Figure S1.

Following termination of behavioral experiments rats were transcardially perfused and brains were extracted, sectioned, and slices were mounted onto slides and Nissl-stained with Cresyl Violet so that cannula placements could be verified histologically under a microscope. For all rats included in the analyses of all experiments, cannula tracts were placed between -2.8 and -3.8mm along the anterior-posterior (AP) axis relative to Bregma using the Paxinos and Watson (2013) rat brain atlas.

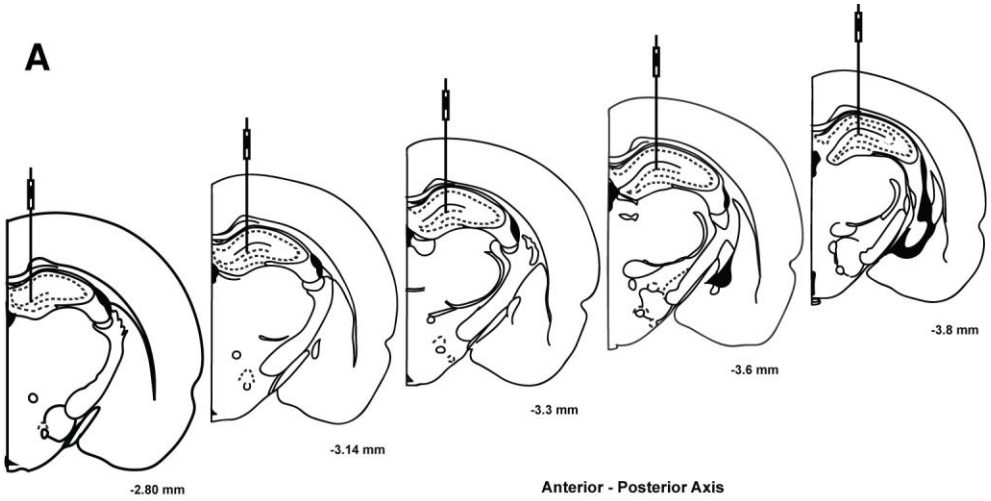

Figure S2. We ran a pilot to determine which arm separations would yield the most comparable results, in terms of behavior and angular distance, to the study from which the DNMP task was adapted. Animals (n = 12) received habituation and pre-training trials (not shown) prior to acquisition-training to assess performance on arm separations 1-6 (S1-6). Dependent measures were: (A) latency to obtain the reward (B) percentage of correct trials and (C) number of errors made. Data is shown for the last 3 days. The most disparate performance was between the 5-arm (S5, 150 degrees, DG-independent, royal blue) and 2-arm conditions (S2, 60 degrees, DG-dependent, magenta). Experiment 1: Prior to acquisition training, animals received 4 days of (D) habituation (HAB 1-4) and then 10 days of (E) pre-training (P1-10) where they were trained to obtain a reward from the maze in under 2 min. (F-H) Acquisition training (A1-A6) lasted 6 days and by the 5th day a difference emerged where rats performed better when they were tested in the S5 condition (black) compared to the S2 condition (grey) (n = 17) demonstrating that the S2 condition was more difficult. Significant differences are denoted with asterisks * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

