

Commentary on Leech, R., Mareschal, D., & Cooper, R. Analogy as Relational Priming: A developmental and computational perspective on the origins of a complex cognitive skill. . To appear in Behavioral and Brain Sciences, 2008.

Relational priming is to analogy-making as one-ball juggling is to seven-ball juggling

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Abstract

Relational priming is argued to be a deeply inadequate model of analogy-making because of its intrinsic inability to do analogies where the base and target domains share no common attributes and the mapped relations are different. The authors rely on carefully handcrafted representations to allow their model to make a complex analogy, seemingly unaware of the debate on this issue 15 years ago. Finally, they incorrectly assume the existence of fixed, context-independent relations between objects.

Although relational priming may indeed play some role in analogy-making, it is an enormous – and unjustified – stretch to say that it is “centrally implicated in analogical reasoning” (sect. 2, para. 2). This is a very strong statement, and the authors have not shown at all that this mechanism – as opposed to, say, explicit structure mapping (Gentner et al. 1983) or slippage (French 1995; Hofstadter & Mitchell 1990; Mitchell 1993) or constraint satisfaction (Holyoak & Thagard 1989) or dynamic binding (Hummel & Holyoak 1997), to name a few – is at the heart of high-level analogy-making.

The proportional analogy that dominates almost three-quarters of this article, both in the theoretical discussion and the simulations, is

BREAD is to CUT BREAD as APPLE is to ?

The possible answers are CUT APPLE, APPLE, BRUISED APPLE, and CUT BANANA.

A simple connectionist attractor network produces the correct answer (CUT APPLE). They claim that “relational priming” – supposedly what the network is doing – is the key to analogy-making and that this mechanism can be extended to full-blown analogy-making. Unfortunately, both claims are dubious, at best.

Let’s start by considering a run-of-the-mill analogy that occurred to me recently.

Ty Cobb, one of baseball’s greatest players ever, did not hit over-the-wall home runs like his archrival, Babe Ruth. However, in May 1925, after being egged on by reporters, he said, “You want me to hit home runs like Babe Ruth? No problem.” So, in the next game he hit three over-the-wall home runs and two more in the following game, after which he said, “I told you I could hit home runs. Now I’m going back to playing baseball the way it was meant to be played.” It occurred to me that this is analogous to a professor who

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publishes only books and who is criticized for never publishing in journals. One day, in response to his critics, he says, “I could publish in journals if I wanted to; I simply chose not to,” and, to prove his point, he rapidly racks up a number of publications in the top journals in his field. Thereafter, he returns to writing books.

Here we have two situations in which the objects have no features in common (*base hits* and *books*; *home runs* and *journal articles*) and where the relations are semantically miles apart (*hitting* and *writing*). And yet, the analogy works perfectly. *This* is the heart of analogy-making, and it is not in the least clear how relational priming, as implemented by the authors, could begin to deal with this problem.

Late in their article, the authors finally come to grips with the necessity of explaining “how such a mechanism [relational priming] might explain the more difficult and complex analogies used to test adults” (sect. 3.4, para. 9). They then discuss how this would occur by considering an analogy between the 1991 Gulf War and World War II (Spellman & Holyoak 1992). But where did the relations and objects on which they train their network come from? This is a textbook case of the problem of representation (Chalmers et al. 1992), a problem that, incredibly, they never mention and one that, arguably, was the greatest problem of traditional artificial intelligence (AI). Once you have handcrafted representations for each situation with a limited number of relations, finding mappings between them is, relatively speaking, a piece of cake.

This careful handcrafting of objects and relations in the two situations into exactly the representations that are needed for an analogy to be found is precisely what certain members of the analogy-making community (Chalmers et al. 1992) have been railing against for years. To be completely clear: There are literally *millions* of relations and objects that could be used to describe the 1991 Gulf War and just as many that characterize World War II. But for their example, Leech et al. have selected *only* those relations that make their analogy work. This is wholly unacceptable as a way forward in analogy-making and, what’s more, tells us essentially nothing about how real analogy-making works because *finding* the relations is part and parcel of the process. It cannot be separated out.

Finally, the authors write as if the relation between two objects exists in a context-independent manner and can thus be primed by the presence of the objects themselves. They write, for example, “we propose that exposure to the *a* (e.g., *puppy*) and *b* (e.g., *dog*) terms of an analogy primes a semantic relation (e.g., *offspring*) that then biases the *c* term (*kitten*) to produce the appropriate *d* term (*cat*).” But this cannot be right. Consider the following example: *puppy : dog :: watch : ?* Most people would say: *clock*. But is a watch an offspring of a clock? Of course not. The point is that the word *watch* helps determine the relationship between *puppy* and *dog*. There is no a priori intrinsic relation between *puppy : dog* that can be used for all analogies, as the Leech et al. model needs to assume. In the latter analogy, the germane relationship was *bigger than* and certainly not *offspring of*. The authors fail to understand this absolutely crucial point about the context dependence of analogy-making. This seems to me to be a deep and, in my opinion, irreparable, flaw in their model. This point is not one that can be simply glossed over or

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easily patched up. The whole manner in which their model is trained up requires there to be an a priori relationship between *a* and *b*, which is then transferred to *c*. But this is deeply wrong. Analogy-making, as the above example clearly shows, doesn't work that way. And one can come up with examples like this all day. For a detailed discussion of this point, see Chalmers et al. (1992).

Conclusion

The ideas presented by the authors in their model are not central to the key principles underlying the mechanisms of analogy-making. Their model is capable of limited relational learning, that is all, something that was done by earlier connectionist models (e.g., Chalmers 1990) almost 20 years ago. In short, as a model of analogy-making, the present model is woefully inadequate. There is much, much more to analogy-making than relational priming.

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