REPLY


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In Kousta, Vigliocco, Vinson, Andrews, and Del Campo (2011), we presented an embodied theory of semantic representation, which crucially included abstract concepts as internally embodied via affective states. Paivio (2013) took issue with our treatment of dual coding theory, our reliance on data from lexical decision, and our theoretical proposal. Here, we address these different issues and clarify how our findings offer a way to move forward in the investigation of how abstract concepts are represented.

Keywords: abstract concepts, dual-coding theory, semantic memory, embodied cognition

Kousta, Vigliocco, Vinson, Andrews, and Del Campo (2011) presented an embodied theory of semantic representation according to which, concrete concepts and words are grounded primarily in our experience with the physical environment around us, whereas abstract concepts and words are grounded primarily in our internal, affective states. The basis for this theoretical account is a behavioral investigation of the differences between concrete and abstract words, reporting three lexical decision experiments and large scale regression analyses of lexical decision reaction times (RTs) from the English Lexicon Project (ELP; Balota et al., 2007). After controlling for imageability and context availability, along with a large number of other lexical and sublexical variables, Kousta et al. (2011) found that abstract words have a processing advantage over concrete words. We explained this residual RT advantage for abstract words in terms of words’ emotional content (i.e., valence), as the abstract–concrete difference was eliminated once valence ratings were also taken into account. In his critical review, Paivio (2013) challenged our criticism of dual coding theory (DCT), and our theoretical proposal. Below, we comment on both issues in turn.

On Kousta et al.'s (2011) Interpretation of Paivio’s Dual Coding Theory

Paivio (2013) wrote, “Their dual coding critique is, however, based on impoverished and, in some respects, incorrect interpretations of the theory and its implications” (p. 282). Regarding our impoverished interpretation, he noted that there is far more, in terms of structural, processing, and functional assumptions to DCT than what Kousta et al. discussed. Once considered in its globality, DCT is a general cognitive theory that can serve as a framework to interpret a large number of effects involving different tasks and contextual information (Paivio, 2013). We appreciate that there is much more to DCT than the brief description provided in Kousta et al.; however, we maintain that the primary point (under DCT, processing of concrete words benefits from information from multiple systems) is a reasonable depiction of DCT’s core assumptions in relation to differences between concrete and abstract words. Paivio (2013) further noted that if DCT is considered at this general level, then it may be able to accommodate many previous findings, especially those emerging from cognitive neuroscience that were argued to be problematic for DCT by Kousta et al. While we disagree about the extent to which DCT can account for the range of findings reported in this literature, it is clearly well beyond the scope of the present reply to answer this question. Rather, we focus on the specific empirical contribution of Kousta et al., arguing that DCT either makes opposite predictions or is silent.

The novel results reported by Kousta et al. (2011) that require an explanation are as follows. When imageability and context availability are controlled (along with other lexical factors often confounded in previous studies such as familiarity), (a) abstract words tend to be more emotionally valenced than are concrete words, (b) abstract words tend to be processed faster than are concrete words, and (c) the differences in valence between abstract words and
concrete words explain the difference in processing time between the two, thus strongly indicating that valence mediates the abstractness effect that we have observed. We consider this effect of emotion to be central to the question of processing abstract and concrete words.

DCT recognizes a role for motivation and emotion (Paivio, 2007). Within DCT, emotions are considered to be directly represented only in the nonverbal system, but connected to emotional language, with the further assumption that language can also assume generic emotional connotations via conditioning (Paivio, 2007, pp. 94–95). In our reading, however, DCT has difficulty accounting for the strong association between the abstractness and the emotional valence of words that is at the core of the findings reported by Kousta et al. (2011). Abstract words within DCT are considered to be represented within the verbal system. Thus, an effect of emotional valence for abstract words referring to emotion could be accounted for in terms of the generic emotional connotations of these words that is established via conditioning. However, our data showed an effect of emotional valence beyond the set of words referring to emotions. Under DCT these emotional connotations would have to be derived via links to the imagistic system. As abstract words are linked to this system far less than are concrete words, emotional effects should be stronger for concrete words than for abstract words, namely, the opposite of what Kousta et al. found.

