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Role of implicit learning abilities in metaphor understanding

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ABSTRACT

Although the use of metaphors is a central component of language, the processes that sustain their comprehension have yet to be specified. Work in the fields of both metaphors and implicit learning suggests that implicit learning abilities facilitate the comprehension of metaphors. However, to date, no study has directly explored the relationships between the understanding of metaphors and so-called implicit learning tasks. We used a meaning decision task comparing literal, metaphorical and meaningless expressions to assess metaphor understanding and a probabilistic serial reaction time task for assessing implicit learning. Our results show that implicit learning positively predicts the time gap between responses to literal and metaphorical expressions and negatively predicts the difference between metaphorical and meaningless expressions. Thus, when confronted with novel metaphors, participants with higher implicit learning abilities are better able to identify that the expressions have some meaning. These results are interpreted in the context of metaphor understanding and psycholinguistic theories.

1. Introduction

1.1. Metaphors

Non-literal language is a kind of language from which, beyond the literal meaning, different interpretations can be extracted (Colston & Gibbs, 2002). In addition to irony and proverbs, metaphors constitute a huge proportion of non-literal language in our daily conversations (Lakoff & Johnson, 1980). Despite their importance, the processes that are involved in the understanding of metaphors are by no means understood.

Metaphors are expressions in which a semantic mapping between two conceptual domains is created. For instance, the sentence “Time is a thief” does not mean that time steals things (the literal meaning) but that time passes quickly and we risk missing opportunities (the figurative meaning). The use of metaphors is so widespread in human language that it is considered to be a fundamental conceptualization strategy (Lai, 2008). Indeed, according to Lai, the act of exploring the set of correspondences from a source to a target domain allows one to better understand the target thanks to the source’s conceptual structure.

Different types of metaphors are described in the literature. These types can be classified according to either their frequency (i.e., conventional vs. novel metaphors) or their structure (e.g., nominal vs. verbal metaphors). Concerning frequency, conventional metaphors (e.g., “Life is a journey”) are used daily, familiar and easy to understand (Giora, 1997; Lakoff & Johnson, 1980). Their meaning is nearly lexicalized and, most often, speakers do not even notice that they are using figurative language (Zufferey & Moeschler, 2015). Unlike conventional metaphors, novel metaphors are unusual in language production and their understanding

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depends on different cognitive processes than those involved in conventional metaphor processing (Ahrens et al., 2007). Whereas conventional metaphors are nearly lexicalized, the meaning of novel metaphors requires a listener to establish links between two concepts, namely the topic and the vehicle (Zufferey & Moeschler, 2015). An example of a novel metaphor appears in the sentence “His legs are rubber,” in which “rubber” is the vehicle and “legs” the topic.

Regarding structure, metaphors are frequently studied in their nominal forms (“X is a Y”; e.g., “Life is a journey”) in which both X and Y belong to the grammatical category of nouns. In this kind of metaphor, the two concepts are linked by applying the terminology of the vehicle to the terminology of the topic (Kiddon & Brun, 2011). For instance, in the sentence “Experience is a candle [...],” a partial similarity of the vehicle “candle” is ascribed to the topic “experience” (Tourangeau & Sternberg, 1982). Hence, in this kind of metaphor, although the two concepts are not semantically close, a similarity is sought between them. In verbal metaphors, the focus is on the link between the verb and the vehicle (e.g., “the storm rumbles”), the topic (e.g., “the peasant tames the land”), or both (e.g., “clouds are courting the stars”) (Le Ny & Franquart-Declercq, 2002; Obert et al., 2014). In other words, metaphors represent a deviation in the meaning of the words composing them (Le Ny & Franquart-Declercq, 2002).