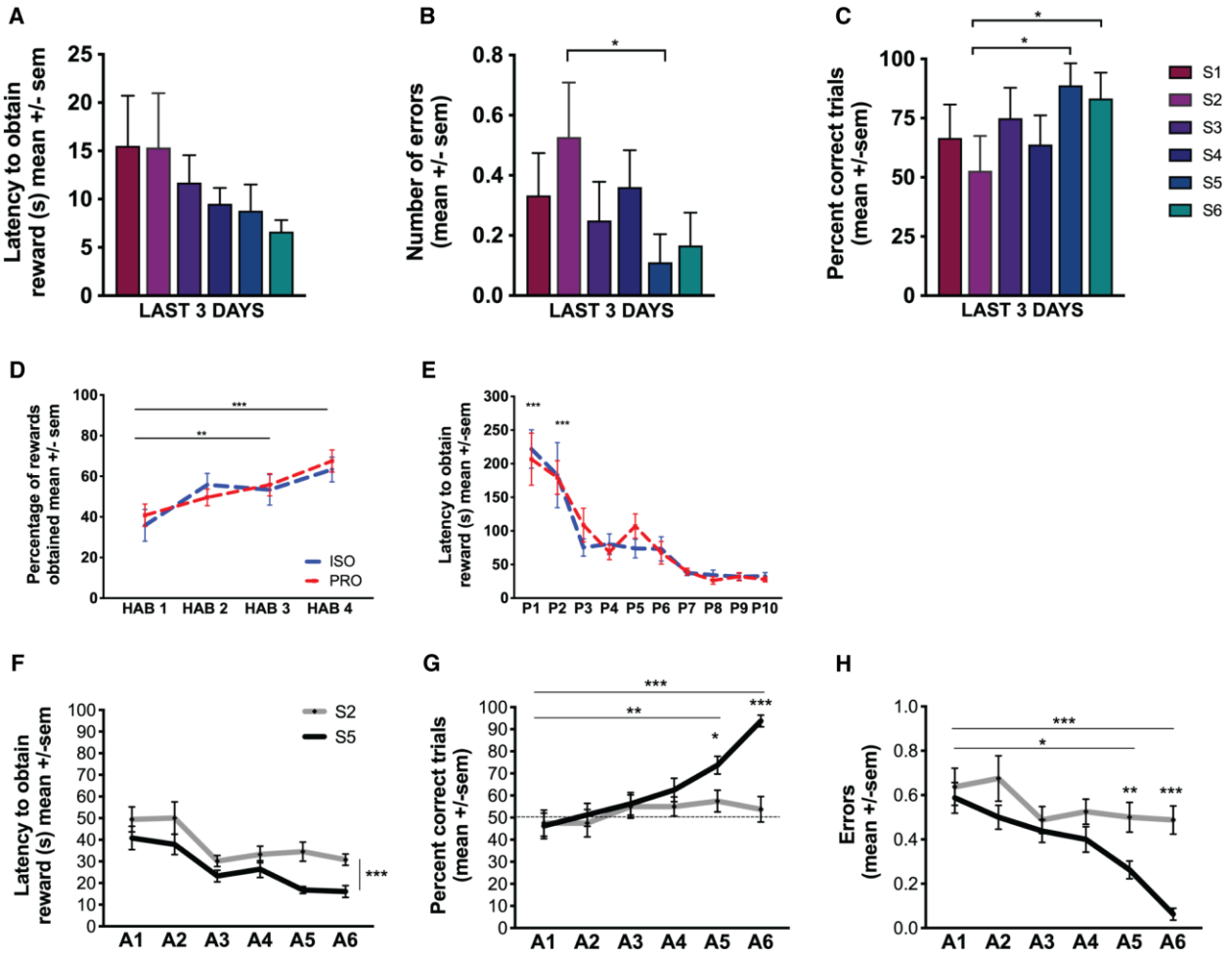

Figure S3 (A-F) Separating the test days, animals tested on S2 (grey; n = 17) and S5 (black; n = 17) conditions were given 4 washout days to ensure the drug had cleared. Dependent measures during washout sessions were latency to obtain reward, percent correct trials and number of errors. Rats were given either isoproterenol (left) or propranolol (right). (G-I) A curtain probe was administered to ensure rats were using extra-maze cues. Compared to the washout (white), during the curtain probe (purple) rats took longer to obtain the reward, demonstrated fewer percent correct trials and made more errors. Significant differences are denoted with asterisks * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, W1-W4 = Washout sessions 1-4.

