Continuous Reward-Place Coding Properties of Dorsal Distal CA1 Hippocampus Cells

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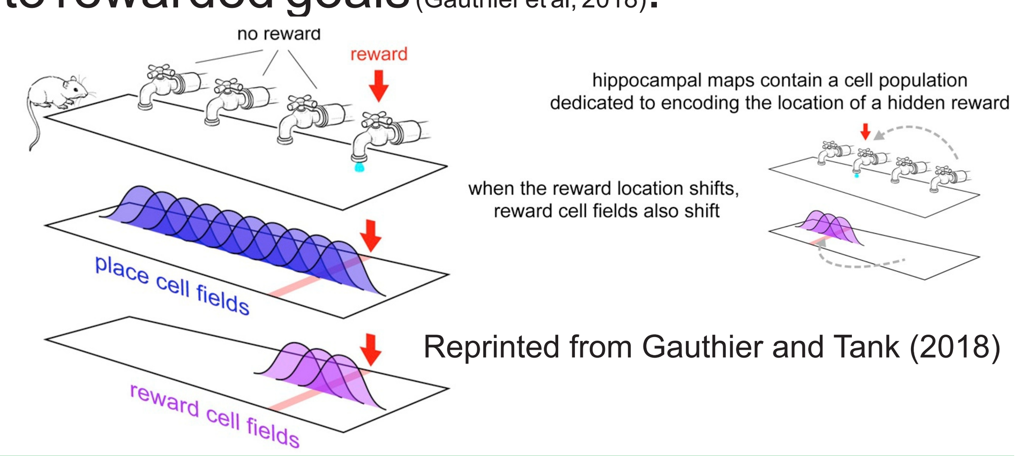
Introduction

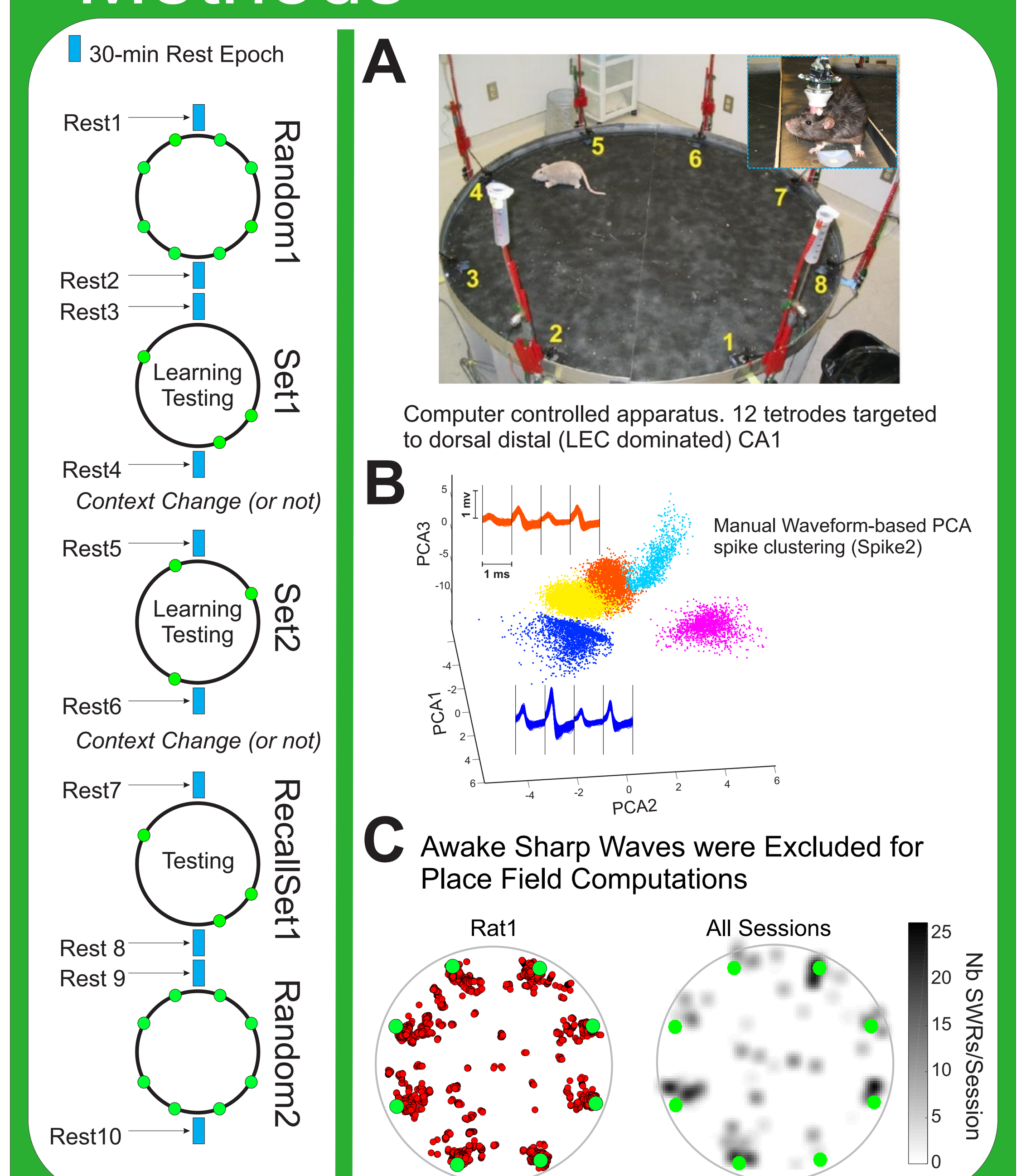
- Hippocampal place cells are involved in goal-directed spatial navigation (O'Keefe et al, 1971).
- Recently, using calcium-imaging in mice navigating in a virtual reality environment, a subpopulation of hippocampal cells was found to be selectively activated in relation to rewarded goals (Gauthier et al, 2018).



