In response to: **The best game in town: The reemergence of the language-of-thought hypothesis across the cognitive sciences**
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Is language-of-thought the best game in the town we live?

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Abstract

There are towns in which language-of-thought (LoT) is the best game. But do we live in one? I go through three properties that characterize the LoT hypothesis: Discrete constituents, role-filler independence, and logical operators, and argue that in each case predictions from the LoT hypothesis are a poor fit to actual human cognition. As a hypothesis of what human cognition ought to be like, LoT departs from empirical reality.

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The effort by Quilty-Dunn et al. to evaluate the language-of-thought hypothesis (LoTH) in light of what has been learned since Fodor's original formulation is commendable. But although it is possible to interpret some behaviors as being compatible with LoT, LoT remains a poor way to understand human cognition. If the target article is the "strongest article-sized empirical case for LoTH" (target article, sect. 1, para. 4), the case of LoT is rather weak.

Let us examine three properties of LoTH. For each, I will consider what we might expect if the property actually holds of human cognition and what we instead tend to find. The reasoning applies to the remaining three properties, but space prohibits further explication.

Discrete constituents: It is true that the English sentence "That is a pink square object" can be decomposed into constituents like "pink" and "square" that can be plugged into other sentences to convey something of the same meaning. Two problems. First, the authors are making a case for discrete constituents of *thought*, but support their core argument with examples from language. It is one thing to show that language has certain properties. It is quite another to show that these properties characterize *thoughts* (Lupyan, 2016; Mahowald et al., 2023; Malt & Majid, 2013; Malt et al., 2015). Supporting the latter would require showing that underlying our language use are discrete concepts (if one holds onto Fodor's extreme nativism, these concepts are also innate – an even higher bar). Evidence against such a view is

too lengthy to review here (Levinson, 1997; Lupyan & Zettersten, 2021; Malt & Majid, 2013), but consider the fuzziness and context-dependence of even the easiest-to-define concepts like ODD, EVEN, and TRIANGLE (Lupyan, 2013, 2015). Second, even language may not be as discrete as is often assumed. To us, literate English-speaking scholars with a habit of reflecting on language as an external artifact, the idea that it is composed of discrete parts may seem self-evident. But this may speak more to what it *can* be than what it typically *is*. For example, literate, but not illiterate children can count words in a spoken sentence (Matute et al., 2012; Olson, 2002) – a surprising result if natural language simply maps onto discrete constituents of thought.

Role-filler independence: John is the agent of "John loves Mary" in the same way that Mary is the agent of "Mary loves John." Does this mean that role-filler independence is a characteristic property of our thoughts? Even if it were, this does not mean that role-filler independence is a core property of (nonlinguistic) cognition. But never mind that. *Agent* together with *patient* does indeed turn out to be perhaps the strongest example of role-filler independence (Rissman & Majid, 2019). However, Rissman and Majid go on to argue that evidence for the abstract nature of other seemingly basic roles like *instrument* and *goal* is rather mixed. Even for *agent*, role-filler independence is more subtle than it seems. In a nonlinguistic task requiring participants to categorize based on agent/patient relationships, a sizable minority (~40%) failed to induce it in the allotted time (Rissman & Lupyan, 2022). Those who did, generalized agency according to how similar the test items were to the items they saw at training as well as to the test item's similarity to agent prototypes (Dowty, 1991). It seems that not all agents are equally good agents, a surprising result if there is true role-filler independence.

The authors correctly point out that connectionist models "simulate compositionality, but fail to preserve identity of the original representational elements" (target article, sect. 2, para. 7). The authors do not consider the possibility that human compositionality may be simulated as well (Dekker, Otto, & Summerfield, 2022; Lahav, 1989).

Lastly, *logical operators* such as AND, IF, and OR are a "hallmark of LoT architectures" (target article, sect. 2, para. 10). Yet children under the age of about five have a notoriously difficult time learning categories based on even the simplest logical rules (Rabi, Miles, & Minda, 2015; Rabi & Minda, 2014). Adults are better (and certainly better than other animals!), but arguably rule-based reasoning is far more difficult than it should be if such logical operators actually

underlie much of our perception and reasoning (Goldwater, Don, Krusche, & Livesey, 2018; Lupyan, 2013; Mercier & Sperber, 2017).

It is true that at least for stimuli composed of easy-to-verbalize and recombine features such as circles and triangles of various colors used by Piantadosi, Tenenbaum, and Goodman (2016) adults can do well, showing patterns of behavior well-explained by the use of logical operators. However, such behavior is fragile in ways unexpected if these operators underlie our everyday cognition. Formally simple operations like XOR are notoriously difficult for people (Shepard, Hovland, & Jenkins, 1961). Even on simple rules like IF A, performance strongly depends on factors like verbal nameability of the constituents (Zettersten & Lupyan, 2020).

Ironically, Piantadosi, cited in support of hard-coded logical connectives (Piantadosi et al., 2016) was explicit that their data concern adults ("our results are not about children," p. 22) making the claim that logical operators underlie our core cognitive processes suspect. He later went on to argue that "primitives" like AND and OR need not in fact be primitives and can be learned (Piantadosi, 2021). I would add that such learning may be supported in part by natural language (Lupyan & Bergen, 2016).

To be fair, not all the evidence the authors use in support of the LoTH is linguistic. A considerable weight is placed on the construct of object files that are somehow meant to explain perception in terms of LoTH. Although object files may be a useful construct for understanding certain perceptual generalizations, there is good reason why research in perception treats visual representations as analog/iconic representations (Block, forthcoming).

In a town inhabited by highly educated people with a Western philosophical bent, LoTH is a sensible starting point in thinking about how cognition works. In towns inhabited by the rest of us, it is a curious game that some learn to play. The most fun games are often those that transport us to imagined worlds. The world of the LoT hypothesis is likely one of these.

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Competing interest

None.

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