloze probability: .88 st. resid: -0.723
IRP+1	count: 88 percentage: 41.12 % cloze probability: .99 st. resid: 0.943	count: 60 percentage: 28.04 % cloze probability: .9 st. resid: -0.503	count: 66 percentage: 30.84 % cloze probability: .99 st. resid: -0.523

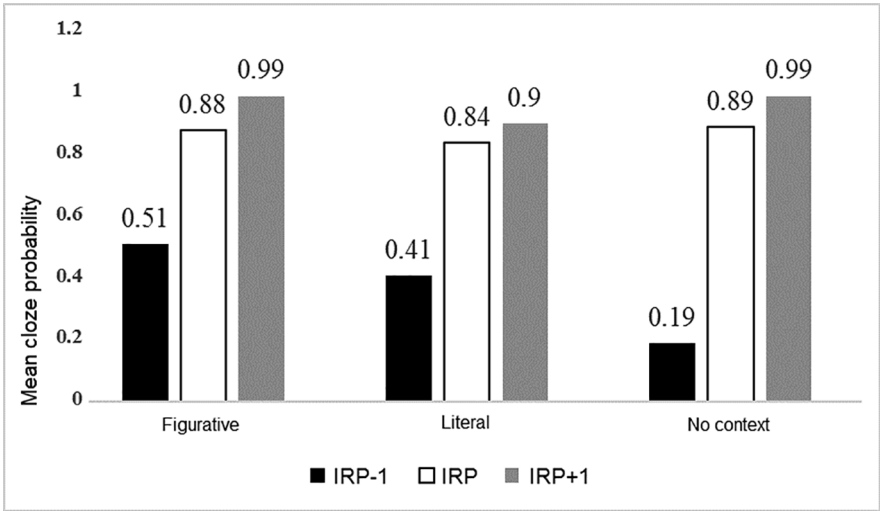


Figure 3: Idiom cloze probabilities for PROMPT LOCATIONS in three context types (Study 1 and Study 2)

A two-way loglinear analysis (PROMPT LOCATION x CONTEXT) produced the final model that retained the two-way interaction effect between the PROMPT LOCATION and CONTEXT conditions ($\chi^2(4) = 15.429$; $p = 0.0039$). The two-way interaction effect was found to be significant ($\chi^2(4) = 14.578$; $p = 0.006$). Standardized residuals inspection revealed a significant result only for idiom recognition in the NO CONTEXT condition for IRP-1 ($z = -2.693 < z = -1.96$).

To determine whether the size of the stimulus and context cue influence the time needed to recognize the idiom (RT), a generalized linear model using *lme* function from *nlme* package (Pinheiro et al. 2017) was fitted. We estimated the significance of main effects and interaction effect with log-likelihood on model comparison. For main effects, we compared a model with one effect to a model with two effects. As for interaction effect, we compared the model with two main effects to a model containing their interaction.

Data analysis was divided into two stages (analysis for NO CONTEXT cue which was tested in **Study 1** and analysis for LITERAL vs. FIGURATIVE context cue which were tested in **Study 2**) due to the fact that different groups of participants were recorded with respect to the levels of the CONTEXT condition. In both analyses, the PROMPT LOCATION and CONTEXT conditions were set as fixed terms, whereas participants and idioms were set as random terms. Analysis was carried out on complete cases only; RTs were log transformed to meet the linear distribution assumption, and outlying observations were removed based on standardized residuals. Outlier removal has resulted in removing 5 % of the data in NO CONTEXT group and 9 % of data in LITERAL vs. FIGURATIVE context group.

Data analysis for RT in cases in which the idioms were presented without any context-cue (NO CONTEXT) has produced a significant effect for PROMPT LOCATION ($\chi^2(2) = 14.601$; $p = 0.0007$). Pairwise comparisons have produced statistically significant differences between IRP and IRP+1 positions ($t(190) = -3.115$; $p = 0.0021$; $\beta = -0.13$); and IRP-1 and IRP+1 positions ($t(190) = -3.431$; $p = 0.0007$; $\beta = -0.16$). No statistically significant difference was found between mean logRTs in IRP-1 and IRP positions ($t(190) = -0.647$; $p = 0.518$).

