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Nouns and verbs in the brain: Implications of linguistic typology for cognitive neuroscience

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ABSTRACT

In recent years, cognitive neuroscience has generated many important findings about how the noun–verb distinction is implemented in the brain, but at the same time it has largely ignored equally important advances in linguistic typology concerning the nature of grammatical categories. Following the lead of Evans and Levinson (2009), we argue that typological data and theory have significant implications not only for the interpretation of recent neuroscientific discoveries about the noun–verb distinction, but also for the direction of future neuroscientific research on this topic.

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1. Introduction

Evans and Levinson (2009) (henceforth E&L) have done a great service to the mind/brain sciences by highlighting the tremendous amount of crosslinguistic diversity that typological studies have revealed, and by pointing out the need for this diversity to be incorporated into research on how language is acquired, processed, and neurally implemented. Although typology has already begun to influence some corners of psycholinguistics, especially involving conceptual development (e.g., Bowerman and Levinson, 2001; Guo et al., 2008) and the language–thought interface (e.g., Gentner and Goldin-Meadow, 2003; Malt and Wolff, 2010), the vast majority of psycholinguistic research has neglected the kinds of crosslinguistic phenomena that E&L emphasize. And the situation is even worse in neurolinguistics, where typology is rarely mentioned, let alone taken seriously as a valuable source of data (for a notable exception see Bornkessel and Schlesewsky, 2006).

In this commentary, we use E&L's remarks about grammatical categories (GCs) as a springboard for exploring some of the implications that typology has for neuroscientific research on what is sometimes considered a basic design feature of language: the noun–verb distinction. E&L observe that GCs are “fundamental to grammar because the application of grammatical rules is made general by formulating them over word classes” (p. 434). They go on to note, however, that typological research on the major parts of speech, including the noun–verb distinction, has been controversial for nearly a century, with debates continuing to this day about whether or not—and, if so, exactly how—these GCs can be said to be

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universal. Here we anchor our discussion of neuroscientific issues in one of the most prominent typological theories of GCs—namely, Croft’s (1991, 2000b, 2001, 2005, 2007a,b, 2009)—while acknowledging in passing that other typological approaches also have much to offer cognitive neuroscience (e.g., Vogel and Comrie, 2000; Dixon, 2010b; Bisang, *in press*; for a different perspective see Baker, 2003). According to Croft, in order to avoid various pitfalls in attempting to chart this treacherous territory, one must distinguish between universal and language-particular aspects of GCs. For this reason, we treat these topics separately, in each case showing how discoveries in linguistic typology have repercussions for cognitive neuroscience.

2. Universal aspects of grammatical categories

GCs are identified primarily by the occurrence or non-occurrence of words in the multifarious morphological and syntactic constructions that constitute the grammatical systems of languages. However, when this classic “distributional method” is applied crosslinguistically, one inevitably finds that the constructions used as diagnostics for GCs in some languages are either absent in others or are employed in ways that seem bizarre compared to English. For example, inflectional criteria are commonly used to distinguish GCs, and in fact GCs do exhibit the following tendencies crosslinguistically: so-called “nouns” are often inflected for features like number, case, gender, definiteness, and possession/alienability, whereas so-called “verbs” are often inflected for features like tense, aspect, mood, modality, and transitivity/valence. However, as E&L observed, some languages, like Vietnamese, lack all inflection, precluding the use of inflectional criteria for identifying GCs; and other languages have inflection but employ it in a surprising manner, as exemplified by Makah, which applies aspect and mood suffixes not only to words for actions that are translated into English as verbs, but also to words for things that are translated into English as nouns. Croft (2001) notes that if one assumed that inflection for aspect and/or mood was a universal diagnostic feature of verbs, one would have to conclude that no words are verbs in Vietnamese and that nearly all words are verbs in Makah.

