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Hippocampal place cell activity influenced by variations of the Novel Object Recognition task in C57BL/6J mice.

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Pyramidal neurons in rodent hippocampus discharge according to the animal's spatial location. The firing of these place cells is influenced by distal and local cues, and likely guides spatial memory and navigation. The rodent hippocampus is also critical for the encoding, consolidation and retrieval of non-spatial object memory, as assessed with a novel object recognition (NOR) paradigm. Here, we tested the influence of local 3D object exploration on place field stability by recording hippocampal CA1 neurons from freely moving male C57BL/6J mice in three
NOR task variations. In the first study, place fields were found to be stable when mice explored a sterile open field arena, and after objects were introduced in both sample and test sessions. Next, place cells were recorded in the same arena containing a polarizing cue card. Place fields did not remap when objects were introduced in either session. In the third study, mice freely explored the sterile arena for 2 min before introducing objects. Here, place fields remained stable throughout all NOR testing stages. Interestingly, on several occasions place fields exhibited in the sterile arena (in the absence of any polarizing cues) were found to rotate in 90˚ increments but were still considered stable. In contrast, place fields never rotated in the presence of the cue card, or when objects were present from the start of the recording session. Together, these data indicate that presence of objects in a familiar environment does not induce remapping, but they can influence the stability of previously established fields.