Reprinted from Gauthier and Tank (2018)

- Are place cells and reward cells truly **mutually exclusive** populations? Can a place cell become a reward cell (or vice versa)?
- Using tetrode recordings, we found CA1 principal neurons with coding properties **continuously** ranging **from place cells to reward cells**.

Methods



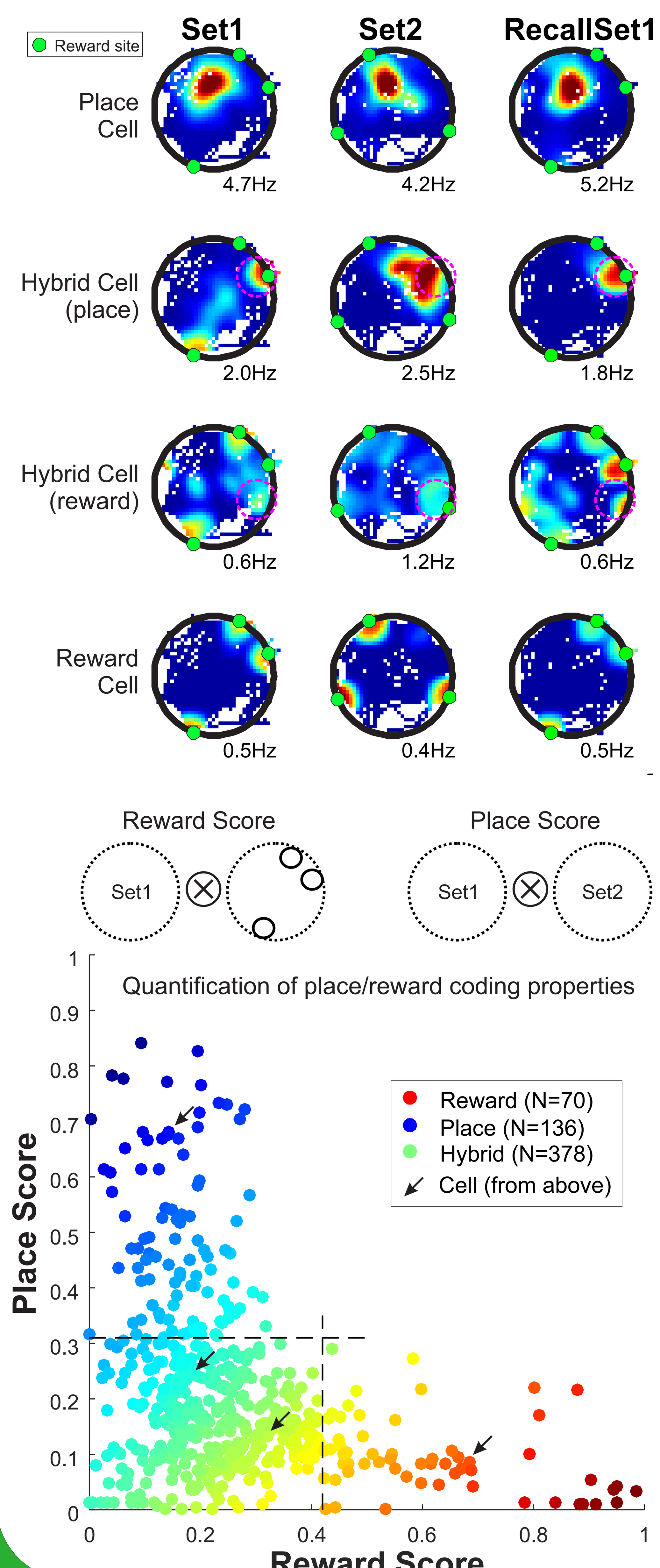
A: Computer controlled apparatus. 12 tetrodes targeted to dorsal distal (LEC dominated) CA1