His solution to terminological quandaries like these—and there are many of them—is to ground a universal-typological theory of GCs in the most fundamental propositional acts of linguistic communication. Specifically, he argues that prototypical nouns and verbs reflect certain default combinations of pragmatic function and semantic class, with nouns involving reference to an object and verbs involving predication of an action. While these combinations give rise to the “unmarked” members of each GC, other combinations give rise to “marked” members, as shown below:

	REFERENCE	PREDICATION
OBJECTS	unmarked nouns	predicate nominals, copulas
ACTIONS	action nominals, complements, infinitives, gerunds	unmarked verbs

Although Croft’s theory defines the centers of the conceptual spaces associated with the two major GCs, it does not define their boundaries. This is because the boundaries are determined in different ways by different languages. The relevant patterns of variation are constrained, however, by two important “markedness” principles. First, the Structural Coding Criterion specifies that “the marked member is encoded by *at least as many* morphemes as the unmarked member”; and second, the Behavioral Potential Criterion specifies that “the unmarked member displays *at least as wide a range* of grammatical behavior as the marked member” (Croft, 2000b:89). Explaining exactly how these criteria apply in particular cases is beyond the scope of this commentary. What matters is simply that they enable the theory to accommodate the attested crosslinguistic diversity of GCs, ranging from languages like English to those like Vietnamese and Makah.

Turning to the cognitive neuroscience of GCs, although many advances have been made, the field still lacks a solid theoretical framework. For example, one sometimes finds blanket statements to the effect that nouns and verbs are universal. Thus, in a major review paper Shapiro and Caramazza (2004:803) assert that “there is agreement among linguists that all natural languages incorporate distinctions between words of at least two syntactic categories, such as nouns and verbs.” And in a more recent review paper Vigliocco et al. (*submitted for publication*) state that “all languages distinguish between nouns and verbs (albeit in different manners).” The problem with such claims is that they are never really unpacked, but are simply transferred from one study to the next, like the unexamined contents of a locked suitcase being passed from one person to another. What the field as a whole needs are clear, detailed, theoretically grounded, typologically informed discussions about how the *linguistic* architecture of GCs might be realized in the *neurobiological* architecture of the brain.

As described above, Croft’s theory maintains that the only aspects of the noun–verb distinction that are truly universal are, first, the combinations of pragmatic and semantic factors that anchor prototypical nouns and verbs, and second, the markedness principles that account for crosslinguistic patterns in the encoding of those GCs. If this theory is correct, it has significant implications for research on the neural substrates of GCs, since it gives investigators well-defined “targets” to search for in the brain. Although cognitive neuroscience has not yet explored in any depth the pragmatic notions of reference and predication, considerable progress has been made in understanding how object and action concepts—i.e., the sorts of concepts that tend to be encoded crosslinguistically as unmarked nouns and verbs—are implemented in the brain.

A large body of data suggests that object concepts depend critically on the ventral temporal lobes (for reviews see Gainotti, 2006; Martin, 2007, 2009; Kemmerer, 2010). These cortical regions—especially the fusiform gyri—are essential for

representing the shape, color, and texture features of entities when they are visually perceived and recognized. And according to recent research in the so-called “embodied cognition” movement, many of these regions also represent the same features, albeit more schematically, when object nouns are produced or understood. For example, comprehending a word like *horse* is thought to include, among other processes, activating a prototypical shape representation of a horse in the fusiform gyri. Evidence for this view comes from neuroimaging studies with healthy subjects as well as from lesion studies with brain-damaged patients. In the current context, the key point is that, together with other ventral temporal regions, the fusiform gyri may subserve the core representational dimensions of the universal conceptual space of objects that, in Croft’s theory of GCs, constitutes the semantic foundation of nouns.

