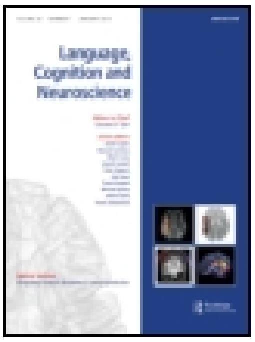

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COMMENTARY

Nominal classification is not positive evidence for language relativity: a commentary on Kemmerer (2016)

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An English speaker and a Mandarin Chinese speaker see two things. The English speaker says "a hammer" and "a snake". The Chinese speaker says "yi [ba] chuizi" (one [ba] hammer) and "yi [tiao] she" (one [tiao] snake). [Ba] and [tiao] are nominal classifiers. The former is usually associated with artefacts that have a handle that can be manipulated and the latter with long things. Does this mean that the conceptual representations of hammer and snake are different for English and Chinese speakers?

The majority of the current research on conceptual representation focuses on universal aspects of object concepts and has revealed domain-specific and modality-specific knowledge dimensions (Binder & Desai, 2011; Chao, Haxby, & Martin, 1999; Epstein & Kanwisher, 1998; Fernandino et al., 2015; Kanwisher, 2010; Mahon & Caramazza, 2011; Martin, Haxby, Lalonde, Wiggs, & Ungerleider, 1995; Miceli et al., 2001; Patterson, Nestor, & Rogers, 2007). Kemmerer (2016) noted the importance of studying language-related variations in conceptual representations and highlighted nominal classification. He reviewed an impressive range of nominal classification languages, analysed semantic parameters that are associated with classifiers, and related them to the most up-to-date findings of the neurobiology of object concepts. This review leads to two central observations: (1) The nominal classification across languages tends to associate with several types of semantic parameters, including animacy, shape, size, and function, which correspond exactly to the organising dimensions for object representation in the visual ventral pathway (ventral temporal cortex, VTC; see Chen, Garcea, & Mahon, 2016; Grill-Spector & Weiner, 2014; Konkle & Caramazza, 2013; Konkle & Oliva, 2012; Kriegeskorte et al., 2008; Nasr, Echavarria, & Tootell, 2014; Wang et al., 2015); (2) There are also many rather unusual classifiers that are associated with highly specific, narrow semantic parameters within these large structures, such as loop- or teardrop-shaped objects, that had not been noticed as salient features in object processing.

These analyses of semantic typology and object conceptual representation findings led to the conclusion that

> … many typological phenomena involving object concepts conform to, and hence help to substantiate, prominent results and ideas in cognitive neuroscience; however, it also suggests that current theories and research may need to be expanded to handle the full range of semantic diversity in this domain.

I fully agree. Critically, the author went one step further: "the extant data from semantic typology are already sufficient to motivate the hypothesis that the ways in which categories of object concepts are organized and represented in the brain reflect not only universal tendencies but also language-particular idiosyncrasies". And that

> This proposal predicts that even during non-linguistic perception and action, processing in modality-specific cortical regions sometimes engages representations that instantiate the modality specific components of word meanings, which are typologically unique to the given person's language … this engagement sometimes modulates subsequent processing in ways that are, *ipso facto*, linguistically biased (though not necessarily linguistically constrained).

I focus in this commentary on the latter, more provocative point: because many languages have classifiers and they differ in terms of the semantic variables that classifiers draw, their object concepts are different and are also different from languages without classifiers. My main point is the following: from the fact that different languages have language elements that draw upon different aspects of the semantic system, it does not follow that the semantic system itself is different. I propose an alternative: classifier selection relies at last

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partly on the linguistic agreement rules with its head nouns, and thus, many of the variations across languages are simply linguistic rule variations. I will then present some existing cognitive and neuroimaging evidence that are relevant for this argument. Given that the author suggested Mandarin Chinese to be an optimal candidate language to test his proposals due to the rich nominal classifier systems and the availability of speakers, I will use Chinese as the example.