Table 4: Descriptive statistics representing mean logRTs in the NO CONTEXT condition (Study 1)

Prompt location	N	mean logRT	sd	Se	Ci
IRP-1	78	-0.3189488	0.2566028	0.02905455	0.05785500
IRP	59	-0.2581972	0.2617039	0.03407095	0.06820041
IRP+1	78	-0.4232380	0.2628572	0.02976272	0.05926515

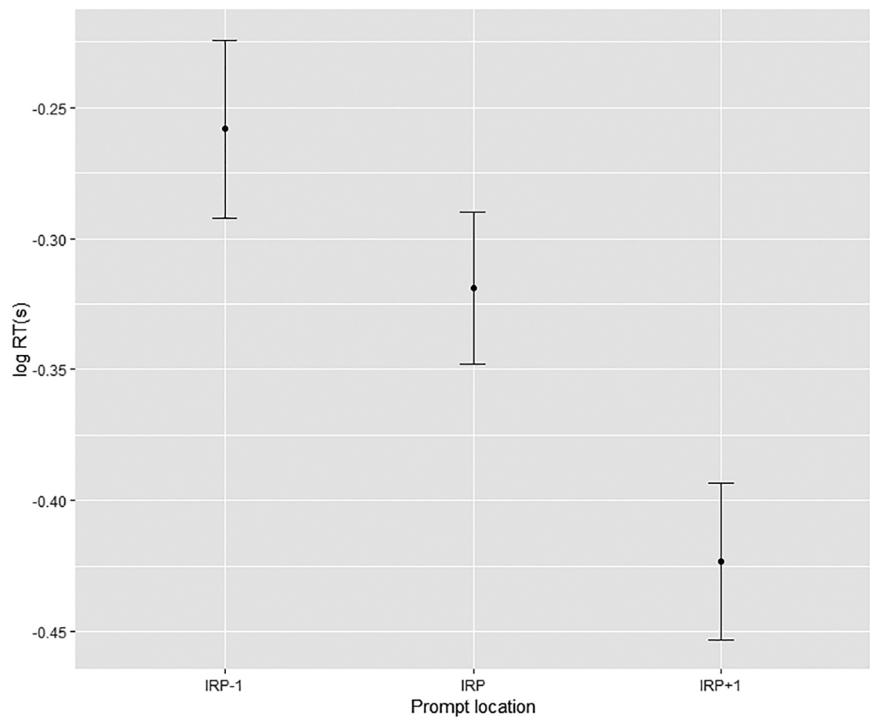


Figure 4: Mean logarithmic response times for PROMPT LOCATIONS in the NO CONTEXT condition (Study 1)

Data analysis for RT in cases in which the idioms were presented in LITERAL and FIGURATIVE CONTEXTs has produced a significant main effect for PROMPT LOCATION ($\chi^2(2) = 152.433$; $p < 0.0001$) and CONTEXT ($\chi^2(1) = 4.137$; $p = 0.0420$) and a significant interaction effect between PROMPT LOCATION and CONTEXT ($\chi^2(2) = 7.900$; $p = 0.0193$). Pairwise comparison for differences between FIGURATIVE and LITERAL CONTEXT has shown that RTs in LITERAL CONTEXT are significantly larger than in FIGURATIVE CONTEXT ($t(322) = 2.032$; $p = 0.043$, $\beta = 0.0534$).

