

Human entorhinal cortex neurons encode movement direction

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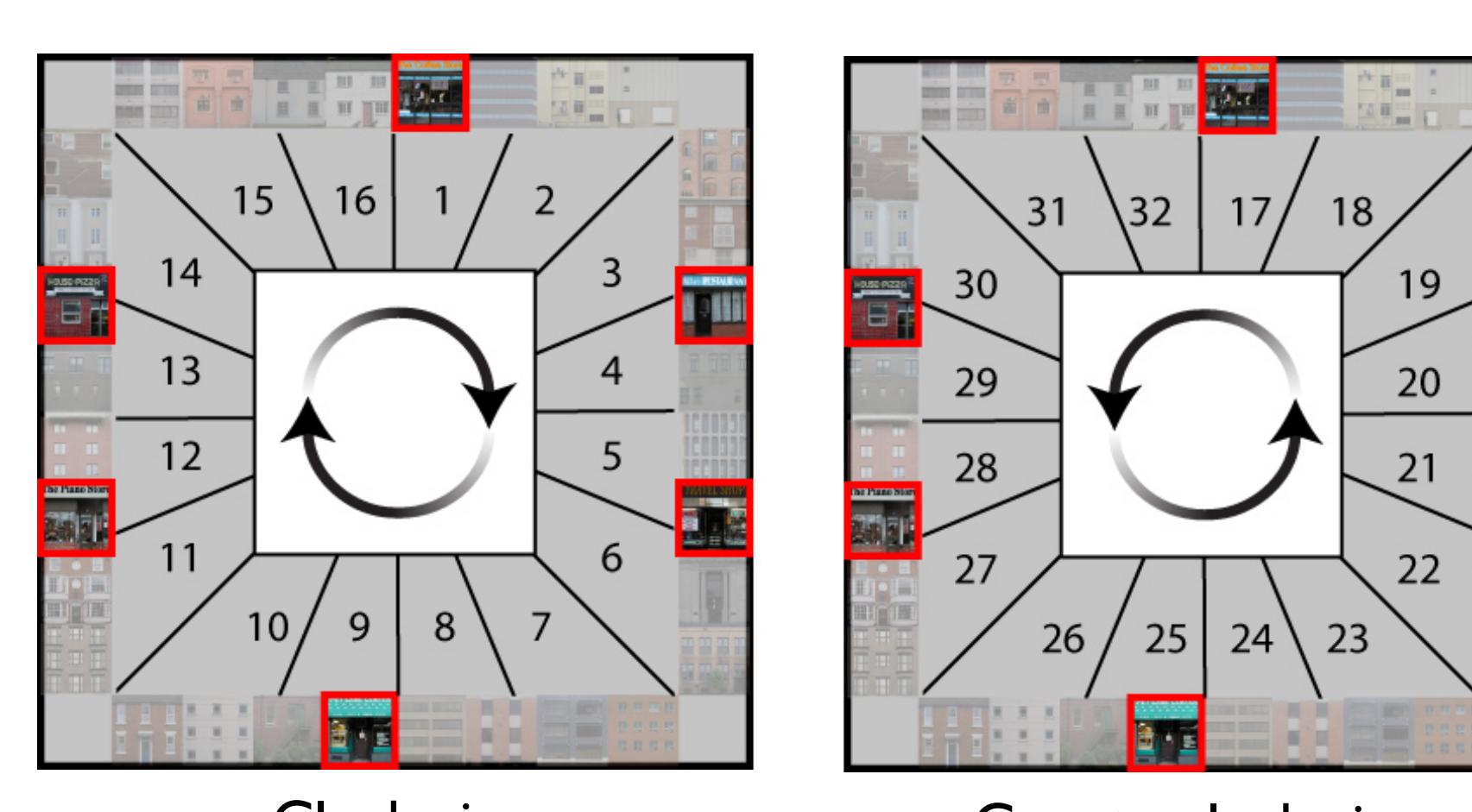
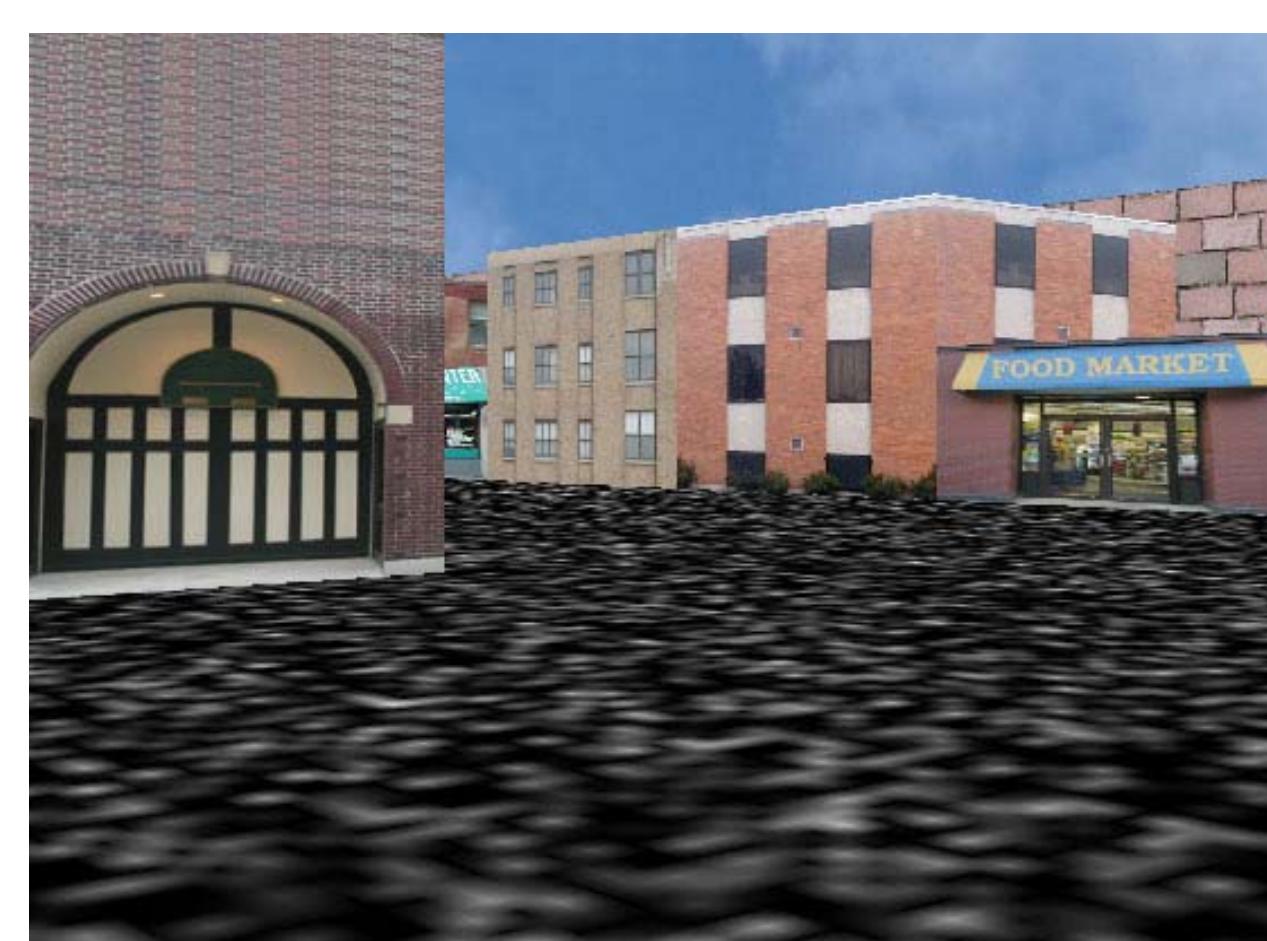
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Introduction

- Rodents possess omnidirectional and unidirectional place cells (Battaglia et al., 2004).
- Human spatial behavior is significantly affected by direction (McNamara, 2003).
- We examined the neuronal correlates of direction in epilepsy patients playing a virtual taxi-driver game.

