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COMMENTARY

Flexible concepts: a commentary on Kemmerer (2016)

Diane Pecher and Rolf A. Zwaan

Psychology Department, Erasmus University Rotterdam, Rotterdam, Netherlands

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Kemmerer (2016) argues that researchers have the mistaken assumption that the conceptual system has the same organisational structure for every individual. He does not question whether the neural structures that are used for concepts are universal, rather he questions whether within those structures concepts are represented in the same way for everyone. That is, are the way in which an office clerk in Rotterdam represents animals or tools the same as the way in which an aboriginal hunter in Australia represents them? The only realistic answer to this question is "no". Obviously, there have to be differences, because these people inhabit different worlds and live completely different lives. Even if they spoke the same language, their conceptual systems must differ, because if they were made to swap places, they would be lost. Thus, their conceptual systems must be adapted to their own environment, and not just because of differences in their grammars. In fact, because concepts are learned any difference in the learning environment will be reflected in conceptual structure. Thus, at least in cognitive psychology, the consensus is that people's conceptual structures vary between individuals.

A more interesting point is that concepts exhibit strong variation in time within individuals. For example, participants who provided definitions for concepts (e.g. *bird*) were asked to return two weeks later to provide definitions again for the same concepts (Barsalou, 1993). The overlap in information given by the same participant between the two occasions was only 66%, suggesting that there is substantial flexibility in concepts. It seems reasonable to assume that the content of memory, that is, all information that has been stored in a person's memory over a lifetime, is quite stable and, apart from some accumulation of knowledge, the content of memory changes only very slowly. This account remains speculative, of course, because we have no direct access to what is stored in memory. Rather, we can study particular concepts, that is, the information that is retrieved from memory at a particular moment to form a mental representation. What is retrieved on a specific occasion, however, is very flexible and should be considered the result of a constructive process involving only a subset of a person's knowledge rather than passive retrieval of stable information (Barsalou, 1993; see Lebois, Wilson-Mendenhall, & Barsalou, 2015; Yee & Thompson-Schill, 2016 for recent discussions).

The flexible nature of concepts was already shown in an early study by Thomson and Tulving (1970, see also Zeelenberg, 2005) in which participants studied words (e.g. *chair*) for a later memory test. The critical manipulation was the cue provided during test. For words studied in isolation a strong associate of the target word (e.g. *table*) resulted in superior recall to a weak associate (e.g. *glue*). This advantage was reversed, however, if the target word had been studied in the context of the weak associate. Thus, the representation of *chair* was altered by the presence of the word *glue* to such a degree that *table* no longer provided a good retrieval cue. Another striking finding is that nonstudied words may be better retrieval cues than studied words if the nonstudied word is a better representation the meaning evoked by the context. For example, *basket* is a better retrieval cue than *container* for the sentence *The container held the apples* (Anderson et al., 1976), suggesting that *container* was instantiated as *basket* during study.

These studies show an effect of overlap in activated meaning between study and test for explicit memory retrieval. In explicit memory tasks people will use conscious strategies such as trying to use cues to search for the particular study episode in memory. In meaning activation, people also search memory in order to form a mental representation of the meaning of a word (the concept) but not consciously. One could argue that the cue generation processes during explicit retrieval strategies are different from the processes that underlie

CONTACT Diane Pecher pecher@fsw.eur.nl

activation of concepts. Barsalou (1993) suggested, however, that concepts also depend on context and recent experiences. Several studies have shown that the activated meaning of words is affected by the current sentence context (Barsalou, 1982; Conrad, 1978; Tabossi, 1988) and by other recent contexts (Cabeza, 1994; Mulligan, Guyer, & Beland, 1999; Pecher, Zanolie, & Zeelenberg, 2007; Pecher, Zeelenberg, & Barsalou, 2004; Van Dantzig, Cowell, Zeelenberg, & Pecher, 2011; Vriezen, Moscovitch, & Bellos, 1995; Zeelenberg, Pecher, Shiffrin, & Raaijmakers, 2003). For example, *The children played with buckets and scoops on the beach* is more likely to activate the feature *sand* for *beach* than *He had a nice tan after a day on the beach*. Thus, people may activate different concepts for the same unambiguous words depending on context.

