



# Selective Access to Semantic Memory for Objects based on Stimulus Modality and Task Demands

Evangelia G. Chrysiou & Sharon L. Thompson-Schill

Department of Psychology, Center for Cognitive Neuroscience, University of Pennsylvania



## Background & Hypotheses

- How does one construct a plausible function for an object? What are the factors that influence the information that is brought to bear on this process?
- Behavioral, neuropsychological, and neuroimaging research has explored the effect of stimulus modality on the speed and outcome of conceptual knowledge retrieval. Evidence suggests that pictorial or verbal stimuli can access different components of semantic knowledge for objects based on the requirements of a given task (e.g., Chainay & Humphreys, 2002; Saffran, Coslett & Keener, 2003; Saffran, Coslett, Martin, & Boronat, 2003; Sevostianov et al., 2002; Vandenberghe et al., 1996).
- We hypothesized that under open-ended conditions of ad hoc object use, when one needs to use an object in an impromptu, goal-determined manner, the functions afforded by the object and the extent to which certain object attributes are accessible are guided by the modality of the stimulus (verbal or pictorial).

## Design & Methods

**Participants:** Sixty-three right-handed, native English speakers ( $N = 63$ ; mean age = 21.12 years, 23 males) were randomly assigned to one of three conditions: (a) The Name condition ( $n = 22$ ); (b) the condition ( $n = 23$ ); or (c) the Name and Picture condition ( $n = 18$ ).

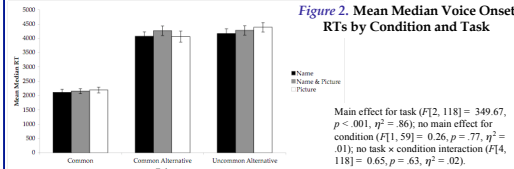
**Materials:** 144 black-and-white images of everyday objects, divided randomly into six blocks of 24 items. Stimuli were presented for 9000 ms, with 3000 ITI.

Figure 1. Examples of Stimuli by Condition and Task

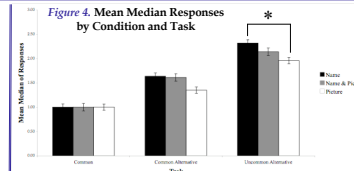
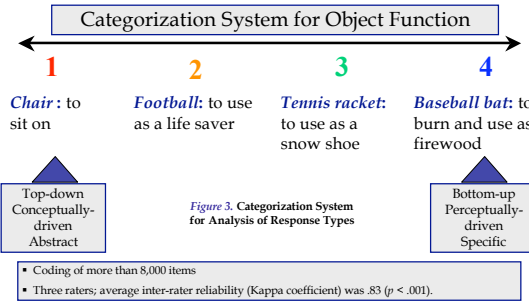
(the Object Use task, adapted from Christensen & Guilford, 1958)

		TASK		
		Common Use	Common Alternative Use	Uncommon Alternative Use
CONDITION	Name	Common Use	Common Alternative Use	Uncommon Alternative Use
	Picture	Common Use	Common Alternative Use	Uncommon Alternative Use
Name & Picture	Name	Common Use	Common Alternative Use	Uncommon Alternative Use
	Picture	Common Use	Common Alternative Use	Uncommon Alternative Use

## Analysis of Voice-Onset Reaction Times

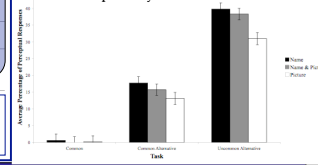


## Analysis of Response Types



CU	CAU		UAU	
	Conceptual	Perceptual	Conceptual	Perceptual
Name	1176.43	446.74	419.31	426.26
Picture	1114.43	1173.85	1242.67	131.89
Name and Picture	2119.13	445.96	432.86	445.47

Figure 5. Average % of Perceptually-based Responses by Condition and Task



## Summary & Discussion

- The presence of stimuli in pictorial format primed aspects of object knowledge that are more closely tied to the object's normative function; in contrast, the presence of an object's name lead to more perceptually-based responses.
- This finding is consistent with the results of previous studies (e.g., Boronat et al., 2005; Saffran, Coslett & Keener, 2003) showing facilitated access to action- and manipulation-related information from pictures relative to words.
- The results are in line with studies of functional fixedness to pictorial examples in design problem solving (e.g., Chrysiou & Weisberg, 2005).
- Function is an emergent property that is based on the demands of a given task, stimulus modality, and the user's goals (Barsalou, Sloman, & Chaigneau, 2005).

## References

Barsalou, L. W., Sloman, S. A., & Chaigneau, S. E. (2005). The HIPPE theory of function. In L. Carlson and E. van der Zee (Eds.), *Representing functional features for language and space: Insights from perception, categorization, and development* (pp. 131-147). Oxford, England: Oxford University Press.

Boronat, C. B., Barbaeu, L. J., Coslett, H. B., Tang, K., Saffran, E. M., Kimberg, D. Y., & Detre, J. A. (2005). Distinctions between manipulation and function knowledge of objects: Evidence from functional magnetic resonance imaging. *Cognitive Brain Research*, 23, 361-373.

Chainay, H., & Humphreys, G. W. (2002). Privileged access to action for objects relative to words. *Psychonomic Bulletin & Review*, 9, 348-355.

Christensen, P. N., & Guilford, J. P. (1958). *Creativity/Fluency Scales*. Beverly Hills, CA: Sheridan Supply, Co.

Chrysiou, E. G., & Weisberg, R. W. (2005). Following the wrong footsteps: Fixation effects of pictorial examples in a design problem-solving task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 31, 1134-1148.

Saffran, E. M., Coslett, H. B., & Keener, M. T. (2003). Differences in word associations to pictures and words. *Neuropsychologia*, 41, 1541-1546.

Saffran, E. M., Coslett, H. B., Martin, N., & Boronat, C. (2005). Access to knowledge from pictures but not words in a patient with progressive fluent aphasia. *Language and Cognitive Processes*, 18, 725-757.

Sevostianov, A., Horowitz, B., Nechaeva, V., Williams, R., Fromm, S., & Braun, A. R. (2002). fMRI study comparing names versus pictures for objects. *Human Brain Mapping*, 16, 168-175.

Vandenberghe, R., Price, C., Wise, R., Josephs, O., & Frackowiak, R. S. J. (1996). Functional anatomy of a common semantic system for words and pictures. *Nature*, 383, 254-256.

## Acknowledgments

This research was supported by NIH grant R01-MH6700 to STS. We thank the members of the STS lab for their suggestions.

## Contact Information

Visit us at: <http://www.psych.upenn.edu/stslab/>  
 Evangelia G. Chrysiou, Ph.D.  
 Department of Psychology  
 University of Pennsylvania  
 3720 Walnut St., Solomon Lab B51  
 Philadelphia, PA 19104  
 Email: [evangelg@psych.upenn.edu](mailto:evangelg@psych.upenn.edu)