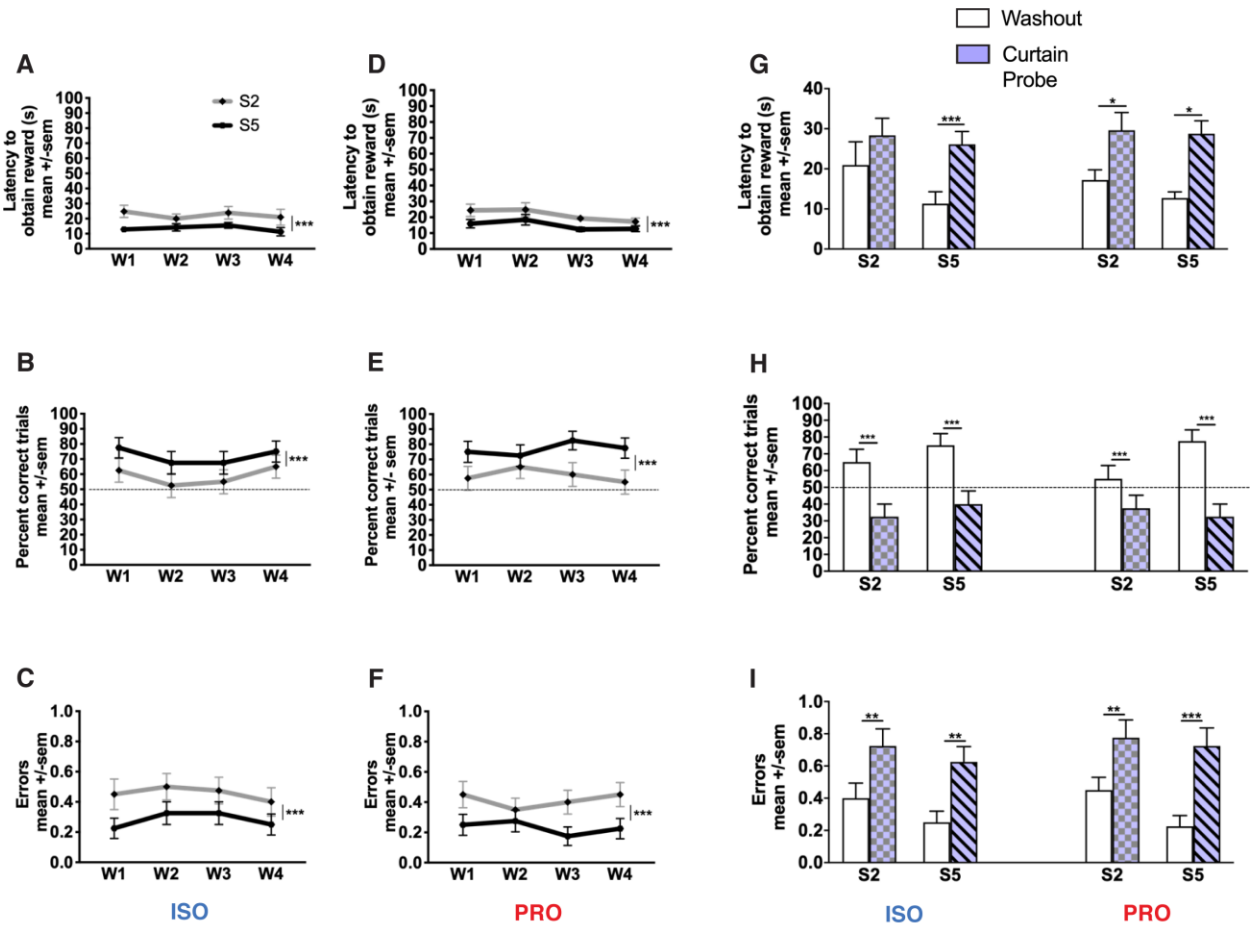

Figure S4. Animals were given a curtain probe trial to ensure they were using extra-maze cues to locate the escape hole. We compared performance during the last trial prior to this (re-training II) to the curtain probe and calculated a difference score. All animals showed impaired performance including increased (A) latency, (B) hole deviations, and (C) reference errors. (D) The percentage of animals using a spatial search strategy also decreased demonstrating that they were using extra-maze cues to solve the task. During the curtain probe, the maze was divided into 20 equal zones. The escape zone contained the escape hole (ZC), and the escape quadrant contained the escape zone plus the 2 zones to the left and right of the escape zone (ZC, ZQ-2, ZQ-1, ZQ+1, ZQ+2). Time spent in the (E) escape zone and the (F) escape quadrant was compared across groups [VEH-VEH n = 6 (grey); VEH-ISO n = 5 (blue); PRO-VEH n = 3 (pink); PRO-ISO n = 3 (green)] during the acquisition probe and the curtain probe to show that the level of impairment induced following administration of ISO (VEH-ISO) during the acquisition probe, was equal in magnitude to the impairment induced if there were no extra-maze cues present to successfully perform the task. In both cases, the animal's "map" needed to solve the task was compromised. (G-J) Time spent in each zone during the curtain probe. Animals were equally impaired across groups and spent an equal amount of time in all zones of the maze. Time spent in the escape zone or quadrant was not greater than chance (dotted line) suggesting that animals used extra-maze cues to locate the escape hole. Significant differences are denoted with asterisks * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. VEH = Vehicle, ISO = Isoproterenol, PRO = Propranolol, ZC = escape zone, ZQ = escape quadrant.