Table 5: Descriptive statistics for Response Times in the FIGURATIVE and LITERAL context (Study 2)

Prompt location	Context type	N	mean logRT	sd	Se	Ci
IRP-1	Figurative	44	0.14630988	0.2993209	0.04512432	0.09100187
IRP-1	Literal	42	0.06192142	0.3130847	0.04831001	0.09756405
IRP	Figurative	76	-0.18070327	0.2520824	0.02891584	0.05760331
IRP	Literal	67	-0.06410177	0.2895117	0.03536949	0.07061746
IRP+1	Figurative	62	-0.36927429	0.2284578	0.02901417	0.05801741
IRP+1	Literal	56	-0.32258924	0.2588346	0.03458823	0.06931636

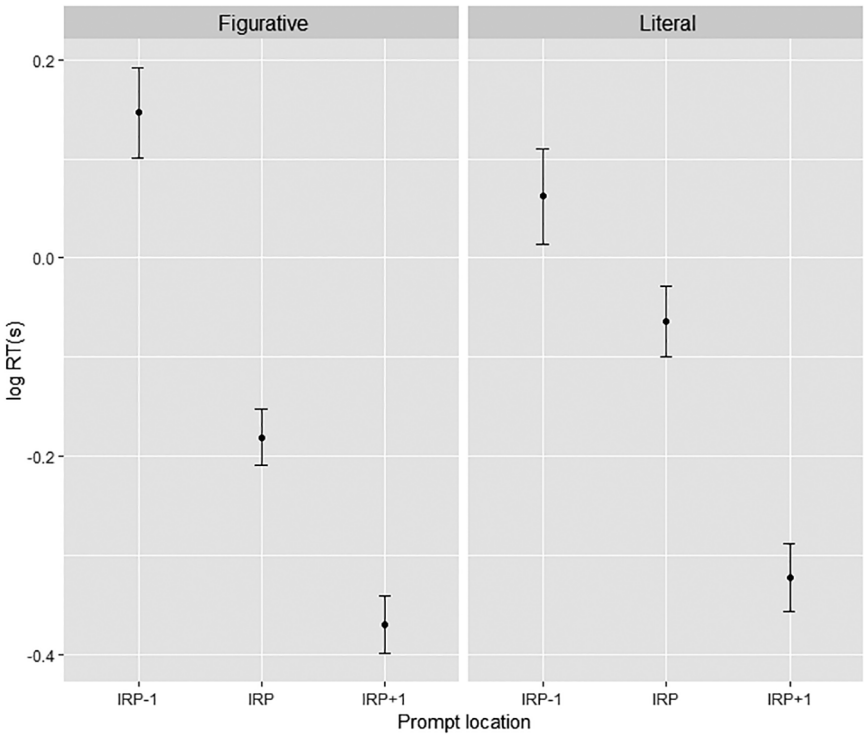


Figure 5: Mean logarithmic response times for PROMPT LOCATIONS in the FIGURATIVE and LITERAL context (Study 2)

5.7 Testing Predictions

Our first prediction was that figurative context should facilitate idiom recognition, which could lead to a shift of the IRP to an earlier position. The obtained results do not seem to fully support the expectation that the IRPs should change their positions in the case of idioms embedded in the FIGURATIVE CONTEXT. The mean cloze probability in the IRP-1 condition ($M = .48$) did not exceed the generally assumed IRP threshold (i.e., .65). We also expected that the facilitating role of context could be reflected in higher cloze probabilities in continuations of idiomatic strings embedded in the FIGURATIVE CONTEXT as compared to the same incomplete idiomatic strings used in NO CONTEXT. This expectation was corroborated to some extent because cloze probabilities were significantly higher in the IRP-1 condition in the FIGURATIVE CONTEXT as compared to NO CONTEXT (see Figure 3). This means that more participants provided the correct continuations of incomplete idiom strings one word before the IRP established without context.

