EPISODIC AND SEMANTIC INFLUENCE IN OBJECT INSTANTIATION

Zachary Ekves (University of Connecticut), Gitte H. Joergensen (University of Connecticut), Xin Kang (The Chinese University of Hong Kong), Gerry T.M. Altmann (University of Connecticut)
zachary.ekves@uconn.edu

Throughout language processing one has to track object-state changes that occur during sentences and transform objects from their typical state to a changed state ("The chef will chop the onion…"). Subsequent to such changes, language can either refer back to that changed object where one needs to retrieve this changed object from episodic memory ("and then he will weigh the onion") or refer to a new object of that same type ("and then he will weigh another onion"). Previous research by Hindy et al. (2012) has shown that in cases where we refer back to these changed objects, there is increased activation in brain regions implicated in conflict and ambiguity resolution, which the authors argue arises from a need to select between the pre- and post-changed state of the object (a chopped or unchopped onion). However, this increased activation does not appear when one refers to "another" of that object type, suggesting that there is instantiation of a new object that is being selected as the referent (Solomon et al., 2015). Despite these results showing processing differences resulting from referring to old or new objects, little work has been done examining the effects of previous information on subsequent object representation. We conducted two eye-tracking experiments to investigate the representational content of these new object instantiations, specifically examining the role of object typicality and previous episodic information in this instantiation.

In the first experiment, we used a visual world paradigm to present participants with a series of potential object referents while they heard sentences that described situations in which an object underwent state change ("The woman will chop the onion"), and then that same object or another object of the same type was referred to ("Then, she will weigh the onion" or "Then, she will weigh another onion"). We examined looks to three critical object types in the scene (Figure 1): changed objects (e.g. a chopped white onion), unchanged objects (an intact white onion), and objects of the same type that were different kinds (an intact red onion). During the sentence final noun when we referred to "another" instantiation of the object ("…another onion") we observed significantly more looks to both the white and red intact onions than to the chopped white onion, with no difference between the two intact onions. We suggest that this indicates that "another onion" is interpreted as potentially referring to any onion (whether the white one or the red one) that is more typical than the atypical chopped onion. That is, "another onion" triggers the creation of a new discourse entity whose features are not inherited from the episodic memory of the original onion, but are instead inherited from semantic memory for more generic onions. The second experiment examined the extent to which previous episodic information influences subsequent representation of new object tokens (e.g., whether the "chopped-ness" of the first onion influences the featural instantiation of the new onion).

The second experiment used sentences of the same structure as experiment 1, but the items in the visual display differed (Figure 2) in one crucial way: The red onion – a relatively typical instantiation of an onion – was replaced by another chopped onion – a relatively less typical instantiation of an onion. Examining the influence of episodic feature information in this way requires there to be a specific chopped onion that is the referent in the first sentence. In order to effect this, the first sentence ("The chef will chop the onion") was played while only one object was displayed in the screen (one of the chopped white onions). During the second sentence ("and then he will weigh the/another onion") the additional critical objects, and distractors, were added to the scene. Critically, the intact onion in the display is the only (potential target) item that has the typical/generic features associated with onions (e.g., all of the chopped onions are relatively less typical exemplars of the onion category – essentially, they reflect a non-canonical form that onions can take). The addition of the second chopped onion allows one to instantiate a new object token that can share the same episodic characteristics as the initial object referred to in the first

sentence. If it's the case that the featural instantiation of new objects is completely isolated from the featural properties of the "old" object, we would expect to see more looks to the intact white onion than the second chopped onion. If it's the case that the episodic features of the original onion can leak into the featural instantiation of the new onion, we should see looks (albeit to a lesser extent perhaps) to the second chopped onion. In fact, during the final word "onion", there were no more looks towards the intact onion than towards the second chopped onion. However, by noun offset, there was a significant preference ($p = .002$) for the intact onion. The equivalent looks towards the two onions during "onion" suggest that any preference to instantiate "another onion" from semantic memory (i.e. as a typical, generic onion) was matched by an equivalent preference to instantiate "another onion" from episodic memory (i.e. with the same atypical feature set as the first, chopped, onion). Further analyses revealed that during "onion", there were more looks away from the second chopped onion than from the intact onion ($p = .001$). We interpret these patterns as suggesting that, initially at least, episodic features from the first (chopped) onion "leak over" to the instantiation of "another onion", causing participants to entertain the second chopped onion, albeit briefly, as a possible referent for the new onion. But this particular instantiation is not sufficiently compelling, and the eyes therefore move away. Thus, despite an influence of episodic information early on, there is an eventual settling on the new, more typical, object.

More generally, these results highlight the importance of previous episodic information acquired through event comprehension and the role of typicality in the representational instantiation of new objects. It further suggests a dynamic interplay between longer-term semantic knowledge (typicality information) and shorter-term episodic information that occurs in the representation of event participants as language unfolds.

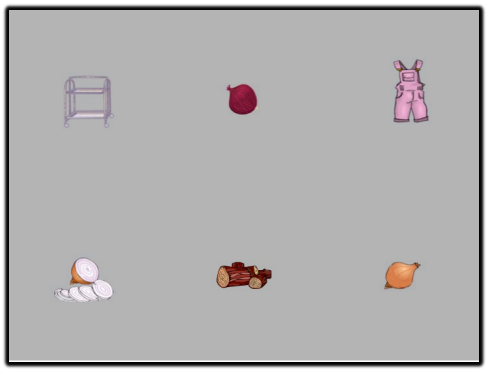

Figure 1: Visual scene for experiment 1.

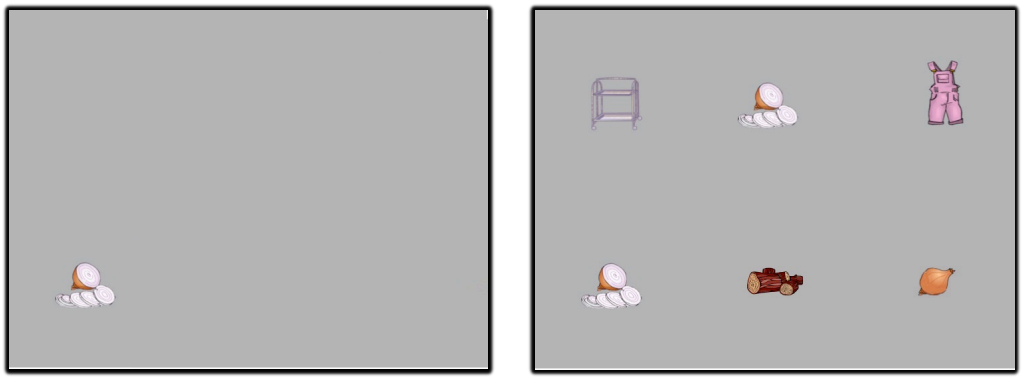

Figure 2: Initial and full display used in experiment 2.

Hindy, N. C., Altmann, G. T. M., Kalenik, E., & Thompson-Schill, S. L. (2012). The Effect of Object State-Changes on Event Processing: Do Objects Compete with Themselves? *The Journal of Neuroscience*, *32*(17), 5795–5803.

Solomon, S. H., Hindy, N. C., Altmann, G. T. M., & Thompson-Schill, S. L. (2015). Competition Between Mutually Exclusive Object States in Event Comprehension. *Journal of Cognitive Neuroscience, 27*(12), 2324-2338.