An alternative: similar concepts, different lexical associations

I propose a simple alternative. The object conceptual representations are universal across languages. This does not mean that there are no individual differences – one's concepts may be coloured by personal experience and culture-related knowledge. Some concepts are simply learned by some individuals and not others (e.g. consider the concept of "quantum" to a physicist versus a layperson; or knowledge about a particular person to his/her acquaintances versus strangers). The central point here, however, is that linguistic properties do not change semantic representations systematically. Languages vary by mapping between the semantic system and the verbal system. In languages with grammatical gender, nouns denoting the same object in different languages vary by gender and the determiners they take, which does not make the object concept more feminine or masculine. In classifier languages, nouns denoting the same object in different languages may vary by the classifiers they take and the relevant semantic parameters that are predictive of the classifier selection. In computer languages, different programming languages use different syntaxes to implement the same ideas. It is important to note that this does not mean that semantic typology is irrelevant for the study of concepts. The specific fine-grained dimensions in various languages provide excellent novel entry points to test the underlying dimensions of conceptual space. In contrast to Kemmerer (2016), who postulated that they reflect language-specific semantic dimensions, I argue that they reflect universal semantic dimensions that are picked up by the language grammatical systems in some languages but not others.

I use Mandarin Chinese here as an example to explain that the correspondence between object concepts and classifiers is rather opaque. Like the other classifier languages Kemmerer (2016) reviewed, semantic parameters such as "animacy", "shape", "use", and "humanness" drive Chinese classifier usage to various degrees (Shi, 1996; Tai, 1994; Tai & Chao, 1994; Tai & Wang, 1990). However, it is not systematic which criterion (e.g. shape or category) applies for a given noun. Shall a snake take an "animacy" classifier or an "elongated shape" classier? Additionally, some members of a classifier cohort may not be related to other members (e.g. Allan, 1977). For instance, nouns referring to animals tend to use the classifier /zhi1/ (e.g. cat, mouse, bird and exceptions include horse, zebra, etc.). Nouns referring to objects with an elongated shape tend to use the classifier /tiao2/ (e.g. river, pants, fish and exceptions include wire etc.). Often, more than one classifier is associated with nouns referring to objects of a given physical shape or from a given category. Both /zhi1/ and /gen1/ are associated with long and thin objects, and which object should be used is usually quite arbitrary. Taken together, the mapping between conceptual properties and classifiers is not unequivocal or transparent and specific noun-classifier associations have to be known by speakers to be used appropriately. The difference of classifier usage may be more about linguistic rules than semantic differences.

Reconsidering the evidence for language relativity

As Kemmerer (2016) noted, there is currently little positive empirical evidence for the language-specific classifier effect on conceptual tasks. Among the few that was cited to support his position was Srinivasan (2010), where Mandarin speakers and non-classifier speakers counted target items as quickly as possible while ignoring distractor objects. The Mandarin speakers, but not the English or Russian speakers, took longer to count target objects (e.g. hammers) when the distractors had the same classifier than when the distractors had a different classifier. The results were taken to indicate that the meanings of classifiers were activated automatically by the picture input and thus the interference effect. However, it is also possible that the lexical form of the classifiers were automatically activated and created an interference effect at the lexical form level.

