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Literal salience in on-line processing of idiomatic expressions by second language learners

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This article addresses the question of how second language (L2) learners understand idiomatic expressions in their second/foreign language and advances the proposition that literal meanings of idiom constituents enjoy processing priority over their figurative interpretations. This suggestion forms the core of the literal-salience resonant model of L2 idiom comprehension, whose major assumptions are outlined in the article. On the literal salience view, understanding L2 idioms entails an obligatory computation of the literal meanings of idiom constituent words, even if these idioms are embedded in a figurative context and if their idiomatic interpretation is well-known to L2 learners. The literal salience assumption was put to the test in a cross-modal lexical priming experiment with advanced Polish learners of English. The experiment showed more priming for visual targets related to literal meanings of idiom constituent words than for targets related figuratively to the metaphoric interpretation of the idiomatic phrase. This effect held true irrespective of whether the stimulus sentence contained a literal or a non-literal idiom.

I Introduction

The relevance of idioms for linguistic and psycholinguistic studies undoubtedly stems from their pervasiveness in everyday language. Pollio *et al.* (1977) have estimated that, on average, about four figurative expressions are produced in every minute of speech. Another approximation of the frequency with which speakers employ figurative

language comes from Glucksberg (1989). Based on a simple frequency count, he estimates that people use 1.8 novel and 4.1 frozen figurative expressions per minute of discourse, which, assuming that people engage in conversation for a minimum of 2 hours daily, yields the figure of 4.7 million novel and 21.4 million frozen metaphors over a 60-year life span. Another important reason for studying idioms is the ease with which idiomatic expressions are understood by language users, despite their often opaque nature. A careful examination of how speakers cope with such expressions as smoothly as they do might shed interesting light on the processes involved in the workings of the language comprehension mechanism.

Whereas the seamless and effortless use of idioms by native speakers is unquestionable, the difficulty they pose for second language learners is well-known (see, for example, Irujo, 1993; Fernando, 1996; Kövecses and Szabo, 1996, among others). Explaining the mechanisms underlying the acquisition and processing of figurative expressions by second language learners is therefore an important research goal.

One of the issues in previous work has been the varying availability of literal and figurative senses of idioms in the course of comprehension. Different theoretical proposals have been developed for both first language (L1) and second language (L2) idiom processing (see Sections II and III). This article proposes that literal meanings enjoy processing priority over figurative meanings in the course of L2 idiom comprehension. This processing priority is referred to here as 'literal salience', the term salience having been borrowed from Giora's (1997; 1999; 2002; 2003) graded salience hypothesis. On the literal salience view, understanding L2 idioms entails an obligatory computation of the literal meanings of idiom constituent words, even if these idioms are embedded in a rich figurative context and if their idiomatic interpretation is well known to L2 learners.

II Literal and figurative meanings in L1 idiom processing models

Research into the status of literal and figurative meanings in idiom processing has had a long tradition in the psycholinguistic literature. More traditional approaches to idioms (Weinreich, 1969; Fraser, 1970; Katz,

1973; Chomsky, 1980) treated idiomatic phrases as non-compositional strings whose figurative meanings are in no way related to the literal meanings of their individual words. These approaches are compatible with the traditional view of figurative language understanding, known as the 'standard pragmatic model' (Clark and Lucy, 1975; Grice, 1975; Searle, 1975; 1979; Janus and Bever, 1985), which treated non-literal language as deviant from 'normal' literal speech. On the standard pragmatic view, in order to comprehend non-literal language, the language user must first compute the literal meaning of the utterance, identify the computed literal meaning as anomalous, and only then arrive at its figurative meaning. The major implication stemming from the standard pragmatic view of figurative language is thus the fact that literal and figurative comprehension processes are essentially different and that literal analysis obligatorily precedes figurative analysis. In fact, the failure of a literal interpretation to make sense is, on this view, a necessary triggering mechanism for figurative processing to be initiated.

In addition to the traditional, non-compositional view of idioms, a class of compositional models has emerged, which proposes that idiomatic meanings are built both out of literal meanings of idiom constituents and the specific figurative interpretation of these constituent word meanings in a given context. These models, like the non-compositional ones discussed above, vary in terms of the status they assign to literal and figurative meanings of idiomatic phrases in the course of their processing by language users. The 'idiom decomposition model' (Gibbs and Nayak, 1989; Gibbs *et al.*, 1989) capitalizes on the idea that idiom processing is affected by the degree of idiom semantic decomposability, that is the degree to which individual meanings of idiom constituents contribute to its overall interpretation. Although not intended as a processing model, it made a number of processing assumptions, the most important of which was the claim that idioms are initially processed in a compositional manner, whereby people analyse the individual constituents of idioms. In line with this assumption, Gibbs *et al.* have suggested that processing non-decomposable idioms may be slower than processing decomposable ones, because people find it difficult to assign independent meanings to these idioms' individual constituents. On the other hand, with decomposable idioms, meanings of individual constituents directly correspond to their figurative meanings

in idiomatic phrases, so compositional analysis of such idioms yields an accurate idiomatic interpretation.

Unlike Gibbs *et al.*'s proposal, the configuration model (Cacciari and Tabossi, 1988; Cacciari and Glucksberg, 1991) specifically emphasizes the role of literal meanings in constructing the figurative interpretations of idioms. The model assumes that, upon encountering an idiomatic expression, the language comprehension device processes the idiom literally, simultaneously with the emergence of its figurative interpretation. Literal processing is, however, terminated upon recognition of the phrase as an idiomatic unit at the point labelled 'idiomatic key'. This is the point at which key content words are encountered that unequivocally point to the phrase's figurative interpretation. The notion of key has been defined by Tabossi and Zardon (1995) as 'the information in the string that has to be processed literally before the figurative meaning of an idiom can be activated' (1995: 275). While some idioms have their key content words suggesting the presence of a figurative interpretation early on in the sequence, other idioms might require that the entire phrase is processed literally before its figurative meaning is activated.

Like the configuration model, which does not favour either literal or figurative meanings in idiom processing, Glucksberg's (1993; 2001) Phrase-Induced Polysemy model treats both meanings on a par, assuming that, through repeated use in figurative contexts, idiom constituents become polysemous and extend their meanings from the originally literal to the figurative meanings present in idiomatic phrases.