B: Manual Waveform-based PCA spike clustering (Spike2)

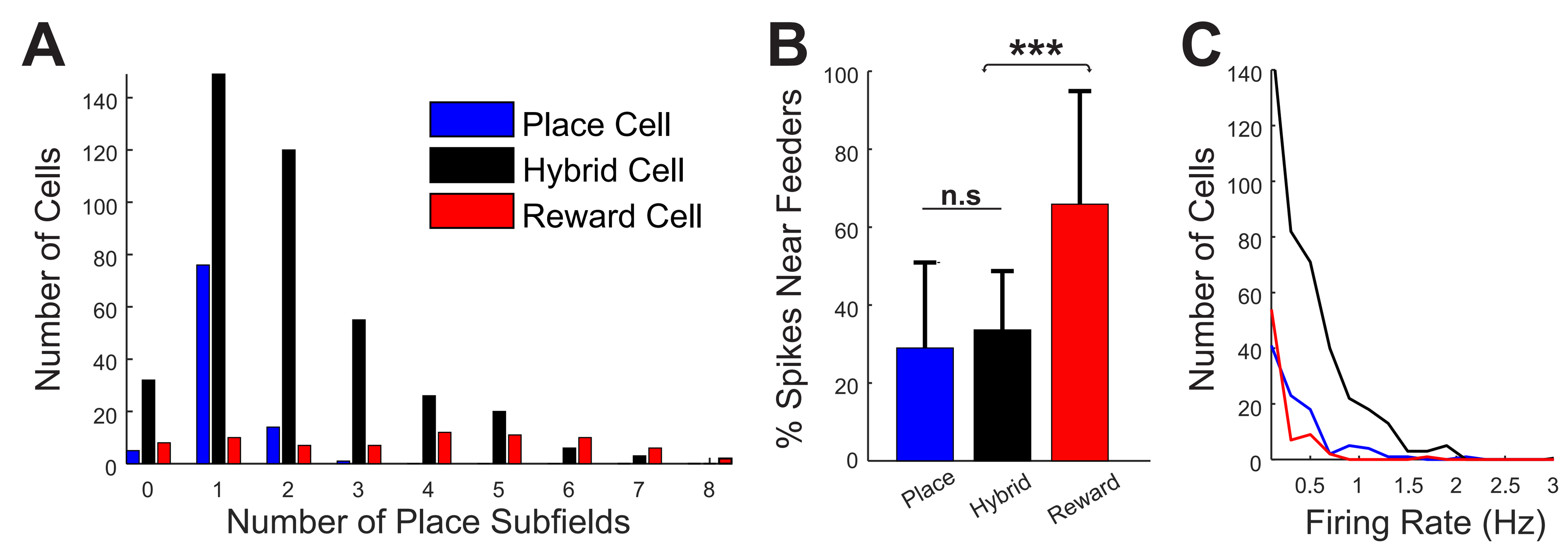
C: Awake Sharp Waves were Excluded for Place Field Computations

