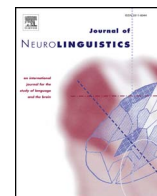




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## Idiom comprehension in aphasia: Literal interference and abstract representation

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### ABSTRACT

We investigate three potential mechanisms underlying the deficit in idiom comprehension seen in aphasia: difficulty inhibiting literal meanings, inability to recognize that a figurative interpretation is required, and difficulty processing abstract words and concepts. Unimpaired adults and PWA read high and moderate familiarity idioms either preceded or followed by a figuratively biasing context sentence. They then completed a string-to-word probe selection task, choosing between a figurative target, a literal lure, and unrelated concrete and abstract lures. PWA chose the figurative target more often for more familiar idioms and after figuratively biasing contexts, suggesting that difficulty accessing figurative meanings may be a key contributor to idiom impairment in aphasia. Importantly, PWA chose abstract lures at the same rate as they chose literal lures, suggesting that abstract lures may be considered equally good matches for weak idiomatic representations in PWA, and therefore that idiomatic figurative meanings may be represented similarly to abstract concepts for PWA. These results have implications for models of idiom comprehension in aphasia, as well as the design of future studies of idiom comprehension in PWA.

### 1. Introduction

Idioms are multiword structures that are understood quickly and easily by unimpaired comprehenders despite the fact that their figurative meanings cannot be computed on the basis of the literal meanings of their individual words (Bonin, Meot, & Bugaiska, 2013; Glucksberg, 1991; Nunberg, Sag, & Wasow, 1994; Titone & Connine, 1994). Many idioms possess both literal and figurative meanings—for example, *sail close to the wind* can mean both *sailing close to the direction from which the wind is blowing* and *behaving recklessly or dangerously*. These different interpretations may be more or less easily accessible during comprehension depending on characteristics of the idiom and the context in which it appears. Although idioms are frequent in everyday language and easily understood by unimpaired comprehenders, idiom comprehension is often impaired in people with aphasia (Cacciari et al., 2006; Papagno, Tabossi, Colombo, & Zampetti, 2004). The present study manipulates two factors that affect comprehension in neurotypical comprehenders—idiom familiarity and the context in which the idiom appears—and investigates their effects on idiom comprehension in people with aphasia (PWA). The findings have implications for three possible mechanisms contributing to idiom comprehension deficits in PWA: interference from literal meanings, difficulty recognizing that a figurative interpretation is appropriate, and difficulty processing abstract concepts.

Research using online measures of comprehension in unimpaired comprehenders has found that higher familiarity idioms are

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easier to process than lower familiarity idioms. This is because more familiar idioms are likely to have stronger associations between the idiom and its figurative meaning, facilitating retrieval of that meaning. Consistent with this, Cronk, Lima, and Schweigert (1993) found that higher-familiarity idioms in figurative contexts were read faster than lower-familiarity idioms in figurative contexts, especially if the words within the idiom were high-frequency. Similarly, across multiple experiments Libben and Titone (2008) found that increased familiarity facilitated idiom comprehension. Finally, Titone and Libben (2014) found a positive correlation between idiom familiarity and priming magnitude 1000 ms post idiom offset. These results, across multiple comprehension measures, all indicate that familiarity facilitates idiom comprehension.

However, the context in which the idiom is embedded also plays an important role in idiom comprehension. Comprehension of lower-familiarity idioms tends to be boosted when these idioms are preceded by a supportive context. Qualls, O'Brien, Blood, and Hammer (2003) found that in isolation, only high and moderate, but not low familiarity idioms were well comprehended. But presenting an explanatory story before the idiom resulted in equally high comprehension of high, moderate, and low familiarity idioms. This pattern appears to generalize to other forms of figurative language: Blasko and Briihl (1997) found that low-familiarity metaphors were read faster when preceded by a related metaphorical context than by an unrelated literal context. This body of work suggests that familiarity and context, both independently and interactively, can bolster activation of the figurative meaning of an idiom in unimpaired language comprehension.