Rather than focusing on the distinction between literal and figurative meanings and investigating which of them enjoys priority over the other, Giora's (1997; 1999; 2002; 2003) 'graded salience hypothesis' posits the priority of salient meanings, which she defines as the meanings which are coded in the lexicon and 'enjoy prominence due to their conventionality, frequency, familiarity, or prototypicality' (Giora, 2002: 490). Salient meanings are, on this view, always processed initially and accessed via a direct look-up in the mental lexicon immediately upon encounter of the language stimulus. With respect to the processing of idioms, the graded salience hypothesis predicts that processing familiar idioms, whose idiomatic meanings are more salient than those phrases' overall 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. Processing less familiar idioms, on the other hand, is likely to evoke a different pattern of activation, since for these idioms the literal meaning is more salient than the idiomatic meaning. Giora's proposal can be categorized as representing the hybrid approach to idioms, which combines aspects of both non-compositional and compositional theories postulated earlier.

This brief review of idiom processing models developed in the monolingual literature seems to indicate that they differ considerably with regard to the role they ascribe to literal meanings in the course of idiom processing. A similar disparity seems to prevail in the less numerous proposals developed in the L2 idiom processing literature.

III Idiom processing in L2

The abundance of L1 idiom processing studies has been accompanied by a regrettable lack of comparable research into the representation and processing of idiomatic expressions by second language learners. The proposals that have been put forward, however, can again be characterized as varying in terms of the status they envisage for literal and figurative processing accompanying idiom comprehension. Whereas some researchers have suggested that L2 learners comprehend idioms by direct retrieval of their figurative meanings (Nelson, 1992), others have claimed that L2 learners first process idioms literally and only then access their figurative readings (Liontas, 2002). A number of studies not directly concerned with on-line processing issues but rather with strategies of coping with L2 idioms have likewise emphasized the importance of literal meanings, either of L2 idiom components themselves or of their L1 translation equivalents (see, for example, Irujo, 1986; Bortfeld, 2002; Charteris-Black, 2002).

Kecskes (2000) has suggested that, due to the lack of metaphorical competence in L2, second language users are more likely to rely on literal meanings of figurative utterances and on their L1 conceptual system when producing and comprehending figurative phrases (situation-bound

utterances in Kecskes' terminology). The strategy of reliance on literal meanings of idiom constituents is also apparent in the Model of Dual L2 Idiom Representation (Abel, 2003). Based on the results of a decomposability rating study conducted with German speakers of English, she concludes that non-native speakers tend to rate opaque, non-decomposable idioms as decomposable, in that they assign meanings to individual constituents of opaque idiomatic phrases which supposedly actively contribute to the idioms' overall figurative interpretation, even if this is not correct. Matlock and Heredia (2002), in turn, have suggested that the role of literal and figurative meanings in the processing of L2 idioms will be determined by the L2 learner's proficiency in the language. Accordingly, they have proposed that non-experienced (beginner) second language learners must first establish direct connections between literal and non-literal meanings of figurative expressions. Following from this assumption, Matlock and Heredia envisage idiom comprehension at early stages of L2 learning as consisting of three steps. In the first step, an L2 idiomatic expression is translated literally into L1. Next, the learner accesses the literal meaning of the expression and attempts to make sense of it. Finally, in the third stage, the figurative meaning is accessed. On the other hand, at more advanced stages of L2 learning the L2 speaker may process figurative expressions in the same manner as a native monolingual speaker, without having to access their literal meanings first.

In conclusion, it is very likely that the status of literal and figurative meanings in processing idiomatic expressions will be different for native language speakers and for second language learners. Since L2 learners become familiar with literal meanings of second language lexical items long before they encounter their figurative meanings in fixed phrases, it seems reasonable to assume that literal meanings enjoy a more salient status than figurative ones in the course of processing idiomatic phrases by second language learners. This assumption forms the core of the L2 idiom comprehension model, a brief review of which is offered in the following section.

IV Assumptions of the literal-salience resonant model of L2 idiom comprehension

The model of L2 idiom comprehension that is tested here (see Cieślicka, 2004) assumes primacy of literal over figurative

meanings; thus, to use Giora's (1997) term, assigning literal meaning a higher salience status in on-line idiom processing. The model assumes that literal meanings of idiom constituents will be more salient than figurative meanings of these constituents in decomposable idioms where, in line with Glucksberg's (1993; 2001) phrase-induced-polysemy proposal (see above), acquiring an idiom entails extending the originally literal meanings of its components with the new figurative meanings involved in the idiomatic interpretation of the phrase. The model further assumes that literal meanings of idiom constituents will be more salient than the overall figurative meanings of non-decomposable idiomatic phrases, in which no discernable relation exists between literal meanings of idiom components and the metaphorical interpretation of the entire phrase.

Salient meanings will be understood here as the meanings which are activated first and most strongly in the course of language processing, due to the fact that their representations in the mental lexicon are much more strongly encoded (in terms of length of storage and completeness of representation) than those of the less salient meanings. Since L2 learners who undergo formal L2 instruction most typically encounter new L2 idiomatic expressions when they are already familiar with literal meanings of words making up those idiomatic phrases, it is these literal meanings that are likely to be much better established in their mental lexicons than the newly acquired figurative ones. Because literal meanings are likely to remain more frequently used than idiomatic ones in an L2 learner's performance, even if the L2 idiom has been automatized and incorporated into the L2 lexical network, it seems reasonable to suggest that literal meanings of L2 idiomatic items will continue to enjoy a more salient status than their figurative meanings, irrespective of whether an L2 idiom is highly familiar or less familiar to the L2 user. Literal salience in L2 idiom processing is directly connected with the process of building a lexical representation of an idiom entry in the course of its acquisition by an L2 learner.