Nevertheless, few studies have explored the mechanisms involved in the production and comprehension of metaphors, although several suggestions have been made. For instance, on the topic of metaphor creation, Beaty and Silvia (2012) highlighted the role of executive functions. As for their understanding, an analogical mapping of different similarity levels, such as the attributes of the concept (in nominal metaphors) or their relations (in verbal metaphors), is required (Glucksberg, McGlone, & Manfredi, 1997; Holyoak & Koh, 1987; Le Ny & Franquart-Declercq, 2002). Thus, the understanding of nominal metaphors requires that the vehicle and the topic share identifiable common properties (Glucksberg et al., 1997). For instance, in the metaphor “this lawyer is a shark,” one should attribute appropriate features from the vehicle “shark” to the topic “lawyer” (e.g., is dangerous) and suppress inappropriate ones (e.g., has 300 teeth, is a marine animal) (Fernández, 2007). According to some authors, verbal metaphors are processed in the same way as nominal ones (Glucksberg, 2003), whereas others consider that they have special status (Le Ny & Franquart-Declercq, 2002; Utsumi & Sakamoto, 2011). For example, Le Ny and Franquart-Declercq (2002) suggest that understanding verbal metaphors depends on the central meaning of the verb, as well as all the topics and vehicles that it is possible to associate with this verb. Although there seems to be no consensus on how metaphors are understood, it nevertheless appears that their understanding may depend on implicit mechanisms.

1.2. Implicit learning

1.2.1. Implicit learning and language

Reber (1967) was the first to suggest that language could be acquired by implicit learning mechanisms. More recently, Saffran, Aslin, and Newport (1996), who first used the term “statistical learning” (also called implicit learning; Perruchet & Pacton, 2006), showed that 8-month infants were able to segment words based only on the statistical properties of language. Since these initial publications, many studies have explored the role of implicit learning in several aspects of language. Implicit learning appears to contribute both to low-level processes and to higher-level ones (Romberg & Saffran, 2010). At a lower level, human beings can apply transitional probabilities when learning speech sounds (e.g., Frost & Monaghan, 2016). At a higher level, they can learn the syntactic structure of a language (Thompson & Newport, 2007) and use verb-related distributional information to construct and understand meaningful sentences (Thothathiri & Rattinger, 2016).

Yu and Smith (2007) showed that the mapping between a word and its referent was remarkably efficient in various learning conditions. Indeed, it appears that adults are highly sensitive to probabilistic relationships between a word and its meaning (Vouloumanos, 2008). Implicit learning mechanisms are also involved in second language acquisition (Pajak, Fine, Kleinschmidt, & Jaeger, 2016). Moreover, the role of implicit learning in language has been explored at the individual level: long-term storage of syntactic structures during childhood (Kidd, 2012) and language comprehension in adults are enhanced in individuals with greater implicit learning abilities (Misyak & Christiansen, 2012).

According to Frost and Monaghan (2016), the same class of mechanisms (i.e., statistical learning) can account for word learning and structural generalization. We suggest that these mechanisms could extend the understanding of figurative language, and specifically metaphors, more broadly. Indeed, Lidz and Gagliardi (2015) argue that the capacity to produce and understand language intrinsically depends on implicit learning mechanisms that sustain the acquisition of relevant information to make inferences about the features of the grammar (i.e., a given class of words must be followed by another specific class of words – e.g., determiners precede nouns in English). This explanation provides a framework that accounts for the capacity to produce and understand novel sentences (i.e., situations that fall outside of a person’s experience). It also explains how one can distinguish possible from impossible sentences of a language.

This view seems coherent with the dual-path model, a connectionist model that represents how humans acquire and process language (Chang, Dell, & Bock, 2006). The architecture of this model has two pathways: a meaning system and a sequencing system. The model is rather similar to Ullman’s (2001) Declarative/Procedural model since the meaning system can be compared with declarative memory and the sequencing system with procedural memory. In the dual-path model, the sequencing system implicitly learns the syntactic structure of language. Interestingly, when the model learns syntactic structure, it also acquires semantic information. For instance, the model learns what kinds of things can be drunk or eaten. Thanks to the way that the sequencing system acquires semantic information about a word in position N , the model can predict what words are allowed in position $N + 1$. For instance, the sequencing system might learn that some kinds of verbs (e.g., *kill*, *hurt*, *assassinate*) are most often followed by animate beings (e.g., humans or animals), are less often followed by abstract concepts (e.g., *hope*, *friendship*), and are never followed by inanimate objects (e.g., *rock*, *sheet*). This mechanism could explain how metaphors are understood thanks to implicit learning

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