



Humanwissenschaftliche Fakultät

Elena S. Kulkova | Martin H. Fischer

## Idioms in the World

A Focus on Processing

Suggested citation referring to the original publication:

Frontiers in Psychology 10 (2019), Art. 1155

DOI <https://doi.org/10.3389/fpsyg.2019.01155>

ISSN (online) 1664-1078

Postprint archived at the Institutional Repository of the Potsdam University in:

Postprints der Universität Potsdam

Humanwissenschaftliche Reihe ; 561

ISSN 1866-8364

<http://nbn-resolving.de/urn:nbn:de:kobv:517-opus4-435704>

DOI <https://doi.org/10.25932/publishup-43570>





# Idioms in the World: A Focus on Processing

Elena S. Kulkova\* and Martin H. Fischer†

Department of Psychology, University of Potsdam, Potsdam, Germany

**Keywords:** embodiment, figurative language, metaphor, idiom, processing

Recent experiment-based psycho- and neuro-linguistic research brought new insights into language processing mechanisms and meaning representation in the brain. More specifically, it highlighted the dynamic nature of brain connections and a constant interplay between distributed neuronal circuits during meaning processing. These developments led to a shift from an amodal view, which perceives conceptual information activation as parallel to and independent from adjoining neural activation in sensorimotor circuits (Mahon and Caramazza, 2008; Meteyard et al., 2012), to the embodied cognition view that highlights the role of sensorimotor experience in the formation of flexible, distributed conceptual representations encompassing features acquired via different perceptual modalities (Fischer and Zwaan, 2008; Barsalou, 2010). Embodied cognition, therefore, suggests that conceptual knowledge and, consequently, semantic knowledge are grounded in bodily experience and situated actions (Glenberg et al., 2008; Pulvermüller, 2013). However, currently there is a tendency toward perceiving embodied and disembodied views not as mutually exclusive distinct theories, but as bridging a gap between them. The hub and spoke model and the sensory-motor model demonstrate attempts to integrate the amodal and modality-specific views (see Mahon, 2015).

A broad range of behavioral, physiological, and neuroimaging data demonstrating co-activation of language- and action-related brain areas support this claim with regard to concrete language (Binder et al., 2005; Pulvermüller et al., 2005; Barsalou, 2008; Hauk et al., 2008). However, the data are less conclusive with regard to figurative expressions, which constitute a significant part of language. One of the reasons is that figurative language subsumes a wide variety of heterogeneous phenomena (metonymy, idioms, metaphors, proverbs, hyperbole, irony) which differ syntactically (from phrasal verbs to compounds and even sentences), as well as in their properties (familiarity, ambiguity, transparency, compositionality, salience, predictability) and essential features (although both irony and hyperbole are based on cognitive contrast, it is a contrast *of kind* for irony and a contrast *in magnitude* for hyperbole; Hsiao and Lily, 2010). This diversity and complexity of non-literal language types does not allow for clear-cut and strictly defined boundaries; it has led to a distinction of non-literal phenomena not dichotomously, but along a conventionality continuum (Cacciari and Papagno, 2012).

Secondly, the linguistic phenomena, embraced by the broad term “non-literal language” have been analyzed to different degrees of detail. Specifically, different aspects of metaphor production comprehension and use have been extensively studied (Gibbs, 2008, 2015; Schmidt and Seger, 2009; Bambini et al., 2011; Gibbs and Colston, 2012; Forgács et al., 2014; Obert et al., 2014; Lai and Desai, 2016; Briner et al., 2018; Rataj et al., 2018; Reilly et al., 2019). Furthermore, metaphors represent a powerful cognitive device guided by environmental experiences, which enabled the studies of metaphor framing influences not only on linguistic communication *per se*, but also on judgments, reasoning, intentions, and actions (Robins and Mayer, 2000; Slepian et al., 2010; Thibodeau and Boroditsky, 2011, 2013; Landau et al., 2014; Marin et al., 2014; Hauser and Schwarz, 2015; Elmore and Luna-Lucero, 2017; Thibodeau et al., 2017). Despite considerable research (Gibbs and Nayak, 1989; Cacciari and Tabossi, 1993; Mashal et al., 2008; Vulchanova et al., 2011; Cuccio et al., 2014; Häuser et al., 2016; Cacciari et al., 2018), the study of idioms still leaves open for debate the

