Available online at www.sciencedirect.com
ScienceDirect
Brain and Language 100 (2007) 111–114
Brain and Language
www.elsevier.com/locate/b&l

Editorial

Is metaphor special?

The assumption that metaphor is unique dates back to Aristotle. In *Poetics*, Aristotle (350 BCEa) contends that metaphor is "the mark of genius." It differs from "the normal idiom" in that it is sophisticated and riddle-like. As such, it elevates style "above the commonplace and mean, while the use of proper words will make it perspicuous" (section 3, parts xxi, xxii). In *Rhetoric*, Aristotle (350 BCEb) suggests that such "variation from what is usual makes the language appear more stately... It is therefore well to give to everyday speech an unfamiliar air" (Book 3, part 2). On this view, then, metaphor is special: it is complex and poetic. It relies on a divergence from "ordinary" or mundane (literal) language.

Aristotle's legacy has survived for a long time, featuring dominantly in a more recent view, termed 'the standard pragmatic model' (Grice, 1975; Searle, 1979). On this view, metaphors differ from literals in that they breach a conversational norm. Deviating from the norm, metaphors require special processes. Thus, in trying to make sense of metaphors, we first compute their primary, literal interpretation, which then has to be rejected as contextually inappropriate and replaced with an appropriate nonliteral interpretation. Whereas understanding literal utterances requires just one processing step, metaphor interpretation involves at least two such stages.

It is this long-standing legacy that led researchers to look for a specific locus and process of metaphor in the brain. If metaphors are processed in brain areas not as intensively recruited for the processing of literals, this will testify to their singularity and will distinguish them from literals.

The assumption that it is the right hemisphere (RH) that is specialized in interpreting metaphors seems to date back to Winner and Gardner (1977). However, even this classical lesion study is often misquoted. Indeed, left-brain-damaged individuals "proved competent in matching a metaphoric figure with its appropriate pictorial interpretation." However, it is not the case that right-brain-damaged individuals did not understand figurative language. Rather, they "were able to offer verbal explications of the metaphors" (p. 727). It is this latter finding that has been mostly ignored. We should acknowledge, then, that already at that early stage of brain research, findings showed that it was not the case that the RH was singled out as the distinctive locus of metaphor comprehension.

Admittedly, a number of studies have shown greater RH involvement in processing metaphor (for a review, see Kacinik & Chiarello, this issue). However, a growing body of evidence suggests that it is not metaphor per se that the RH is specialized in but more generally linguistic reinterpretation and inferencing (e.g., Bihrle, Brownell, Powelson, & Gardner, 1986; Brownell, Michel, Powelson, & Gardner, 1983; Brownell, Potter, Bihrle, & Gardner, 1986; Zaidel, 1979) and coarse coding (Beeman et al., 1994; Beeman, 1998). Indeed, enough evidence has been accumulated to support the view that the RH activates distantly related word meanings and interpretations (Chiarello, 1991, 1998; Jung-Beeman, 2005; Titone, 1998).

In a more recent lesion study, Giora, Zaidel, Soroker, Batori, and Kasher (2000) suggest that rather than assuming different processes for literals and nonliterals, it is the salient (coded and prominent)–nonsalient (novel and inferred) continuum that the brain is sensitive to (see also Giora, 1997, 2003). Indeed, in this study, the salient (metaphoric) meaning of conventional metaphors was shown to recruit the LH. [For similar results, see Ramachandran (2005), who implicated the left angular gyrus for the understanding of conventional proverbs. See also Lee and Dapretto (2006), who showed LH involvement in similarly salient metaphoric and literal meanings.] In contrast, the nonsalient (ironic) interpretation of ironies (Giora et al., 2000; see also Eviatar & Just, 2006; Shamay-Tsoorym, Tomer, & Aharon-Peretz, 2005) and the nonsalient (metaphoric) interpretation of novel metaphors (see Bottini et al., 1994) engaged primarily the RH.

Does this special issue, dedicated to the study of metaphor and the brain, lend support to the traditional view (known as the RH hypothesis) that implicates the right hemisphere in the processing of metaphors? Does the collection of studies compiled here indicate specific areas in the processing of metaphors so that it can substantiate

0093-934X/$ - see front matter
doi:10.1016/j.bandl.2006.08.001

the longstanding distinction between literal and nonliteral language? The answer is "not necessarily."