V The study

The study was designed to test on-line aspects of idiom processing and to investigate the differential availability of literal and figurative meanings of L2 idiomatic expressions in the course of their processing by second language learners. It employed a cross-modal lexical priming

paradigm, in which participants are simultaneously involved in a passive and active task. The passive task consists in attending to spoken sentences presented continuously one after another. During sentence presentation, a visual target appears in the middle of the computer screen and participants perform an active lexical decision task, i.e. decide, as quickly and as accurately as possible, if a displayed probe spells a word or a non-word. The probes for lexical decision are presented at various points during the presentation of the auditory sentence, depending on the experimental focus. For example, during the presentation of the sentence 'The postal clerk put the package on a postal scale * to see if it had enough postage', the word FISH is displayed at the offset of the word 'scale' (depicted by the asterisk) and the participant makes a lexical decision on that word. The assumption behind the cross-modal priming technique is that automatic priming and hence facilitation of a lexical decision will be demonstrated only for the visual stimulus related to the meanings that have been accessed from the auditorily presented input. Thus, given our example sentence, if a participant's lexical decision to the visual target FISH is facilitated, in that it is shorter than the lexical decision to its matched control word (e.g. CHAIR), then the fish-related meaning of the word 'scale' must have been accessed in the course of language processing.

The cross-modal priming technique has been widely employed in lexical ambiguity research to address the question of multiple access during the comprehension of ambiguous words (e.g. Swinney, 1979; Onifer and Swinney, 1981; Simpson, 1981; Seidenberg *et al.*, 1982; Tanenhaus and Donnenwerth-Nolan, 1984; Tabossi, 1988), as well as to demonstrate the mechanisms underlying figurative language processing (see, for example, Cacciari and Tabossi, 1988; Blasko and Connine, 1993; Tabossi and Zardon, 1993; Titone and Connine, 1994a; Van de Voort and Vonk, 1995; Hillert and Swinney, 2001). Since the recently developed models of L1 idiom processing have been tested with the use of the cross-modal priming paradigm, the same paradigm has been employed in the current work, so as to allow a more direct comparison of the performance of monolingual and bilingual participants.

In the version of the cross-modal priming task employed in the experiment described here, participants were auditorily presented with sentences that contained familiar idioms and did not provide any clear

bias toward the figurative completion of the idiomatic strings (e.g. 'George wanted to *bury the hatchet* soon after Susan left'). While listening to each sentence, subjects were visually presented with a word related either to the figurative meaning of the idiom (e.g. FORGIVE) or to the literal meaning of the last word in the idiomatic string (e.g. AXE) and had to perform a lexical decision task on this word. Visual targets occurred at one of two points: at the penultimate position of the idiom (after *the*), and at the offset position (after *hatchet*). Differences in the subjects' reaction times (RTs) to decide that the targets are words in each of the two possible positions were taken to reflect the state of activation of idiomatic and literal meanings at various points during idiom processing.

1 Participants

The participants were 43 fourth-year students of English Philology (35 female and 8 male, average age 23.5), all studying at the School of English, Adam Mickiewicz University, Poznań, Poland. They were fluent speakers of English, who had successfully passed their Practical English Examination administered at the end of Year 3 and located at the level described as proficient by the University of Cambridge Local Examinations Syndicate. All of them volunteered to take part in the experiment. All participants were native speakers of Polish and had no hearing or visual impairments.

2 Materials and apparatus

The experimental materials consisted of 40 idioms, which were selected from descriptive norms for English idiomatic expressions developed by Titone and Connine (1994b) and from a semantic decomposability rating list developed by Gibbs *et al.* (1989). The idioms varied with respect to their literality, which can be defined as the extent to which an idiomatic string can be interpreted in a literal fashion. An idiom was classified as literal if its literality rating recorded in Titone and Connine's (1994b) norms was above 6.0 and as non-literal if its literality rating was below 4.0 (out of 10.0). Another dimension of idiom variability was semantic decomposability, which can be defined as the extent to which individual constituents of idioms contribute to their

overall figurative interpretations. The semantically decomposable idioms had a decomposability rating of 70.00 or higher (out of 100) according to the norms developed for native speakers of English by Titone and Connine (1994b) and a decomposability rating of 5 or higher (out of 7) in the rating list developed by Gibbs *et al.* (1989). The non-decomposable idioms were all drawn from Titone and Connine's norms and their rating of non-decomposability was close to or higher than 70.00 (out of 100).

Native speaker norms for literality and decomposability were verified in a separate norming study run prior to the experiment with Polish advanced learners of English. Fifty fourth-year students of English Philology (who did not take part in the cross-modal priming experiment) were shown a list of 80 idiomatic expressions and asked to rate them according to their literality, decomposability and familiarity on a scale from 1–10, where 1 indicated that a given idiom was non-literal, non-decomposable or unfamiliar, whereas 10 indicated that it was literal, decomposable and familiar. Being fully familiar with an idiomatic expression was defined in the instructions as knowing its meaning, restrictions on its use, syntactic behaviour, connotations, etc. as a result of encountering it in L2 spoken or written discourse, as well as using it productively in speech and/or writing. This definition was based on Titone and Connine's (1994b: 250) norms, in which idiom familiarity is referred to as the 'frequency with which a listener or reader encounters a word in its written or spoken form and the degree to which the meaning of a word is well known or easily understood'.

Decomposability and literality ratings obtained in the L2 group for familiar idioms overwhelmingly coincided with those reported in the native speaker norms. The 40 idioms chosen for the experiment achieved a familiarity rating of 9 or higher. Since, however, familiarity seems to be a highly subjective measure, very much related to the individual learner's experience and frequency of exposure to the idiom (see Cronk and Schweigert, 1992), it was necessary to ensure that L2 users participating in the experiment were also familiar with the idiomatic items. Hence, participants' familiarity with the idioms was additionally verified after the completion of the experiment. Out of the 40 idioms employed in the experiment, 22 were literal and 18 non-literal. As far as the dimension of decomposability is concerned, out of the 40 idioms,

20 were semantically decomposable and 20 were semantically non-decomposable (for a full list, see Appendix 1). Whereas the analysis of the data pertaining to decomposable vs. non-decomposable idioms is fully discussed elsewhere (Cieślicka, 2004), the present article focuses on the data obtained for idioms varying along the dimension of literality.

Each idiom was embedded in a neutral sentence, whose beginning did not bias the figurative reading of the upcoming idiom string (e.g. 'Peter was planning to *tie the knot* later that month'). Some of the neutral sentences were selected from the materials employed by Titone and Connine (1994a) in their cross-modal priming experiment with native speakers of English and some were constructed by the experimenter.