## OPEN ACCESS

### Edited by:

Gary Libben,  
Brock University, Canada

### Reviewed by:

Patrick Bonin,  
Université de Bourgogne, France  
Mila Vulchanova,  
Norwegian University of Science and  
Technology, Norway

### \*Correspondence:

Elena S. Kulkova  
kulkova@uni-potsdam.de  
orcid.org/0000-0002-2145-8956

†Martin H. Fischer  
orcid.org/0000-0003-3818-7272

### Specialty section:

This article was submitted to  
Language Sciences,  
a section of the journal  
Frontiers in Psychology

**Received:** 31 October 2018

**Accepted:** 02 May 2019

**Published:** 24 May 2019

### Citation:

Kulkova ES and Fischer MH (2019)  
Idioms in the World: A Focus on  
Processing. *Front. Psychol.* 10:1155.  
doi: 10.3389/fpsyg.2019.01155

questions of defining idioms or differentiating them from other types of non-literal expressions (Cacciari, 2014). One of the main confusions is in defining idioms from metaphors, as it was debated whether idiom processing is possible without constant recourse to conceptual metaphors (Owens, 2016). However, although some idioms are indeed derived from metaphors and can still be partially motivated by conceptual mappings between domains (Gibbs, 1992), idioms as a class comprising syntactically and compositionally differing phenomena (Caillies and Butcher, 2007) are divergent from metaphors. The crucial difference is that idiomatic meaning is predominantly fixed and conventional, and it can be modified but not changed when used in various contexts. Metaphoric meaning, in turn, is flexible and intricate, can be profoundly changed by the context, and therefore always requires online construction (Cacciari, 2014; Bambini et al., 2016). Distinctive neural correlates for processing of idioms (left MTG and left IFG, involved in selection-inhibition operations) and metaphors [left precentral gyrus (BA 6), linking concrete and abstract domains and the left inferior parietal lobe (IPL), executing higher-order cognitive motor functions; Fogassi and Luppino, 2005] also argue against conflating them.

Disregarding these principal differences between the two linguistic forms results in their interchangeable use (e.g., Aziz-Zadeh et al., 2006), which, in turn, may posit serious confoundment, as comprehending these figurative devices that have different mental representations engages dissimilar cognitive mechanisms; based on both semantic and structural analysis of meaning and retrieval from semantic memory during idiom processing, and focused on the conceptual models and templates underlying metaphor meaning construction. Vulchanova et al. (2019) provide a detailed overview of the models of figurative language processing.

Recent studies on processing non-literal expressions with action-related semantics reported activation of motoric brain areas during either literal (Raposo et al., 2009), metaphoric (Desai et al., 2011), or only during metaphor but not idiom processing (Cacciari et al., 2011; Desai et al., 2013). Only limited publications present evidence of sensorimotor engagement during idiomatic meaning comprehension (Boulenger et al., 2009, 2012). Overall, the studies emphasize the role of context in meaning disambiguation and suggest that an increase in abstractness of the language stimuli leads to a decrease in the sensorimotor system's involvement (especially in case of idioms). However, these results could be interpreted not in favor of idiom disembodiment, but as a demonstration of different processing schemas that idioms and metaphors employ: the dual-reference

idiomatic nature enables engagement of a hybrid processing mechanism that encompasses both compositional and holistic context-based analysis during idiom comprehension (Caillies and Butcher, 2007; Boulenger et al., 2012; Cacciari and Pesciarelli, 2013). Metaphors, which retain stronger links to the original meaning of the constituent words, rely more on online mental simulation to compute complex, flexible meanings.

