The State of the Onion: Grammatical aspect modulates object representation in event comprehension

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Events are units comprising information on several dimensions, i.e., time, location, and the participants in them, such objects (Radvansky & Zacks, 2014). Objects and their affordances are central as they carry the trajectory of change happening in an event. Indeed, Hindy et al. (2012; 2013) show that tracking of object states and object-state change is a fundamental mechanism in event comprehension. For example, the representation of a whole onion and that of a chopped onion are both active, and compete with one another, when people read about a chopping event compared to a smelling event (Hindy et al., 2012; Solomon et al., 2015). Here, we ask whether *grammar* can modulate our representation of objects and their states during online event comprehension by manipulating viewpoint aspect: In an English sentence like '*John chopped the onion.*' the verb in the simple past (*chopped*) marks the action as completed (perfective aspect), with a change in state of the object achieved. By contrast, the past progressive (*was chopping*) highlights the ongoingness of an action in the past (progressive aspect) (Comrie 1976; see also Madden & Zwaan, 2003). We thus hypothesized that change-of-state events (e.g., to chop an onion) described with the perfective should draw attention to an object's changed-state, but descriptions with the progressive should *defocus* attention to state-change.

Thirty-six English native speakers (M_{age} = 24.14 years, *SD* = 3.58; 23 female) participated in a sentence-picture verification task adapted for EEG. All sentences followed a subject-verb-object structure, with each verb presented both in the perfective and progressive aspect. Crucially, *all* verbs described an irreversible change in the object in the past (e.g., *chop*). For each trial (*N* = 204), participants read a sentence chunk-by-chunk (e.g., *[John] [chopped/was chopping] [the onion.]*). Thereafter, they saw a colour photograph of the object in its changed-state (e.g., a fully chopped onion), the object in its original, unchanged state (e.g., an unchopped onion) or an unrelated object (e.g., a cactus) (*Figure 1*). Pseudo-randomly, participants received a question on half of the trials, asking them to indicate whether the object in the picture was mentioned in the sentence. A Yes/No answer had to be provided by button-press. We focused on the N400 as an indicator of semantic processing with ERPs time-locked at picture onset. We expected the difference in processing of changed-state vs. original-state pictures to be larger following sentences in the simple past (e.g., *chopped*) compared to sentences in the past progressive (e.g., *was chopping*).

In both sentence types, unrelated pictures elicited a clear N400, reflecting categorical semantic matching (Hirschfeld et al., 2011; 2012). However, when comparing ERPs between sentence types, the processing of state-change pictures shows a more positive P300 following simple past (e.g., *chopped*), than past progressive sentences (e.g., *was chopping*). This difference was smaller for original-state pictures. As the P300 reflects attention and stimulus evaluation (Polich, 2007), the results indicate that participants indeed evaluated object states in detail. Interestingly, this effect was modulated by aspect: the perfective drove most attention to the end-state of an object, whereas progressive aspect defocused object state-change. In sum, our data extend the view that object representations during event comprehension include information on their states by showing that grammatical cues modulate the activation of object state representations during event comprehension.

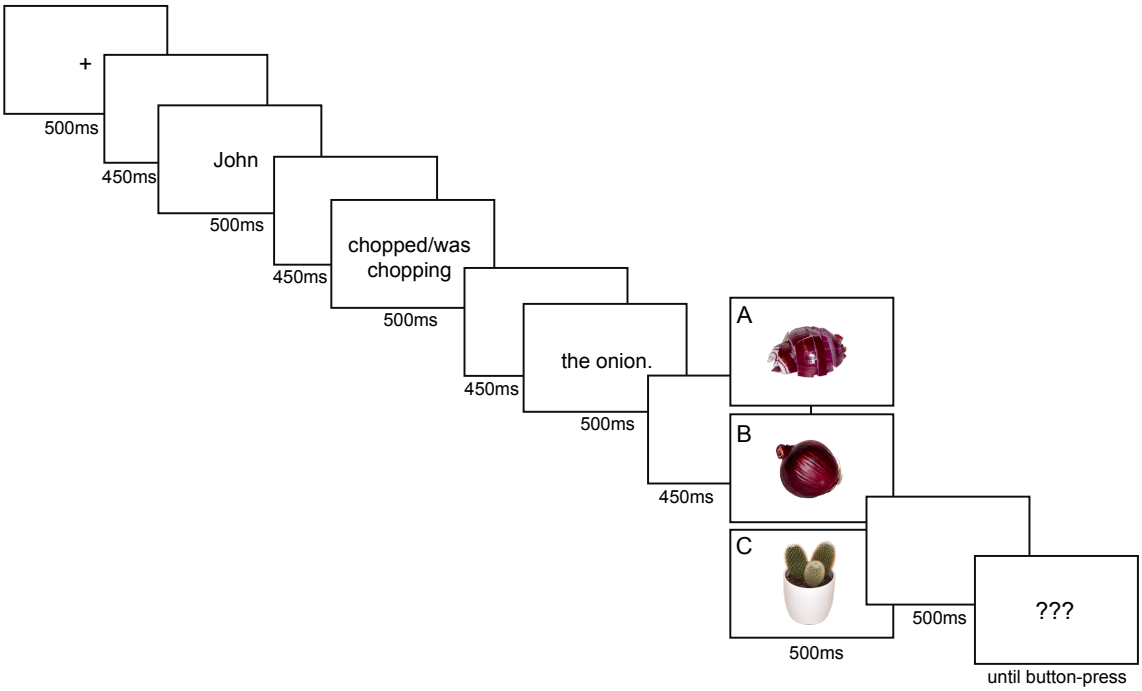

Figure 1. Example of all possible experimental conditions within a trial; each sentence was followed by a picture of the object in its changed state (A), the object in its original state (B) or an unrelated picture (C), and a question on half the trials.

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