Supplementary Methods

Amnesic Participants

There were four amnesic participants (two males, two females) (See Supplementary Table 1). For three of these patients amnesia was consequent to an anoxic/hypoxic episode (cardiac arrest in 2563 and 2363, and an allergic reaction leading to status epilepticus in 0001); for the other (0002) amnesia resulted from closed head injury. The anoxic amnesics all had bilateral hippocampal damage confirmed by structural MRI. For one of these patients (2363), high-resolution volumetric MRI analyses showed hippocampal volumes decreased by more than 2.5 standard deviations compared to age-matched comparison subjects, but without significant extra-hippocampal damage in associated medial temporal lobe regions. All four of the patients had memory impairments that were sufficiently severe to interfere with daily life, including preventing them from being employed since the onset of their amnesia, and all exhibited severe memory impairment on standardized tests of memory.

Methods for examining linguistic output and content: Descriptions for referencing cards

All trials from the collaborative referencing task were audio and video taped, and transcripts for each pair were generated and analyzed. The resulting dialogues are extensive. For analyses, each trial was divided into a series of 12 card placement sequences (CPS). Each CPS focused on identifying and placing a target card on the correct place number of the matchers’ board. For coding purposes, once a CPS was initiated, the pair was considered to be acting within the CPS until the target card was placed or until the pair agreed to skip the card. Within a CPS it was possible, and in fact common, for pairs to engage in additional or side talk about other cards, the rules and procedures of the task, and non-task talk. In some cases, after an initial attempt had been made to place all twelve cards, the pair returned to cards that had been skipped, were considered problematic, or that were incorrectly placed.

For the main analyses reported in the paper, only the first attempt at describing a target card within that trial – the initial description – was used. However, total word counts, i.e., word counts for the entire dialogues, were compiled for participant pairs, together, as well as for directors and matchers separately. These data are shown in the Supplementary Figure 1.

Initial Descriptions

An initial description is the directors’ (patients’) first attempt on each trial at describing each of the 12 cards, and includes their entire first turn. A turn was defined as one or more utterances produced by one individual until such time that there was a change in speaker. The concept of turns is illustrated in Table 1 of the paper, where the bold text shows when the matcher contributed to the dialogue; the alternation between the non-bold and bold portions of text shows the pair alternating turns. The initial description of each card, then, refers to the words generated by the director prior to the first contribution by the matcher for that card.

The purpose of identifying the initial description for each card was to document how the directors (patients) described each of the 12 cards on each of the 24 trials (in terms of number of words and the content of their descriptions), before any input from the matcher on that trial. Tracking changes across trials in the number of words and the semantic content of the initial descriptions provided us with quantitative and qualitative assessments of the learning.

Editing the initial descriptions

Across the 24 trials of the interactive barrier task, the participants and their partners communicated about many things, including the cards, the rules and procedures for the task, the task materials (e.g., the numbered boards and the barrier), strategies for referencing the cards and completing the task, as well as topics not related to the task (e.g., what they would do when they got home), sometimes even within the period of the initial description. Accordingly, to get word counts that are a pure reflection of the actual card descriptions by the directors in their
initial descriptions, it was necessary to edit the dialogues, leaving in only those words involved in their describing or referencing each card. The resulting counts are called **description word counts**. The various categories of words that were edited out are described below, along with examples of each category.

**Task Management:** Task management refers to discussion of the barrier task and the associated rules and procedures. Words occurring in the initial description which were dedicated to task management were excluded from the word counts. The following words, phrases, and sentences in parenthesis were considered task management: 1) discussion and review of rules, participant roles, procedures, and strategies (e.g., (Starting with number one), the figure with the kicking (One, two, three, four, five. Yeah, this is figure five.) It’s got a diamond at the top of the figure, and it’s barely touching the bottom part of the figure. 2) overt displays of transitions from task to non-task talk or transitions between cards (e.g., (Now let’s take care of some of these dogs.) The dog is facing the left, he’s got the perfect square is on top of the rectangular square; (The next one is) the siesta man; (Then) the dude laying there taking a nap, laying against something.

**Reference to place:** Reference to the place number or physical location for placement of the target card was excluded from the word counts for the initial description. The following words and phrases in parenthesis were considered reference to place: 1) (Number three is) the figure facing right that’s pretty solid with knees bent; 2) (The last one goes on one and) it has a triangle to the right of it, 3) Race horse (on three), 4) (First one on bottom row is) the Viking ship.

**Mazing:** A maze is defined as a series of words or initial parts of words which do not add up, either to meaningful communication or to structural units (Loban, 1963). The following were considered mazes: 1) exact repetition of words or phrases (e.g., This guy is (standing on) standing on his head), 2) false starts and revisions (e.g., (there’s a there’s a a a a, there’s a) there’s two of them that kind of look like houses), 3) abandoned utterances or phrases (e.g., (this, there’s, I am trying to do the, there’s) there’s a number of ‘em that have a little square); 4) nonlinguistic vocalizations (e.g., The house with the (uh) straight up and down chimney) and 5) word parts (e.g., The guy (kn) kneeling down, spreading his arms over head).

**Other:** Words or phrases that were not essential parts of the initial description were excluded from the word counts. The following are examples of words or phrases that fell into the other category: 1) exophoric comments (e.g., that’s all I can think of), 2) carrier phrases (e.g., (this one looks like) a guy leaning against a tree), 3) sentence tags (e.g., you know what I mean; I guess; whatever), and 4) discourse markers (e.g., okay, alright, well).

Once the initial descriptions had been edited, the remaining words were counted. Words were broadly defined in order to describe the amount of verbal space used by the directors. Therefore, contractions (e.g., can’t) and elided words (e.g., kinda, hafta) were each counted as one word.