Engaging different processing mechanisms may result in spatially and temporally different patterns of neurocognitive involvement (Rapp et al., 2012; Yang and Shu, 2016). For example, Cacciari et al. (2011) reported no motor engagement in idiom processing, but single-pulse TMS applied at the end of sentences to register meaning-induced MEPs could be inefficient to record idiom-induced motor activation, since idioms are processed online (mentally simulated) only until the idiom is recognized, and then a switch to the non-compositional mode (retrieval from semantic memory) occurs. Lack of motor engagement during idiom comprehension can be explained by heterogeneity of idioms: e.g., Raposo et al. (2009) used highly familiar and opaque idioms, which minimized the need for mental simulation during their processing and consequently may have reduced the level of sensorimotor cortical activation. Therefore, idiomatic meaning may be less embodied compared to metaphoric meaning, but not totally disembodied.

This evidence highlights the need for a more profound exploration of properties specific to figurative language types and subtypes of each phenomenon, which could considerably benefit present-stage figurative language research and promote a better understanding of the mechanisms the human brain employs for their acquisition, production, and processing. This will provide an integrative theoretical model that can more comprehensively and consistently outline the cognitive mechanisms and neural circuitry underlying processing of heterogeneous and multifaceted figurative language. Taken together, it will inform the development of more precise neuro-cognitive models, support AI applications and enhance understanding of language processing in general.

## AUTHOR CONTRIBUTIONS

EK and MF have contributed equally to this submission.

## FUNDING

This study was supported by University of Potsdam, library funds.

## REFERENCES

- Aziz-Zadeh, L., Wilson, S. M., Rizzolatti, G., and Iacoboni, M. (2006). Congruent embodied representations for visually presented actions and linguistic phrases describing actions. *Curr. Biol.* 16, 1818–1823. doi: 10.1016/j.cub.2006.07.060
- Bambini, V., Bertini, C., Schaeken, W., Stella, A., and Di Russo, F. (2016). Disentangling metaphor from context: an ERP study. *Front. Psychol.* 7:559. doi: 10.3389/fpsyg.2016.00559
- Bambini, V., Gentili, C., Ricciardi, E., Bertinetto, P. M., and Pietrini, P. (2011). Decomposing metaphor processing at the cognitive and neural level through functional magnetic resonance imaging. *Brain Res. Bull.* 86, 203–216. doi: 10.1016/j.brainresbull.2011.07.015
- Barsalou, L. W. (2008). "Grounding symbolic operations in the brain's modal systems," in *Embodied Grounding Social, Cognitive, Affective, and Neuroscientific Approaches*, eds G. R. Semin and E. R. Smith (New York, NY: Cambridge University Press), 9–42. doi: 10.1017/CBO9780511805837.002

