Supporting Information

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SI Methods

Subjects. Sixteen male Long-Evans rats [*Rattus norvegicus* (Harlan); 76 days old and 269 g, on average, at the start of the experiment] were individually housed with light onset and offset in the colony at 7:00 a.m. and 7:00 p.m. Eastern Standard Time, respectively. They received 45-mg chow and chocolate pellets (F0165 and F0299, respectively; Bio-Serv) during experimental sessions and 15–20 g/day of 5001-Rodent-Diet (Lab Diet) after completing each session. Water was available *ad libitum*, except during brief testing periods. All procedures were approved by the institutional animal care and use committee and followed the guidelines of the National Research Council *Guide for the Care and Use of Laboratory Animals*.

Apparatus. The 8-arm radial maze (described in refs. 1 and 2) had a central hub and 8 guillotine doors and arms. A food trough and a 45-mg pellet dispenser were located at the distal end of each arm. A photobeam in the trough detected head entries. Additional photobeams were 3.8 and 5.1 cm from guillotine doors. White noise masked outside noise. Experimental events (guillotine doors and food) were computer controlled from an adjacent room. Data (photobeam breaks) were recorded (10-ms resolution) with MED-PC software (version 4.0). Maze arms were cleaned with Nolvasan (Fort Dodge Animal Health) after each rat was removed from the maze. Chow and chocolate pellets were placed beside the filled pellet dispensers (i.e., food odors were constant throughout all parts of the experiment).

Preliminary Training. Pretraining permitted the rats to explore the maze in 3 20-min daily sessions, in which chow pellets were placed in 7 arms and corresponding troughs and 1 randomly chosen arm and trough contained chocolate pellets. During initial training, rats were individually placed in the central hub beginning at 7:00 a.m. for half the rats and 1:00 p.m. for the remaining rats (within each subset, rats were tested in a consistent order each day throughout all experiments to establish approximately constant times of day); all 8 doors were then opened. A visit was defined by the interruption of a food-trough photobeam; interruption of the photobeam near the guillotine door was required before the next interruption of a food-trough photobeam was counted as a visit. Food was dispensed into a trough contingent upon interruption of the photobeam located in that trough. Each arm containing chow dispensed one pellet per day. The arm containing chocolate (randomly selected each day) could dispense 3 pellets per visit. Rats could revisit locations with distinctive foods up to 5 times and receive 3 pellets per visit (additional food was not available after the fifth visit). Fifteen daily sessions ended when food was earned at each location or 10 min had elapsed.

Experiment 1. In block testing, 4 blocks of 15–20 morning and afternoon sessions alternated (73 sessions overall). For half of the rats, the chocolate location replenished in the morning but not in the afternoon session (designated as replenish and non-replenish conditions, respectively). This contingency was reversed for the other rats. Each session consisted of study (first helpings) and test (second helpings) phases, separated by a retention interval of 1.71 ± 0.05 min (mean ± SEM). Rats were individually placed in the central hub. In the study phase (first helpings), 4 doors (randomly chosen for each rat each day) were opened, with the restriction that 1 arm dispensed 3 chocolate pellets; all other accessible arms dispensed 1 chow pellet. The pellet(s) were delivered to accessible troughs contingent on the first interruption of the trough photobeam. The study phase ended when food had been dispensed at each accessible location, and then the rat was removed. After ≈2 min, the animal was returned to the hub for a test phase (second helpings) with all doors open. In the test phase, chow-flavored food was available at each arm not previously accessible at study (first helpings). Additionally in test phases (second helpings), the study-phase chocolate location provided 3 chocolate pellets per visit for up to 5 visits in the replenishment (but not in the non-replenishment) condition. The test phase ended when food had been dispensed at each of the baited locations (i.e., after 4 or 5 different arms had provided food in non-replenish and replenish conditions, respectively). On any given day, a morning or an afternoon session (but not both) was conducted.

In mixed testing, replenish and non-replenish sessions (24 overall) were conducted in random order, using blocks of 6 sessions (3 trials of each type), with the constraint that no more than 3 consecutive sessions of the same type occurred (see Fig. 1*A*). In all other respects, mixed testing was the same as block testing.

Experiment 2. Light onset occurred at 12:00 a.m. instead of 6:00 a.m., and a morning session was conducted as described in Experiment 1; light offset was as in Experiment 1, and each rat was presented with the early light onset only once (see Fig. 1*B*). The manipulation was presented to the rats in 2 subsets because typical session times could only be preserved if half the rats were tested in the morning. Consequently, half of the rats received this manipulation immediately after completion of Experiment 1. The other rats were placed in a nearby colony for 1 night with the Experiment-1 light cycle, and they were not tested for 1 day; next these rats were returned to the original colony, they received 4 days of additional mixed testing, and then they received the manipulation described above.

Experiment 3. Experiment 3 began after the rats were not tested for 5–10 days. Study-test sequences were identical to Experiment 1 except the retention interval was 7 h. Consequently, in the early session, first helpings occurred at 7:00 a.m. and second helpings at 2:00 p.m. In the late session, first helpings occurred at 1 p.m. and second helpings at 8:00 p.m. (Fig. 1*C*). The first 2 sessions were replenish and non-replenishment conditions, respectively (the order was determined randomly). The subsequent 16 sessions were presented in random order as described in mixed testing of Experiment 1. All other details were as described in Experiment 1.

Experiment 4. A study phase started at 1:00 p.m., and a test phase started at 2:00 p.m. (see Fig. 1*D*). Testing was again conducted for 2 subsets (as in Experiment 3), except that the order of testing subsets was reversed, and 1 day of mixed testing occurred before the second subset was tested.

1. Babb SJ, Crystal JD (2005) Discrimination of what, when, and where: Implications for episodic-like memory in rats. *Learn Motiv* 36:177–189.

2. Babb SJ, Crystal JD (2006) Discrimination of what, when, and where is not based on time of day. *Learn Behav* 34:124–130.

Table S1. Accuracy* in avoiding revisits to depleted chow-flavored locations

Procedure	Mean ± SEM
Experiment 1 block testing	0.77 ± 0.01
Experiment 1 mixed testing	0.72 ± 0.03
Experiment 2	0.80 ± 0.05
Experiment 3 initial	0.73 ± 0.04
Experiment 3 terminal	0.70 ± 0.01
Experiment 4	0.75 ± 0.04

*Accuracy was measured as the proportion correct in the first 4 choices excluding the chocolate location in a test phase. This analysis of the first 4 choices was restricted to the 7 non-chocolate arms. Accuracy expected by chance (i.e., random arm entries) is 0.46.