For instance, using functional magnetic resonance imaging (fMRI), Mashal, Faust, Hendler, and Jung-Beeman testify to increased involvement of RH areas [especially the right posterior superior temporal sulcus (PSTS) and the right inferior frontal gyrus (IFG)] in the processing of nonsalient (metaphoric) interpretations of novel, nonliteral two-word Hebrew expressions when their nonliteral nature was reflected on (see also Mashal, Faust, & Hendler, 2005). However, in a more recent study, Mashal, Faust, Hendler, and Jung-Beeman (2006) demonstrate similar processes for nonsalient (literal) interpretations of highly familiar Hebrew idioms. While the highly salient (idiomatic) meaning was processed in left-sided areas [especially in the middle temporal gyrus (MTG), IFG, thalamus, and insula regions], the nonsalient (literal) interpretation of these idioms was processed in the right-sided areas [especially in MTG and anterior/medial part of the right superior temporal gyrus (STG)].

These findings are inconsistent with the strong version of the RH hypothesis. They are also inconsistent with the assumption that literals and nonliterals require different processes, when their meaningfulness is assessed. Rather, they are predicted by the graded salience hypothesis and the fine-coarse coding model (Beeman, 1993, 1998; Jung-Beeman, 2005). They show that salient meanings, which involve relatively finely tuned semantic relationships, are processed in the LH, regardless of figurativity (see also Oliveri, Romero, & Papagno, 2004). In contrast, nonsalient meanings, involving distant semantic relationships, are processed in the RH, regardless of figurativity.

Further support for the graded salience and fine-coarse coding models comes from Schmidt, DeBuse, and Seger's contribution. Using divided visual half field technology, Schmidt and her colleagues found a RH advantage for low- and very-low-familiarity English sentences containing nonsalient meanings involving distant semantic relationships, and a LH advantage for high- and very-high-familiarity sentences containing salient and close semantic relationships, regardless of figurativity. Such findings defy the literal–nonliteral distinction and further challenge the traditional RH hypothesis. They suggest a different division of labor between the hemispheres than assumed so far.

Using fMRI technology, Rapp, Leube, Erb, Grodd, and Kircher's study also questions prevailing views. While it casts doubt on the traditional RH hypothesis, it also defies the literal–nonliteral distinction insofar as it concerns making judgments and assessing connotations. In their study, both judging the metaphoric content of literal and (relatively novel) German metaphoric sentences (of "A is a B" type) and assessing the positivity and negativity of their connotations showed no significant differences in laterality in any of the regions of interest (the STG, the MTG, the inferior temporal gyrus, the triangular and the opercular part of the IFG, the precuneus, the temporal pole, and the hippocampus). Instead, both tasks relied on the LH, regardless of figurativeness. On the face of it, these findings are also inconsistent with either the graded salience or coarse coding views, assuming that some of the stimuli are relatively novel and probably involve distant semantic relationships. However, these results might be a consequence of the specific tasks of assessment of connotations and judgment making.

The traditional RH hypothesis is also challenged by Stringaris, Medford, Giampietro, Brammer, and David's study. Using event-related functional magnetic resonance imaging (ER-fMRI), Stringaris et al. demonstrate that literal and (rather conventional) English metaphoric sentences (of "A is a B" type), which took equally long to read outside the scanner, recruited the LH when the task involved meaningfulness judgments. In addition, however, they show that, compared to literal sentences, deriving meaning from metaphoric sentences activated the left IFG (which was also recruited for nonmeaningful sentences) and the left thalamus. The involvement of the left thalamus in metaphor interpretation has not been demonstrated before. [For corroborating results, however, see a more recent study by Mashal et al. (2006), which testifies to the involvement of this region in the processing of the salient, idiomatic meanings of idioms.] Such findings argue in favor of different processing pathways for literals and nonliterals, albeit in the LH. Indeed, the authors propose that the activation of the left thalamus might reflect the "open-ended" nature of the metaphors used (as defined by, e.g., Black, 1993; see also Stringaris et al., 2006), regardless of salience and finely tuned coding.

Ahrens, Liu, Lee, Gong, Fang, and Hsu found different neurological processes for literals and metaphors and for conventional and anomalous metaphors in Mandarin Chinese. Thus, when compared with reading literals, reading conventional metaphors slightly increased activation in the right inferior temporal gyrus, even though pretesting reading times did not disclose any difference. In contrast, reading anomalous metaphors, which in the pretest took longer than reading literals, increased activation in the frontal and temporal gyri bilaterally. Anomalous metaphors, then, are significantly different from literals whereas conventional metaphors differ from them only slightly.