- Barsalou, L. W. (2010). Grounded cognition: past, present, and future. *Top. Cogn. Sci.* 2, 716–724. doi: 10.1111/j.1756-8765.2010.01115.x
- Binder, J. R., Westbury, C. F., McKiernan, K. A., Possing, E. T., and Medler, D. A. (2005). Distinct brain systems for processing concrete and abstract concepts. *J. Cogn. Neurosci.* 17, 905–917. doi: 10.1162/0898929054021102
- Boulenger, V., Hauk, O., and Pulvermüller, F. (2009). Grasping ideas with the motor system: semantic somatotopy in idiom comprehension. *Cereb. Cortex* 19, 1905–1914. doi: 10.1093/cercor/bhn217
- Boulenger, V., Shtyrov, Y., and Pulvermüller, F. (2012). When do you grasp the idea? MEG evidence of simultaneous idiom understanding. *Neuroimage* 59, 3502–3513. doi: 10.1016/j.neuroimage.2011.11.011
- Briner, S. W., Schutzenhofer, M. C., and Virtue, S. M. (2018). Hemispheric processing in conventional metaphor comprehension: the role of general knowledge. *Neuropsychologia* 114, 101–109. doi: 10.1016/j.neuropsychologia.2018.03.040
- Cacciari, C. (2014). Processing multiword idiomatic strings: many words in one? *Ment. Lex.* 9, 267–293. doi: 10.1075/ml.9.2.05cac
- Cacciari, C., Bolognini, N., Senna, I., Pellicciari, M. C., Miniussi, C., and Papagno, C. (2011). Literal, fictive and metaphorical motion sentences preserve the motion component of the verb: a TMS study. *Brain Lang.* 119, 149–157. doi: 10.1016/j.bandl.2011.05.004
- Cacciari, C., Corradini, P., and Ferlazzo, F. (2018). Cognitive and personality components underlying spoken idiom comprehension in context. An exploratory study. *Front. Psychol.* 9:659. doi: 10.3389/fpsyg.2018.00659
- Cacciari, C., and Papagno, C. (2012). “Neuropsychological and neurophysiological correlates of idiom understanding: how many hemispheres are involved,” *The Handbook of the Neuropsychology of Language*, ed M. Faust (Chichester, UK: Wiley-Blackwell Publishing Ltd.), 368–385. doi: 10.1002/9781118432501.ch18
- Cacciari, C., and Pesciarelli, F. (2013). Motor activation in literal and non-literal sentences: does time matter? *Front. Hum. Neurosci.* 7:202. doi: 10.3389/fnhum.2013.00202
- Cacciari, C., and Tabossi, P. (1993). *Idioms. Processing, Structure and Interpretation*. Hillsdale, NJ; Hove: Lawrence Erlbaum Associates.
- Caillies, S., and Butcher, K. (2007). Processing of idiomatic expressions: evidence for a new hybrid view. *Metaphor Symbol* 22, 79–108. doi: 10.1080/10926480709336754
- Cuccio, V., Ambrosecchia, M., Ferri, F., Carapezza, M., Piparo, F. L., Fogassi, L., et al. (2014). How the context matters. Literal and figurative meaning in the embodied language paradigm. *PLoS ONE* 9:e115381. doi: 10.1371/journal.pone.0115381
- Desai, R. H., Binder, J. R., Conant, L. L., Mano, Q. R., and Seidenberg, M. S. (2011). The neural career of sensory-motor metaphors. *J. Cogn. Neurosci.* 23, 2376–2386. doi: 10.1162/jocn.2010.21596
- Desai, R. H., Conant, L. L., Binder, J. R., Park, H., and Seidenberg, M. S. (2013). A piece of the action: modulation of sensory-motor regions by action idioms and metaphors. *Neuroimage* 83, 862–869. doi: 10.1016/j.neuroimage.2013.07.044
- Elmore, K. C., and Luna-Lucero, M. (2017). Light bulbs or Seeds? How metaphors for ideas influence judgments about Genius. *Soc. Psychol. Pers. Sci.* 8, 200–208. doi: 10.1177/1948550616667611
- Fischer, M. H., and Zwaan, R. A. (2008). Embodied language: a review of the role of the motor system in language comprehension. *Q. J. Exp. Psychol.* 61, 825–850. doi: 10.1080/17470210701623605
- Fogassi, L., and Luppino, G. (2005). Motor functions of the parietal lobe. *Curr. Opin. Neurobiol.* 15, 626–631. doi: 10.1016/j.conb.2005.10.015
- Forgács, B., Lukács, A., and Pléh, C. (2014). Lateralized processing of novel metaphors: disentangling figurativeness and novelty. *Neuropsychologia* 56, 101–109. doi: 10.1016/j.neuropsychologia.2014.01.003
- Gibbs R. W. Jr. (2015). Do pragmatic signals affect conventional metaphor understanding? A failed test of deliberate metaphor theory. *J. Pragmat.* 90, 77–87. doi: 10.1016/j.pragma.2015.05.021
- Gibbs R. W. Jr. (ed.) (2008). *The Cambridge Handbook of Metaphor and Thought*. New York, NY: Cambridge University Press. doi: 10.1017/CBO9780511816802
- Gibbs R. W. Jr., and Colston, H. L. (2012). *Interpreting Figurative Meaning*. New York, NY: Cambridge University Press. doi: 10.1017/CBO9781139168779
- Gibbs R. W. Jr., and Nayak, N. P. (1989). Psycholinguistic studies on the syntactic behavior of idioms. *Cogn. Psychol.* 21, 100–138. doi: 10.1016/0010-0285(89)90004-2