For each idiom two pairs of target words to be displayed visually were constructed. One of them consisted of the word related to the figurative meaning of the idiomatic expression (e.g. the word MARRY was an idiomatic target constructed for the sentence 'Peter was planning to tie the knot later that month') and of its control (unrelated) word, which was matched on frequency (Francis and Kucera, 1989), orthographic complexity, and length with the idiomatic target (e.g. the control for MARRY was LIMIT). The second pair consisted of a literal target, which was semantically related to the literal meaning of the last word of the idiom (e.g. the word ROPE was a literal target constructed for the sentence 'Peter was planning to tie the knot later that month') and of its control (unrelated) word, which matched the literal target in terms of frequency, orthographic complexity and length (e.g. the control for ROPE was RIPE). Examples of the idiomatic sentences employed in the experiment, along with their idiomatic, literal and control targets, are presented in Appendix 2. In addition to the 40 idiomatic sentences, a total of 80 non-idiomatic filler sentences were included in the list of auditory stimuli.

The 120 sentences were recorded by a male speaker in a recording studio and, along with the visual targets, programmed as sound files into a computer using the E-Prime (1.1) psychology software tool (Schneider *et al.*, 2002). The order of trials within each list was randomized for each subject. There was a 5-second interval between the auditory sentences. The visual targets were displayed on the computer screen at the penultimate or offset position of the auditorily presented idioms. To maximize the probability of the idiomatic meaning being

detected, the targets were displayed 100 ms after the penultimate or last word of the idiom string rather than at its exact end (see Tabossi and Zardon, 1993). For non-idiomatic filler sentences, word and non-word targets were displayed at various positions, ranging from the beginning to the end. The targets remained on the screen for 1500 ms and their display was terminated when the subject made a lexical decision. Subjects made their lexical decision by pressing any key for the 'YES' answer and doing nothing for the 'NO' answer. The complete experimental session was divided into three blocks, with subject-controlled rest pauses between them. One break was set at trial 60 and another at trial 90. The rest pauses were programmed into the session after the pilot study, whose subjects complained of not being able to concentrate throughout the whole session.

3 Design

A factorial design was used, which can be summarized as follows:

- There were three factors (independent variables), with two (or three) levels each:
 - target type: literal, idiomatic, or control;
 - position of target word display: penultimate or offset;
 - literality of idiom: literal or non-literal;
- There was one dependent variable: RT (Reaction Time).

4 Research hypotheses

Comparing performance differences with respect to idioms varying along the dimension of literality can be a litmus test for the literal salience view espoused here. In other words, if it can be shown that an idiom's literal meanings are activated more substantially than figurative meanings – irrespective of whether the idiom can be understood literally (KICK THE BUCKET) or only non-literally (BE UNDER THE WEATHER) – then literal meanings must indeed enjoy processing priority over figurative meanings, in accordance with the literal-salience resonant model of L2 idiom comprehension.

Following from the literal salience postulate of the model, target words related literally to the auditorily presented idiomatic sentences

(i.e. literal targets) should thus demonstrate a significant priming advantage over target words related idiomatically to the figurative meaning of these sentences (i.e. idiomatic targets). In terms of the RT data obtained for target words accompanying idiomatic expressions employed in the study, RT differences between literal targets and control words should be greater than RT differences between idiomatic targets and control words. As mentioned earlier, the literal-salience resonant model envisages no significant processing differences in terms of the activation of idioms' literal or figurative meanings as a function of idiom literality. Hence, both literal and idiomatic targets should manifest comparable priming effects when displayed with literal and non-literal idiomatic sentences.

With respect to the position of target display, slight differences should obtain for target words presented at the penultimate and offset positions of L2 idioms. The activation of literal and idiomatic meanings is bound to be higher after the whole of the idiomatic string has been heard than after only one of its constituents has been encountered. Thus, when the node for POP (the first word of the idiom POP THE QUESTION) is activated, both its literal and figurative meanings become available for processing. Since, under the view proposed here, lexical entry for an idiom is a cluster of associated nodes, the activated node for POP will resonate its activation to the remaining constituents of the idiom string: THE and QUESTION, making the literal and figurative meanings of these constituents available for processing as well. However, resonant co-activation of idiom constituents will be secondary to the initial activation of strong literal and weaker figurative meanings of the node POP. It is therefore likely that more priming will be obtained for literal and idiomatic targets displayed at the offset than at the penultimate position of the idiom, since by the end of the idiom string enough activation will have been received by the remaining constituents to make their meanings prime the processing of targets literally and idiomatically related to them. These suggestions concerning the processing of L2 idioms can be formulated as the following two hypotheses:

- Hypothesis 1: No significant priming differences should be observed between targets displayed with literal and non-literal idioms. Thus,

RT differences between literal targets and their controls recorded at both positions of literal idioms should be comparable to RT differences between literal targets and their controls recorded at the corresponding positions of non-literal idioms. Likewise, RT differences between idiomatic targets and their controls recorded at both positions of literal idioms should be comparable to RT differences between idiomatic targets and their controls recorded at the corresponding positions of non-literal idioms.

- Hypothesis 2: The priming advantage recorded for literal targets should exceed that obtained for idiomatic targets at both penultimate and offset positions of both literal and non-literal idioms. In addition, the priming advantage recorded for both target types should be bigger at the offset than at the penultimate position, for both literal and non-literal idioms. Hence, RT differences between literal targets and their controls should be greater than RT differences between idiomatic targets and their controls, and RT differences between targets and their controls displayed at the offset should be greater than RT differences between targets and their controls displayed at the penultimate position, for both literal and non-literal idioms.

5 Procedure

Each participant was tested individually in a session that lasted approximately 30 minutes. They were instructed to look at the fixation point on the computer screen as they listened and to make a lexical decision about the string of letters displayed in place of the fixation point. Upon seeing the string, they were thus asked to decide, as quickly and as accurately as possible, whether the displayed string was an English word or not. To ensure that participants attended to the auditory sentences, they were given a comprehension test to complete. The test consisted of 54 sentences, 22 of which had been presented during the experimental session, while the remaining 32 were new. The participants' task was to tick the sentences they thought they had just heard.

6 Data analysis

First, subjects' performance on the comprehension test was examined. The comprehension error criterion of 66% correct was set (see Blasko

and Connine, 1993). The mean of correct recognitions was 76% and none of the subjects had a performance below 66% correct identification. Error rates for each subject were next examined for evidence of a speed-accuracy trade-off. The lexical decision criterion of 85% correct was set (see Titone and Connine, 1994a). No subjects failed to reach the 85% threshold, and the majority of participants actually reached the rate of over 95% of accurate responses. Analysis of the error rates reported for the three target types revealed that identical error rates were obtained for literal, idiomatic and control targets. Each type of target obtained 96% of accurate responses. Since the error rate was so low and identical for all target types, it was concluded that a speed-accuracy trade-off did not occur and no further analysis was performed on the error data. Incorrect responses were subsequently excluded from further analysis.