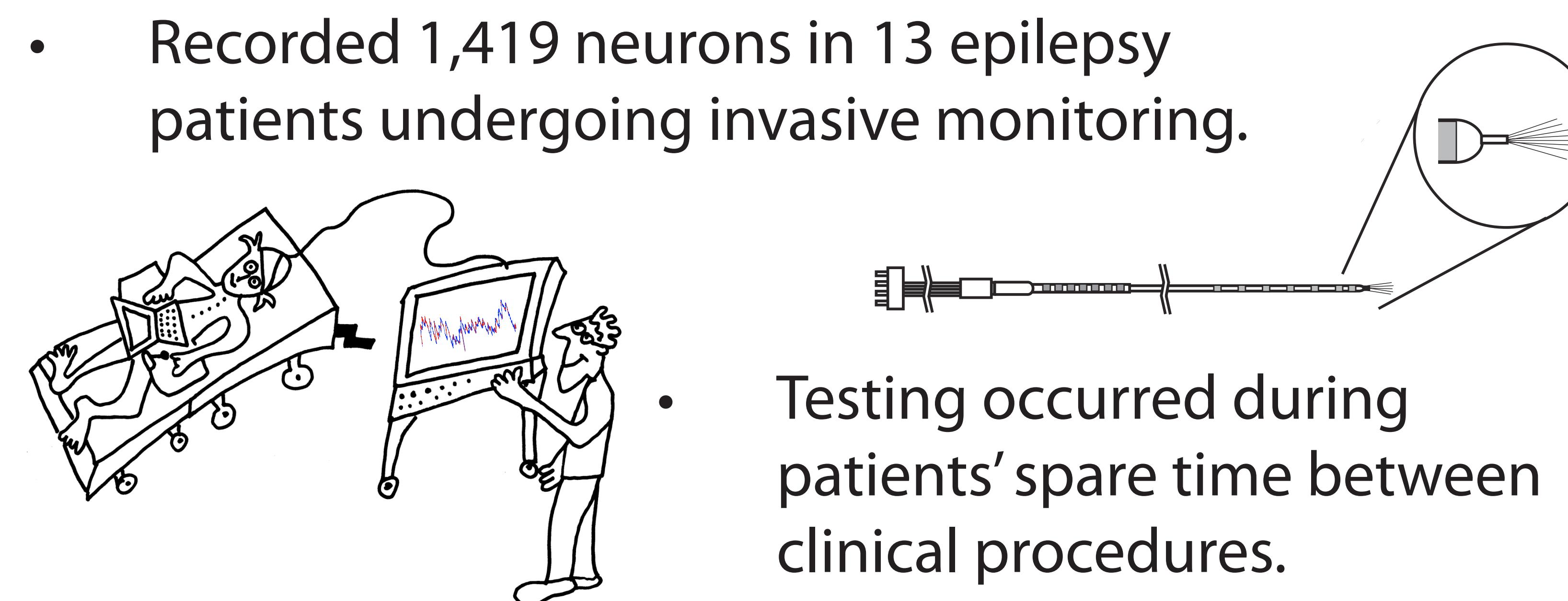
Yellow Cab taxi-driver task

- Patients navigated a virtual narrow square-shaped track on a bedside laptop computer.
- We compared neuronal firing rates in each region across clockwise and counterclockwise movement.
- Nonparametric ANOVA across 32 location–direction bins; bootstrap used to assess statistical significance.



