Abstract View

TRACKING HEAD LOCATION, DIRECTION, TILT AND ROLL FOR DETERMINING PLACE CELL EGOCENTER IN THREE DIMENSIONS

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The activity of a hippocampal place cell depends on where the head of an animal is located in the environment, but the point for representing head location has been chosen arbitrarily. For example, when two light-emitting diodes are used for video tracking a rat, any point in the sagittal plane of the head may be chosen as the representing point, and for a typical place cell, a unique point in the plane yields the most compact place field (Soc. Neurosci. Abst. 24:932, 1998): this point is called the egocenter for that place cell. However, with only two diodes there is an ambiguity in the roll angle (left ear up vs. right ear up). In order to define an egocenter in 3-D space, we sought to determine head location, direction, tilt and roll from the video images of a head-stage with 11 light-emitting diodes after taking into account geometric distortion, light smearing and blockage effects to suitably place and orient a rigid geometric model. The accuracy of the method was calibrated on a video with known direction, tilt, and roll angles. In a preliminary analysis of several place cells, each place field had only a single compactness minimum in the 3-D space around the rat's head, which suggests that the egocenter can be defined in 3-D space and raises further questions about the stability of the egocenter and its relation to phase precession and the theta rhythm.
Supported by: Howard Hughes Medical Institute, NS20331 & MH01565

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