Paivio mentioned one study (Paivio, 1978) in which subjects were fastest in making valence judgments for pictures and slowest for abstract words (with concrete words in the middle). This result is at odds with our findings of a greater role for emotion in the representation of abstract words. However, the jury is out regarding whether the results of Paivio (1978) would be replicated with more stringent lexical control of the stimuli (see Kousta, Vinson, & Vigliocco, 2009, for an illustration of how failure to control crucial variables may produce entirely different conclusions concerning the role of emotion on lexical processing).

Of course, one can argue than that lexical decision is not an appropriate task to assess predictions by DCT because lexical decision only taps into early processes, whereas the engagement of the imagistic system would occur later (Paivio, 2013, pp. 282). Semantic effects are, however, consistently observed in lexical decision, whether reflected in the thousands of studies in which semantic priming is observed (e.g., Lucas, 2000; Neely, 1991) or reflected in numerous other studies showing the effects of semantic variables at the single-word level (e.g., Balota, Yap, Cortese, & Watson, 2008; Chumbley & Balota, 1984; James, 1975). In addition to the effects of concreteness that we already mentioned, Kousta et al. (2011) also found effects of other semantic variables, such as imageability, context availability, and emotional valence. Thus, lexical decision taps into automatic meaning activation and not just into form-based aspects of words. This, of course, does not mean that a replication, with a different task, of the advantage for abstract words observed by Kousta et al. using lexical decision would not be desirable.

Paivio (2013) further noted that our interpretation of certain aspects of DCT is incorrect, given that we wrote, "from a theoretical point of view, imageability ratings are a proxy for concreteness only in the dual coding theory and not, for example, in the context availability hypothesis" (Kousta et al., 2011, p. 16). The crucial word here is *ratings*—we did not claim that according to DCT, the concepts of concreteness and imagery are identical. We did follow Paivio et al. (1968), however, in claiming that according to DCT, imageability ratings tap into the ontological distinction that the concept of concreteness indexes; that the two scales are virtually identical, and in this sense, imageability ratings can function as a proxy for concreteness because the two scales “appear to be defining a common dimension of word meaning derived from associations of the words with concrete objects and events”; and that "for research purposes either scale, or a combination of the two, can be used for item selection" (Paivio et al., 1968, p. 7).

It is this conflation of the scales (due to the high correlation between concreteness and imageability ratings) that obscured the distinction between concreteness and imagery as concepts in the previous literature and that we sought to elucidate in our article (see especially the discussion on p. 14 in Kousta et al., 2011)—in this respect, we maintain that we interpreted the above quotes from Paivio et al. (1968) correctly in our article when we asserted that imageability ratings are a proxy for (the concept of) concreteness in DCT. To our mind, the statement that “the major effective psychological attribute underlying linguistic abstractness—concreteness was postulated to be imagery” (Paivio et al., 1968, p. 2, quoted in Paivio, 2013) is equivalent to our statement that the scale of imageability is a proxy for the concept of concreteness in DCT. Relatively, the quotes above from Paivio et al. (1968) support our claim the differences between the two scales are considered in the literature to be noise—otherwise, what reason would there be for the advice to use the two scales interchangeably for research purposes if the differences between the two scales were not theoretically meaningful?

**On Paivio’s Interpretation of Kousta et al.’s (2011) Theoretical Proposal**

Kousta et al. (2011) presented a theoretical proposal based on the following three main assumptions:

1. Two classes of information contribute to the representation of all concepts (both concrete and abstract): experiential (sensory, motor, and affective) and linguistic (verbal associations arising through patterns of co-occurrence and syntactic information).

2. Differences between concrete and abstract word meanings, as well as differences within each domain (i.e., the domain of concrete words and the domain of abstract words) arise as a result of types and relative proportions of experiential and linguistic information they bind.

