Recognition memory for questions and their answers

Melissa J. Evans[1], Natalie Andreoli[1], Daphna Heller[2], & Sarah Brown-Schmidt[1]

1 Vanderbilt University 2 University of Toronto

Conversation involves exchanging information, which needs to be retained in memory to make subsequent conversational moves. For example, questions are normally used when a speaker does not know something, but they assume that the addressee does. According to a recent proposal, when asking a question, the speaker represents the addressee's knowledge, including a temporary placeholder to represent the information that the speaker seeks and that they assume the addressee has[1]. This proposal mirrors proposals in formal linguistics that the meaning of a question is the set of its possible answers[2]. Thus, both cognitive and linguistic proposals place the thrust of the representation of a question on the *answer* to that question. We therefore predict that the focus of attention would be on the answer to a question. Given well-known links between attention and memory[3], attention should therefore orient towards the answer, and therefore increase the ability to remember that answer later. We tested this prediction in two experiments where participant pairs performed a communication task and completed a recognition test for items discussed.

Experiment 1. Pairs of participants (N=43) played an unscripted game in English, where they had to determine if their (separate) screens matched (Fig. 1A; mismatches were on fillers). On each trial, participants alternated who asked a question first, but otherwise participants were free to converse. For example, a participant may ask *"What's next to the lemon?"*, to which their partner may answer *"a tree"*. After completing the communication game, a recognition memory task (½ old, ½ new) probed memory for the images including the question material (lemon) and answer material (tree) (Fig. 1B).

To test the hypothesis that *answers* are prioritized in memory, we tested memory for the images, using a pre-registered GLMM. Memory was indeed better for images mentioned in *answers* vs. *questions* (e.g., tree > lemon; $\beta = .82, p < .001$), consistent with our hypothesis that answers are prioritized in memory. Memory was also better for images mentioned by *oneself* vs. the *partner*, replicating the well-established "generation benefit"[4] ($\beta = 1.57, p < .001$). There was also a significant interaction ($\beta = .53, p < .01$), with a smaller generation benefit for answers, likely due to a ceiling effect in memory for answers. The findings support the predicted link between question meaning (sum of its possible answers) and memory and are consistent with reports of a memory advantage for answers in task-based conversation[5]. However, in Q-A pairs, the question consistently precedes the answer, and typically question materials are *given* while answer materials are *new*. Thus, in E2 we test the hypothesis that the answer benefit in memory is due to its answer status, rather than the fact that answers are typically mentioned last, by experimentally manipulating in a single study whether 1st vs. 2nd mentioned items appeared in Q-A pairs vs. assertions.

Experiment 2. Participants (N=60) discussed images in Q-A pairs as in E1 or were asked to 'describe a pair on your own' (manipulated within-*ss*). Utterances were unscripted, so assertions were of various forms (e.g., *"Next to the lemon I have a tree"* or *"I've got a lemon with a tree"*, etc.) and the partner replied freely (e.g., *"yup"*). Analysis of referential form found that 73% and 83% of 1st and 2nd-named items in assertions were *indefinite* (e.g., *a tree*), suggesting both items were presented as *new*. In contrast, the referential form of questions was *definite* (e.g., *the tree*) in 94% of questions and *indefinite* in 88% of answers.

Analysis of memory revealed (i) a generation benefit, with better memory for images mentioned by oneself ($\beta = 1.44, p < .001$); (ii) better memory for images discussed in Q-A pairs vs. assertions ($\beta = .19, p = .015$); and (iii) better memory for images mentioned 2nd (regardless of whether they were mentioned in a Q-A pair or an assertion) ($\beta = -0.76, p < .001$). The interaction between task and order was not significant ($\beta = -0.10, p = .35$), indicating that 2nd mentioned items were better remembered than 1st-mentioned items, regardless of utterance form. So while *answers* are better remembered, the memory benefit may be partially determined by the fact that answers follow the questions that prompt them.