Another set of findings suggests that action concepts depend critically on the frontal and parietal lobes, as well as on posterolateral temporal regions (for reviews see [Pulvermüller, 2005, 2008](#); [Grafton, 2009](#); [Kemmerer and Gonzalez Castillo, 2010](#); [Kemmerer, 2010, forthcoming](#)). It is well-established that motor areas in the frontal and parietal lobes underlie the planning and execution of actions, and there is growing evidence that, in concert with posterolateral temporal regions that represent visual motion patterns, these motor areas also contribute to the perceptual understanding of actions. Moreover, a number of studies motivated by the “embodied cognition” perspective suggest that some of the same frontal, parietal, and posterolateral temporal regions are engaged during the semantic processing of action verbs. For example, comprehending a verb like *throw* may involve, in part, a covert neurocognitive simulation of what it is usually like to see and perform the designated type of action. Support for this view comes not only from studies that focus on the brain structures that are normally engaged in healthy subjects during verb processing tasks, but also from studies that focus on the brain structures that are damaged in patients with verb processing deficits. Overall, the data suggest that these brain structures subserve the core representational dimensions of the universal conceptual space of actions that, in Croft’s theory of GCs, constitutes the semantic foundation of verbs.

Crucially, regardless of what language one speaks, correspondences between object nouns and ventral brain regions, and between action verbs and dorsal brain regions, should reliably occur.

3. Language-particular aspects of grammatical categories

As the American structuralists originally discovered (e.g., [Bloomfield, 1933](#); [Harris, 1946, 1951](#)), and as [Croft \(2001\)](#) consistently emphasizes, when the distributional method is carefully adhered to in the study of particular languages, one often finds that the set of words that fill the role of a GC in one construction are rarely 100% identical to the set of words that fill the role of what is supposedly the same GC in another construction; instead there are distributional mismatches that spread far and wide across many constructions. This was robustly verified by [Gross \(1979\)](#), who found that in a large-scale grammatical model of French containing 12,000 words and 600 rules, no two words had exactly the same distribution across constructions, and no two constructions licensed exactly the same set of words. More recent research indicates that particular languages usually contain vast numbers of constructionally defined GCs arranged in complex networks or inheritance hierarchies (e.g., [Culicover, 1999](#); [Malouf, 2000](#); [Croft, 2001](#); [Taylor, 2004](#); [Haspelmath, 2007](#)). Regarding the noun–verb distinction, [Croft \(2001\)](#) maintains that this line of investigation leads inexorably to the seemingly “radical” conclusion that individual words in particular languages cannot be straightforwardly linked with maximally general symbols like [N] or [V], but must instead be associated with arrays of much more precise symbols for the various hierarchically organized, construction-specific GCs that license them. We elaborate this perspective in greater detail below, and discuss some of its consequences for cognitive neuroscience.

English has a morphological construction for number marking that allows words like *dog* and *cat* to be pluralized as *dogs* and *cats*, and it also has a morphological construction for tense marking that allows words like *walk* and *sprint* to be expressed in the past tense as *walked* and *sprinted*. According to [Croft \(2001\)](#), however, these constructions do not contain abstract GCs like [N] and [V]; instead, they define specific GCs like [N_{MORPH-NBR}] and [V_{MORPH-TNS}]. Why? Because English has many other nominal and verbal constructions as well, and most if not all of them involve GCs for uniquely restricted classes of words. For example, in the domain of nominal constructions, proper nouns must be distinguished from common nouns; the latter class breaks down further into count nouns and mass nouns; and each of those classes breaks down into even smaller and quirkier groupings, many of which exhibit interesting correspondences between grammatical behavior and semantic content (e.g., [Croft, 2000a](#)). Similarly, in the domain of verbal constructions, there are separate classes for monovalent, bivalent, and trivalent verbs, and each of them comprises multiple subclasses—again, many with well-studied correlations between morphosyntactic and semantic properties (e.g., [Levin, 1993](#)). Notably, developmental data suggest that children who learn English as a native language acquire these myriad, hierarchically organized GCs in a bottom-up, construction-specific, usage-based manner (e.g., [Tomasello, 2003](#)).