In order to reduce variability, data points for each subject were next screened to eliminate outliers. Reaction times exceeding three times the standard deviation from the subject means (per target type condition) counted as outliers and were excluded from the set of valid responses. Outliers accounted for 1.6% of all the responses and they were approximately equally distributed across conditions. The reaction time data of the remaining responses were subsequently exported from the E-Prime program to the statistical program (SPSS 11.5 for Windows) for further analysis.

VI Results

A 2 (literal vs. non-literal) \times 2 (penultimate vs. offset) \times 3 (literal vs. idiomatic vs. control) ANOVA was conducted for subjects and items. Following the ANOVA analyses, a modified Bonferroni procedure was used for planned comparisons, which tested the significance of lexical priming for targets accompanying various types of idiomatic expressions. An alpha level of .05 was adopted for all statistical tests.

In the subjects analysis, the only significant effect was obtained for target type: $F(2, 42) = 9.92, p < 0.0001$. No main effects were found for either position: $F(1, 42) = 0.57, p > 0.05$; or literality: $F(1, 42) = 0.06, p > 0.05$. None of the interaction effects was found to be significant across subjects. In the item analysis, the overall robust effect of target type: $F(2, 39) = 5.87, p < 0.001$ was found. In addition, a two-way

position by target interaction: $F(2, 39) = 4.53, p < 0.05$ turned out to be significant, and the interaction between literality and position: $F(1, 39) = 4.09, p = 0.05$ reached a marginal statistical significance.

Lack of the main effect of literality in subject and item analyses testifies to the validity of Hypothesis 1, which precludes significant priming differences between targets displayed in company of literal and non-literal idioms. In both literal and non-literal idioms, the priming effect recorded for literal targets at the penultimate position was 19 ms (see Table 1). Likewise, the priming effects recorded for literal targets at the offset position were highly comparable in both the literal and non-literal idiom conditions (89 ms for literal idioms and 77 ms for non-literal ones). With regard to the idiomatic targets, no priming effect seems to have been obtained for those targets which were displayed at the penultimate position of literal idioms. These targets actually took, on average, 14 ms longer to recognize than their controls. A highly similar result has been demonstrated for idiomatic targets displayed at the penultimate position of non-literal idioms, where idiomatic targets took 13 ms longer to recognize than their respective controls. The meaning of an L2 idiom was clearly not yet available for the language processing mechanism after only the first component of the idiom string had been accessed. RTs recorded at the offset position in both conditions seem to differ more substantially, in that the priming effect obtained for idiomatic targets at the offset of literal idioms was 48 ms, while the corresponding priming effect for idiomatic targets in the non-literal idiom condition was only 11 ms. The difference in RTs elicited for idiomatic targets accompanying both idiom types, however, failed to reach statistical significance in the Bonferroni test ($t(126) = -1.02, p > 0.05$).

Table 1 Mean reaction times (RTs) and priming effects (obtained by subtracting mean RT for a given target type from mean RT for its corresponding control) for literal and idiomatic targets as a function of position (penultimate and offset) and idiom literality

Target type	Literal idioms				Non-literal idioms			
	Penultimate		Offset		Penultimate		Offset	
	<i>M</i>	Priming effect	<i>M</i>	Priming effect	<i>M</i>	Priming effect	<i>M</i>	Priming effect
Literal	674.90	19	664.57	89	694.75	19	640.99	77
Idiomatic	707.69	-14	705.04	48	726.81	-13	706.98	11

In accordance with Hypothesis 2, which predicts priming advantage of literal over idiomatic targets in both literal and non-literal idiom conditions, priming effects obtained by literal targets have significantly exceeded those obtained by idiomatic targets (see Table 2). While the priming effect was substantial for literal targets (54 ms in the literal idiom and 48 ms in the non-literal idiom condition), with *t*-test revealing a statistically significant difference between RTs obtained for literal targets and their controls ($t(79) = -2.07, p < 0.05$), idiomatic targets seem to have been only slightly primed in the literal idiom condition (17 ms) and not at all in the non-literal idiom condition (-0.7 ms). No statistically significant difference between idiomatic targets and their controls was revealed in the *t*-test ($t(79) = -0.57, p > 0.05$), even if idiomatic targets manifested an overall slight (15.52 ms) advantage over their controls in terms of the obtained RTs. These results quite straightforwardly support the literal salience assumption of the literal-salience resonant model of L2 idiom processing. Finally, contrast between literal and idiomatic targets turned out to be marginally significant ($t(79) = -1.50, p = 0.07$), adding to the strength of our predictions concerning priming advantage for literal over idiomatic meanings.

In line with the second prediction of Hypothesis 2, priming advantage was demonstrated for both literal and idiomatic targets at the offset position compared to the penultimate position (see Table 3). Whereas literal targets obtained the priming effect of 19 ms at the penultimate position of the idiomatic phrases, that effect increased to 84 ms at the offset position, and the difference between RTs elicited for targets at both positions turned out to be marginally significant ($t(79) = -1.15, p = 0.1$). Similarly, idiomatic targets, which took 13 ms longer than their controls to recognize at the penultimate position of literal and non-literal idioms, obtained a priming effect of 31 ms at the offset position; the priming difference, however, failed to yield statistical significance ($t(79) = -1.10$,

Table 2 Mean RTs and priming effects for literal and idiomatic targets as a function of idiom literality