Anomalous and conventional metaphors also differ significantly. Such a comparison results in longer reading times for anomalous metaphors and in bilateral activation in the middle frontal gyrus, the precentral gyrus, and right hemisphere activation in the superior frontal gyrus. Left hemisphere activation is found in the IFG and fusiform gyrus. While left hemisphere activation in the frontal and temporal gyri suggests recruitment of traditional language-based areas for anomalous metaphor sentences (see also Stringaris et al.'s findings regarding meaningless sentences), the right hemisphere activation suggests that remote associations are being formed. These findings demonstrate that not all metaphors are alike. They further show that, to some extent, conventional metaphors and literals are not that alike either.

The contribution by Coulson and Severens further complicates the picture. It suggests not only that metaphors are not all alike but also that literals are not all alike. And to make matters even more intriguing, this study further introduces the element of biasing context, which allows insight into hemispheric sensitivity to such information. In their study, event-related potentials (ERPs) were recorded as participants listened to English literal puns (*During branding, cowboys have sore calves*). In the context of puns, the different meanings ('cow'; 'leg') of a key word (*calves*) need to be attended to for the pun to come across as such. In addition, it is the less salient meaning that is the contextually appropriate meaning while the salient meaning is not. To test the time course of making sense of puns and the hemispheres' involvement in the process, participants had to respond to probes visually presented to either the left or right visual half field (LVF/RVF). Coulson and Severens demonstrate hemispheric asymmetry immediately (0 ms) after offset of targets. Under such a delay condition, both the salient ('cow') and less salient ('leg') meanings of the pun (*calves*) are activated in the LH. In contrast, LVF presentation indicates activation of only the salient meaning in the RH. However, this asymmetry disappears when comprehenders are allowed longer processing times. At an ISI of 500 ms, both meanings are similarly activated in both hemispheres. These findings lend support to the acknowledged temporal priority of the left brain: the LH is fast at activating both the salient and less salient meanings, while the RH lags behind and initially activates the salient meaning only, with the less salient meaning taking longer to get activated. However, these findings further reveal that the LH does not induce suppression of contextually inappropriate meanings ('cow') automatically as assumed earlier for context-less (Anaki, Faust, & Kravetz, 1998) and contextualized items (Faust & Gernsbacher, 1996). Rather, they show that, when such meanings are conducive to the final interpretation of the utterance, they are preserved even in the hemisphere known for its efficient and fast suppression mechanisms (see Giora, 2003, 2006, for evidence against an automatic view of suppression). Thus, when invited by context, less salient meanings, featuring distant semantic relations, can be entertained for quite a while even in the LH and not necessarily at the cost of dampening the salient but contextually inappropriate meaning.

That suppression is not automatic, not just in the RH but not even in the LH, is further demonstrated by Kacinik and Chiarello. In their study, lexicalized English metaphors (*bright*), having salient (literal) and less salient (metaphoric) senses, were embedded in neutral (*We all really admired the **bright** COLORS/STUDENT*) and biasing contexts (*It's the building with the **bright** COLORS* vs. *The teacher praised the **bright** STUDENT*). Using divided visual field methodology, Kacinik and Chiarello found priming effects for both senses in both hemispheres, regardless of salience. These effects were generally greater following biasing contexts, although the RT results suggest these contexts slightly (but nonsignificantly) benefited the less salient metaphoric sense in the RH and the more salient literal sense in the LH. Importantly, both hemispheres retained both senses, because both are conducive or at least not detrimental to the final representation.

That suppression of 'inappropriate' meanings is not automatic was also shown for more novel metaphors (*Henry thought her eyes were **petals***) when compared with literals (*That plant keeps losing its **petals***). Findings show that both hemispheres are sensitive to contextually appropriate meanings, activating such meanings, regardless of figurativity. However, they also show that only in the RH do metaphor sentence-contexts also prime contextually inappropriate literal probes (*wilted*). Such results support the view that, compared to literals, novel metaphors are rather open-ended, involving distant conceptual domains (see Stringaris et al.), which, as predicted by the fine-scoarse coding model, are entertained in the RH. In all, findings by Kacinik and Chiarello show that metaphors are not localized and that novelty and open-endedness matter. They further show that while both hemispheres are relatively sensitive to context, the RH also tends to activate contextually inappropriate meanings.

