

Pre-Lexical Processing of the Passive Voice in Hebrew

One of the biggest questions in cognitive language research is how linguistic knowledge is represented. It has been claimed that visual word recognition is divided to two different stages: an initial morpho-orthographic stage, in which readers are insensitive to the semantic traits of morphemes, and a subsequent morpho-semantic stage [1,2]. On the other hand, readers were found to be sensitive to cues that are statistically consistent in their language even in early stages of processing [3]. Hebrew morphology provides an interesting case study for examining the different factors that can affect morphological representation and organization: all Hebrew verbs are comprised of seven possible verb templates (Binyanim), that systematically encode information regarding the verb, e.g., voice and verb argument, thereby creating statistical relations between certain forms and certain grammatical-semantic functions. The current study is designed to check whether the mere processing of a verb template's form will create predictions regarding the information this form carries for the Hebrew speaker. This question was tested with regards to the passive voice: using a masked priming paradigm, unconscious processing of Hebrew verbs was examined, enabling us to check whether Hebrew speakers are sensitive to the passive information encoded in the passive verb patterns based only on their orthographic-phonological characteristics. We compared the influence of four types of primes on reaction times to a passive target (*Pu'al* or *Huf'al*): a verb in a different passive Binyan, a verb in *Nif'al* Binyan (which is not exclusively passive) an identity prime and an active control prime. We ran a mixed-effect linear regression model with logged reaction time as the predicted variable. In contrast with our research hypothesis, seeing a passive prime did not reduce reaction times to the passive target. However, we found that the type of the passive Binyan influenced reaction times; responses were significantly slower to *Pu'al* targets compared to *Huf'al* targets ($B = 0.05$ ($SE = 0.014$), $p < .001$). We ran an additional mixed-effect logistic regression model with accuracy (correct vs. incorrect responses) as the predicted variable, type of target (*Pu'al* vs. *Huf'al*) as a fixed effect, and participant and item as random effects, and found that participants made significantly more mistakes with *Pu'al* as targets ($B = -1.19$ ($SE = 0.24$), $p < .001$), regardless of the prime condition. *Pu'al* verbs were thus discovered to be problematic stimuli in this design: when reading unpointed Hebrew (as participants did in our experiment), the string of letters of *Pu'al* can be read both as *Pu'al* - a passive and not frequent template, and as *Qal* - the most frequent template. Thus, not only does the 'unpointed *Pu'al*' activates two different Binyanim (and therefore, presumably - two different verb functions), this competition is not in favor of the passive form. When we excluded *Pu'al* stimuli from the analysis, RTs were seemingly faster than control. This was however not statistically significant, possibly due to the fact that looking only at half of the stimuli considerably diminished the power of the experiment. Therefore, we conducted a second experiment, only with *Nif'al* and *Huf'al* verbs. We compared the influence of three types of primes on reaction times to passive targets (*Huf'al* or *Nif'al*): a different passive Binyan, identity and control. Contrary to our research hypothesis, participants were not faster to respond to passive targets after seeing passive primes. Thus, according to the findings of both current experiments, we cannot infer that Hebrew readers are sensitive to high-order grammatical-semantic information in early stages of processing. This is compatible with the claims that the initial processing stage is insensitive to semantics. Suggestions for further ways to test this hypothesis are discussed.

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2. Rastle, K., & Davis, M. H. (2008). Morphological decomposition based on the analysis of orthography. *Language and Cognitive Processes*, 23(7/8), 942–971.
3. Rastle, K., Davis, M. H., & New, B. (2004). The broth in my brother's brothel: morpho-orthographic segmentation in visual word recognition. *Psychonomic Bulletin & Review*, 11(6), 1090–1098.