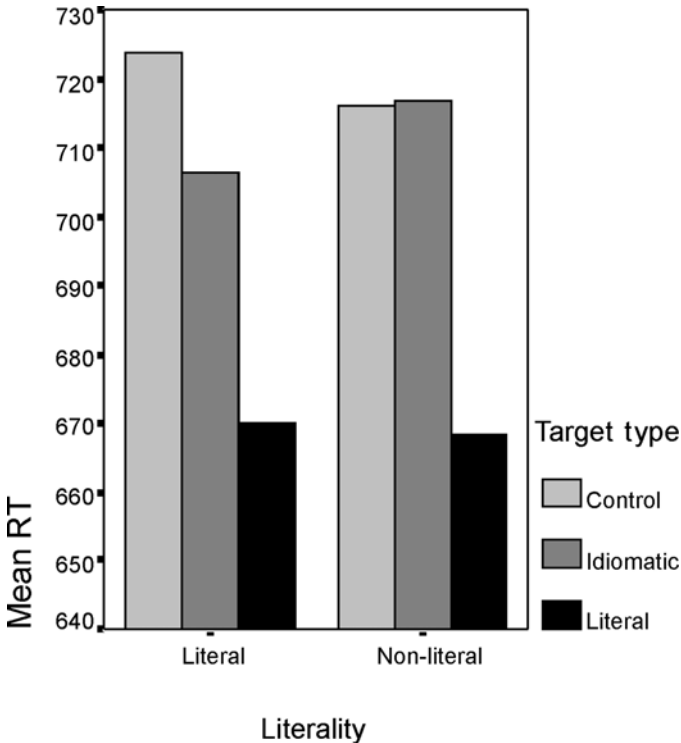
Target type	Literal idioms		Non-literal idioms	
	<i>M</i>	Priming effect	<i>M</i>	Priming effect
Literal	670.08	54	668.30	48
Idiomatic	706.44	17	716.79	-0.7

Table 3 Mean RTs and priming effects for literal and idiomatic targets as a function of position in both literal and non-literal idiom conditions

Target type	Penultimate position		Offset position	
	<i>M</i>	Priming effect	<i>M</i>	Priming effect
Literal	683.97	19	653.21	84
Idiomatic	716.01	-13	705.95	31

$p = > 0.05$). RT differences obtained for idiomatic and literal targets displayed with literal and non-literal idioms at both positions are summarized in the graph presented in Figures 1 and 2.

Figure 1 illustrates processing priority and, hence, priming advantage of literal over idiomatic targets obtained in the experiment, as well as a lack of difference in priming obtained for both target types displayed in company of literal and non-literal idioms. Thus, the black bars, represent-

**Figure 1** Mean RT by literality and target type

ing literal targets, are of comparable size in both literal and non-literal conditions. The dark grey bars, in turn, standing for idiomatic targets, differ more markedly, in that the bar in the non-literal idiom condition is longer than the one in the literal idiom condition. In addition, the black (literal target) bars are much shorter than the light grey (control target) bars in both literal and non-literal idiom conditions. The priming advantage is much less visible for idiomatic targets. Thus, while the dark grey (idiomatic target) bar is slightly shorter than the light grey (control target) bar for literal idioms, the two are almost similar in size for non-literal idioms. Figure 2, in turn, shows priming advantage obtained for both target types displayed at the offset position. Accordingly, the black bar (literal targets) and the grey bar (idiomatic targets) are shorter at the offset than their corresponding bars at the penultimate position.

All in all, the results obtained in the cross-modal priming study with Polish advanced learners of English broadly confirm research

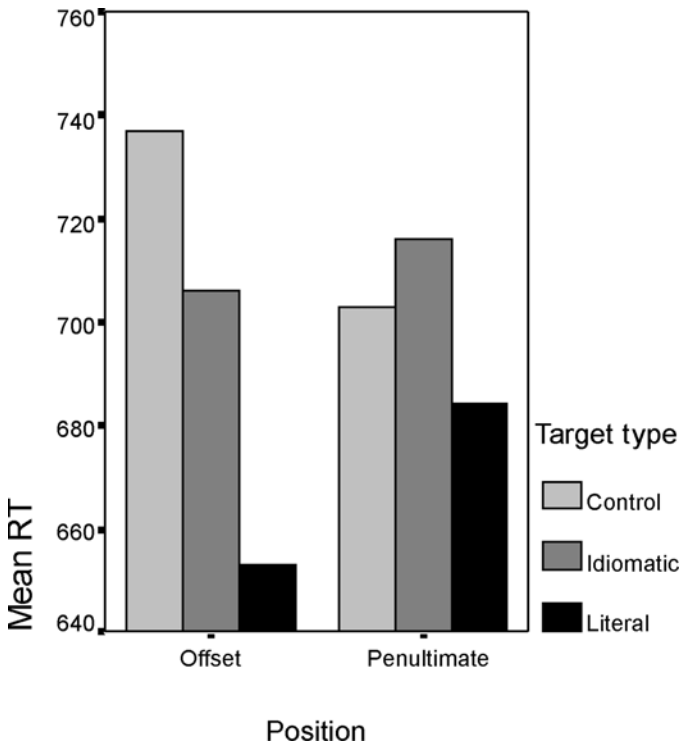


Figure 2 Mean RT by position and target type

hypotheses formulated earlier for L2 learners' performance in the literal and non-literal idiom conditions. It was claimed that literality of idiom *per se* does not affect the activation of literal and figurative meanings of words making up an idiomatic phrase. Hence, both literal and non-literal idioms were predicted to elicit comparable RTs to literal targets on the one hand and idiomatic ones on the other (Hypothesis 1). This prediction was confirmed in the ANOVAs, which showed that literality had no significant influence on RTs obtained for literal and idiomatic targets. It was further assumed, in line with the literal salience priority postulated here, that literal targets should show an overall priming advantage over idiomatic targets in both literal and non-literal idiom conditions (Hypothesis 2). A robust main effect of target type found in the ANOVAs for both subjects and items strongly supports this postulate. Finally, even though no main effect was found for position, a significant position by target interaction was demonstrated in the item analysis and RTs elicited to literal and idiomatic targets were shown to be longer at the penultimate than at the offset positions of literal and non-literal idioms.

VII Discussion

Results of the cross-modal task described in this article can be interpreted against L1 models of idiom comprehension that have been proposed in the psycholinguistic literature. Beginning with the models proposed within the non-compositional camp, the obtained data allow rejecting them as inappropriate to account for L2 learners' performance, on the grounds that they preclude the contribution of idiom constituents to the construction of an idiom's overall figurative interpretation. Yet such an active contribution of idioms' literal meanings is exactly what has been demonstrated in the cross-modal priming study.

