

How are exemplar representations transformed by encoding, retrieval, and explicit knowledge? A commentary on Ambridge (2020)

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How are exemplar representations transformed by encoding, retrieval, and explicit knowledge?

A commentary on Ambridge (2020)

Abstract

The radical exemplar model resonates with work on perceptual classification and categorization highlighting the role of exemplars in memory representations. Further development of the model requires acknowledgment of both the fleeting and fragile nature of perceptual representations and the gist-based, good-enough quality of long-term memory representations. Retrieval operations potentially serve as a mechanism for abstraction as representations of exemplars are distorted through reconstructive processes. As a framework applicable to both first and second language acquisition, the model needs to account for how explicit knowledge arises and its role in filtering input via selective attention.

The radical exemplar model of language acquisition (Ambridge, 2019) resonates with decades of research emphasizing the role of exemplars in perceptual classification and categorization (Medin & Smith, 1984; Nosofsky & Palmieri, 1997). This commentary highlights two issues that need further discussion. First, the radical exemplar model needs to acknowledge the distinction between verbatim, episodic perceptual representations, which are fragile and fleeting, and gist representations retrieved from long-term memory, which are schematic and “good enough” for whatever task is at hand (Ferreira, Bailey, & Ferraro, 2002; Reyna & Brainerd, 1995). The fleeting nature of linguistic input requires the learner to extract information and compute similarities quickly while input is passing through the “now-or-never” bottleneck (Christiansen & Chater, 2016). Specific contextual details of individual exemplars become inaccessible once attention has moved on to whatever comes next, as indicated by poor source memory (Drummey & Newcombe, 2002; Sprondel, Kipp, & Mecklinger, 2011) and tendencies to regularize inconsistent grammatical patterns in the input (Bowerman, 1982; Singleton & Newport, 2004). Selective attention at the time of encoding inadvertently leads to inattentional blindness or deafness (McDonald & Lavie, 2011). Encoding is influenced by prior knowledge and hence subject to bias. In the case of language, such filtering of contextual detail has been termed “thinking for speaking” where speakers selectively attend to the aspects of events associated with the requirements of obligatory grammatical marking in whatever language they speak (Slobin, 1996).

In addition to information loss associated with selective attention at the time of encoding, the reconsolidation that occurs as gist is retrieved from long-term memory also alters representations. Retrieval operations make information more accessible for future use, as

indicated by research on the benefits of testing for long-term retention (Roediger & Karpicke, 2006; Rowland, 2014). Such operations may also account for the priming effects that are pervasive in language processing (Bock, Dell, Chang, & Onishi, 2007; Pickering & Branigan, 1999), where recent activation of linguistic structures makes them more likely to be used again. Crucially, each act of retrieval from long-term memory creates a new memory trace, potentially altering features of the recalled exemplar as constructive memory processes fill in details based on recent events, priors, central tendencies, plausibility given the context at hand, etc. The considerable evidence for false memories (Loftus, 1997; Roediger & McDermott, 1995) is testimony for this effect. Reconstructive processes may serve to entrench prototypical or expected features at the expense of other features. Thus, even if they are “on the fly” analogical generalizations, the products of retrieval operations are processed like other exemplars and accrue frequency to the extent that they are identified as instances of the same type. In this sense, as the idiosyncratic features of specific exemplars fade over time, the retrieval of gist from long-term memory may pave the way for abstraction as it is instantiated, for example, in language learning accounts that differentiate between types and tokens (Bybee, 2010). The key question is how representations of exemplars are linked so that token frequencies can accrue over time and be recognized as instances of the same type.

Second, the radical exemplar model needs to explain how explicit knowledge arises and its role in filtering perceptual input via selective attention. Even though the radical exemplar model might go as far as rejecting the very existence of categories, it needs to be able to account for evidence that shows how category labels and representations modify perception and processing, especially when they become part of explicit knowledge. Research on second

language acquisition (e.g., de Keyser, 2008; Rebuschat, 2015, Schmidt, 1990) emphasizes the benefits of explicit knowledge, gained from noticing and conscious awareness of relevant features, in guiding learning of morphosyntactic regularities more so than research on first language acquisition, yet explicit knowledge also emerges naturally during childhood with implications for learning strategies (see Karmiloff-Smith (1992) for a developmental account).