Complex networks of construction-specific GCs are also manifested in other languages, but in ways that often fail to pattern with Eurocentric conceptualizations of GCs. Ostensibly well-understood GCs like those in nominal constructions can fractionate into semantically motivated subclasses. For example, proto-Bantu morphology involves a complex agreement system that is sensitive to such semantic distinctions as living vs. man-made, human vs. animal, extended vs. non-extended, and cohesive vs. dispersive ([Demuth, 2000](#)). Similarly, in many languages, such as Haida, Tachelhit, and Lango, there are multiple possessive markers whose use depends on whether the possessed nominal is a body-part term, affinal kin term, consanguineal kin term, or other object term ([Dixon, 2010a](#), pp. 5–6). Close examination of verbal constructions in particular languages also reveals GCs that exhibit correlations between grammatical properties and semantic properties. For instance,

Wagiman and Jaminjung have a distinct GC—coverb—each member of which not only encodes a type of event but also selects for a unique closed-class generic verb on the basis of what *kind* of event is encoded (Wilson, 1999; Schultze-Berndt, 2000). Thus, manner of motion coverbs select for a generic *go*-type verb. Again, we see that conceptual classes motivate relevant grammatical groupings, a key claim of Croft's theory. Stepping back from the details, the main point is this: Close examination of particular languages does not reveal abstract, atomic GCs like [N] and [V], but leads instead to a proliferation of construction-specific GCs that often impose idiosyncratic semantic maps on the universal conceptual spaces of objects and actions.

Shifting to cognitive neuroscience, there is mounting evidence that the left posterior middle and inferior frontal gyri play essential roles in computing various types of inflectional morphology, such as number and tense marking, not only in English but also in a handful of other, mostly Indo-European, languages (for reviews see Shapiro and Caramazza, 2009; Bornkessel and Schlesewsky, 2009). These findings are impressive and valuable. However, the investigators usually assume that they are pinpointing the neural substrates of crosslinguistically universal and maximally general GCs like [N] and [V], when in fact they are only dealing with a few language-specific and construction-specific GCs. To be sure, the number and tense marking constructions that are typically used in such experiments involve GCs with relatively large memberships of words. But they still represent only a fraction of the inventories of GCs that populate particular languages. Moreover, the experiments usually do not distinguish between, on the one hand, the purely combinatorial process of affixation, and on the other, the relevant semantic features of the number and tense marking constructions. This is an important limitation, given that some languages, like Lahir, have separate number morphemes for singular, dual, trial, paucal, and larger quantities (Corbett, 2000), and some languages, like Bamilike-Dschang, make up to five tense contrasts in both the past and the future (Whaley, 1997).

Some neuroscientific research has begun to explore how certain narrowly defined classes of words are implemented in the brain, but most of this work has ignored the kinds of insights about language-particular GCs that come from a broad typological orientation. For example, there is a small but growing literature on the neural substrates of the count-mass distinction in English and in a few other languages (Semenza et al., 1997; Garrard et al., 2004; Bisiacchi et al., 2005; Taler et al., 2005; Vigliocco et al., 2005; Crutch and Warrington, 2007). These studies have generated some important empirical discoveries, but from a theoretical perspective most of them are rather parochial, since they do not consider the count-mass distinction in the context of the tremendous diversity of nominal classification systems that have been documented crosslinguistically (Senft, 2000; Aikhenvald, 2003). Explicitly embracing such diversity could have many advantages, such as helping to bridge the gap between the cognitive neuroscience of GCs and the cognitive neuroscience of conceptual knowledge. Similarly, a number of studies have explored the neural bases of particular types of transitive and intransitive verbs in English and in a few other languages, but most of them have ignored the typological literature on transitivity. As an illustration, several neuropsychological and neuroimaging studies have concentrated specifically on what is sometimes—rather confusingly (see Dixon, 2010b:155–156)—called the unergative-unaccusative distinction (Luzzatti et al., 2002; Thompson, 2003; Lee and Thompson, 2004; Shetreet et al., in press). However, none of them mention, let alone make use of, relevant findings about crosslinguistic patterns involving split intransitivity and clause alignment systems (e.g., DeLancey, 1981; Mithun, 1991; Croft, 1998; Dixon, 2010b). Because of these oversights, the studies fail to recognize the language-specific nature of the GCs under investigation, and this limits the inferences that can be drawn about how those GCs might be implemented in the brain. In short, what typology calls for is a new wave of research that directly probes the neural underpinnings of language-particular grammatical-semantic parcellations of the universal conceptual spaces of objects and actions.