It appears that our L2 results are much more compatible with general processing predictions of compositional models of idiom processing. Thus, in line with the notion of compositionality espoused by all compositional models, individual components of idiomatic strings have been shown to significantly contribute to their processing. As far as Gibbs' (Gibbs and Nayak, 1989; Gibbs *et al.*, 1989) idiom decomposition model is concerned, the L2 data are broadly compatible with the

major tenet of the model, under which the processing of idioms entails compositional analysis of their component parts. Unlike Gibbs' model, which remains vague with respect to whether compositional meanings of idiom elements are literal in nature, the model proposed here specifically acknowledges the role of literal meanings in constructing figurative interpretations of L2 idioms.

With regard to the configuration model (Cacciari and Tabossi, 1988; Cacciari and Glucksberg, 1991; Titone and Connine, 1994a), the L2 data are again broadly compatible with its major assumption, in that both literal and figurative senses of idioms have been shown to become simultaneously activated in the course of their processing by second language learners. More specific predictions of the configuration hypothesis are connected with the notion of the idiomatic key and its role in accessing figurative meanings of high- and low-predictable idioms. Verifying if the notion of the idiomatic key holds true for L2 idiom processing, however, would call for an additional norming study to establish clear criteria of L2 idiom predictability. Given the highly idiosyncratic nature of this measure, it seems that, for the norms to be reliable, the norming study should be run on the same population as the one participating in the subsequent cross-modal priming experiment. This, in turn, would compromise research results, unless the norming study were run significantly earlier than the subsequent priming experiment, so as to avoid priming effects due to repetition. On the other hand, a required long delay between the norming and processing studies would render the norming data obsolete and no longer applicable to the population being tested, as learners' perception of L2 idioms' predictability is likely to change substantially with their increasing figurative proficiency.

Unreliability of the criterion of predictability even for native speakers of the language is best demonstrated by conflicting research findings obtained by Cacciari and Tabossi (1988), on the one hand, and Titone and Connine (1994a), on the other. Whereas Cacciari and Tabossi did find the varying availability of idioms' figurative meanings to be a function of their predictability, Titone and Connine failed to find any processing differences in the activation of figurative meanings at the offset of high- and low-predictable idioms. Titone and Connine tried to account for this inconsistency by positing that the idioms they employed were

highly familiar, which might have evoked earlier activation of their figurative senses; this is an explanation that actually calls into question the justifiability of introducing the dimension of idiom predictability altogether. In other words, can predictability be taken as an objectively defined, pure processing factor if, in itself, it is contaminated by other dimensions of idiom variability, such as familiarity? Until a more rigorous procedure is established to make predictability a pure, objectively operationalized measure, treating it an essential factor in idiom processing is bound to be questionable.

Other predictions of the configuration hypothesis, however, are readily interpretable against the obtained L2 data. Thus, consistent with the configuration hypothesis, highly-predictable literal idioms should demonstrate greater activation of the literal meaning of the idiom final word than highly-predictable non-literal idioms. On the other hand, similar priming should be reported for literal targets displayed at the offset of low-predictable literal and non-literal idioms. This prediction stems from the nature of lexical level representations of idiomatic phrases postulated within the configuration model. Since, on the configuration view, connections between lexical nodes of highly-predictable idioms are more heavily weighted than they are for low-predictable idioms, processing highly-predictable idioms involves earlier activation of the idiom-final word. Titone and Connine (1994a) used this assumption of the configuration model to account for the difference in activation of the idiom-final word between highly-predictable literal and highly-predictable non-literal idioms that they obtained in their experiment. While with highly-predictable literal idioms, which allow a literal interpretation of the phrase, the idiom-final word was activated at the idiom offset, with highly-predictable non-literal idioms, for which a literal interpretation is impossible, the idiom-final word was not activated. On the other hand, with low-predictable idioms, which preclude early activation of the appropriate idiomatic meaning and the simultaneous suppression of the inappropriate literal reading, the idiom-final word was activated at the offset, irrespective of idiom literality. As will be recalled from the analysis of our L2 data, no reaction time differences were manifested for literal targets displayed with idioms varying in terms of their literality. Both types of idioms evoked comparable priming effects for literal targets displayed at their offset. If the data were to

be explained within the configuration framework, then all of the L2 idioms employed in our cross-modal priming experiment would have to be viewed as low-predictable, which is highly unlikely, given the reported high familiarity of many of these idioms to the participants, as determined in the debriefing sessions, and the likelihood of familiar idioms being more predictable, in accordance with Titone and Connine's (1994a) suggestions.

Comparison of the priming patterns obtained by Titone and Connine (1994a) in their monolingual study with the data reported for our Polish–English learners reveals further interesting observations. First, contrary to the results demonstrated by Titone and Connine, no decrease in idiomatic activation when moving from penultimate to offset positions was found for literal idioms. According to Titone and Connine, such a decrease in the activation of idiomatic meanings shown for literal, but not for non-literal idioms, implies competition between literal and figurative senses in the course of idiom processing. On this reasoning, literal meanings remain activated at the offset of idioms, provided they are useful for building an idiom's higher-level interpretation, as is the case with literal idioms. On the other hand, if the idiom is non-literal and, hence, its literal interpretation implausible, literal meanings, even if initially activated on account of idiom's literality, become quickly suppressed and unavailable at the offset. These predictions stand in sharp contrast to what was demonstrated for the processing of literal and non-literal idioms by the second language learners participating in our study. Neither literal nor idiomatic activation was found to decrease from the penultimate to offset positions of literal and non-literal idioms. Both types of idioms actually yielded a substantial increase in the activation of literal and idiomatic meanings when moving from the penultimate to offset position.

With regard to the third compositional model, namely Glucksberg's (1993; 2001) Phrase-Induced Polysemy model, the data obtained for Polish–English bilinguals are consistent with the major assumption of this model, according to which all idiomatic expressions, regardless of their semantic analysability, are automatically analysed in a literal fashion. Literal activation was indeed demonstrated for all idiom types. Likewise, the idea of idiom constituents' becoming polysemous is reflected in the literal-salience resonant model, under which words

making up semantically decomposable idioms acquire figurative meanings in addition to the already established literal ones. Since Glucksberg does not specify in his model what happens to literal meanings after the idiomatic string has been recognized as a figurative configuration, the obtained priming effects for literal targets displayed at the offset of all idioms cannot be interpreted either in favour or against the Phrase-Induced Polysemy proposal.