Regarding the possible differences between LITERAL and FIGURATIVE CONTEXT, our expectation was that the processing of the idiomatic strings should be hindered under the literal bias. This expectation was motivated by the assumption based on Cacciari & Corradini (2015) and Giora (1997, 2003) that once the IRP is reached, the idiomatic meaning is automatically activated, and if it is not compatible with the literal context, it must be revised, and the composition of the literal meaning starts with a delay. The need of revision should lead to slower response times on critical words (words processed at and after the IRP) in LITERAL CONTEXT as compared to FIGURATIVE CONTEXT. This expectation was confirmed as we found significantly faster response times when the idioms were embedded in contexts supporting their salient (i.e., figurative) meaning as opposed to when the idioms were embedded in contexts supporting their less salient (i.e., literal) meaning.

The difference between literal and figurative context could also be reflected in terms of cloze probabilities. More precisely, lower cloze probabilities were expected in continuations of idiomatic strings embedded in LITERAL CONTEXT as compared to the same strings used in FIGURATIVE CONTEXT (based on Holsinger 2013). This expectation was not confirmed as we found no significant differences between LITERAL and FIGURATIVE CONTEXT in terms of cloze probability. In other words, it appears that the figurative context did not facilitate, and the literal context did not hinder the idiom recognition.

Taken together the results of the present study show that the literal sentential context does *not* bias the parser so strongly towards the literal meaning of an ambiguous idiomatic string that the comprehender is not able to reach the idiom recognition point. If this was the case, the inability to reach the IRP in the literal

context should be reflected in significantly lower cloze probabilities in the LITERAL when compared with the FIGURATIVE CONTEXT condition, which was not observed in our study. Rather, obtained results indicate that an ambiguous expression is recognized as idiomatic even if embedded in a literal context. The figurative meaning is accessed automatically in this case, but it must be immediately abandoned after the comprehender realizes that the salient (idiomatic) meaning does not match the previously encountered literal context, and the contextually required literal meaning must be composed from the individual constituents of the idiomatic string. The need of abandonment was reflected in longer response times in the LITERAL CONTEXT condition as compared with the FIGURATIVE CONTEXT condition at the IRP, but importantly, cloze probabilities were similar in the two context types.

6 General Discussion

The aim of the two timed cloze-response experiments described above was to assess the role of context in the recognition of idioms. First (in Study 1), we presented the participants with the fragments of Polish idioms without any context. Thanks to that, we were able to determine the IRP for each idiom. Later, in Study 2, we embedded the same idioms in two types of contexts: (i) supporting the figurative meaning and (ii) supporting the literal meaning of the idiomatic strings. Two psycholinguistic measures (cloze probability and response times) were taken for all idioms presented in three versions: with the prompt to provide the continuation before, at, or after the IRP established earlier (i.e., in Study 1). Thanks to that, we were able to determine whether context would facilitate the processing in terms of the number of idiomatic completions. Also, the technique enabled us to investigate possible differences related to the two context types, and more specifically, whether the context promoting the more salient (i.e., figurative) meaning of an idiom would facilitate the recognition to a greater extent when compared with the context suggesting the less salient (i.e., literal) meaning of a given idiomatic string.

Our results are compatible with contemporary models of idiom representation, and more specifically, with hybrid models (Cutting & Bock 1997; Sprenger et al. 2006). In sum, the results of the reported study indicate that the sentential context can facilitate the recognition of idioms in terms of higher cloze probability, though, contrary to our initial predictions, no changes in the IRP locations were observed. Furthermore, no significant differences were observed between literal and figurative contexts in terms of cloze probabilities, but in the literal context, the responses were significantly slower at the IRP as compared to the

figurative context condition. This finding is compatible with Giora's (1997, 2003) Graded Salience Hypothesis, according to which the idiomatic meaning of an ambiguous expression is more salient and, at least in the case of one's native language, is always activated first. It might then be argued that comprehenders employ a reanalysis mechanism to match the interpretation of the idiom with the relevant context, i.e., the comprehenders access and immediately abandon the figurative meaning of an idiomatic string in the literal context. The abandonment of the earlier activated figurative meaning as well as the computation of a new literal meaning of an expression would be reflected in the time difference between the LITERAL as opposed to the FIGURATIVE condition.