- Gibbs, R. W. (1992). What do idioms really mean?. *J. Mem Lang*, 31, 485–506.
- Glenberg, A. M., Sato, M., Cattaneo, L., Riggio, L., Palombo, D., and Buccino, G. (2008). Processing abstract language modulates motor system activity. *Q. J. Exp. Psychol.* 61, 905–919. doi: 10.1080/17470210701625550
- Hauk, O., Shtyrov, Y., and Pulvermüller, F. (2008). The time course of action and action-word comprehension in the human brain as revealed by neurophysiology. *J. Physiol. Paris* 102, 50–58. doi: 10.1016/j.jphysparis.2008.03.013
- Hauser, D. J., and Schwarz, N. (2015). The war on prevention: Bellicose cancer metaphors hurt (some) prevention intentions. *Pers. Soc. Psychol. Bull.* 41, 66–77. doi: 10.1177/0146167214557006
- Häuser, K. I., Titone, D. A., and Baum, S. R. (2016). The role of the ventro-lateral prefrontal cortex in idiom comprehension: an rTMS study. *Neuropsychologia* 91, 360–370. doi: 10.1016/j.neuropsychologia.2016.09.003
- Hsiao, C. H., and Lily, I. (2010). Metaphor and hyperbolic expressions of emotion in Mandarin Chinese conversation. *J. Pragmat.* 42, 1380–1396. doi: 10.1016/j.pragma.2009.09.006
- Lai, V. T., and Desai, R. H. (2016). The grounding of temporal metaphors. *Cortex* 76, 43–50. doi: 10.1016/j.cortex.2015.12.007
- Landau, M. J., Oyserman, D., Keefer, L. A., and Smith, G. C. (2014). The college journey and academic engagement: how metaphor use enhances identity-based motivation. *J. Pers. Soc. Psychol.* 106, 679. doi: 10.1037/a0036414
- Mahon, B. Z. (2015). What is embodied about cognition? *Lang. Cogn. Neurosci.* 30, 420–429. doi: 10.1080/23273798.2014.987791
- Mahon, B. Z., and Caramazza, A. (2008). A critical look at the embodied cognition hypothesis and a new proposal for grounding conceptual content. *J. Physiol. Paris* 102, 59–70. doi: 10.1016/j.jphysparis.2008.03.004
- Marin, A., Reimann, M., and Castaño, R. (2014). Metaphors and creativity: direct, moderating, and mediating effects. *J. Consum. Psychol.* 24, 290–297. doi: 10.1016/j.jcps.2013.11.001
- Mashal, N., Faust, M., Hendler, T., and Jung-Beeman, M. (2008). Hemispheric differences in processing the literal interpretation of idioms: converging evidence from behavioral and fMRI studies. *Cortex* 44, 848–860. doi: 10.1016/j.cortex.2007.04.004
- Meteyard, L., Cuadrado, S. R., Bahrami, B., and Vigliocco, G. (2012). Coming of age: a review of embodiment and the neuroscience of semantics. *Cortex* 48, 788–804. doi: 10.1016/j.cortex.2010.11.002
- Obert, A., Gierski, F., Calmus, A., Portefaix, C., Declercq, C., Pierot, L., et al. (2014). Differential bilateral involvement of the parietal gyrus during predicative metaphor processing: an auditory fMRI study. *Brain Lang.* 137, 112–119. doi: 10.1016/j.bandl.2014.08.002
- Owens, J. (2016). The lexical nature of idioms. *Lang. Sci.* 57, 49–69. doi: 10.1016/j.langsci.2016.05.004
- Pulvermüller, F. (2013). How neurons make meaning: brain mechanisms for embodied and abstract-symbolic semantics. *Trends Cogn. Sci.* 17, 458–470. doi: 10.1016/j.tics.2013.06.004
- Pulvermüller, F., Hauk, O., Nikulin, V. V., and Ilmoniemi, R. J. (2005). Functional links between motor and language systems. *Eur. J. Neurosci.* 21, 793–797. doi: 10.1111/j.1460-9568.2005.03900.x
- Raposo, A., Moss, H. E., Stamatakis, E. A., and Tyler, L. K. (2009). Modulation of motor and premotor cortices by actions, action words and action sentences. *Neuropsychologia*, 47, 388–396.
- Rapp, A. M., Mutschler, D. E., and Erb, M. (2012). Where in the brain is nonliteral language? A coordinate-based meta-analysis of functional magnetic resonance imaging studies. *Neuroimage* 63, 600–610. doi: 10.1016/j.neuroimage.2012.06.022
- Rataj, K., Przekoracka-Krawczyk, A., and van der Lubbe, R. H. (2018). On understanding creative language: the late positive complex and novel metaphor comprehension. *Brain Res.* 1678, 231–244. doi: 10.1016/j.brainres.2017.10.030
- Reilly, M., Howerton, O., and Desai, R. H. (2019). Time-course of motor involvement in literal and metaphorical action sentence processing: A TMS study. *Front. Psychol.* 10:371. doi: 10.3389/fpsyg.2019.00371
- Robins, S., and Mayer, R. E. (2000). The metaphor framing effect: metaphorical reasoning about text-based dilemmas. *Discourse Process.* 30, 57–86. doi: 10.1207/S15326950dp3001\_03
- Schmidt, G. L., and Seger, C. A. (2009). Neural correlates of metaphor processing: the roles of figurativeness, familiarity and difficulty. *Brain Cogn.* 71, 375–386. doi: 10.1016/j.bandc.2009.06.001

