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Priming is swell, but it's far from simple

Jayden Ziegler, [Jesse Snedeker](#), and [Eva Wittenberg](#)

ABSTRACT

Clearly, structural priming is a valuable tool for probing linguistic representation. But we don't think that the existing results provide strong support for B&P's model, largely because the priming effects are more confusing and diverse than their theory would suggest. Fortunately, there are a number of other experimental tools available, and linguists are increasingly making use of them.

MAIN TEXT

Branigan & Pickering (B&P) tell a straightforward tale. Linguists rely on grammaticality judgments to uncover representations. Judgments have limitations, but no (other) psycholinguistic methods systematically reveal linguistic structure. Fortunately, priming offers a direct window onto representation, providing evidence for two distinct levels: a surface syntactic form, independent of meaning and void of lexical content, and a semantic form that includes information about thematic roles, quantifier scope, and information structure.

We are fond of priming ourselves, but this elegant story is misleading in several ways.

First, the priming literature does not strongly support the theory that B&P propose. As they dive deeper, the loose ends and contradictions emerge, but their final conclusions bypass this complexity. If we rearrange the evidence a bit, the theoretical ambiguity becomes clearer.

The primary evidence for syntactic representations comes from studies of argument alternations (dative or active-passive) that perfectly confound surface syntax with thematic mappings. B&P note that a few foundational studies demonstrated that syntax *can* be primed independent of thematic mappings (section 2.1). Thus, they privilege syntax in their theory. But there is now an equally robust literature demonstrating that thematic mappings can be primed independent of syntax (e.g., Cai et al., 2012; Chang et al., 2003; Cho-Reyes et al., 2016; Hare & Goldberg, 1999; Salamoura & Williams, 2007; Ziegler & Snedeker, 2016a). B&P acknowledge this work (2.4), but treat it as a secondary, interface phenomenon: thematic information remains separate from syntax (Figure 1).

Similarly, the observation that priming can occur in the absence of lexical overlap motivates a theory in which the syntactic skeleton is separate from the lexical content. To account for the lexical boost, B&P must complicate their story, by linking lemmas to structures (2.3). But perhaps we should revisit the claim that the syntactic structure lacks lexical nodes. Indeed, function words can be a locus of priming (Bencini et al., 2002; Ferreira, 2003). We know that only partial overlap in the syntactic skeleton is needed for structural priming (2.1), but we don't assume that the unnecessary pieces are removed from the syntactic representation. Lexical content may be similar: always present and sometimes contributing to priming via overlap.

The evidence for their semantic level is also sparse. We know: quantifier scope can be primed, this priming is isolated to the particular quantifier used (e.g., *each* does not prime *every*), and it abstracts away from the nouns and verbs in a sentence (Feiman & Snedeker, 2016; Raffray & Pickering, 2010). However, B&P's claim that scopal priming is bound to thematic roles and cannot be captured by an LF representation is controversial (Chemla & Bott, 2015). It rests on a single null result with prime stimuli ("A boy climbed every tree") that have not been shown to produce priming when thematic roles are the same. Furthermore, the manipulation used confounds verb-specific roles, thematic roles, and the notion of deep subject/object. It's just too early to conclude that scope and thematic roles are tightly coupled, or that LF isn't the locus of scopal priming.

It seems that under the right conditions almost any linguistic representation, mapping, or process can be primed. Consequently, evidence for priming is always interpretable to some degree (it demonstrates a commonality between prime and target). But the absence (or magnitude) of an effect is often less constraining, because there is so much variability across tasks and stimuli. In some comprehension tasks, there is no priming in the absence of verb overlap (Arai et al., 2007), while in others, abstract priming is robust (Thothathiri & Snedeker, 2008a/b). This problem isn't unique to comprehension. The pattern of effects in production can depend on how the sentences are elicited (stem completion vs. full sentence generation; Ziegler & Snedeker, 2016b).

Understanding this instability is critical; we suspect that the answer lies in thinking through the processes involved in each task and how they engage both stored representations and representations that are constructed on the fly. To do this, we will have to move beyond the notion of priming as a static, atemporal phenomenon that targets stable representations independent of the process of production (or comprehension).

While priming is not the transparent window that B&P promise, psycholinguists do have a much wider range of tools than the paper suggests. Some are behavioral. Novel word generalization studies going back to the 1950s have revealed structural regularities in the representation of linguistic form and meaning (Berko, 1958; Fisher, 2002; Gropen et al., 1989; Naigles, 1990; Prasada & Pinker, 1993). Similarly, artificial language learning sheds light on the representations learners extract from linguistic data and use to guide generalization (Pothos, 2007; Reber, 1967; Saffran et al., 2008; for review, see Erickson & Thiessen, 2015).

New methods for analyzing imaging data also provide greater constraint on representational theories. For example, multi-voxel pattern analysis, a class of machine learning algorithms that examine patterns of neural activity (Haxby et al., 2001), has revealed regions of the left temporal cortex that appear to bind arguments to something roughly like thematic roles (Frankland & Greene, 2015).

Structural priming is therefore only one useful tool of many.

Finally, we think that B&P are too pessimistic in their assessment of linguists and their tools. There are long-standing traditions of experimental work in phonetics, phonology, and language acquisition. In recent years, experimental work has also become common in syntax, semantics, and pragmatics (e.g., Arunachalam, 2013; Cowart, 1997; Myers, 2009; Sorace & Keller, 2005). Indeed, the question of how armchair judgments translate into generalizable conclusions has received considerable attention (Sprouse & Almeida, 2012; Sprouse et al., 2013). From our perspective, the remaining disputes do not reflect an over-reliance on grammaticality judgments or a dearth of appropriate methodologies; they stem from: the close parallels between the theories that are still standing (similar operations assigned to different theoretical levels), the lack of falsifiability for the contrasting features, and the danger we all face of letting our “affection for [our] intellectual child[ren]” (Chamberlin, 1897) guide our interpretation of the data.

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