# Labels facilitate learning of novel categories


## Gary Lupyan

**Center for the Neural Basis of Cognition and Department of Psychology, Carnegie Mellon University, Pittsburgh PA**


## The traditional view

Language is just a tool for communication


The facts of grammar make it difficult to argue that language shows design for the expression of thought in any sense that is substantially distinct from communication.

[Language is] nothing more than a transparent medium through which thoughts flow.


### …is wrong

A growing body of work shows the traditional view to be wrong. Recent cross-cultural findings have provided evidence that language is closely linked to the human ability to appreciate exact numerosities (Gordon, 2004) and to form color categories (Davidoff et al, 1999; Özgen, 2004). Evidence has also shown that in neuropsychological conditions affecting the ability to name (anomia), the ability to form and act based on category knowledge is severely compromised (Roberson et al., 1999). There are numerous sometimes-subtle, but pervasive effects of language on non-linguistic cognition (Gentner and Goldin-Meadow, 2003).

**Many animals form categories. Only humans have names for theirs.** Words can act as "invitations" to form categories (e.g., Waxman and Markow, 1995), but **do words play a role in category learning apart from their meaning?**

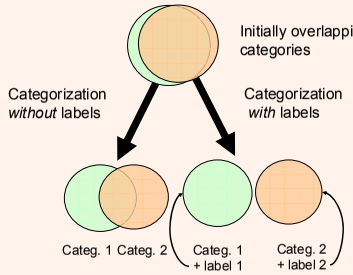
One possibility is that labels serve as conceptual "anchors" (Clark, 1997) enabling humans to form representations that would otherwise be more difficult or impossible to form by providing perceptually-invariant category information.

## The Questions

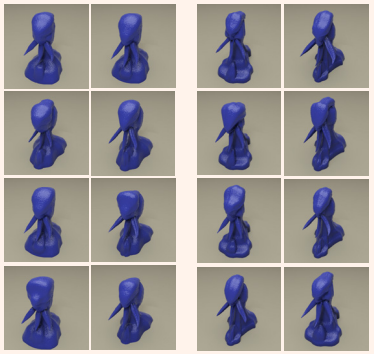
1. Are labeled categories easier to learn (even when the labels are entirely redundant)?
2. Are representations of categories learned with labels more stable than those learned without labels?

## The Framework

Labels as conceptual "anchors"




[move away] {+"grecious"} [move towards] {+"leebish"}




## Materials and Methods

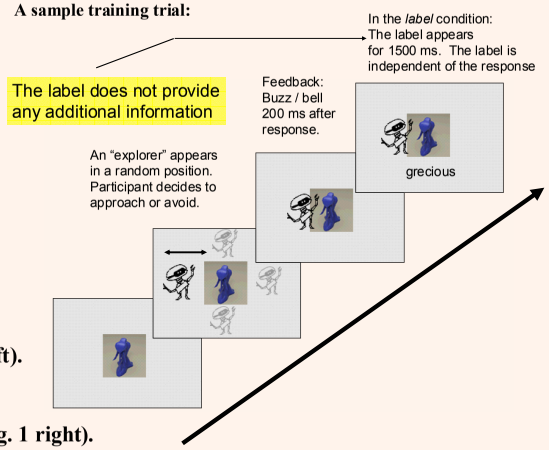
**Participants:** 40 Carnegie Mellon undergraduates

**Materials:** Two categories of "aliens" (YUFOs)—one to be approached, one to be avoided; two nonsense labels: "leebish" and "grecious."

**Procedure:** Participants were divided into *label* and *no-label* conditions. **All participants performed the identical task of learning to classify YUFOs into those that should be approached and those that should be avoided.**

144 categorization trials with feedback—correct/incorrect followed by 144 testing trials without feedback or labels.

**A sample training trial:**




## Results

**The presence of labels resulted in faster learning even though the labels did not provide additional information (Fig. 1 left).**

**Learning labeled categories produced more stable category representations (Fig. 1 right).**

## Additional issues:

***Are words special?***

A follow-up experiment has shown that the *label* advantage persists for hieroglyphic symbols, (as well as auditory labels) suggesting that it is not specific to words, but may extend to other discrete environmental cues that are highly correlated with the categories. (Words are special in that they normally constitute these discrete environmental cues.)

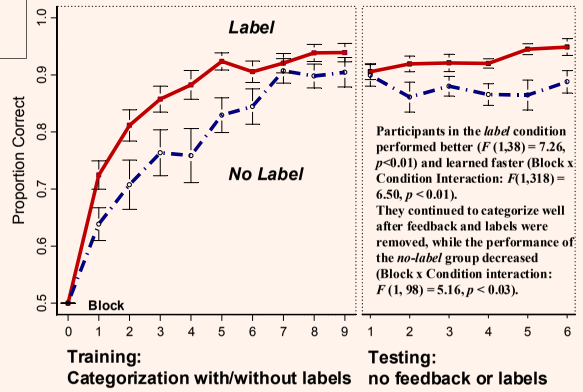
***Did the* label *advantage arise from greater time spent on task?***

No, there is no difference in latencies between the two conditions).

***Were participants really doing category learning (or merely memorizing exemplars)?***

Participants in both conditions performed well (>85%) on generalization trials of novel stimuli (included at test), suggesting that they were not entirely relying on memory for specific exemplars.

Figure 1




## For further information

Please contact Gary Lupyan at *glupyan@cnbc.cmu.edu*. A PDF copy of this poster is available at www.cnbc.cmu.edu/~glupyan/lupyanLehigh2005.pdf

## Conclusions

**Providing redundant labels facilitated learning of novel categories and resulted in more stable category representations.**

Despite undergoing the same amount of experience categorizing perceptual stimuli into behavioral categories (*move away* or *move towards*), the presence of labels (nonsense words: "leebish"/"grecious") helped normal English-speaking adults to represent the stimuli in terms of the appropriate behavioral categories.

Words or other discrete modes of representation may be necessary for entertaining certain abstract concepts like large exact numerosities (Gordon, 2004). However, learning to associate words even with more ordinary perceptually-based categories such as those used here, facilitates their acquisition and results in more robust subsequent knowledge.

## References


Clark, A. (1997). *Being There: Putting brain, body, and world together again.* Cambridge, MA: MIT Press.

Davidoff, J., Davies, I., & Roberson, D. (1999). Colour categories in a stone-age tribe (vol 398, pg 203, 1999). *Nature, 402,* 604.

Gentner, D. & Goldin-Meadow, S. (2003). *Language in Mind: Advances in the Study of Language and Thought.* Cambridge, MA.: MIT Press.

Gordon, P. (2004). Numerical cognition without words: Evidence from Amazonia. *Science, 306,* 496-499.

Ozgen, E. (2004). Language, Learning, and Color Perception. *Current Directions in Psychological Science, 13,* 95-98.

Roberson, D., Davidoff, J., & Braisby, N. (1999). Similarity and categorisation: neuropsychological evidence for a dissociation in explicit categorisation tasks. *Cognition, 71,* 1-42.

Waxman, S. R. & Markow, D. B. (1995). Words as invitations to form categories: Evidence from 12- to 13-month-old infants. *Cognitive Psychology, 29,* 257-302.


## Acknowledgments


Thanks to Jay McClelland, David Rakison, Brian MacWhinney for useful discussion, Mike Tarr for kindly providing the YUFO stimuli, and Brian Mathias for help with data collection. This work was supported in part by a NSF Graduate Fellowship to the author.


Carnegie Mellon

CNBC Center for the Neural Basis of Cognition