Altogether, the results of the present study complement the earlier findings of Cacciari & Corradini (2015), who investigated the interaction of idiom predictability with the following literal and figurative continuations, and showed that the time when an idiom is recognized as such affects its integration with later idiomatic or literal continuations. More precisely, their results show that it was difficult to integrate predictable idioms with literal continuations, probably because their idiomatic meaning was activated before the end of the idioms. Such an activation necessitated a revision of the initial figurative interpretation, which in turn triggered the computation of the literal meaning of the idiomatic string. Hence, in the case at hand, longer reading times were observed due to the necessary revision process together with the process of building the literal meaning of idioms compositionally in the working memory.

Our study set out to investigate the question, not answered clearly in the literature so far, whether an earlier context can influence the choice between the literal and the idiomatic interpretation of an idiomatic string, and whether it can prevent the parser from considering the literal or idiomatic meanings of idiomatic strings. The obtained results show that once an idiomatic configuration is recognized as an idiom, its figurative meaning is accessed automatically and independently of the preceding context. Because of that, even if we have access to the literal meanings of an idiom's single lemma, the composition of the literal meaning of the whole fixed expression, when supported by context, is delayed. This finding is particularly interesting since it shows that even a strongly supportive literal context is not strong enough to prevent the automatic activation of the idiomatic meaning of the processed and recognized idiomatic string.

In order to provide further support for the assumption that, even in the context strongly supporting the literal meaning of an ambiguous idiomatic expression, the comprehenders automatically access the figurative meaning of an idiomatic string and then discard it due to its incompatibility with the previously encountered literal context, additional experimental evidence is needed. One possible way to confirm if the figurative meaning is indeed accessed and dis-

carded would be an ERP experiment. One could expect markers associated with reanalysis and repair to be elicited as a response towards the less salient (i.e., literal) meanings of ambiguous idiomatic strings. For instance, a P600 might be observed. Though traditionally associated with syntactic anomalies, the P600 has also been elicited as a response to grammatical stimuli associated with temporary misanalysis, such as long *wh*-dependencies and garden path sentences (see, e.g., Friederici et al. 2001; Gouvea et al. 2010). Under this scenario, one could expect the P600 to be different from the one elicited in the case of grammatically ill-structured sentences, and more specifically, differences in the P600 latency and amplitude, which are believed to reflect the ease of retrieval, would be likely to occur (Gouvea et al. 2010: 172–173). On the other hand, assuming that the figurative meaning is not accessed in the case of the less salient (i.e., literal) meaning of an ambiguous idiomatic string, no components associated with revision and repair would be observed. Some other ERP effects may appear instead, such as the slow negative shift which is often associated with the extensive use of working memory and the lack of commitment to one interpretation of ambiguous expressions (see Dwivedi et al. 2010 for discussion).

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Appendix

Idioms used in the study followed by their literal translations and the collected results for idiom cloze probabilities (CPs) and response times (RTs) in the three PROMPT LOCATION conditions (i.e., IRP-1, IPR, IRP+1).⁶

Idiom in Polish	Literal translation in English	FIGURATIVE CONTEXT	LITERAL CONTEXT	NO CONTEXT
budować zamki na piasku	'to build castles in the sand'	IRP-1: CP 20, RT: 1200 IRP: 60, RT: 1400	IRP-1: CP 0 IRP: 50, RT: 1400	IRP-1: CP 0 IRP: 71.4, RT: 900
chować głowę w piasek	'to hide your head in the sand'	IRP-1: CP 0 IRP: CP 100, RT: 1100 IRP+1: CP 100, RT: 800	IRP-1: CP 100, RT: 900 IRP: CP 100, RT: 900 IRP+1: CP 100, RT: 900	IRP-1: CP 29, RT: 1000 IRP: CP 100, RT: 1000 IRP+1: CP 100, RT: 1000

⁶ Some of the idioms were presented only in one or two prompt location conditions (see Table 2). Hence, in the case of those idioms, the data included in the table embraces only the IRP-1 and/or IRP conditions.