- Slepian, M. L., Weisbuch, M., Rutchick, A. M., Newman, L. S., and Ambady, N. (2010). Shedding light on insight: priming bright ideas. *J. Exp. Soc. Psychol.* 46, 696–700. doi: 10.1016/j.jesp.2010.03.009
- Thibodeau, P. H., and Boroditsky, L. (2011). Metaphors we think with: the role of metaphor in reasoning. *PLoS ONE* 6:e16782. doi: 10.1371/journal.pone.0016782
- Thibodeau, P. H., and Boroditsky, L. (2013). Natural language metaphors covertly influence reasoning. *PLoS ONE* 8:e52961. doi: 10.1371/journal.pone.0052961
- Thibodeau, P. H., Hendricks, R. K., and Boroditsky, L. (2017). How linguistic metaphor scaffolds reasoning. *Trends Cogn. Sci.* 21, 852–863. doi: 10.1016/j.tics.2017.07.001
- Vulchanova, M., Milburn, E., Vulchanov, V., and Baggio, G. (2019). Boon or Burden? The role of compositional meaning in figurative language processing and acquisition. *J Logic Lang Information*, 1–29. doi: 10.1007/s10849-019-09282-7
- Vulchanova, M., Vulchanov, V., and Stankova, M. (2011). Idiom comprehension in the first language: a developmental study. *Vigo Int. J. Appl. Linguist.* 8, 207–234.
- Yang, J., and Shu, H. (2016). Involvement of the motor system in comprehension of non-literal action language: a meta-analysis study. *Brain Topogr.* 29, 94–107. doi: 10.1007/s10548-015-0427-5

**Conflict of Interest Statement:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2019 Kulkova and Fischer. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.