Could the different findings be a consequence not just of the different stimuli type but also of the different tasks (decision making vs. unmediated responses to stimuli) and technologies used, as might be suspected when comparing behavioral and automatic results (see Ahrens et al., Stringaris et al.)? Papagno and Caporali bring this question to the fore. In a lesion study involving opaque Italian idioms, aphasic patients performed three tasks: a sentence-to-picture matching task, an oral definition task, and a sentence-to-word matching task. While, overall, patients performed worse than healthy controls, they fared relatively better on the sentence-to-word matching task. Unlike earlier findings involving transparent metaphors (e.g., Winner & Gardner, 1977), here performance on sentence-to-picture matching was as impaired as performance on the oral definition. Results thus confirm the relevance of task and idiom type in drawing conclusions about figurative language interpretation in brain-damaged individuals.

What, then, is the take-home message? Reviewing the results on metaphor processing presented in this special issue, it seems safe to conclude that metaphor per se is not unique. The brain is not sensitive to metaphoricity or literalness as such. Instead, it is sensitive to degrees of meaning salience, remoteness of semantic relationships, open-endedness, transparency of stimuli's meanings, and speakers' intention (regardless of contextual appropriateness). The nature of the task and the measures employed might also affect processing. The evidence accumulated so far, then, subverts the classical division of labor of the hemispheres (see also Kutas, 2006) and supports a more appropriate interpretation of Aristotle as singling out not the figurative but the innovative—that which gives everyday speech "an unfamiliar air" (see also Giora et al., 2004; Shuval & Giora, 2005).

References

Anaki, D., Faust, M., & Kravetz, S. (1998). Cerebral hemispheric asymmetries in processing lexical metaphors. *Neuropsychologia, 36*, 691–700.

Aristotle (350 BCEa). *Poetics*. Translated by Butcher S. H. The internet classic archive <http://classics.mit.edu/Aristotle/poetics.1.1.html>.

Aristotle (350 BCEb). *Rhetoric*. Translated by Roberts Rhys W. The internet classic archive <http://classics.mit.edu/Aristotle/rhetoric. html>.

Beeman, M. (1993). Semantic processing in the right hemisphere may contribute to drawing inferences from discourse. *Brain and Language, 44*, 80–120.

Beeman, M. (1998). Coarse semantic coding and discourse comprehension. In M. Beeman & C. Chiarello (Eds.), *Right hemisphere language comprehension: Perspectives from cognitive neuroscience* (pp. 255–284). Mahwah, NJ: Erlbaum.

Beeman, M., Friedman, R. B., Grafman, J., Perez, E., Diamond, S., & Lindsay, M. B. (1994). Summation priming and coarse semantic coding in the right hemisphere. *Journal of Cognitive Neuroscience, 6*, 26–45.

Bihrle, A. M., Brownell, H. H., Powelson, J., & Gardner, H. (1986). Comprehension of humorous and non-humorous materials by left and right brain-damaged patients. *Brain and Cognition, 5*, 399–411.

Black, M. (1993). More about metaphor. In A. Ortony (Ed.), *Metaphor and thought* (2nd ed., pp. 19–41). Cambridge, MA: Cambridge University Press.

Bottini, G., Corcoran, R., Sterzi, R., Paulesu, E., Schenone, P., Scarpa, P., et al. (1994). The role of the right hemisphere in the interpretation of figurative aspects of language: a positron emission tomography activation study. *Brain, 117*, 1241–1253.

Brownell, H. H., Michel, D., Powelson, J., & Gardner, H. (1983). Surprise but not coherence: sensitivity to verbal humor in right-hemisphere patients. *Brain and Language, 18*, 20–27.

Brownell, H . H., Potter, H. H., Bihrle, A. M., & Gardner, H. (1986). Inference deficits in right brain damaged patients. *Brain and Language, 27*, 310–321.

Chiarello, C. (1991). Interpretation of word meanings by the cerebral hemispheres: one is not enough. In P. J. Schwanenflugel (Ed.), *The psychology of word meanings* (pp. 251–278). Hillsdale, NJ: Lawrence Erlbaum Associates.

Chiarello, C. (1998). On codes of meaning and the meaning of codes: semantic access of retrieval within and between hemispheres. In M. Beeman & C. Chiarello (Eds.), *Right hemisphere language comprehension: Perspectives from cognitive neuroscience* (pp. 141–160). Mahwah, NJ: Lawrence Erlbaum Associates.