The examples that Kemmerer describes may throw an interesting light on the online processing of language. Several studies have shown that the shape of objects is activated during online comprehension (e.g. Kellenbach, Wijers, & Mulder, 2000; Pecher, Van Dantzig, Zwaan, & Zeelenberg, 2009; Pecher, Zeelenberg, & Raaijmakers, 1998; Schreuder, Flores d'Arcais, & Glazenborg, 1984; Zwaan & Pecher, 2012; Zwaan, Stanfield, & Yaxley, 2002). Kemmerer discusses languages that have a shape-related classifier system, such as Haida. Languages that are typically used in research in shape activation during language comprehension, such as English or Dutch, do not have such classifiers. Speakers of these Indo-European languages, however, can mentally represent object shape in response to linguistic stimuli. Zwaan *et al*. showed that people mentally represent a particular shape for objects dependent on the sentence context. For example, they are more likely to represent a bird with outstretched wings than with folded wings after the sentence *The ranger saw the eagle in the sky* but the opposite is true after the sentence *The ranger saw the eagle in the nest*. When people process object nouns in isolation, they may not automatically activate the object's shape, but recent experiences with the noun in a context that makes shape relevant influences later meaning activation for the same noun (Pecher et al., 1998, 2009). These findings suggest that, although shape may not be automatically activated for isolated nouns, it will be in meaningful contexts. Thus, the interesting question is not so much if the conceptual systems of people speaking Dutch or Haida differ in terms of how shape is represented, but if Haida speakers more automatically activate shape than Dutch speakers. Although research shows that it only takes a bit of context to activate shape, it is possible that speakers of languages with a shape-related classifier system activate shape automatically even for isolated nouns. It is interesting to speculate how having a grammatically encoded feature for shape plays out in online comprehension. Prima facie, the grammatically encoded shape feature should bring about more visual activation than is found in languages without this feature. However, the feature is not always predictive; for example, OBLONG is also used for a trampled banana. Perhaps the feature does not affect processing for this reason. However, if mismatches are rare, one might predict that the feature is not ignored and therefore creates interference in case of a mismatch (OBLONG-trampled banana) but otherwise facilitation. A fruitful line of research could be launched to investigate these questions.

These examples show that cognitive psychologists do not see the human conceptual system as a stable and rigid system, but rather as a fluid and constant reconstructive process in which context determines the content of concepts. The categorisation that may occur due to classifiers seems to be available to speakers of different languages as well. When people use classifiers that categorise objects by a particular attribute such as shape, the classifier may cause shape to be a frequent attribute in the mental concept, whereas it may be less so for speakers of different languages.

What does it mean that concepts are *organised*? A strict hierarchical structure of conceptual memory has already been refuted in early seventies (Rips, Shoben, & Smith, 1973). A strict hierarchy entails that categories are containers, where each concept has to be inside a container. That would entail that concepts cannot be in more than one category. However, *apples* can be categorised as fruits, foods, red things, round things, ingredients for pie, things that fall down, things that are associated with the original sin, etc. (Barsalou, 1983). As we have argued above, conceptual structure is highly flexible, so it seems unlikely that the conceptual system has a clear structure. More likely, concepts are represented by sets of features in a multidimensional feature space (Masson, 1995; McRae, De Sa, & Seidenberg, 1997; Plaut, 2002). In each context, a different subset of features might be activated for a concept (Barsalou, 1982; 1993; Lebois et al., 2015; Yee & Thompson-Schill, 2016; Zwaan, 2016). Classifiers may constitute a particular context in which particular features are made salient. That concepts differ between people who speak different languages or live in different cultures does not mean that their conceptual systems are fundamentally different. Although they may activate different subsets of features, the underlying mechanism might be the same. We agree with Kemmerer that currently there is not much research that addresses this question. Studying the role of classifiers in the activation of concepts, and their impact on language processing, will

provide important new insights into the flexibility of the human conceptual system.

Disclosure statement

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