Results

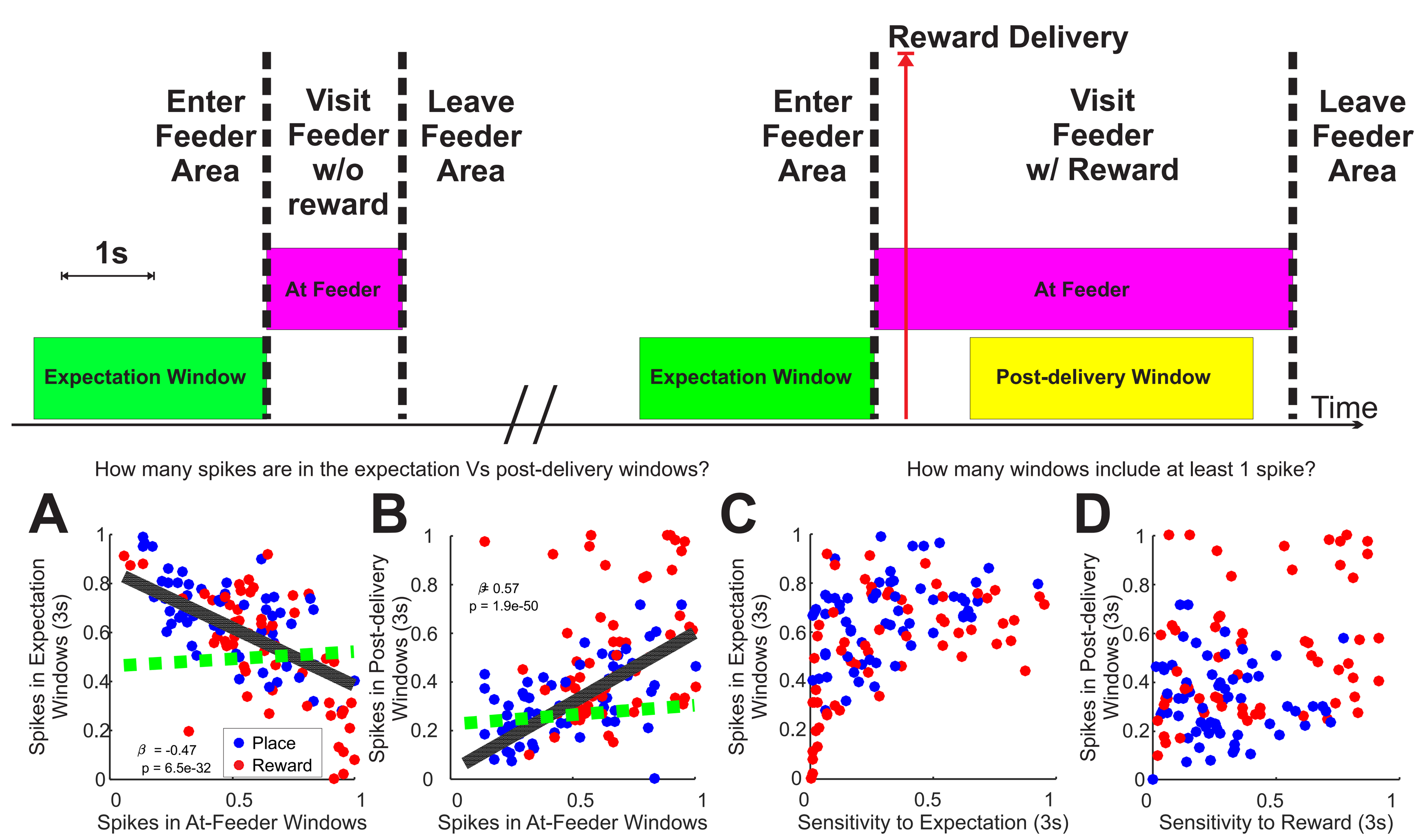
1. A Population with Continuous Coding Property



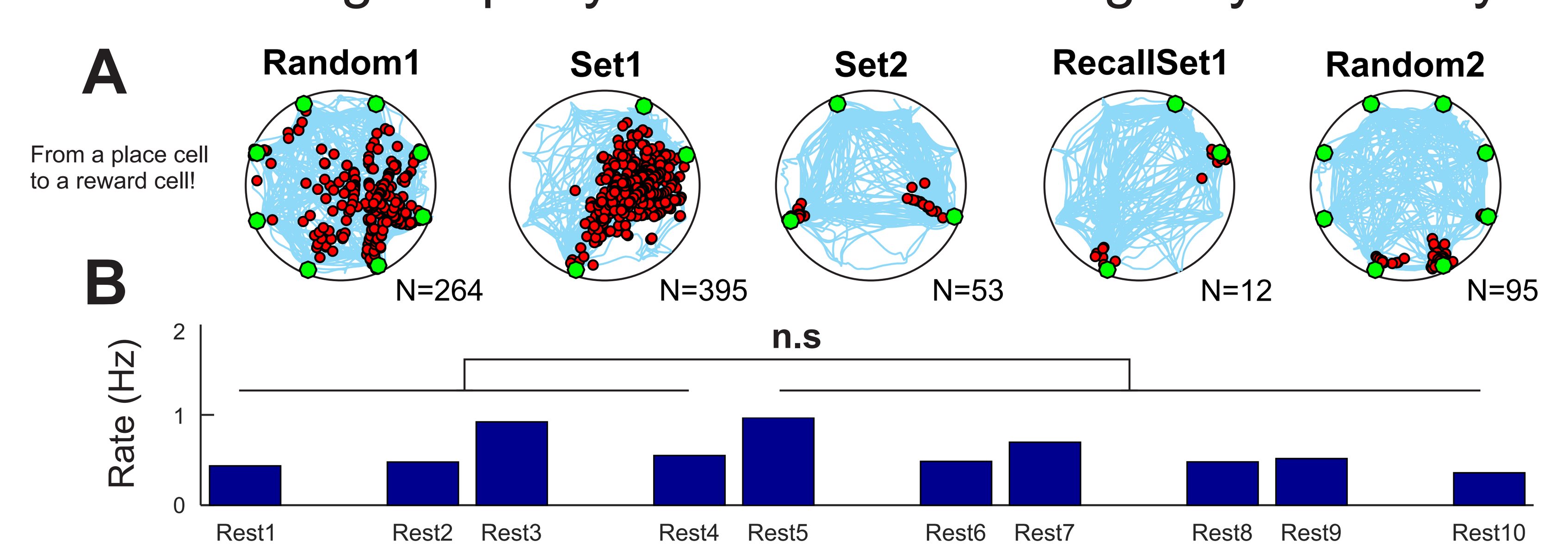
2. Reward Cells Have More Subfields and Lower Firing Rate



