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

Mahsa Morid, Shuzhen Wang, Ed Griffiths & Tania Zamuner
University of Ottawa

Research Objective

- To investigate the differences between the storage of concrete and abstract words in the brain using eye-tracking techniques.

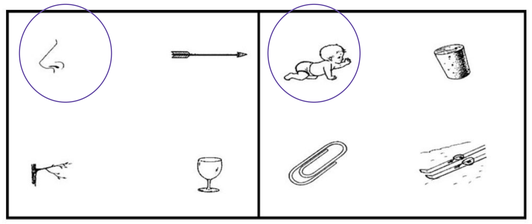
Background

Concrete vs abstract words

- Concrete words may be organized in the mental lexicon in a semantic categorical network; whereas abstract words may be organized in an associative network (Crutch, 2006; Crutch & Warrington 2005).
- To exemplify the difference, LION and TIGER are close in a categorical network, and LION and DANGER are close in an associative network.(Warrington, 1981).

Dunabeitia et al (2009)

- Our study seeks to replicate Dunabeitia et al's (2009) study on Spanish concrete and abstract words and extended it into English.
- The original study used the Visual World Paradigm (VWP) to present an array of four images, in which one was the target image.
- A Spanish audio stimulus was presented to participants and their eye movements were tracked. In the target condition, the audio stimulus contained a Spanish word associated with the target image.
- In some cases, the stimulus was a concrete word, e.g., the target image was a **baby**, and the concrete associated word heard was *cuna* (**crib**).
- In other cases, the stimulus was an abstract word, e.g., the target image was a **nose** and the abstract associated word heard was *olor* (**smell**).
- Dunabeitia and colleagues hypothesized that abstract words would show both stronger and faster association effects in the eye data than concrete words. Their results supported this hypothesis.



Research Question

- In a visual world paradigm study, when a participant hears an audio stimulus of a word associated with an image, will fixations to that image be faster and more frequent for abstract stimuli than concrete stimuli?

Methods

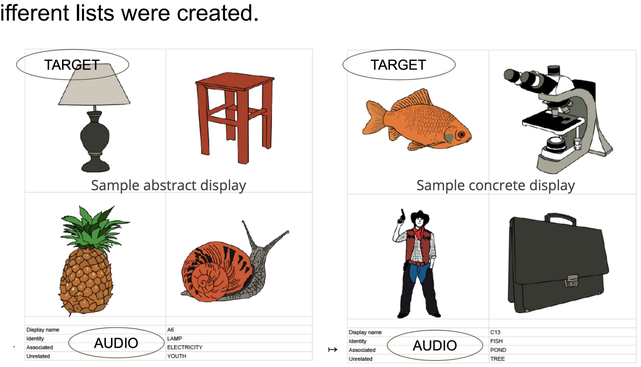
Independent variables: word type (concrete, abstract) and condition (identity, association, unrelated)
Dependent variable: number of fixations over time (200 ms time slots)

Abstract identity	hear LAMP, look at LAMP
Abstract association	hear ELECTRICITY, look at LAMP
Abstract unrelated	hear YOUTH, look at LAMP

Concrete identity	hear FISH, look at FISH
Concrete association	hear POND, look at FISH
Concrete unrelated	hear TREE, look at FISH

Stimuli

- Each participant saw all 30 displays in 3 conditions (+ 6 practice trials) = total 96 displays each
- To counterbalance the order of the presentation of the blocks, 6 different lists were created.

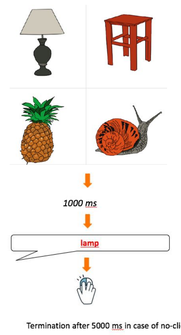


Participants

- Twenty-seven native English speakers recruited from the University of Ottawa

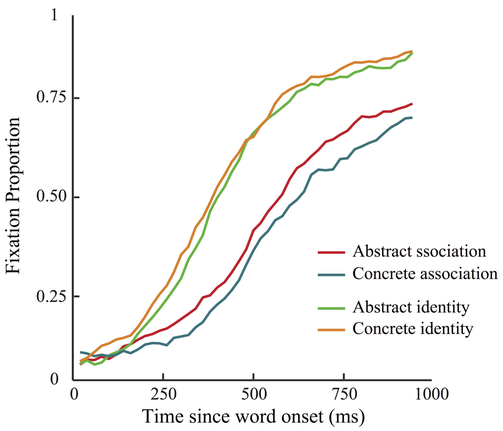
Procedure

- Central fixation (drift correction)
- Visual stimuli remained for 1000 ms
- Presentation of the audio words
- "Click the object which matches the audio"
- Trial moved on to the next display after a mouse click; or timed-out after 5000ms in case of no click



Results

- Only correct trials were included in the analysis (i.e., trials where there was a mouse-click in the identity or associated condition, or no mouse-click in the unrelated condition).



- To address the research question, we tested whether there is significant difference (in terms of overall likelihood of launching an eye movement and the time course of such an eye movement) between two experimental conditions (Abstract association and Concrete association)

- Importantly, such a difference should not be present between the two control conditions (Abstract identity and Concrete identity)

- A Growth curve analysis with the following features (Mirman, 2014) was conducted

  Model: a third-order (cubic) orthogonal polynomial model

  Fixed effects: condition (Concrete association versus Abstract association)

  Random effects: participant and participant-by-condition

- 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)
- No significant effects on any orthogonal terms
- The difference between two identity conditions was not significant.

Discussion and Conclusion

- The result can be interpreted as evidence in support of an associative network for abstract words and concepts.
- When we learn concrete words, we use actual physical objects in the world as referents. When we learn abstract words, we more likely learn them through making connections with their associates.

References

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