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Review

Hemispheric differences in figurative language processing: Contributions of neuroimaging methods and challenges in reconciling current empirical findings

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ABSTRACT

The following review critically synthesizes the literature on hemispheric differences in idiom and metaphor comprehension. It has long been debated whether figurative language is inherently different from literal language and is processed specifically in the right hemisphere (RH), or rather, whether figurative and literal language form a continuum rather than a dichotomy, and call upon a similar network of brain areas. In this paper, a number of neuropsychological, behavioral and neuroimaging studies are reviewed in the context of major theoretical accounts of metaphor and idiom comprehension. Specifically, the role played by the RH in metaphor and idiom processing is evaluated, and advancements that neuroimaging methods have made to our understanding of figurative language comprehension are assessed. This review also highlights a number of critical methodological discrepancies between studies, and emphasizes how such inconsistencies in operational definitions, stimuli and tasks pose a serious challenge to reconciling the debate on hemispheric differences, and do not allow for a clear-cut conclusion of which neural networks underlie figurative language processing.

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1. Introduction

The greatest thing by far is to be a master of metaphor.
It is the one thing that cannot be learned from others;
It is also a sign of genius, since a good metaphor implies an eye for resemblance.
∼ Aristotle, De Poetica, 322 B.C.

In our everyday language, we often hear people describe life as a roller-coaster ride, speak of broken hearts and open minds, and compare sly politicians to foxes. Occasionally, we give someone a taste of our own medicine, we lend them our ears and we bend over backwards to get something accomplished. When we hear such expressions, whether they are commonly used or constructed on the fly, we know not to take them literally. In fact, if taken literally, most idiomatic and metaphoric expressions would be implausible or false. Instead, in order to grasp their intended meaning, we must often search beyond the strict literal sense of the constituent words and make a conceptual leap between two distant semantic domains which are normally unrelated to each other. The fact that figurative (or non-literal) language is so pervasive in our speech and understood effortlessly has intrigued philosophers and researchers from the time of Aristotle, and has been the subject of much research over the past few decades. More recently, our knowledge of the cognitive processes underlying figurative language comprehension – largely gained from neuropsychological investigations such as patient studies and behavioral investigations such as divided visual field experiments – has benefitted from advances in neuroimaging techniques. The aim of the current paper is to provide a critical review of the research examining the neurocognitive mechanisms for processing figurative language, with a specific emphasis on idioms and metaphors. Other forms of non-literal language such as sarcasm, humor and indirect requests will not be addressed. This review centers on the longstanding debate of whether figurative language is inherently different from literal language, or whether figurative and literal language form a continuum rather than a dichotomy and call upon similar processing strategies and brain areas during comprehension.

This paper focuses on one of the major areas of controversy in research on figurative language comprehension: the question of HEMISPHERIC SPECIALIZATION in the comprehension of idioms and metaphors. Although there is also considerable debate around the question of how figurative language is stored and accessed during online processing, due to space constraints, the current review will not address the cognitive theories and recent neuroimaging research examining the *time-course* of access of idioms and metaphors. With respect to hemispheric specialization, it remains a much debated question whether, and to what extent, the right hemisphere (RH) is specialized for the comprehension of idiomatic and metaphoric language compared to the left hemisphere (LH), due to hemispheric differences in meaning analysis and integration. Whereas some neuropsychological and neurolinguistic evidence has supported the "RH is special" theory (Anaki, Faust, & Kravetz, 1998; Bottini et al., 1994; Winner & Gardner, 1977), other studies have found no RH involvement (Faust & Weisper, 2000; Kacinik & Chiarello, 2007; Lee & Dapretto, 2006; Rapp, Leube, Erb, Grodd, & Kircher, 2004; Stringaris, Medford, Giampetro, Brammer, & David, 2007) and still some others have argued that the degree of RH recruitment depends on lexical and contextual factors rather than figurativity per se (Mashal, Faust, & Hendler, 2005; Mashal, Faust, Hendler, & Jung-Beeman, 2007; Schmidt, De Buse, & Seger, 2007). To date, there is still no consensus on what precise aspects of figurative language the right hemisphere may be particularly sensitive to.

The controversial findings in the literature will be critically synthesized within the framework of main theoretical accounts of hemispheric differences in processing idioms and metaphors. First, the review will cover early neuropsychological studies, as these patient data played a key role in motivating the "RH is special" theory. Next, the debate of whether the RH *is* indeed primarily responsible for processing figurative language will be evaluated in the light of divided-visual field experiments, as well as several neuroimaging studies. The goals of this paper are threefold: (1) to review the role of the RH in processing idioms and metaphors, by contrasting evidence for and against this theory, from a range of methodologies; (2) to evaluate the contributions of neuroimaging studies, and assess whether these findings have extended the knowledge gained from behavioral paradigms, and (3) to highlight