3. The apparent dichotomy between concrete and abstract word meanings arises because of a statistical preponderance of sensorimotor information to underlie concrete word meanings and a statistical preponderance of affective and linguistic information to underlie abstract word meanings.is one in which abstract concepts and words are also grounded.” (Kousta et al., 2011, p. 26)

Thus, whereas sensor–motor information plays a central role in learning, representing, and processing concrete concepts and words; emotional information plays a central role in learning, representing, and processing abstract concepts and words. The experimental work reported on Kousta et al. (2011) provided the critical evidence in favor of such a view. Why would affective associations be especially important for abstract words? We pro-
pose that emotion plays a critical role during language acquisition, providing a bootstrapping mechanism for the acquisition of abstract lexical concepts and their labels at early stages. In support of this possibility, Kousta et al. presented initial data from an analysis of age of acquisition norms for abstract words, showing that valenced abstract words are learned earlier than more neutral abstract words (Kousta et al., 2011, Figure 7, p. 26).

In the commentary, our theoretical approach is referred to as a kind of “embodied” DCT approach to concrete and abstract word processing, expressed in terms of “experiential” and linguistic information (Paivio, 2013, p. 285). Glossing over the scare quotes, we readily recognize that DCT provides the critical inspiration to our account (just like it has provided inspiration to a number of other views in the literature, e.g., Warrington and Shallice’s, 1984, distinction between verbal and visual semantics). There are, however, many differences in focus and mechanisms assumed, as well as novel assumptions of our account. Examples are listed below.

1. Emotion is considered to be a critical type of information in semantic representation in our proposal; it has a relatively marginal role in DCT.

2. We characterize both concrete and abstract words in terms of what is special to each of them (sensory–motor vs. emotion). DCT (as all other existing hypotheses) explains differences in processing between concrete and abstract in terms of what makes concrete words special (they engage both the imagistic and the verbal codes) and what abstract words lack (they do not engage the imagistic code).

3. We argue that experiential information (which includes visual information, along with sensory, motor, and affective information) is foundational for all knowledge, both concrete and abstract. DCT argues that imagistic information would be foundational for concrete words but not abstract words.

4. We make the novel prediction that emotional development, in addition to linguistic development, is critical for the development of an abstract vocabulary. DCT would predict that the acquisition of an abstract vocabulary would depend solely or primarily on linguistic development.

Just like DCT (and other proposals, e.g., Barsalou, 2009; Barsalou, Simmons, Barbey, & Wilson, 2003), we assume that semantic representations include linguistic information, in addition to imagistic/experiential information. In related lines of work, using computational methods, we have asked the critical question of whether better semantic representations (i.e., that better predict semantic effects in different behavioral tasks) are learned by statistically integrating experiential and linguistic information versus learning semantic representation on the basis of only experiential information (assumed to be sole or at least primary by many researchers, especially in the embodied cognition tradition, e.g., Barsalou et al., 2003; Glenberg & Gallese, 2011) or only linguistic information (assumed to be sole or at least primary by some researchers in computational sciences, e.g., Jones & Mewhort, 2007).

Andrews, Vigliocco, and Vinson (2009) contrasted models that differed only on the basis of the type of data and not on the basis of architectural assumptions, demonstrating that models that integrate both types of information are better at predicting semantic effects. This, we believe, is an important tribute to DCT because this theory has been the first to advocate the importance of considering linguistic information together with some type of more experiential information. As far as we know, this work is the first to have demonstrated how this can be done empirically.¹

Conclusions

To summarize, it is clearly the case that DCT provides continuous inspiration concerning semantic representation and processing and that, especially in its broader formulation, can account for a variety of semantic effects in different tasks and contexts. However, DCT cannot account for the basic findings reported in Kousta et al. (2011). To account for these novel findings, Kousta et al. put forward a new embodied theory of the representation of abstract words that moves the field forward in suggesting a greater integration between affective and cognitive systems.

¹ In order to address this question computationally, of course, simplifications must be made. One simplification has been to use “speaker-generated” features (i.e., features that speakers list as defining and describing specific concepts, McRae, Cree, Seidenberg, & McNorgan, 2005; Vigliocco, Vinson, Lewis, & Garrett, 2004; Vinson & Vigliocco, 2002, 2008) as a proxy to experiential information. As spelled out in detail in the article, we readily admit the limitations of this choice; however, we disagree with Paivio’s (2013) description, according to which we define experiential information in terms of verbal associations (Paivio, 2013, pp. 286). The theory is explicit concerning what we mean by experiential information. Our computation work is explicit in recognizing that speakers’ generated features are nothing more than a proxy.

References


REFRENCES


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