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Short Communication

Implicit learning of mappings between forms and metaphorical meanings

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ABSTRACT

Previous research has shown that people can implicitly acquire mappings between word forms and literal meanings (Williams, 2004, 2005). We argue, from the metaphor-representation and embodiment perspectives, that people can unconsciously establish mappings between word forms and not only literal but also metaphorical meanings. Using Williams' (2005) paradigm, we found that transfer of form-meaning connections from a concrete domain (space) to an abstract domain (power) was achieved in a metaphor-consistent way without awareness. Our results support the view that unconscious knowledge can be flexibly deployed in an abstract way not previously explored in the implicit learning literature.

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1. Introduction

Humans are equipped with powerful learning mechanisms for acquiring knowledge of regularities in the environment without awareness (Reber, 1989). The more flexible such knowledge is in applying to new situations, the more useful it would be. Indeed, Reber (1969) argued that implicit knowledge was abstract and could apply to new domains, perceptually different from the domain trained on (see also Altmann, Dienes, & Goode, 1995; Goschke & Bolte, 2007; Scott & Dienes, 2010; Tunney & Altmann, 2001; Turk-Browne & Scholl, 2009). By contrast, others have argued that implicit knowledge is based on storing just the details of particular exemplars (e.g. Brooks & Vokey, 1991; Jamieson & Mewhort, 2011) or their parts (e.g. Dulany, Carlson, & Dewey, 1984; Perruchet & Pacteau, 1990; Servan-Schreiber & Anderson, 1990). Both sides of the debate have made compelling demonstrations; for example, the exemplar view has demonstrated just how well a system can generalize even though learning consists only of storing studied exemplars (Dienes, 1992; Jamieson & Hauri, 2012; Pothos, 2007). On the other hand, it has also been shown that people can implicitly learn abstract structures, such as melodic structure, symmetries or recursive embeddings, above and beyond the chunk structure or even repetition patterns of individual exemplars (e.g. Jiang et al., 2012; Rohrmeier, Fu, & Dienes, 2012; Rohrmeier, Rebuschat, & Cross, 2011). Here we explore implicit learning involving a different type of abstract knowledge: the metaphorical relation between something concrete and the more abstract idea it represents (Boroditsky, 2000; Boroditsky & Ramscar, 2002; Lakoff & Johnson, 1980, 1999). That is, implicit learning may be a mechanism by which embodied concrete knowledge extends into the conceptual abstract domain.

Metaphor is at least one way people understand abstract concepts (e.g., time) by using knowledge of a more concrete domain (e.g., space). Cognitive linguists (e.g., Lakoff & Johnson, 1980, 1999) have argued that most metaphors are

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unconsciously and automatically learned. The major goal of the current research was to explore whether unconscious knowledge acquired through implicit learning could transfer from a concrete domain to an abstract one in a metaphor-consistent way. This issue was addressed by adopting a paradigm introduced for investigating word form–meaning connections (Williams, 2004, 2005). In Experiment 1 of Williams (2005), participants were first taught four novel words (gi, ro, ul and ne, which were introduced as determiners) and told that they encoded a certain meaning dimensions (gi and ro occurred with near objects, ul and ne with far objects). What they were not told was that the use of determiners also depended on the animacy of the nouns (gi and ul were used with animate nouns and ro and ne with inanimate nouns). The novel words were embedded in English sentences (e.g., “At the fair they threw balls at ne plates.”). In training, participants had to repeat the sentences, indicate whether the novel word meant near or far, and form a mental image of the situation portrayed by the sentence. In testing, participants were exposed to novel contexts and had to choose between two possible determiners, one of which violated the animacy rule (e.g., “After my meal I went to the sink to wash ro/gi cup.”). With oral report, 33 out of 41 of the participants remained unaware of the relevance of animacy to determiner usage. Nonetheless, they performed significantly above chance in selecting appropriate determiner for a noun, even though that determiner–animacy combination had never been encountered during training. This finding provided evidence of implicit learning of form–meaning connections (see also Leung & Williams, 2011).

Word form–meaning connections are more complicated than a word form having a one-to-one correspondence with a literal meaning (VanPatten, Williams, Rott, & Overstreet, 2004). A word may have both literal and metaphorical senses. For example, “high” means “having a relatively great elevation” as in “a high tower” literally and “eminent in rank or status” as in “a high official” metaphorically. Spatial height and social power correspond to the literal and metaphorical meanings of “high” respectively. Schubert (2005) suggested that activation of meanings of height primes the meaning of power automatically. He asked participants to evaluate pairs of powerful and powerless groups (e.g., captain–sailor) presented on a computer screen. Participants reacted faster when powerful groups were presented at the top and powerless groups were shown at the bottom of the screen. This is a typical case of the “high status is up” metaphor (Lakoff & Johnson, 1980). This argument converges with theories of embodied cognition (Barsalou, 1999, 2008; for a review, see Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005), which posit that people use concrete physical experience in their abstract conceptual thinking. So, the current study sought to use a vertical representation of power (Giessner & Schubert, 2007; Lakoff & Johnson, 1980, 1999; Schubert, 2005) to explore whether the transfer of form–meaning connections from a concrete domain (e.g., space) to an abstract domain (e.g., power) can be achieved unconsciously, using the paradigm of Williams (2005).

A central question to implicit learning research is how we can be sure that implicit, rather than explicit, learning took place. Williams (2004, 2005) addressed the question with free report. In addition to this method, there are three subjective measures used to assess the conscious status of the knowledge. The zero–correlation criterion (Dienes & Berry, 1997) posits that knowledge is unconscious when there is a lack of correlation between confidence and accuracy. The guessing criterion (Cheesman & Merikle, 1984) states that if people perform above chance when they believe they are guessing, the knowledge is unconscious. However, Dienes and Scott (2005) argued that the zero–correlation and guessing criteria only assess the conscious status of judgment knowledge (knowledge about whether a particular test item has the same structure as the training items) rather than of structural knowledge (knowledge of the structure of the training items). Based on the distinction between judgment knowledge and structural knowledge, Dienes and Scott (2005) developed a third subjective measure – trial-by-trial structural knowledge attributions – to assess the conscious status of the knowledge of the structure of a domain. After a judgment, participants made one of four attributions about the basis of their judgment. “Guess” indicated that the judgment was based on nothing at all, it could just as well be based on a toss of a coin; “Intuition” indicated that the judgment was based on a hunch or feeling that could not be explicated further, i.e. there was confidence in the judgment but the person had no idea why the judgment was right; “Memory” indicated that the judgment was based on a recollection; “Rules” indicated that the judgment was based on a rule that could be stated if asked. Among the four attributions, ‘guess’ and ‘intuition’ are *prima facie* cases of unconscious structural knowledge and ‘rules’ and ‘memory’ of conscious structural knowledge. By using this measure, Chen et al. (2011) conducted a study with Chinese phrases showing the existence of unconscious knowledge of word form–literal meaning connections, confirming the findings of Williams (2005). As trial by trial subjective measures are particularly sensitive measures of the conscious status of knowledge (Norman, 2010; Ziori & Dienes, 2006), the current study sought to explore the conscious status of knowledge by using confidence ratings and the structural knowledge attributions of Dienes and Scott (2005) (see also Guo et al., 2011; Rebuschat, 2008, for additional applications of these measures to language learning).

In sum, we hypothesized people can unconsciously transfer their knowledge of form–meaning connections from a concrete domain to an abstract domain in a metaphor-consistent way.

2. Method

2.1. Participants

Sixteen volunteers (eight females) with an average age of 22.63 years ($SD = 4.33$) from the university community participated in this study.

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