Idiom comprehension is often impaired in aphasia: PWA frequently appear to interpret idioms literally even when instructed to focus on figurative interpretations (Cacciari et al., 2006; Cieřlicka, Ratal, & Jawroska, 2011; Nenonen, Niemi, & Laine, 2002; Papagno et al., 2004). Cacciari et al. (2006) found high rates of literal errors when PWA were tasked with choosing the meanings of idioms from sets including a literal meaning, a figurative meaning, and an unrelated distractor. For example, PWA were given the idiom “he has raised the elbow”, an Italian idiom roughly meaning “he has been drinking too much”, and then were asked to select between a figurative target (wine), a literal lure (leg), an unrelated foil that could plausibly be an object of the verb (box), and a foil that matched the concreteness of the figurative target (tree). They found that the most common error was the literal lure. On the basis of these results, they proposed two potential loci of aphasic idiom impairment. The first potential locus of impairment is in recognizing that a figurative meaning is required. Under this account, interpretation of an idiom proceeds literally until the comprehender encounters a cue that a figurative interpretation is required (for example, opacity or syntactic ill-formedness) and activates the figurative meaning while suppressing the literal meaning. PWA may be relatively insensitive to such cues. Indeed, there is independent evidence that PWA put less weight on syntactic or form-based cues than controls (e.g., Gibson, Sandberg, Fedorenko, Bergen, & Kiran, 2016; Warren, Dickey, & Liburd, 2017). Another potential locus of impairment is in suppressing literal meanings once they are activated (see also Cieřlicka et al., 2011). High rates of literal errors may reflect impairment in PWA's ability to suppress literal meanings. These two potential loci of impairment are not mutually exclusive; it is possible that both mechanisms may play a role in idiom comprehension impairment in PWA.

Both of these proposed mechanisms of aphasic idiom impairment—difficulty recognizing the need for a figurative interpretation and inability to suppress literal meanings—are consistent with the assumption that idiomatic representations are intact in aphasia. However, another possibility is that the impairment may be rooted in the representations of the figurative meanings of idioms themselves. One potential reason to think this is that figurative meanings are often abstract. In a norming study of more than 600 German idioms, Citron et al. (2016) quantified idiom abstractness, finding that highly figurative idioms were also considered to be more abstract. Visual examination of 271 English idioms tested in large-scale norming studies (Nordmann, Cleland, & Bull, 2014; Titone & Connine, 1994) also indicates that the majority are associated with abstract concepts (i.e. death, debt, danger, drunkenness). If PWA have particular difficulty with abstract concepts, it could contribute to impairment during idiom comprehension.

Even in unimpaired comprehenders, concreteness, or the degree to which a word's referent can be perceived with the senses (James, 1975), affects comprehension (Paivio, 1971). Processing is usually slower and less accurate for abstract words (e.g. *patience*) compared to concrete words (e.g. *medal*). However, PWA usually show larger concreteness effects than unimpaired comprehenders (Barry & Gerhand, 2003; Berndt, Haendiges, Burton, & Mitchum, 2002; Kiran, Sandberg, & Abbott, 2009), suggesting they have particular difficulty accessing and representing abstract concepts. Kiran et al. (2009) found that training abstract words promoted learning of associated concrete words in PWA. However, the reverse was not true: training concrete words only promoted learning of associated concrete words. They proposed that this pattern of results reflects differences in the ways that abstract and concrete concepts are represented: abstract concepts are represented based on their relationships with other concepts, both abstract and concrete. In contrast, concrete concepts are represented based on the sensory experiences they evoke (Bird, Howard, & Franklin, 2003), and have less widely distributed meanings. Under this account, PWA may show greater concreteness effects because the more distributed and relational structure of abstract concept representations might make them more likely to be affected by circumscribed neural damage to perisylvian language regions than concrete concept representations.

Cacciari et al. (2006) found hints that concreteness may play a role in PWA's idiom comprehension, even when idioms are highly familiar. They found high rates of literal errors in their study of idiom comprehension in PWA using string-to-word matching. Critically, on trials in which the figurative target was abstract, accuracy was lower than on trials in which the target was concrete. However, this analysis was conducted post-hoc and the abstract/concrete nature of the target was not systematically manipulated. This finding can therefore be taken as only suggesting that concreteness may be an important factor to consider in PWA's idiom comprehension.

In contrast, Papagno and Cacciari's case study of a person with aphasia (MC) with a reversed concreteness effect on nouns (Papagno and Cacciari, 2010) suggests that mechanisms other than concreteness can contribute to idiom impairments in PWA. MC had preserved abstract word comprehension, but difficulty generating figurative idiom meanings despite the fact that these meanings were also abstract. The factor accounting for much of MC's impairment in idiom comprehension was ambiguity: MC showed greatest

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