4. Conclusion

Overall, we strongly endorse E&L's argument that typology has profound implications for the mind/brain sciences, and we share their vision of “a new neurocognition of language” that takes crosslinguistic diversity seriously (p. 480). In this commentary, we have focused on a single topic—GCs—in an effort to highlight some of the specific ways in which typology can inform neurolinguistics. The main take-home message is captured by the following question: Would the cognitive neuroscience of GCs look any different if the dominant language in the world were not English but rather, say, Makah, or Lango, or Jaminjung?

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References

- Aikhenvald, A., 2003. *Classifiers: A Typology of Noun Categorization Devices*. Oxford University Press, Oxford.
- Baker, M.C., 2003. *Lexical Categories: Verbs, Nouns, and Adjectives*. Cambridge University Press, Cambridge, UK.
- Bisang, W., in press. Word classes. In: Song, J.J. (Ed.), *The Oxford Handbook of Language Typology*. Oxford University Press, Oxford.
- Bisiacchi, P., Mondini, S., Angrilli, A., Marinelli, K., Semenza, C., 2005. Mass and count nouns show distinct EEG cortical processes during an explicit semantic task. *Brain and Language* 95, 98–99.
- Bloomfield, L., 1933. *Language*. Holt, Rinehart, & Winston, New York.

- Bornkessel, I., Schlesewsky, M., 2006. The Extended Argument Dependency Model: a neurocognitive approach to sentence comprehension across languages. *Psychological Review* 113, 787–821.
- Bornkessel, I., Schlesewsky, M., 2009. *Processing Syntax and Morphology: A Neurocognitive Perspective*. Oxford University Press, Oxford.
- Bowerman, M., Levinson, S.C. (Eds.), 2001. *Language Acquisition and Conceptual Development*. Cambridge University Press, Cambridge, UK.
- Corbett, G., 2000. *Number*. Cambridge University Press, Cambridge, UK.
- Croft, W., 1991. *Syntactic Categories and Grammatical Relations: The Cognitive Organization of Information*. University of Chicago Press, Chicago.
- Croft, W., 1998. Event structure in argument linking. In: Butt, M., Geuder, W. (Eds.), *The Projection of Arguments: Lexical and Compositional Factors*. CSLI, Stanford, pp. 21–64.
- Croft, W., 2000a. Countability in English Nouns Denoting Physical Entities: A Radical Construction Grammar Analysis. , Unpublished manuscript available at: <http://www.unm.edu/~wcroft/WACpubs.html>.
- Croft, W., 2000b. Parts of speech as typological universals and as language particular categories. In: Vogel, P., Comrie, B. (Eds.), *Approaches to the Typology of Word Classes*. Mouton de Gruyter, Berlin, pp. 65–102.
- Croft, W., 2001. *Radical Construction Grammar: Syntactic Theory in Typological Perspective*. Oxford University Press, Oxford.
- Croft, W., 2005. Word classes, parts of speech, and syntactic argumentation. *Linguistic Typology* 9, 431–441.
- Croft, W., 2007a. Beyond Aristotle and gradience: a reply to arts. *Studies in Language* 31, 409–430.
- Croft, W., 2007b. The origins of grammar in the verbalization of experience. *Cognitive Linguistics* 18, 339–382.
- Croft, W., 2009. Methods for finding language universals in syntax. In: Scalise, S., Magni, E., Bisetto, A. (Eds.), *Universals of Language Today*. Springer, New York, pp. 145–164.
- Crutch, S.J., Warrington, E.K., 2007. The semantic organization of mass nouns: evidence from semantic refractory access dysphasia. *Cortex* 43, 1031–1124.
