Commentary on Target Article: An Experimental Approach to Linguistic Representation,
Holly P. Branigan and Martin J. Pickering

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The Malleability of Linguistic Representations Poses a Challenge to the Priming-based
Experimental Approach.

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Abstract: Recent findings show that experience with a syntactic structure has long-term consequences for how that structure will be processed in the future, which suggests linguistic representations are not static entities that can be reliably probed without alteration. Thus, leveraging the effect of previous exposure to a syntactic structure appears to be an inappropriate method for studying invariant properties of language.

We agree with Branigan and Pickering that understanding the nature of linguistic representations is a key question for psycholinguists and linguists alike, but relying on acceptability judgments imposes serious limitations on what can be learned. Further, we agree that implicit processing measures can provide valuable insights about linguistic representations. However, we have concerns about the use of syntactic priming as the primary measure for the investigation of purportedly stable linguistic representations. The first concern is of a practical nature: syntactic priming effects are often subtle and many of the potential links between structures of interest may be very difficult to detect reliably, rendering the picture more uncertain rather than clearer. Second, and more importantly, recent evidence suggests that language representations are not stable but rather continuously updated based on recent experience. The current proposal for a unified model of language representations, as seen through the lens of syntactic priming, can only provide a partial and possibly inaccurate account if it ignores the multiple timescales and contexts in which learning, and thus, language change, takes place.

The logic of the proposed method as described in the target article requires that a) the facilitatory effect of a prime structure on a test structure is a direct reflection of how closely related those structures are in representational space and b) that the underlying representations of the language are not affected by recent exposure to either of the structures or their prior co-occurrence. In order for a syntactic priming paradigm to be a useful tool for understanding the structure of linguistic representation, it must be assumed that the act of processing the prime and target structures has no effect on that same

language user's syntactic representations, or that such effects are transient (Branigan, Pickering, & Cleland, 1999).

In contrast, recent findings show that experience with a syntactic structure has long-term consequences for how that structure will be processed in the future, both in comprehension (e.g., Fine, Jaeger, Farmer, & Qian, 2013; Fine & Jaeger, 2016; Kamide, 2012; Long & Prat, 2008; Luka & Barsalou, 2005; Ryskin, Qi, Duff, & Brown-Schmidt, 2016; Tooley, Swaab, Boudewyn, Zirnstein, & Traxler, 2014; Wells, Christiansen, Race, Acheson, & MacDonald, 2009) and production (e.g., Bock, Dell, Chang, & Onishi, 2007; Bock & Griffin, 2000; Branigan, Pickering, Stewart, & McLean, 2000; Hartsuiker, Bernolet, Schoonbaert, Speybroeck, & Vanderelst, 2008; Jaeger & Snider, 2013; Kaschak, Kutta, & Coyle, 2014; Kaschak, Kutta, & Jones, 2011; Kaschak, Kutta, & Schatschneider, 2011). These results point to an error-based learning mechanism underlying syntactic priming across modalities (Chang, Dell, & Bock, 2006; Chang, Janciauskas, & Fitz, 2012). On this account, exposure to the prime sentence makes a sentence with that same structure more expected and this up-weighting process is cumulative, such that the target sentence also serves the same function. Further, by the same error-based learning mechanism, the co-occurrence of structures with particular lexical items in the sentences should lead to an increased expectation for that combination in the future. Indeed, repeatedly exposing listeners to a novel pairing of a verb and a syntactic structure—“Rub the duck with the lollipop” which is *high attachment* (the ambiguous PP, “with the lollipop” attaches to the verb) if the visual context constrains the lollipop to be an instrument, but *low attachment* (the ambiguous PP

attaches to the head noun) if the lollipop is an accessory tied to the duck—leads listeners to form a new verb bias (Ryskin et al., 2016). In other words, the representation of a verb and its link to a structure is malleable and shaped by the context in which that verb appears. This context may consist of the other words in the sentence, the visual environment, or even the identity of the speaker (Kamide, 2012).

Does this present a challenge for the use of syntactic priming as a tool for studying language representations? Evidence for the cumulative learning underlying syntactic representations suggests that syntactic priming experiments may often miss the links investigators wish to uncover. In a paradigm where test stimulus A is preceded by primes B or C, the presentations of A, B, and C lead to those representations becoming more active or more probable. Given that priming experiments typically involve repeated measures, over the course of the task the activation level for all relevant structures may be brought to some ceiling level at which the additional facilitation conferred by B is no longer detectable. Indeed, cumulative priming may contribute to the small effect sizes observed in the priming literature (Mahowald, James, Futrell, & Gibson, 2016; Tooley & Traxler, 2011; see Fine et al., 2013 for a similar methodological point). Continued use of syntactic priming to test more and more subtle connections between structures will likely lead to many null findings from which no conclusions about the true nature of syntactic representations can be drawn.

From a theory-building perspective, the proposed approach overlooks a large swath of the current literature and thus can only provide an incomplete picture of language

representation. On many current accounts (Chang et al., 2006; Chang et al., 2012; Jaeger & Snider, 2013; Fine et al., 2013), syntactic priming effects are a by-product of the continuous learning that shapes language representations. Based on these findings, we can infer that experiences with individual prime or target structures will accumulate to change the relative probabilities of these structures. Further, the probabilistic bindings between lexical items (e.g., verbs) and structures are subject to the same cumulative learning through verb-structure co-activation. In this context, the question of whether structure A is more similar to B or C may be ill posed. The answer provided by a syntactic priming experiment may be entirely dependent on the particular time-point at which the language user is probed and what linguistic experiences preceded this sampling. To understand the nature of linguistic representations, then, a more useful approach will be to examine how the learning prompted by interpretation of a single utterance in a given context, scales up to support language learning and language change throughout the lifespan.

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