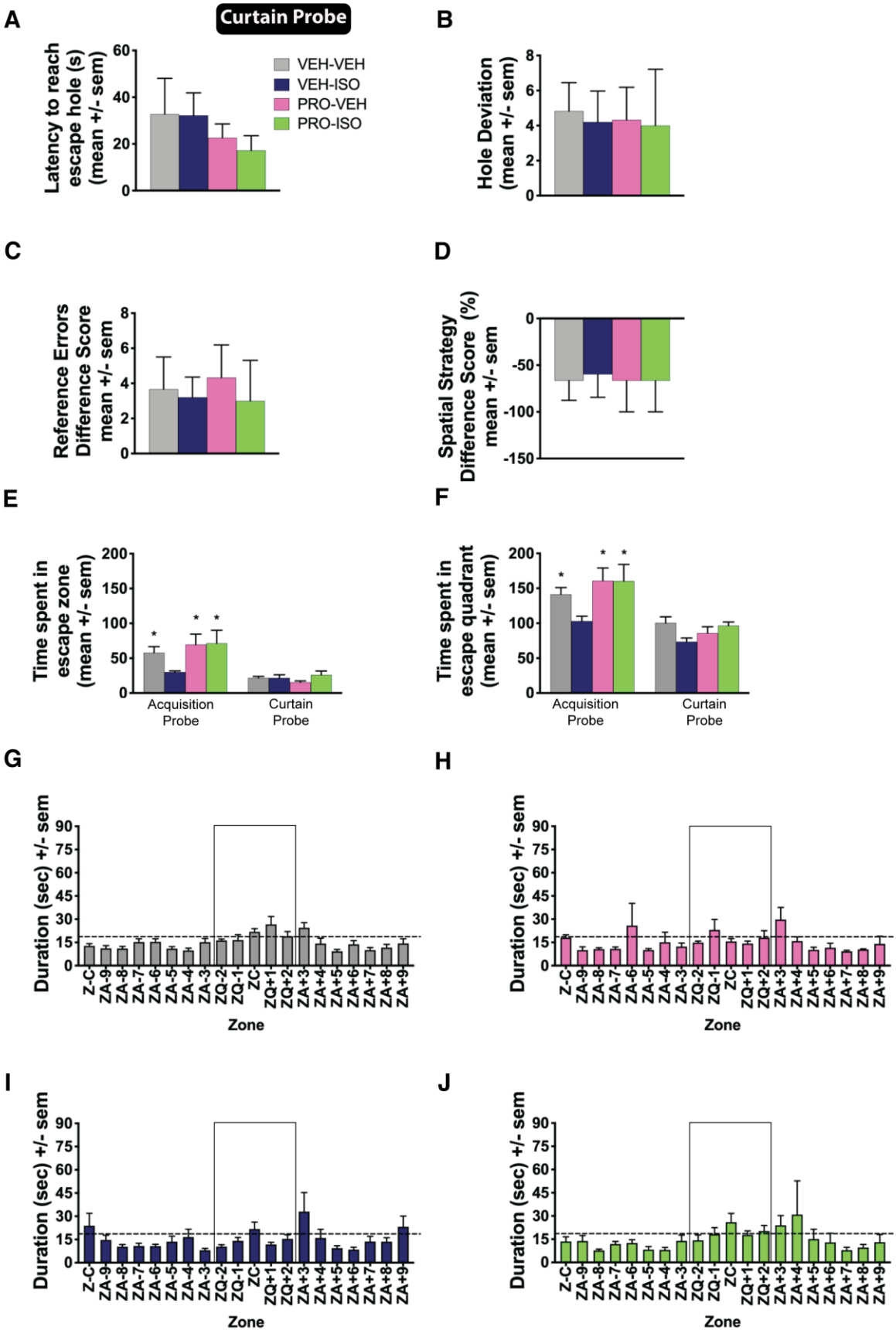
A
Curtain Probe
Latency to reach escape hole (s) (mean +/- sem)
VEH-VEH
VEH-ISO
PRO-VEH
PRO-ISO
B
Hole Deviation (mean +/- sem)
C
Reference Errors Difference Score mean +/- sem
D
Spatial Strategy Difference Score (%) mean +/- sem
E
Time spent in escape zone (mean +/- sem)
Acquisition Probe
Curtain Probe
F
Time spent in escape quadrant (mean +/- sem)
Acquisition Probe
Curtain Probe
G
Duration (sec) +/- sem
Z-C ZA-9 ZA-8 ZA-7 ZA-6 ZA-5 ZA-4 ZA-3 ZQ-2 ZQ-1 ZC ZQ+1 ZQ+2 ZA+3 ZA+4 ZA+5 ZA+6 ZA+7 ZA+8 ZA+9
Zone
H
Duration (sec) +/- sem
Zone
I
Duration (sec) +/- sem
Zone
J
Duration (sec) +/- sem
Zone

Figure S5. Total distance was measured in each of the probes (A) acquisition probe (B) curtain probe and the (M) reversal probe. Groups: [VEH-VEH n = 6 (grey); VEH-ISO n = 5 (blue); PRO-VEH n = 3 (pink); PRO-ISO n = 3 (green); VEH-VEH-ISO n = 3 (blue with grey stripes)]. Significant differences are denoted with asterisks * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.