As far as the hybrid approach to idiom processing is concerned (see Titone and Connine, 1999), the L2 results are again generally consistent with its major tenets, in that both idiomatic and literal meanings have been shown to be simultaneously activated in the course of L2 idiom processing. The obtained priming for literal meanings at the offset of idioms is likewise consistent with Titone and Connine's hybrid proposal, which, unlike the configuration model, allows for literal computation of idiom constituents to continue even after the idiom's figurative interpretation has been retrieved from the mental lexicon. The role of the idiomatic key in triggering the activation of idioms' figurative meanings, which is central to Titone and Connine's hybrid proposal, could not however be verified with our data, given the dubious nature of the criterion of predictability and lack of predictability norms for L2 idioms.

The L2 data obtained in the experiment are perhaps most readily interpretable within the graded salience framework (Giora, 1997; 2002; 2003), on which the L2 model proposed here is based. Thus, in accordance with the graded salience hypothesis, the meaning postulated to be more salient was indeed accessed first and activated most strongly in the course of language processing. However, the graded salience hypothesis assumes that activation of either literal or figurative meanings of idioms is, among others, a function of their familiarity. Accordingly, processing familiar idiomatic phrases by native language speakers is predicted to evoke primarily their idiomatic meanings, regardless of contextual bias, as for such idioms it is figurative meanings that enjoy a high salience status in lexical storage. On the other hand, the literal salience model of L2 idiom comprehension proposed here ascribes a higher salience status to literal meanings, regardless of whether an L2 idiom is familiar to the learner or not, and regardless of contextual bias.

A relatively low overall priming score found for idiomatic meanings in our study is compatible with the findings reported by Colombo

(1993). In her self-paced reading experiment investigating the effects of context on the activation of literal and figurative meanings of idiomatic phrases, Colombo found that, in the absence of figuratively biasing context, predominantly literal computations were performed on an idiom string. Activation of figurative meanings was demonstrated to require the presence of the idiomatically biasing context. It is therefore likely that low priming effects found for idiomatic targets in our study were caused by the neutral context employed for idiomatic sentences. The choice of the neutral context for the cross-modal priming experiment with L2 learners was deliberate and dictated by the desire to isolate the effect of idiom literality, which, had the idioms been embedded in literal or figurative-biasing contexts, would have inevitably conflated dimensions of idiom variability with contextual effects.

Predominance of literal over figurative activation demonstrated in L2 idiom processing is also consistent with a bias toward the literal interpretation found in recent studies on idiom comprehension by aphasic patients (see Papagno and Genoni, 2004; Papagno *et al.*, 2004). Papagno *et al.* suggest that the damage of language processing resources in aphasic patients prevents the suppression of idioms' literal meanings and the retrieval of their figurative interpretations. As a result, patients are more likely to erroneously select literal pictures of idioms in the string-to-picture matching task, especially if idiomatic stimuli are syntactically well-formed and have a plausible literal meaning. The suppression mechanism may hence take longer to reject the literal meaning in such patients. Similarly, because of the high salience status of literal meanings in L2 idiom processing, the suppression mechanism in L2 users may require more time to inhibit the literal reading and retrieve the figurative alternative.

One possible reason for the obtained weak figurative activation at the end of L2 idioms might be a relatively short stimulus onset asynchrony (SOA; 100 ms) used in our experiment. Whereas the time lag of 100 ms might be sufficient for the activation of figurative senses of idioms in the course of their processing by monoglots (see Titone and Connine, 1994a), it might have been too short to allow the suppression of literal meanings and sufficiently strong activation of idioms' figurative senses in the bilingual mode. The results of Experiment 3 conducted by Cacciari and Tabossi (1988) add plausibility to this suggestion. In this

experiment they used the same materials as in previous experiments, which failed to show activation of idiomatic meanings at the end of low-predictable idioms, but displayed visual targets 300 ms after the last word of the idiom. With the 300 ms delay, Cacciari and Tabossi did find facilitation in responses to idiomatic targets, simultaneous to the activation of literal targets. According to the authors, the increased SOA allowed enough time for the onset of postperceptual, integrative processes. Further work could show if employing longer SOAs or embedding idioms in the figurative biasing context would produce higher priming effects for idiomatic targets in L2 idiom processing.

VIII Conclusions

The experimental study reported in this article lends support to the priority of literal meanings in the course of processing L2 idioms by second language learners. Whereas some of the data could be viewed as generally consistent with the suggestions put forward in the monolingual literature on figurative language processing, none of the L1 idiom processing models would be capable of accounting for all the aspects of our L2 learners' performance. Further experimental work, with the use of versatile off-line and on-line tools, is needed to unravel the intricacies of processing metaphors, idioms, and other figurative expressions by second language learners.

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Appendix 1 Idioms used in the cross-modal priming experiment

Literal	Non-literal
<i>Semantically non-decomposable idioms:</i>	
take the bull by the horns	shoot the breeze
bury the hatchet	out of the blue
have cold feet	have a fling
tie the knot	be under the weather
let the cat out of the bag	blow one's top
below the belt	give somebody the cold shoulder
wear the pants	make no bones about something
kick the bucket	bite somebody's head off
a piece of cake	nip something in the bud
paint the town	be on cloud nine
<i>Semantically decomposable idioms:</i>	
cash in one's chips	can't believe my ears
cover up one's tracks	learn the lesson by heart
lose one's grip	wear out one's welcome
play with fire	put on some weight
save one's skin	praise someone to the skies
shut one's trap	seal the fate
steal the show	slip one's mind
take a back seat	make up one's mind
throw somebody to the wolves	
turn back the clock	
waste one's breath	
put one's foot down	

Appendix 2 Examples of the auditory idiomatic sentences along with their literal, idiomatic, and control targets

Sentence	Idiomatic target	Control	Literal target	Control
1. Maria was the first to <u>take the bull by the horns</u> during the recent crisis.	CONTROL	COMMON	ANTLERS	ANTHEM
2. George wanted to <u>bury the hatchet</u> soon after Susan left.	FORGIVE	GESTURE	AXE	ACE
3. The young student <u>had cold feet</u> about giving the presentation.	NERVOUS	LEATHER	TOES	TOLL
4. Peter was planning to <u>tie the knot</u> later that month.	MARRY	LIMIT	ROPE	RIPE
5. He was the first to <u>let the cat out of the bag</u> at the office.	TELL	FIND	PLASTIC	PARKING