Eviatar, Z., & Just, M. (2006). Brain correlates of discourse processing: an fMRI investigation of irony and metaphor comprehension. *Neuropsychologia, 44*, 2348–2359.

Faust, M., & Gernsbacher, M. A. (1996). Cerebral mechanisms for suppression of inappropriate information during sentence comprehension. *Brain and Language, 53*, 234–259.

Giora, R. (1997). Understanding figurative and literal language: the graded salience hypothesis. *Cognitive Linguistics, 7*, 183–206.

Giora, R. (2003). *On our mind: Salience, context and figurative language*. New York: Oxford University Press.

Giora, R. (2006). Anything negatives can do affirmatives can do just as well, except for some metaphors. *Journal of Pragmatics*, 38, 981–1014. http://dx.doi.org/10.1016/j.pragma.2005.12.006.

Giora, R., Fein, O., Kronrod, A., Elnatan, I., Shuval, N., & Zur, A. (2004). Weapons of mass distraction: optimal innovation and pleasure ratings. *Metaphor and Symbol, 19*, 115–141.

Giora, R., Zaidel, E., Soroker, N., Batori, G., & Kasher, A. (2000). Differential effects of right- and left-hemisphere damage on understanding sarcasm and metaphor. *Metaphor and Symbol, 15*, 63–83.

Grice, H. P. (1975). Logic and conversation. In P. Cole & J. L. Morgan (Eds.), *Syntax and semantics: Vol. 3. speech acts* (pp. 41–58). New York: Academic Press.

Jung-Beeman, M. (2005). Bilateral brain processes for comprehending natural language. *Trends in Cognitive Sciences, 9*, 512–518.

Kutas, M. (2006). One lesson learned: frame language processing–literal and figurative–as a human brain function. In A. Katz (Ed.), *Metaphor and Symbol, Vol. 21,* pp. 285–325 *(Special issue Nonliteral language and the Brain)*.

Lee, S. S., & Dapretto, M. (2006). Metaphorical vs. literal word meanings: fMRI evidence against a selective role of the right hemisphere. *NeuroImage, 29*, 536–544.

Mashal, N., Faust, M., & Hendler, T. (2005). The role of the right hemisphere in processing nonsalient metaphorical meanings: application of principal components analysis to fMRI data. *Neuropsychologia, 43*(14), 2084–2100.

Mashal, N., Faust, M., Hendler, T., & Jung-Beeman, M. (2006). Right hemisphere involvement in accessing the literal meaning of idioms: an fMRI investigation (submitted for publication).

Oliveri, M., Romero, L., & Papagno, C. (2004). Left but not right temporal involvement in opaque idiom comprehension: a repetitive transcranial magnetic stimulation study. *Journal of Cognitive Neuroscience, 16*, 848–855.

Ramachandran, V.S. (May, 2005). Role of temporal-parietal-occipital junction and mirror neurons in action-metaphors. The 17th Annual Convention of the American Psychology Association, Los Angeles, May 26–29.

Searle, J. (1979). *Expression and meaning*. Cambridge, England: Cambridge University Press.

Shamay-Tsoorym, S. G., Tomer, R., & Aharon-Peretz, J. (2005). The neuroanatomical basis of understanding sarcasm and its relationship to social cognition. *Neuropsychology, 19*(3), 288–300.

Shuval, N., & Giora, R. (2005). Beyond figurativeness: optimal innovation and pleasure. In S. Coulson & B. Lewandowska-Tomaszczyk (Eds.), *On the literal/nonliteral distinction* (pp. 239–254). Berlin: Peter Lang.

Stringaris, A., Medford, N., Giora, R., Giampietro, C. V., Brammer, J. M., & David, S. A., (2006). How metaphors influence semantic relatedness judgments: the role of the right frontal cortex. *NeuroImage, 33,* 784–793.

Titone, D. (1998). Hemispheric differences in context sensitivity during lexical ambiguity resolution. *Brain and Language, 65*, 361–394.

Winner, E., & Gardner, H. (1977). The comprehension of metaphor in brain-damaged patients. *Brain, 100*, 717–729.

Zaidel, E. (1979). Performance on the ITPA following cerebral commissurotomy and hemispherectomy. *Neuropsychologia, 17*, 259–280.

Rachel Giora *

Department of Linguistics, Tel Aviv University, Israel

E-mail address: giorar@post.tau.ac.il

Accepted 28 July 2006

Available online 7 September 2006

* Fax: +1 831 457 2403.