Discussion: Drawing on proposals in linguistics and cognitive approaches to conversation, we argue the thrust of an information question is its *answer*, leading to a predicted memory advantage for answer vs. question material. Our findings reveal that answers are remembered better than questions, but the order in which information is introduced into conversation matters as well. Communication requires building and maintaining memory representations of past exchanges. We demonstrate that these representations are multiply determined, requiring consideration of meaning, temporal structure, and form.
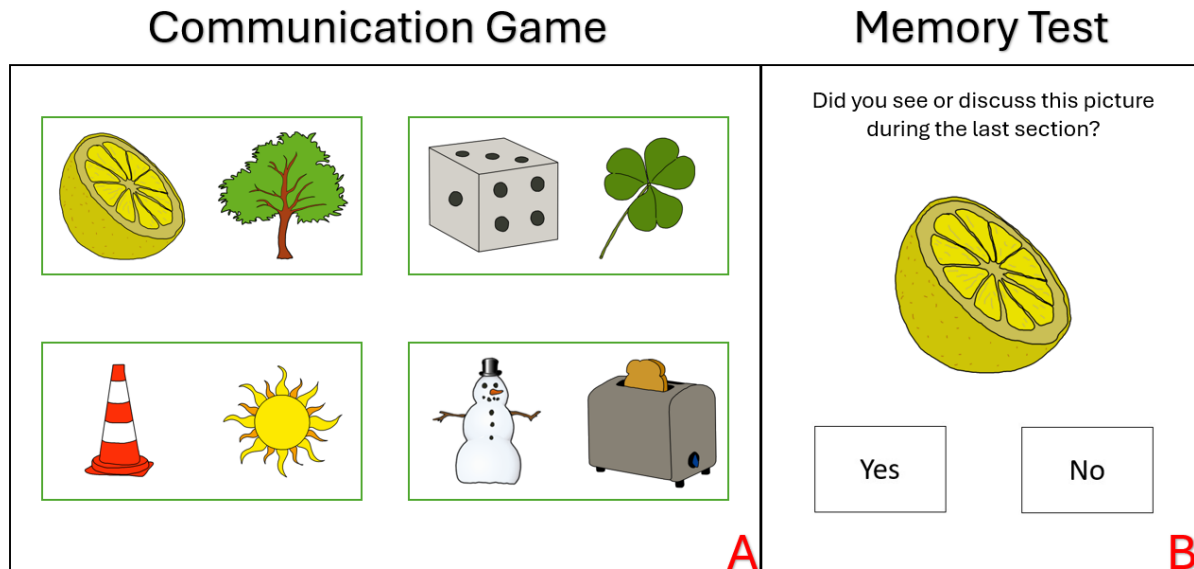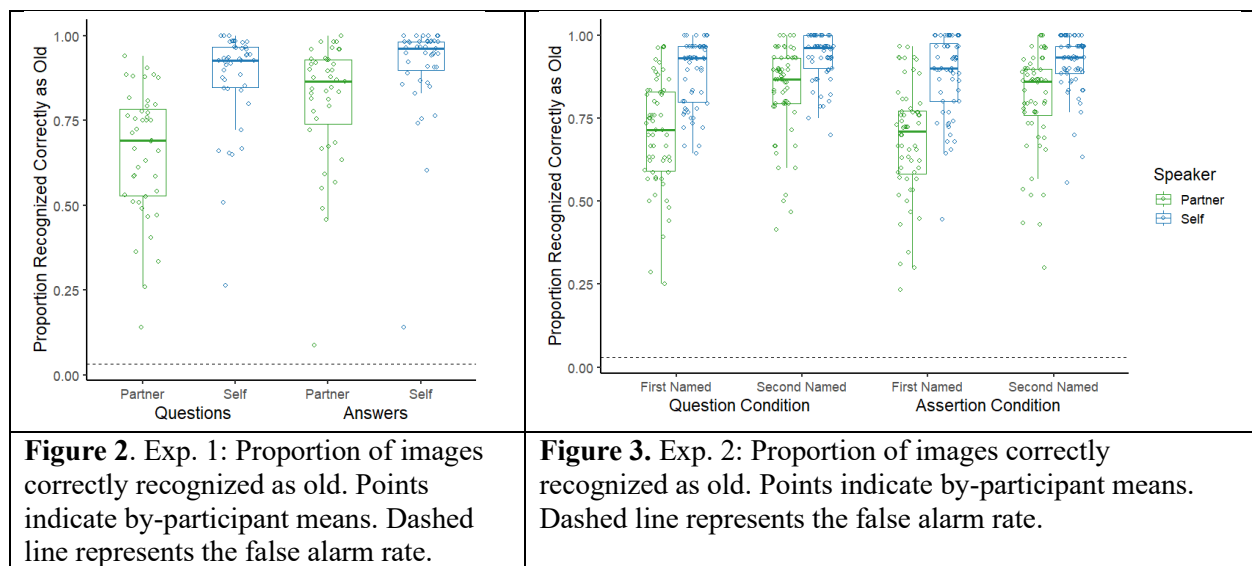
Figure 1. Visuals that participants viewed during (A) the communication game and (B) the memory test. Participants were cued as to whose turn it was to ask a question (or make an assertion, in Experiment 2).

Figure 2. Exp. 1: Proportion of images correctly recognized as old. Points indicate by-participant means. Dashed line represents the false alarm rate.

Figure 3. Exp. 2: Proportion of images correctly recognized as old. Points indicate by-participant means. Dashed line represents the false alarm rate.

References

1. Heller, D., & Brown-Schmidt, S. (2023). The Multiple Perspectives Theory of Mental States in Communication. *Cognitive Science*, *47*(7), e13322. https://doi.org/10.1111/cogs.13322
2. Groenendijk, J. A. G., & Stokhof, M. J. B. (1984). *Studies on the semantics of questions and the pragmatics of answers* [Doctoral dissertation]. Univ. Amsterdam.
3. Bentin, S., Kutas, M., & Hillyard, S. A. (1995). Semantic processing and memory for attended and unattended words in dichotic listening: Behavioral and electrophysiological evidence. *Journal of Experimental Psychology: Human Perception and Performance*, *21(1)*, 54–67.
4. Slamecka, N. J., & Graf, P. (1978). The generation effect: Delineation of a phenomenon. *Journal of Experimental Psychology: Human Learning and Memory, 4*(6), 592–604.
5. Zormpa, E., Meyer, A. S., & Brehm, L. E. (2023). In conversation, answers are remembered better than the questions themselves. *Journal of Experimental Psychology: Learning, Memory, and Cognition*.