We have conducted a study that is also relevant to the current discussion (Bi, Yu, Geng, & Alario, 2010). In a blocked picture naming experiment, Chinese speakers were asked to name the picture with either a bare noun or classifier noun phrase, which are both natural, in separate experiments. Two conceptual dimensions – semantic category and visual shape – were tested. Greater semantic category interference with phrases than with nouns was observed, suggesting similar semantic categorical effects for both classifier and noun selection. Importantly, items with similar shapes produced an interference effect when they were named with classifier–noun phrases, but not with bare nouns. That is, object shape modulated classifier, but not noun selection. The absence of shape effect in the bare noun condition was consistent with findings using picture–word interference and visual world paradigms in Indo-European languages (Huettig & Hartsuiker, 2008; Mahon, Costa, Peterson, Vargas, & Caramazza, 2007), and also suggested that the shape interference in phrase production did not arise from the picture recognition or object conceptual retrieval per se. We reasoned that the classifier-specific shape interference might stem from an increased difficulty in selecting the target classifier representation at the lexical or response levels. Given that shape is one dimension along which classifier–noun is associated, other candidate classifiers consistent with the target object shape were more strongly activated and lead to greater interference in the homogeneous condition. Despite facets of visual shape being activated to enable classifier selection, these facets did not promote interference among nouns. Thus, the condition for observing interference lies in the long-term mapping between the meaning to be expressed and the representations of the words. For nouns and some classifiers, such meaning relies mostly on category membership. For other classifiers, but not for nouns, the core meanings to be expressed lie in the visual shape of the object. In line with this reasoning, a dimension of meaning characterising actions or events – thematic structure – has been shown to drive interference effects during verb production in the picture–word task (Tabossi, Collina, & Sanz, 2002).

Further evidence for the language universality of concepts

Kemmerer (2016) also made interesting predictions about the cross-linguistic differences in the currently well-established dimensions of object concepts. For the animacy effect in VTC in speakers of non-classifier languages, he argued that the results seem to be in conflict, with majority of studies showing an animate/inanimate dichotomy (e.g. Grill-Spector & Weiner, 2014; Kriegeskorte et al., 2008; Mur et al., 2013) and some studies showing the animacy to be more gradient in nature (Connolly et al., 2012; Sha et al., 2012). He then postulated that classifier languages that include classifiers with animacy parameters might have a more dichromatic animacy distinction in VTC object representation. However, while animacy is the strongest dimension in VTC representation in both humans and nonhuman primates, gradients within each domain have long been reported, with faces and bodies being different from animals and small tools being different from large non-manipulable objects (Konkle & Caramazza, 2013; Mahon, Milleville et al., 2007). Second, there are indeed already quite a few studies on object representation in VTC with Chinese speakers. Both the animate/inanimate distinction and the gradients within animate and inanimate domains have been observed (He et al., 2013; Peelen et al., 2013; Wang et al., 2015), with perfect similarity to English speakers.

I wish to bring up another domain of research that highlights how classifiers take on the existing universal dimensions of the conceptual system – the developmental perspective. Loke and Harrison (1986) observed that Chinese-speaking children acquire shape classifiers earlier than function classifiers and non-extension round shape classifiers earlier than extended shape classifiers. This order is consistent with the order of concept acquisition (Andersen, 1978), which indicates that the same universal natural categorisation principles underlie classifier and semantic development (see also Erbaugh, 1986).

To conclude, Kemmerer's (2016) demonstration of how the major dimensions of the nominal classification system conforms to object conceptual dimensions observed in neuroscience, beautifully demonstrates how language-specific features have common roots in the universal conceptual space in humans. His argument that we should also pay more attention to variations of conceptual representation across individuals and cultures should be fully embraced. His proposal that the many highly specific semantic aspects that the classifier systems use offers new potential dimensions for object concept research, such as the useful elements of shape representation and further distinctions of various animate categories, is also highly illuminating. However, instead of saying that they are *ipso facto* evidence for cross-linguistic differences for object conceptual representation, I argue that they are likely to reflect significant potential dimensions for all speakers. Classifiers simply draw upon various aspects of semantics. Most of them draw on the major dimensions and some draw on more fine-grained dimensions. I thus make the following prediction instead: if we look closer, we will find that shape representations can be parcellated to loop- or teardrop-shaped elements for speakers of all languages, including non-classifier ones. To answer the question posed in the opening paragraph, the English and Chinese speakers represent the concepts ("snake" and "hammer") similarly. Chinese speakers use further dimensions, including elongated shape and manipulation, and also agreement rules with the corresponding head nouns, to retrieve the additional classifier lexical forms.

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