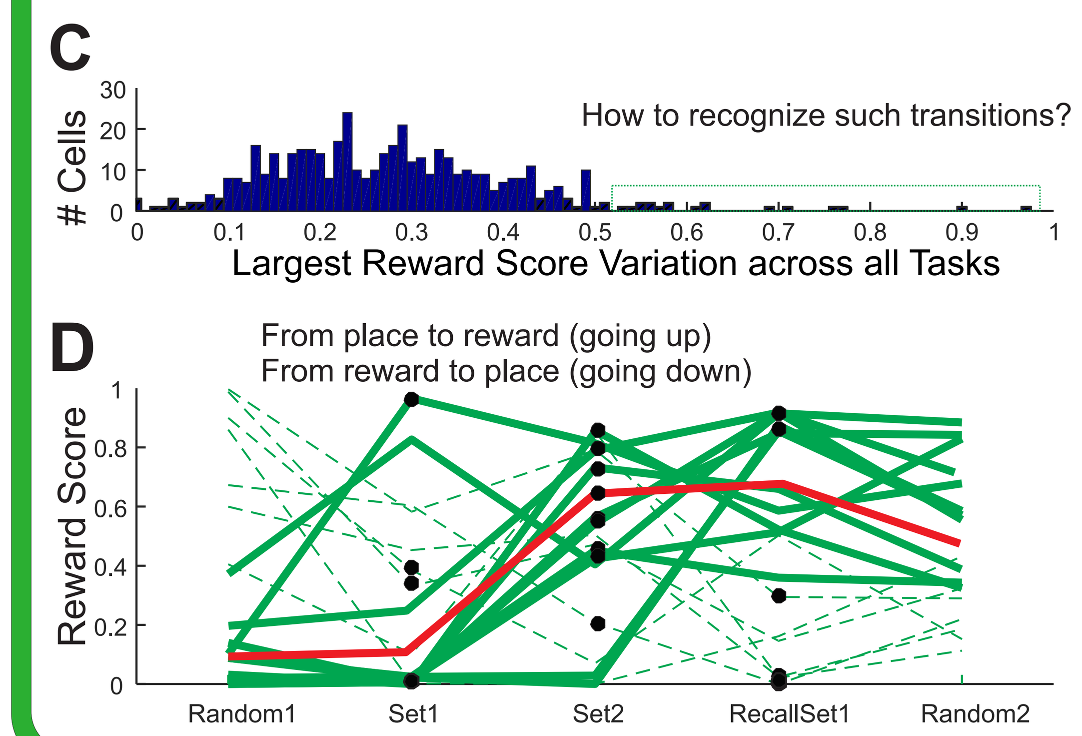
3. Reward Cells Respond More to the Acquisitions Than to the Expectations of Rewards



4. The Coding Property of Cells Can Change Dynamically



4. Continued



Conclusions

- We found reward cells in 2-dimensional real (non-virtual) space.
- Hippocampal cells showed **continuous** coding properties, from "place" to "reward".
- The coding property of a cell can change.
- Unlike Gauther and Tank (2018), our reward cells tend to respond to the acquisition of rewards.
- **These results suggest a plastic and adaptive reward-place coding system involving the hippocampus.**

Note: Why our results are different from G&T's?

- 1 Vs 2 dimensions, real/virtual space, recording methods…
- We may be looking at different cells (distal vs proximal)?

Relevant References

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