Idiom in Polish	Literal translation in English	FIGURATIVE CONTEXT	LITERAL CONTEXT	NO CONTEXT
chwycić byka za rogi	'to take the bull by the horns'	IRP-1: CP 80, RT: 1500 IRP: CP 80, RT: 700 IRP+1: CP 100, RT: 600	IRP-1: CP 100, RT: 1100 IRP: CP 100, RT: 900 IRP+1: CP 100, RT: 600	IRP-1: CP 0 IRP: CP 100, RT: 700 IRP+1: CP 86, RT: 600
dolewać oliwy do ognia	'to add olive to the fire'	IRP-1: CP 100, RT: 1000 IRP: CP 80, RT: 600 IRP+1: CP 100, RT: 800	IRP-1: CP 40, RT: 1100 IRP: CP 100, RT: 1000 IRP+1: CP 100, RT: 700	IRP-1: CP 17, RT: 800 IRP: CP 100, RT: 600 IRP+1: CP 100, RT: 600
dzielić włos na czworo	'to split a hair into four parts'	IRP-1: CP 50, RT: 800 IRP: CP 40, RT: 600	IRP-1: CP 80, RT: 1100 IRP: CP 80, RT: 1500	IRP-1: CP 43, RT: 1000 IRP: CP 100, RT: 700
kuć żelazo póki gorące	'to forge the iron while it is hot'	IRP-1: CP 80, RT: 1300 IRP: CP 100, RT: 600 IRP+1: CP 100, RT: 600	IRP-1: CP 60, RT: 1200 IRP: CP 100, RT: 800 IRP+1: CP 100, RT: 800	IRP-1: CP 29, RT: 800 IRP: CP 86, RT: 900 IRP+1: CP 100, RT: 600
kupować kota w worku	'to buy a cat in a sack'	IRP-1: CP 40, RT: 1600 IRP: CP 100, RT: 800 IRP+1: CP 80, RT: 600	IRP-1: CP 0 IRP: CP 75, RT: 800 IRP+1: CP 80, RT: 800	IRP-1: CP 0 IRP: CP 83, RT: 900 IRP+1: CP 100, RT: 700
mieć asa w rękawie	'to have an ace up a sleeve'	IRP-1: CP 0 IRP: CP 100, RT: 800 IRP+1: CP 100, RT: 600	IRP-1: CP 60, RT: 1200 IRP: CP 100, RT: 800 IRP+1: CP 100, RT: 500	IRP-1: CP 0 IRP: CP 100, RT: 800 IRP+1: CP 100, RT: 600
mieć głowę na karku	'to have a head on the neck'	IRP-1: CP 100, RT: 1300 IRP: CP 100, RT: 700	IRP-1: CP 25, RT: 1100 IRP: CP 60, RT: 900	IRP-1: CP 57, RT: 800 IRP: CP 100, RT: 700