One widely studied example concerns the influence of labeling on the encoding of exemplars. It has been suggested that the act of labeling serves as an invitation to form a category (Waxman & Markow, 1995), directing attention to shape or other features (e.g., function, material) that help the learner to identify exemplars of the category (Kemler Nelson, Frankenfield, Morris, & Blair, 2000; Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002; Subrahmanyam, Landau, & Gelman, 1999). Verbal labels also impact what features are encoded with implications for memory representations (Lupyan, 2008; Schooler & Engstler-Schooler, 1990). Notably the effect of labeling may become stronger over time; for example, Sloutsky and Fisher (2004) found that 5-year-olds were more accurate in recalling specific category exemplars (i.e., individual cats) than adults, which they argued was due to stronger reliance on category-based as opposed to similarity-based induction in adults, which stems from their spontaneous labeling of the set of exemplars. Crucially, providing a verbal label prior to showing children the exemplars eliminated their advantage in item memory.

Another prominent example of explicit knowledge impacting perception comes from literacy research. Acquisition of letter-sound associations alters phonological processing, as knowledge of correspondences between graphemes and phonemes or syllables becomes more explicit. Such changes are evident in performance on phonological awareness tasks such as

rhyme detection, alliteration, and phoneme deletion (see Huettig & Mishra (2014) for a review of research comparing phonological processing in literate and illiterate individuals). Other research suggests that orthographic representations become associated with idealized auditory representations of words and their constituent phonemes, which enhances categorical processing of speech (McMurray, Danelz, Rigler, & Seedorff, 2018). This and related evidence suggest that explicit, categorical representations shape processing thereby altering the memory traces of individual exemplars. A radical exemplar model needs to be able to explain how such explicit knowledge can be generated by “on the fly” analogy formation and give rise to top-down effects on exemplar processing.

References

- Ambridge, B. (2019). Against stored abstractions: A radical exemplar model of language acquisition. *First Language*. <https://doi.org/10.1177/0142723719869731>
- Bock, K., Dell, G. S., Chang, F., & Onishi, K. H. (2007). Persistent structural priming from language comprehension to language production. *Cognition*, *104*(3), 437-458. <https://doi.org/10.1016/j.cognition.2006.07.003>
- Bowerman, M. (1982). Starting to talk worse: Clues to language acquisition from children's late speech errors. In S. Strauss (Ed.), *U shaped behavioral growth* (pp. 101-145). New York: Academic Press.
- Bybee, J. (2010). *Language, usage and cognition*. Cambridge, UK: Cambridge University Press.

- Christiansen, M. H., & Chater, N. (2016). The now-or-never bottleneck: A fundamental constraint on language. *Behavioral and Brain Sciences*, 39, e62.
<https://doi.org/10.1017/S0140525X1500031X>
- DeKeyser, R. (2008). Implicit and explicit learning. In C. J. Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 313-348). Malden, MA: Blackwell.
- Drummey, A. B., & Newcombe, N. S. (2002). Developmental changes in source memory. *Developmental Science*, 5(4), 502-513. <https://doi.org/10.1111/1467-7687.00243>
- Ferreira, F., Bailey, K. G., & Ferraro, V. (2002). Good-enough representations in language comprehension. *Current Directions in Psychological Science*, 11(1), 11-15.
<https://doi.org/10.1111/1467-8721.00158>
- Huettig, F., & Mishra, R. K. (2014). How literacy acquisition affects the illiterate mind – A critical examination of theories and evidence. *Language and Linguistics Compass*, 8(10), 401-427. <https://doi.org/10.1111/lnc3.12092>
- Karmiloff-Smith, A. (1992). *Beyond modularity: A developmental perspective on cognitive science*. Cambridge, MA: MIT Press.
- Kemler Nelson, D. G., Frankenfield, A., Morris, C., & Blair, E. (2000). Young children's use of functional information to categorize artifacts: Three factors that matter. *Cognition*, 77(2), 133-168. [https://doi.org/10.1016/S0010-0277\(00\)00097-4](https://doi.org/10.1016/S0010-0277(00)00097-4)
- Loftus, E. F. (1997). Creating false memories. *Scientific American*, 277(3), 70-75.
<https://www.jstor.org/stable/24995913>

