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Review

Body ownership and beyond: Connections between cognitive neuroscience and linguistic typology

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ABSTRACT

During the past few decades, two disciplines that rarely come together—namely, cognitive neuroscience and linguistic typology—have been generating remarkably similar results regarding the representational domain of personal possessions. Research in cognitive neuroscience indicates that although the core self is grounded in body ownership, the extended self encompasses a variety of noncorporeal possessions, especially those that play a key role in defining one's identity. And research in linguistic typology indicates that many languages around the world contain a distinct grammatical construction for encoding what is commonly called "inalienable" possession—a category of owned objects that almost always includes body parts, but that also tends to include several other kinds of personally relevant entities. Both of these independent lines of investigation are summarized, and a number of interdisciplinary connections between them are discussed.

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1. Introduction

It is well-established that many aspects of consciousness, cognition, and culture are reflected in the way we talk (e.g., Enfield, 2002; Jackendoff, 2007; Malt & Wolff, 2010; Pinker, 2007). But so far only a few studies have demonstrated in detail how, for particular representational domains, mutually informative interdisciplinary connections can be made between, on the one hand, cognitive neuroscience, which investigates the neural implementation of all forms of psychological

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phenomena, and on the other hand, linguistic typology, which investigates similarities and differences among the roughly 6000 languages in the world (e.g., Bornkessel-Schlesewsky & Schlesewsky, 2013; Giraud et al., 2007; Kemmerer, 2006, 2012). The purpose of this paper is to pursue precisely this kind of cross-field integration, specifically by showing that, during the past few decades, cognitive neuroscience and linguistic typology have been developing, in their own separate ways, closely related treatments of a mental domain that is fundamental to human identity, namely personal possessions, with special reference to body parts and certain noncorporeal classes of entities.

Back in the late 19th century, William James (1890) made some seminal observations about the nature of the self, noting that even though one's identity is clearly centered in one's body, it extends beyond the boundaries of the skin to incorporate many other possessions, including those that one is frequently in physical contact with (e.g., clothing, jewelry, sentimental objects, etc.) and those that one is tightly bound to in other ways (e.g., family members, reputation, creative accomplishments, etc.). As James (1890, pp. 291–2) put it, "a man's Self is the sum total of all that he CAN call his, not only his body and his psychic powers, but his clothes and his house, his wife and children, his ancestors and friends, his reputation and works, his lands and yacht and bank-account. All these things give him the same emotions. If they wax and prosper, he feels triumphant; if they dwindle and die away, he feels cast down—not necessarily in the same degree for each thing, but in much the same way for all." It has already been shown that these ideas are highly relevant to behavioral economics and several branches of psychology (Belk, 1988; Belk, 1991; see also Jarrett, 2013). Here the goal is to show that they also underlie some striking parallels between cognitive neuroscience and linguistic typology.

The first section reviews recent research in cognitive neuroscience which indicates that, in keeping with James's original insights, there seems to be a continuum between the core self, which depends on body ownership, and the extended self, which encompasses extracorporeal possessions, especially privileged ones. The next section then reviews recent research in linguistic typology which indicates that in many languages around the world, a distinct grammatical construction is used to encode what is generally referred to as "inalienable" possession. Although the scope of this conceptual category varies across cultures, it is usually restricted to certain subsets of entities that fall along the aforementioned continuum between the core self and the extended self, most notably body parts, family members, mental traits/states, and objects that are conventionally considered to be integral to one's identity. Finally, the last section discusses some of the implications of these intriguing correspondences between cognitive neuroscience and linguistic typology.

2. Cognitive neuroscience and the continuum between the core self and the extended self

Recent theoretical and empirical work has led to the view that the experience of "being someone"—that is, of having a core self—requires, at a minimum, the following features: identification with a body; spatiotemporal self-location within that body; and a first-person perspective from that body, typically anchored behind the eyes (Blanke & Metzinger, 2009). The main focus here is on the first feature, which is usually called body ownership.

The precise nature of body ownership remains mysterious, but the dominant hypothesis is that it depends on multisensory integration operating in the context of a stored predictive model of the body schema (Apps & Tsakiris, 2014; Blanke, 2012; Ehrsson, 2012; Tsakiris, 2010). For example, when one moves through the world, one receives tightly correlated visual and proprioceptive signals about the dynamically changing positions of one's body parts. Similarly, when one sees something contact the surface of one's body, one receives tightly correlated visual and tactile signals about the location on the skin where the contact occurred. Such multisensory afferents converge in high-level cortical regions where they are integrated to form a continuously updated representation of one's body in space. In conjunction with the sense of agency and a lifelong background of egocentrically framed corporeal experience, these sorts of close associations among multiple perceptual inputs are interpreted as self-specifying and hence give rise to body ownership—the feeling that this particular body is "mine."

Some of the most compelling evidence for this hypothesis comes from a number of studies in which striking body illusions are induced by means of intersensory conflict. For example, in the classic "rubber hand illusion" (Botvinick & Cohen, 1998), brush strokes are applied synchronously and repeatedly to the participant's real hand, which is hidden from view, and to a life-sized realistic rubber hand, which is in full view. After a short period (about 10–30 s), most participants (about 70%) begin to experience some strange sensations. Not only do they feel the strokes at the location of the rubber hand rather than the real hand, but they feel as if the rubber hand has become their own. This remarkable illusion is triggered by an overriding of proprioceptive signals by visual information—a process which reveals that the representation of body ownership is not rigid but instead quite plastic, being easily modifiable by simple experimental manipulation. Moreover, the occurrence of the illusion has been confirmed not only by subjective reports, but also by a variety of objective measures, including proprioceptive drift (when participants are asked to close their eyes and point to the location of their real hand, their errors are toward the location of the rubber hand), simulated injury (when the rubber hand is threatened with a sharp instrument, skin conductance responses are elevated), and temperature drop (the real hand cools by up to 0.27 °C, and the amount of change correlates with the strength of the illusion). The illusion does not work, however, if the brush strokes are asynchronous, if the rubber hand is too far away, or if a noncorporeal object, like a wooden block, is substituted for the rubber hand. For a review of these findings see Ehrsson (2012), and for other relevant results see Tsakiris, Tajadura-Jimenez, and Costantini (2011), Maister, Sebanz, Knoblich, and Tsakiris (2013), and Moguillansky, O'Regan, and Petitmengin (2013).

Additional evidence for the integration hypothesis comes from full body illusions, many of which employ a set-up in which the participant receives tactile stimulation on part of their real body (e.g., the abdomen) while simultaneously seeing,