- Culicover, P.W., 1999. *Syntactic Nuts: Hard Cases, Syntactic Theory, and Language Acquisition*. Oxford University Press, Oxford.
- DeLancey, S., 1981. An interpretation of split ergativity and related patterns. *Language* 57, 626–657.
- Demuth, K., 2000. Bantu noun class systems: loanword and acquisition evidence of semantic productivity. In: Senft, G. (Ed.), *Systems of Nominal Classification*. Cambridge University Press, Cambridge, UK, pp. 270–292.
- Dixon, R.M.W., 2010a. *Basic Linguistic Theory*, vol. 1, Methodology. Oxford University Press, Oxford.
- Dixon, R.M.W., 2010b. *Basic Linguistic Theory*, vol. 2, Grammatical Topics. Oxford University Press, Oxford.
- Evans, N., Levinson, S.C., 2009. The myth of language universals: language diversity and its importance for cognitive science. *Behavioral and Brain Sciences* 32, 429–492.
- Gainotti, G., 2006. Anatomical, functional, and cognitive determinants of semantic memory disorders. *Neuroscience and Biobehavioral Reviews* 30, 577–594.
- Garrard, P., Carroll, E., Vinson, D.P., Vigliocco, G., 2004. Dissociating lexico-semantics and lexico-syntax in semantic dementia. *Neurocase* 10, 353–362.
- Gentner, D., Goldin-Meadow, S. (Eds.), 2003. *Language in Mind: Advances in the Study of Language and Thought*. MIT Press, Cambridge, MA.
- Grafton, S.T., 2009. Embodied cognition and the simulation of action to understand others. *Annals of the New York Academy of Sciences* 1156, 97–117.
- Gross, M., 1979. On the failure of generative grammar. *Language* 55, 859–885.
- Guo, J., Lieven, E., Budwig, N., Ervin-Tripp, S., Nakamura, K., Ozcaliksan, S. (Eds.), 2008. *Crosslinguistic Approaches to the Study of Language: Research in the Tradition of Dan Isaac Slobin*. Psychology Press, Philadelphia.
- Harris, Z.S., 1946. From morpheme to utterance. *Language* 22, 161–183.
- Harris, Z.S., 1951. *Methods in Structural Linguistics*. University of Chicago Press, Chicago.
- Haspelmath, M., 2007. Pre-established categories don't exist: consequences for language description and typology. *Linguistic Typology* 11, 119–132.
- Kemmerer, D., 2010. How words capture visual experience: the perspective from cognitive neuroscience. In: Malt, B., Wolff, P. (Eds.), *Words and the Mind: How Words Capture Experience*. Oxford University Press, Oxford, pp. 289–329.
- Kemmerer, D., forthcoming. Visual and motor features of the meanings of action verbs: a cognitive neuroscience perspective. In: Almeida, R.G., Manouilidou, C. (Eds.), *Verb Concepts: Cognitive Science Perspectives on Verb Representation and Processing*. Oxford University Press, Oxford.
- Kemmerer, D., Gonzalez Castillo, J., 2010. The Two-Level Theory of verb meaning: an approach to integrating the semantics of action with the mirror neuron system. *Brain and Language* 112, 54–76.
- Lee, M., Thompson, C.K., 2004. Agrammatic aphasic production and comprehension of unaccusative verbs in sentence contexts. *Journal of Neurolinguistics* 17, 315–330.
- Levin, B., 1993. *English Verb Classes and Alternations*. University of Chicago Press, Chicago.
- Luzzatti, C., Raggi, R., Zonca, G., Pitarini, C., Contardi, A., Pinna, G.-D., 2002. Verb-noun double dissociation in aphasic lexical impairments: the role of word frequency and imageability. *Brain and Language* 81, 432–444.