- Macdonald, J. S., & Lavie, N. (2011). Visual perceptual load induces inattentional deafness. *Attention, Perception, & Psychophysics*, *73*(6), 1780-1789.
<https://doi.org/10.3758/s13414-011-0144-4>
- McMurray, B., Danelz, A., Rigler, H., & Seedorff, M. (2018). Speech categorization develops slowly through adolescence. *Developmental Psychology*, *54*(8), 1472-1491.
<https://doi.org/10.1037/dev0000542>
- Medin, D. L., & Smith, E. E. (1984). Concepts and concept formation. *Annual Review of Psychology*, *35*(1), 113-138. <https://doi.org/10.1146/annurev.ps.35.020184.000553>
- Nosofsky, R. M., & Palmeri, T. J. (1997). An exemplar-based random walk model of speeded classification. *Psychological Review*, *104*(2), 266-300. <https://doi.org/10.1037/0033-295X.104.2.266>
- Pickering, M. J., & Branigan, H. P. (1999). Syntactic priming in language production. *Trends in Cognitive Sciences*, *3*(4), 136-141. [https://doi.org/10.1016/S1364-6613\(99\)01293-0](https://doi.org/10.1016/S1364-6613(99)01293-0)
- Rebuschat, P. (Ed.) (2015). *Implicit and explicit learning of languages*. Amsterdam, NL: John Benjamins Publishing Company.
- Reyna, V. F., & Brainerd, C. J. (1995). Fuzzy-trace theory: An interim synthesis. *Learning and individual Differences*, *7*(1), 1-75. [https://doi.org/10.1016/1041-6080\(95\)90031-4](https://doi.org/10.1016/1041-6080(95)90031-4)
- Roediger III, H. L., & Karpicke, J. D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, *17*(3), 249-255.
<https://doi.org/10.1111/j.1467-9280.2006.01693.x>

- Roediger III, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21(4), 803-814. <https://doi.org/10.1037/0278-7393.21.4.803>
- Rowland, C. A. (2014). The effect of testing versus restudy on retention: a meta-analytic review of the testing effect. *Psychological Bulletin*, 140(6), 1432-1463. <https://doi.org/10.1037/a0037559>
- Schmidt, R. (1990). The role of consciousness in second language learning. *Applied Linguistics*, 11, 129-158. <https://doi.org/10.1093/applin/11.2.129>
- Schooler, J. W., & Engstler-Schooler, T. Y. (1990). Verbal overshadowing of visual memories: Some things are better left unsaid. *Cognitive Psychology*, 22(1), 36-71. [https://doi.org/10.1016/0010-0285\(90\)90003-M](https://doi.org/10.1016/0010-0285(90)90003-M)
- Singleton, J. L., & Newport, E. L. (2004). When learners surpass their models: The acquisition of American Sign Language from inconsistent input. *Cognitive Psychology*, 49(4), 370-407. <https://doi.org/10.1016/j.cogpsych.2004.05.001>
- Slobin, D. (1996). From "thought and language" to "thinking for speaking". In J. Gumperz and S. Levinson (Eds.), *Rethinking linguistic relativity* (pp. 70-96). New York: Cambridge University Press.
- Sloutsky, V. M., & Fisher, A. V. (2004). When development and learning decrease memory: Evidence against category-based induction in children. *Psychological Science*, 15(8), 553-558. <https://doi.org/10.1111/j.0956-7976.2004.00718.x>

- Smith, L. B., Jones, S. S., Landau, B., Gershkoff-Stowe, L., & Samuelson, L. (2002). Object name learning provides on-the-job training for attention. *Psychological Science, 13*(1), 13-19. <https://doi.org/10.1111/1467-9280.00403>
- Sprondel, V., Kipp, K. H., & Mecklinger, A. (2011). Developmental changes in item and source memory: Evidence from an ERP recognition memory study with children, adolescents, and adults. *Child Development, 82*(6), 1638-1953. <https://doi.org/10.1111/j.1467-8624.2011.01642.x>
- Subrahmanyam, K., Landau, B., & Gelman, R. (1999). Shape, material, and syntax: Interacting forces in children's learning in novel words for objects and substances. *Language and Cognitive Processes, 14*(3), 249-281. <https://doi.org/10.1080/016909699386301>
- Waxman, S. R., & Markow, D. B. (1995). Words as invitations to form categories: Evidence from 12-to 13-month-old infants. *Cognitive Psychology, 29*(3), 257-302. <https://doi.org/10.1006/cogp.1995.1016>