Idiom in Polish	Literal translation in English	FIGURATIVE CONTEXT	LITERAL CONTEXT	NO CONTEXT
mieć klapki na oczach	'to have blinkers on one's eyes'	IRP-1: CP 80, RT: 1200 IRP: CP 100, RT: 1000 IRP+1: CP 100, RT: 900	IRP-1: CP 0 IRP: CP 100, RT: 900 IRP+1: CP 100, RT: 800	IRP-1: CP 0 IRP: CP 86, RT: 900 IRP+1: CP 86, RT: 600
postawić kropkę nad i	'to put a dot above an i'	IRP-1: CP 0 IRP: CP 100, RT: 1100 IRP+1: CP 100, RT: 900	IRP-1: CP 20, RT: 1600 IRP: CP 100, RT: 900 IRP+1: CP 75, RT: 900	IRP-1: CP 0 IRP: CP 100, RT: 700 IRP+1: CP 83, RT: 700
prowadzić kogoś za rękę/ rączkę	'to lead somebody by their hand'	IRP-1: CP 20, RT: 1400 IRP: CP 100, RT: 1000 IRP+1: CP 100, RT: 1000	IRP-1: CP 75, RT: 1500 IRP: CP 60, RT: 1000 IRP+1: CP 80, RT: 700	IRP-1: CP 0 IRP: CP 83, RT: 1000 IRP+1: CP 86, RT: 900
rozstawiać kogoś po kątach	'to order somebody into a corner'	IRP-1: CP 50, RT: 1100 IRP: CP 80, RT: 1000 IRP+1: CP 100, RT: 700	IRP-1: CP 20, RT: 1600 IRP: CP 100, RT: 1100 IRP+1: CP 100, RT: 800	IRP-1: CP 0 IRP: CP 71, RT: 1000 IRP+1: CP 100, RT: 1200
szukać dziury w całym	'to look for a hole in the whole'	IRP-1: CP 60, RT: 1100 IRP: CP 100, RT: 800 IRP+1: CP 80, RT: 700	IRP-1: CP 0 IRP: CP 25, RT: 800 IRP+1: CP 60, RT: 1000	IRP-1: CP 14, RT: 700 IRP: CP 86, RT: 800 IRP+1: CP 100, RT: 600
trzymać coś w garści	'to hold something in the palm of one's hand'	IRP-1: CP 0	IRP-1: CP 40, RT: 900	IRP-1: CP 14, RT: 900
trzymać język za zębami	'to hold one's tongue behind one's teeth'	IRP-1: CP 40, RT: 1000 IRP: CP 60, RT: 1300 IRP+1: CP 100, RT: 600	IRP-1: CP 80, RT: 1300 IRP: CP 40, RT: 1200 IRP+1: CP 100, RT: 700	IRP-1: CP 16, RT: 2000 IRP: CP 100, RT: 800 IRP+1: CP 100, RT: 500

Idiom in Polish	Literal translation in English	FIGURATIVE CONTEXT	LITERAL CONTEXT	NO CONTEXT
trzymać kogoś pod kloszem	'to hold somebody under a cloche'	IRP-1: CP 80, RT: 1200	IRP-1: CP 25, RT: 800	IRP-1: CP 57, RT: 1500
urabiać ręce po łokcie	'to mould one's hand up to the elbows'	IRP-1: CP 50, RT: 1100 IRP: 100, RT: 1000	IRP-1: CP 0 IRP: 100, RT: 1700	IRP-1: CP 43, RT: 1500 IRP: 83, RT: 700
wrzucić coś na ruszt	'to throw something onto the grill'	IRP-1: CP 100, RT: 600	IRP-1: CP 100, RT: 700	IRP-1: CP 50, RT: 700
wsadzić kij w mrowisko	'to put a stick into an anthill'	IRP-1: CP 60, RT: 1900 IRP: CP 100, RT: 900 IRP+1: CP 80, RT: 700	IRP-1: CP 50, RT: 1100 IRP: CP 100, RT: 900 IRP+1: CP 80, RT: 600	IRP-1: CP 0 IRP: CP 83, RT: 900 IRP+1: CP 71, RT: 800
wyłożyć karty na stół	'to lay one's cards on the table'	IRP-1: CP 0 IRP: CP 100, RT: 1200 IRP+1: CP 100, RT: 900	IRP-1: CP 20, RT: 1900 IRP: CP 100, RT: 800 IRP+1: CP 100, RT: 700	IRP-1: CP 17, RT: 1500 IRP: CP 71, RT: 800 IRP+1: CP 86, RT: 800
zadać cios poniżej pasa	'to punch somebody below the belt'	IRP-1: CP 40, RT: 1000 IRP: 100, RT: 700	IRP-1: CP 20, RT: 1100 IRP: 100, RT: 700	IRP-1: CP 14, RT: 800 IRP: 100, RT: 700