

DOES GREATER USE OF LANGUAGE PROMOTE GREATER CONCEPTUAL ALIGNMENT?

HETTIE ROEBUCK ^{*}1, GARY LUPYAN¹

^{*}Corresponding Author: hroebuck@wisc.edu

¹Department of Psychology, UW-Madison, Madison, USA

People show a surprisingly high degree of conceptual alignment even in the face of sometimes large differences in perceptual experience (Dieciuc & Folstein, 2019). For example, when asked to generate features of common objects, sighted and congenitally blind people show near perfect agreement ($r=0.96$) (Lenci, Baroni, Cazzolli, & Marotta, 2013; Bedny, Koster-Hale, Elli, Yazzolino, & Saxe, 2019; Kim, Elli, & Bedny, 2019). People also show quite high agreement in more open-ended tasks people, e.g., asked to draw a piece of furniture (one of the current studies), 47% of people drew a chair.

Here, we ask whether conceptual alignment is increased by the use of language. Why would language promote alignment? At its most basic, language provides us with a set of category labels which group together distinct perceptual experiences. This applies across concrete concepts: an ant and a butterfly might both be labeled as “insects”, to more abstract concepts: a painting on a wall and an apple on a table are labeled as instances of “on”-ness (Bedny et al., 2019; Kim et al., 2019). Different experiences, when labeled using common categorical terms, become represented as more similar and because labels highlight category-diagnostic dimensions, may become represented as more typical (Lupyan, 2012).

Examining links between language and conceptual alignment is relevant for understanding the evolution of language because it helps us understand the *functions* of language. To the extent that greater conceptual alignment facilitates both communication and cooperation (Markman & Makin, 1998; Silvey, Kirby, & Smith, 2019), finding that language itself increases conceptual alignment hints that such an increase may have acted as a selection pressure on the emergence of language.

Here, we test the link between language and conceptual alignment in a novel way: by taking advantage of natural variability in people’s self-reported internal verbalization. While most people describe frequently experiencing inner speech, and consciously relying on language while planning, problem-solving, and

recalling memories, others do so to a much lesser degree, or not at all (e.g., Alderson-Day & Fernyhough, 2015; Hurlburt, Heavey, & Kelsey, 2013).

We used a questionnaire to quantify differences in people's internal verbalization using Likert-type questions such as 'If I am walking somewhere by myself, I often have a silent conversation with myself.' Our questionnaire shows high reliability and predicts a number of objective difference in spontaneous uses of language (Roebuck & Lupyan, 2019). We then correlated this measure of *internal verbalization* with two measures of conceptual alignment. In Study 1, we asked people (64 adult English speakers) to rank photographs from common categories on their relative typicality, and then assessed whether the similarity of their rankings (a proxy for conceptual alignment), is predicted by their internal verbalization score. In Study 2, we presented people ($n=200$) with four drawing prompts (*piece of furniture, kitchen appliance, dessert, reptile*) and then recruited new people to rate each drawing on its typicality of the prompt category. We then used a convolutional neural network to measure visual similarity between each pair of images drawn from the same cue (e.g., all *reptile* drawings).

Study 1 found that people with higher internal verbalization rated the typicality of photographs (e.g., types of cars, dogs, etc.) in more similar ways to one another. Study 2 showed that people with higher internal verbalization produced drawings that were more typical exemplars of the cued category (Fig. 1). Although internal verbalization did not predict *which* basic-level types people drew when prompted with a superordinate cue (i.e., lizard vs. snake vs. turtle), higher internal verbalization was associated with drawing more typical lizards, snakes etc. (even when controlling for how well-drawn the image was $t=2.0$). When we compared pairs of drawings (e.g., every cake with every other cake), we found that more *similar* internal verbalization between drawers was associated with more similar ratings of typicality and more visual similarity between drawings ($t=3.2$). Taken together, the results support the idea that greater use of internal language promotes conceptual alignment, even for very familiar and concrete categories.

Our finding of lower conceptual alignment among people who report relying less on language offers a provocative hint at how much lower our alignment might be if we could not rely on language at all. Our ongoing work is testing the *causal* role of internal language in conceptual alignment by manipulating the availability of task relevant language.

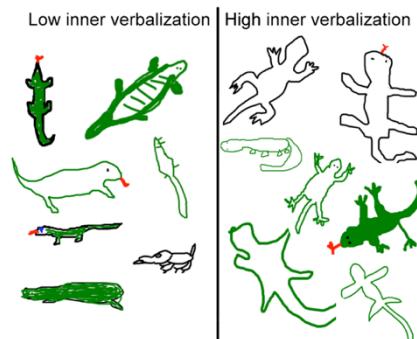


Fig 1 Example of lizard drawings from the *draw a reptile* prompt from people with low vs. high internal verbalization scores. Greater internal verbalization was associated with greater measured category typicality.

Acknowledgements

This research was supported by NSF-PAC Grant 1734260 to GL.

References

- Alderson-Day, B., & Fernyhough, C. (2015). Inner speech: Development, cognitive functions, phenomenology, and neurobiology. *Psychological Bulletin, 141*(5), 931–965. <https://doi.org/10.1037/bul0000021>
- Bedny, M., Koster-Hale, J., Elli, G., Yazzolino, L., & Saxe, R. (2019). There's more to "sparkle" than meets the eye: Knowledge of vision and light verbs among congenitally blind and sighted individuals. *Cognition, 189*, 105–115. <https://doi.org/10.1016/j.cognition.2019.03.017>
- Dieciuc, M. A., & Folstein, J. R. (2019). Typicality: Stable structures and flexible functions. *Psychonomic Bulletin & Review, 26*(2), 491–505. <https://doi.org/10.3758/s13423-018-1546-2>
- Hurlburt, R. T., Heavey, C. L., & Kelsey, J. M. (2013). Toward a phenomenology of inner speaking. *Consciousness and Cognition, 22*(4), 1477–1494. <https://doi.org/10.1016/j.concog.2013.10.003>
- Kim, J. S., Elli, G. V., & Bedny, M. (2019). Knowledge of animal appearance among sighted and blind adults. *Proceedings of the National Academy of Sciences, 116*(23), 11213–11222. <https://doi.org/10.1073/pnas.1900952116>
- Lenci, A., Baroni, M., Cazzolli, G., & Marotta, G. (2013). BLIND: A set of semantic feature norms from the congenitally blind. *Behavior Research Methods, 45*(4), 1218–1233. <https://doi.org/10.3758/s13428-013-0323-4>
- Lupyan, G. (2012). What Do Words Do? Toward a Theory of Language-Augmented Thought. In *Psychology of Learning and Motivation* (Vol. 57, pp. 255–297). <https://doi.org/10.1016/B978-0-12-394293-7.00007-8>
- Markman, A. B., & Makin, V. S. (1998). Referential communication and category acquisition. *Journal of Experimental Psychology: General, 127*(4), 331–354. <https://doi.org/10.1037/0096-3445.127.4.331>
- Roebuck, H., & Lupyan, G. (2019, May 9). The Internal Representations Questionnaire: Measuring modes of thinking. <https://doi.org/10.31234/osf.io/euhcn>
- Silvey, C., Kirby, S., & Smith, K. (2019). Communication increases category structure and alignment only when combined with cultural transmission. *Journal of Memory and Language, 109*, 104051. <https://doi.org/10.1016/j.jml.2019.104051>