- Malouf, R.P., 2000. *Mixed Categories in the Hierarchical Lexicon*. CSLI, Stanford.
- Malt, B., Wolff, P. (Eds.), 2010. *Words and the Mind: How Words Capture Experience*. Oxford University Press, Oxford.
- Martin, A., 2007. The representation of object concepts in the brain. *Annual Review of Psychology* 58, 25–45.
- Martin, A., 2009. Circuits in mind: the neural foundations for object concepts. In: Gazzaniga, M.S. (Ed.), *The Cognitive Neurosciences*. 4th edition. MIT Press, Cambridge, MA, pp. 1031–1046.
- Mithun, M., 1991. Active/agentive case marking and its motivations. *Language* 67, 510–546.
- Pulvermüller, F., 2005. Brain mechanisms linking language and action. *Nature Reviews Neuroscience* 6, 576–582.
- Pulvermüller, F., 2008. Brain embodiment of category-specific semantic memory circuits. In: Semin, G.R., Smith, E.R. (Eds.), *Embodied Grounding: Social, Cognitive, Affective, and Neuroscientific Approaches*. Cambridge University Press, Cambridge, UK, pp. 71–97.
- Schultze-Berndt, E., 2000. Simple and Complex Verbs in Jaminjung: A Study of Event Categorization in an Australian Language. (MPI Series in Psycholinguistics, 14) University of Nijmegen, Nijmegen.
- Semenza, C., Mondini, S., Cappelletti, M., 1997. The grammatical properties of mass nouns: an aphasia case study. *Neuropsychologia* 35, 669–675.
- Senft, G. (Ed.), 2000. *Systems of Nominal Classification*. Cambridge University Press, Cambridge.
- Shapiro, K., Caramazza, A., 2004. The organization of lexical knowledge in the brain: the grammatical dimension. In: Gazzaniga, M.S. (Ed.), *The Cognitive Neurosciences*. 3rd edition. MIT Press, Cambridge, MA, pp. 803–814.
- Shapiro, K., Caramazza, A., 2009. Morphological processes in language production. In: Gazzaniga, M.S. (Ed.), *The Cognitive Neurosciences*. 4th edition. MIT Press, Cambridge, MA, pp. 777–788.
- Shetreet, E., Friedmann, N., Hadar, U., in press. The neural correlates of linguistic distinctions: unaccusative and unergative verbs. *Journal of Cognitive Neuroscience*.
- Taler, V., Jarema, G., Saumier, D., 2005. Semantic and syntactic aspects of the mass/count distinction: a case study of semantic dementia. *Brain and Cognition* 57, 222–225.
- Taylor, J.R., 2004. *Linguistic Categorization: Prototypes in Linguistic Theory*, 2nd edition. Oxford University Press, Oxford.
- Thompson, C.K., 2003. Unaccusative verb production in agrammatic aphasia: the argument structure complexity hypothesis. *Journal of Neurolinguistics* 16, 151–167.
- Tomasello, M., 2003. *Constructing a Language: A Usage-Based Theory of Language Acquisition*. Harvard University Press, Boston.
- Vigliocco, G., Vinson, D.P., Druks, J., Barber, H., Cappa, S.F., submitted for publication. Nouns and verbs in the brain: a review of behavioural, electrophysiological, neuropsychological, and imaging studies. *Neuroscience and Biobehavioral Reviews*.
- Vigliocco, G., Garrard, P., Vinson, D.P., Carroll, E., 2005. Dissociating semantics and English count-mass: evidence from semantic dementia and progressive non-fluent aphasia. *Brain and Language* 95, 96–97.
- Vogel, P.M., Comrie, B. (Eds.), 2000. *Approaches to the Typology of Word Classes*. Mouton de Gruyter, Berlin.
- Whaley, L.J., 1997. *Introduction to Typology: The Unity and Diversity of Language*. Sage, Thousand Oaks.
- Wilson, S., 1999. *Coverbs and Complex Predicates in Wagiman*. CSLI Publications, Stanford.