Semantic simplicity can facilitate reading but specificity improves memory: Effects of event structure and event specification on verb processing times and verb memory

Margit Scheibel (Heinrich Heine University Duesseldorf)
scheibel@uni-duesseldorf.de

Previous research on verb processing demonstrated that an increase in semantic information can correlate with both inhibitory and facilitating effects. Gennari & Poeppel (2003) and Brennan & Pylkkänen (2010) reported longer reading times for eventive verbs than stative verbs, suggesting that the processing costs for verbs are a function of the complexity of the decompositional structure (decomposition hypothesis). However, other results suggest that the processing costs are a function of the degree of embodiment: The more concrete, imageable and sensorimotor-specified a verb, the more dimensions of meaning representations contribute to its activation, whereby (sooner) greater activation can be reached (embodiment hypothesis). Palazova et al. (2013) reported shorter processing times for verbs denoting a perceivable action than those denoting non-perceivable events, Marino et al. (2012) found shorter processing times for action verbs associated with a particular motor-program than those lacking sensorimotor specifications, and Sidhu & Pexman (2016) reported better memory accuracy for high embodied verbs than low embodied verbs.

The present study investigated verb processing times and verb memory by contrasting three types of verbs: abstract stative verbs, abstract action verbs, and method-specific action verbs. According to the embodiment hypothesis, the method-specific action verbs should show a privileged mental status as compared to both abstract verb types, because only the specific action verbs permit a precise mental image and motor simulation, i.e. multimodal concept activations. According to the decomposition hypothesis however, processing costs should be lowest for stative verbs, higher for abstract action verbs and highest for specific action verbs due to the additionally lexicalized method component in specific action verbs.

In a self-paced reading experiment (n subjects = 36), short stories of two sentences were presented (word-by-word in a stationary window). The first sentence was of the form S-V-O and included the experimental manipulation, see example in table 1. The short stories were identical for all verb conditions except for the critical verb. Test verbs (n= 60) were selected tripletwise. It was controlled that the three verbs of a triplet match as tightly as possible in confounding variables, e.g. word length, frequency, familiarity, but differ in their event type (state vs. action) and method specification (abstract vs. method-specified action verb). For the two action verbs it was controlled that both can refer to the same action, but only the specific verb lexicalizes the method by which the action is carried out. Each test story was followed by a probe recognition task (filler stories by semantic comprehension questions).

The results of the verb reading times (see Fig. 1) revealed that stative verbs were processed about 20 ms faster than action verbs ($p = .08$), replicating previous findings and supporting the decomposition hypothesis. However, the reading times of the abstract and the method-specific action verbs did not differ significantly ($p > .1$), suggesting that the encoding costs for an additional method component could be compensated by the embodiment effect of specificity.

The results of the probe recognition task (see Fig. 1) revealed that verb memory was significantly improved by semantic specificity (main effect of Verb Type, $p < .01$). Method-specific action verbs showed about 40 ms shorter latencies than both types of abstract verbs ($p < .05$, practically no difference between stative and abstract action verbs) and showed the best memory accuracy ($p < .05$, error rates increased from specific action through unspecific action to stative verbs). The privileged memory status – that was specific to method-specific action verbs – suggests that it is the multimodality of concept representations, rather than the complexity of the semantic representations, that improves verb memory.

To conclude, the findings suggest that an increase in semantic information correlates with higher encoding costs for verbs in principle. However, when the additional information improves the imageability and simulation of the denoted action, embodiment effects can compensate this complexity effect. Thus, both semantic and embodiment effects seem to modulate verb processing times. Verb memory however seems to be determined by embodiment effects in the main.

Table 1. Example of a German test story (English translations in italics). Verbs of the three experimental conditions are given in parentheses {method-specific action verb | abstract action verb | abstract stative verb}

Story	Test word
Martin {pflückt | erntet | benötigt} die Stachelbeeren. Er will einen Obstkuchen fürs Abschlussfest machen.	{pflücken | ernten | benötigen}
Martin {is picking | is harvesting | needs} the gooseberries. *He wants to bake a fruit pie for the graduation party.*	*{pick | harvest | need}*

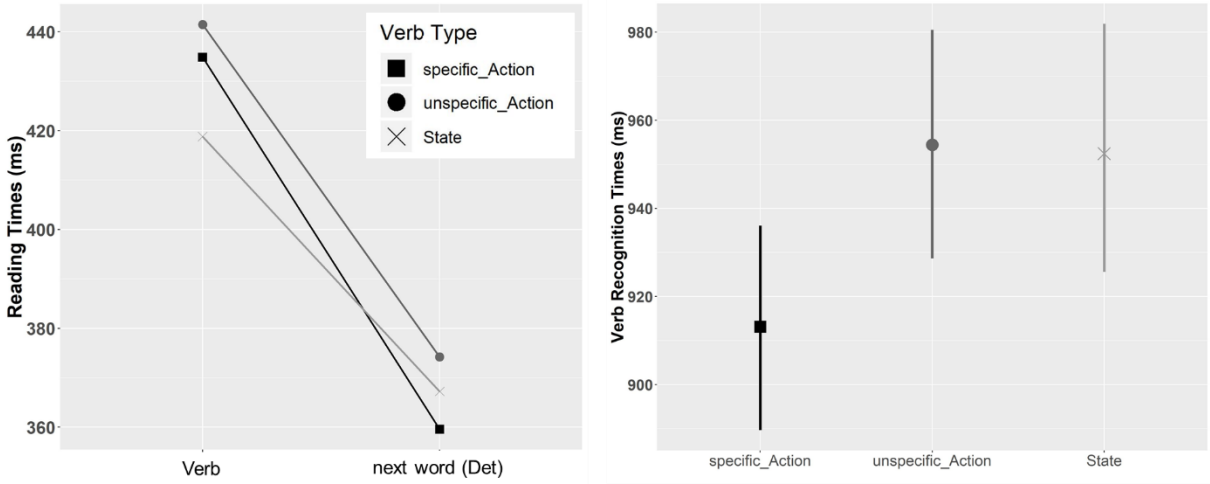

Figure 1. Left panel: Mean word reading times in milliseconds (ms) of the critical verb and the word following the critical verb (Determiner) as a function of Verb Type. Right Panel: Mean verb recognition times in milliseconds (ms) in the probe recognition task as a function of Verb Type with 95% CIs.

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