Brief article

Revealing ontological commitments by magic

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A B S T R A C T

Considering the appeal of different magical transformations exposes some systematic asymmetries. For example, it is more interesting to transform a vase into a rose than a rose into a vase. An experiment in which people judged how interesting they found different magic tricks showed that these asymmetries reflect the direction a transformation moves in an ontological hierarchy: transformations in the direction of animacy and intelligence are favored over the opposite. A second and third experiment demonstrated that judgments of the plausibility of machines that perform the same transformations do not show the same asymmetries, but judgments of the interestingness of such machines do. A formal argument relates this sense of interestingness to evidence for an alternative to our current physical theory, with magic tricks being a particularly pure source of such evidence. These results suggest that people's intuitions about magic tricks can reveal the ontological commitments that underlie human cognition.

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What is a better magic trick, turning a glass of milk into a white dove, or turning a white dove into a glass of milk? The first trick seems intuitively more interesting, but why? It could be because transformations are evaluated based on similarity, and similarity is asymmetric (Tversky, 1977), or simply because it is more exciting to make a bird appear than a beverage. In this paper, I suggest a deeper explanation: our intuitions about magic tricks reveal the fundamental categories and conceptual structures that we use to organize our experience – what philosophers call *ontological commitments* (e.g., Ryle, 1938).

The ontology of a language or conceptual structure characterizes the set of entities that can exist and the kinds of relations that can hold between them (or, as Quine (1948) put it, "what there is"). Our ontological commitments also constrain the properties that entities are allowed to have. For example, we can say that "Water is heavy", but not "Water is sorry". Sommers (1959, 1965) argued that these "predicability" relationships can be captured in a hierarchical structure (see Fig. 1). Entities acquire applicable predicates as they move down the hierarchy, ending in animate, intelligent entities such as people. Keil (1979, 1983) explored the ontological commitments of children and adults by examining their willingness to extend predicates over entities at different locations in a hierarchy. He found that both adults and children constrained predicates in the way predicted by this account. Following critiques of this approach (Carey, 1983; Gerard & Mandler, 1983), Keil (1989) used a different method to investigate the ontological commitments of children: transformations. Children were more resistant to the possibility of surgical transformations that crossed ontological categories (e.g., an animal into a plant) than those that remained within ontological categories (e.g., an animal into another animal).

Kelly and Keil (1985) reported results that suggest ontological commitments might have an effect on the

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way that people think about magic. They studied the properties of a different class of transformations – the magical transformations that appear in myths and fairy tales. Kelly and Keil (1985) found that the transformations that appear in Ovid's *Metamorphoses* and Grimms' fairy tales tend to cover shorter distances in a predicability hierarchy than might be expected by chance. For example, it is more common for people to be transformed into animals than transformed into inanimate objects. These results were explained as the outcome of the adaptation of stories to be comprehensible by human audiences, for whom crossing many ontological boundaries would be too counter-intuitive. However, Kelly and Keil (1985) also pointed out some of the potential confounds in these results due to the fact that transformations take place in stories (for example, it is hard to maintain a narrative without a main character who is animate).

The apparent influence of ontological commitments on magical transformations in myths and fairy tales suggests that the same factor might be at work in our intuitions about the quality of magic tricks. Research at the intersection of psychology and magic has tended to focus on how theories and empirical results from psychology can be used to systematically organize the principles behind conjuring (Lamont & Wiseman, 1999; Nardi, 1984; Triplett, 1900) or on the psychological and neural basis of specific magic tricks (Cavina-Pratesi, Kuhn, Ietswaart, & Milner, 2011; Cui, Otero-Millan, Macknik, King, & Martinez-Conde, 2011; Demacheva, Ladouceur, Steinberg, Pogossova, & Raz, 2012; Kuhn, Amlani, & Rensink, 2008; Martinez-Conde & Macknik, 2008; Olson, Amlani, & Rensink, 2013; Otero-Millan, Macknik, Robbins, & Martinez-Conde, 2011; for a

review and critique of some of this work, see Lamont, Henderson, & Smith, 2010). This previous research has typically explored the effects of attention and perception, rather than higher-level cognition. However, developmental research has examined the relationship between magical and causal reasoning (Chandler & Lalonde, 1994; Johnson & Harris, 1994; Phelps & Woolley, 1994; Rosengren & Hickling, 1994), and magic tricks are routinely used to investigate the ontological commitments of infants: measuring the surprise shown when objects appear and disappear has been used to study infants' expectations about the properties of objects and the nature of number (for classic examples, see Baillargeon, Spelke, & Wasserman, 1985; Wynn, 1992; Xu & Carey, 1996).

Magic tricks might thus provide a tool for exploring the ontological commitments of adults. Transforming a glass of milk into a white dove moves down the predicability hierarchy shown in Fig. 1, while the opposite transformation moves up the hierarchy. To explore the possibility that direction of movement in an ontological hierarchy might explain why certain transformations intuitively strike us as better magic tricks, I conducted an experiment in which people answered a simple question – judging how interesting a trick would be – for a variety of transformations. Asking the question for the same transformation in different directions (across different participants) provides the opportunity to examine the robustness of the asymmetry. By also collecting judgments of similarity and the interestingness of tricks featuring the appearance and disappearance of different objects, the influence of the direction of movement in the hierarchy could be assessed while controlling for other possible explanations for the asymmetry.
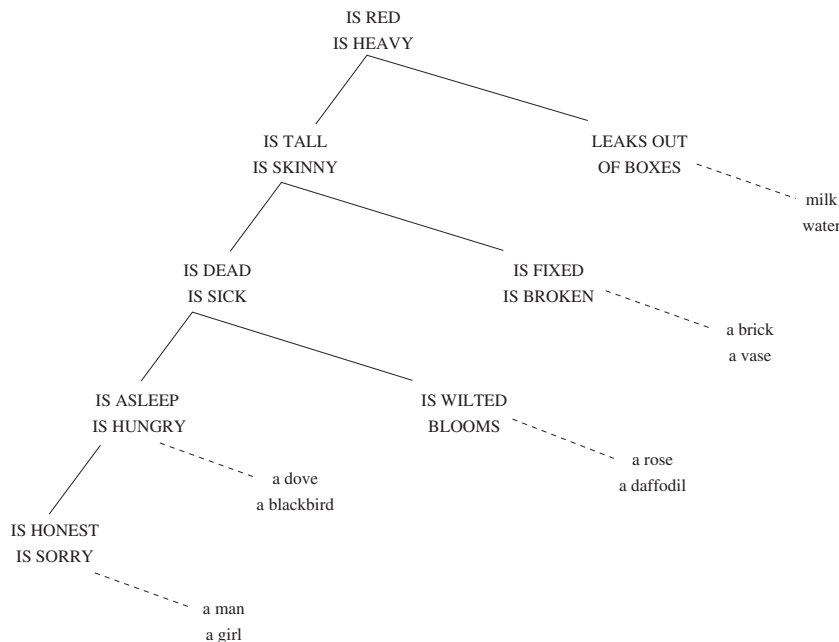
Fig. 1. Ontological commitments as reflected in a predicability hierarchy. Predicates appear in capitals, entities in lowercase. An entity can have any of the predicates that appear along the path from the root to the entity. Modified from Keil (1979).