

The Representation of Concrete Versus Abstract Words: An Eye-tracking Study

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A word is considered concrete when it has available sensory referents and an easily accessible mental image. For example, the word “bread” describes an object which can be directly tasted, smelled and touched. Compared to concrete words, abstract words, e.g., “justice”, lack the same amount and/or types of direct sensory referents. Some researchers claim that the processing differences between concrete and abstract words are mainly due to the *quantitative* differences between the amount (and partly the type) of available information for these two categories of words (e.g., Schwanenflugel & Stowe, 1989). Contrarily, some researchers have highlighted the *qualitative* differences between these two types of words. On this view, the claim is that concrete words have connections to other words in the mental lexicon that are “categorical” and mainly based on semantic similarity, while abstract words are organized in an associative network whose connections are primarily based on their *association* with other words (e.g., Crutch, 2006). One of the first eyetracking studies investigating qualitative/associative differences between concrete and abstract words on healthy participants was done by Duñabeitia et al., (2009), in Spanish. Using the Visual World Paradigm (VWP), they found that when participants heard a word, they fixated on competitor images that represented an association with the target word. More importantly, this shift of visual attention was quicker and greater when the target-competitor pairs were abstract vs. concrete. They concluded that abstract words have less demanding access to their respective associated concepts than concrete words.

Given the importance of organization and processing of concrete versus abstract words for language theories, we sought to replicate and extend Duñabeitia et al.’s study into English, to further investigate whether the difference between concrete and abstract words is rooted in the words’ qualitative differences. In a VWP experiment, 26 English native speakers heard a word while they saw four images (one target and three distractor images). Importantly, the audio stimuli on different trials varied three ways with respect to the target image: Identical trials, Associated trials or Unrelated trials. Each participant was exposed to only one example per condition (total of 30 displays). Half of the trials were concrete (e.g., target image “fish” paired with either audio *fish* (identical), audio *pond* (associated), audio *tree* (unrelated)) and half of the trials were abstract (e.g., target image “nose” paired with either audio *nose* (identical), audio *smell* (associated), audio *moment* (unrelated)). The critical trials for our analyses were the associated trials that were either Concrete or Abstract. Based on the association hypothesis, we hypothesized that there should be more fixations and faster fixations to the target image when the associated relationship was Abstract (e.g., audio *smell*, target “nose”) vs concrete (e.g., audio *pond*, target “fish”). A Growth curve analysis (Mirman, 2014) was used to analyze the target gaze data from 200ms to 2000ms after word onset, in 100 ms timebins. The time course of target fixations was modeled with a third-order (cubic) orthogonal polynomial and fixed effects of condition (concrete-Association versus abstract-Association; within-participants), with participant and participant-by-condition random effects. There was a significant effect of condition on the intercept term, indicating *lower* overall target fixation proportions for the Concrete-Association relative to the Abstract-Association (Estimate = -4.414e-02, SE = 1.639e-02, $p = 0.01$). There were no significant effects on any orthogonal terms. This indicates that participants looked less to the image of a “fish” when they heard *pond*, and in comparison looked more to the image of the “nose” when they heard *smell*. However, the speed in looking to the target images in the different conditions was not different.

In this study, we extended a study by Duñabeitia et al into English. Consistent with their

findings, our results can be interpreted as an evidence in support of an associative network for abstract words and concepts. This work makes contributions towards understanding of representation of abstract and concrete concepts which in turn has implication for language and memory theories.

References

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