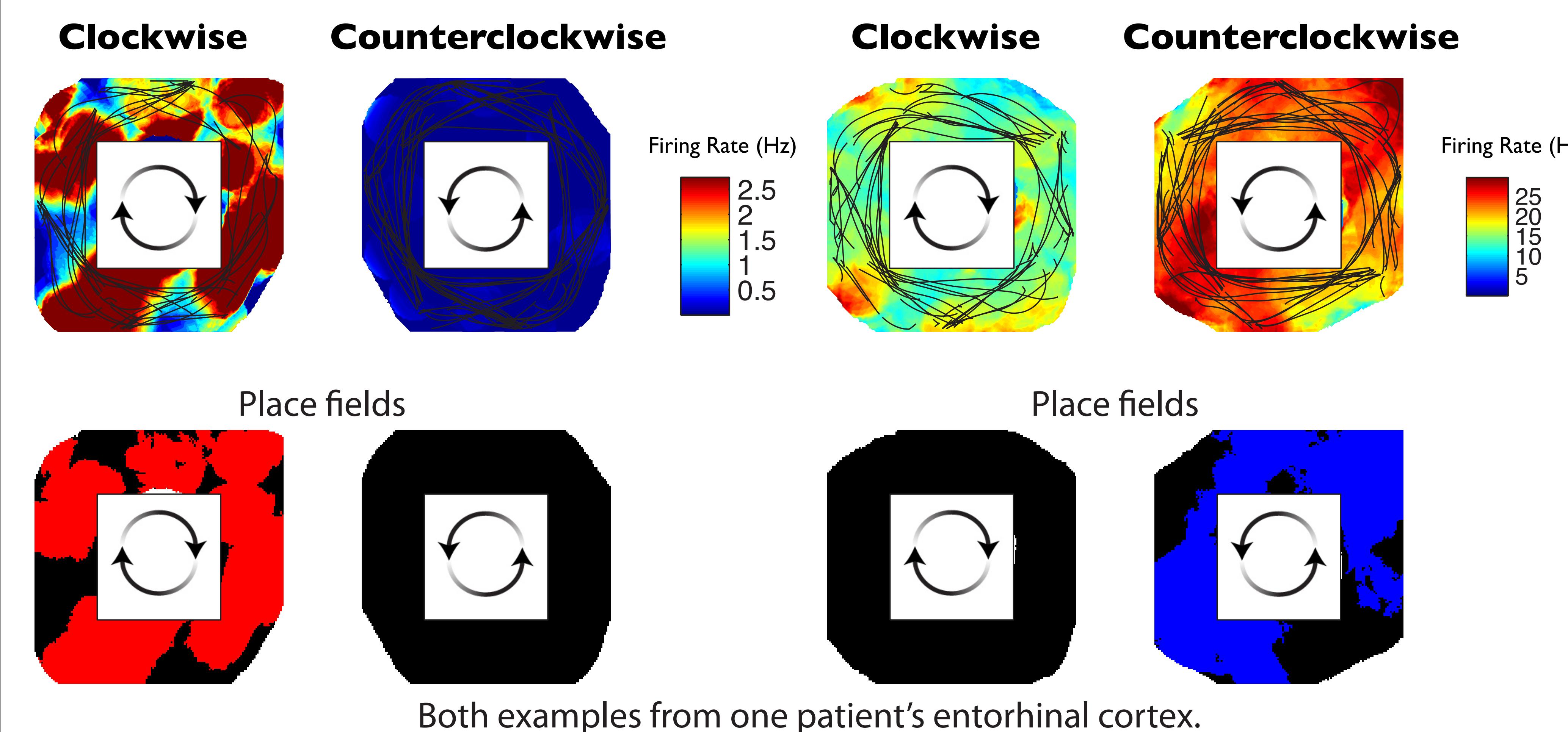
Electrophysiology

- Recorded 1,419 neurons in 13 epilepsy patients undergoing invasive monitoring.

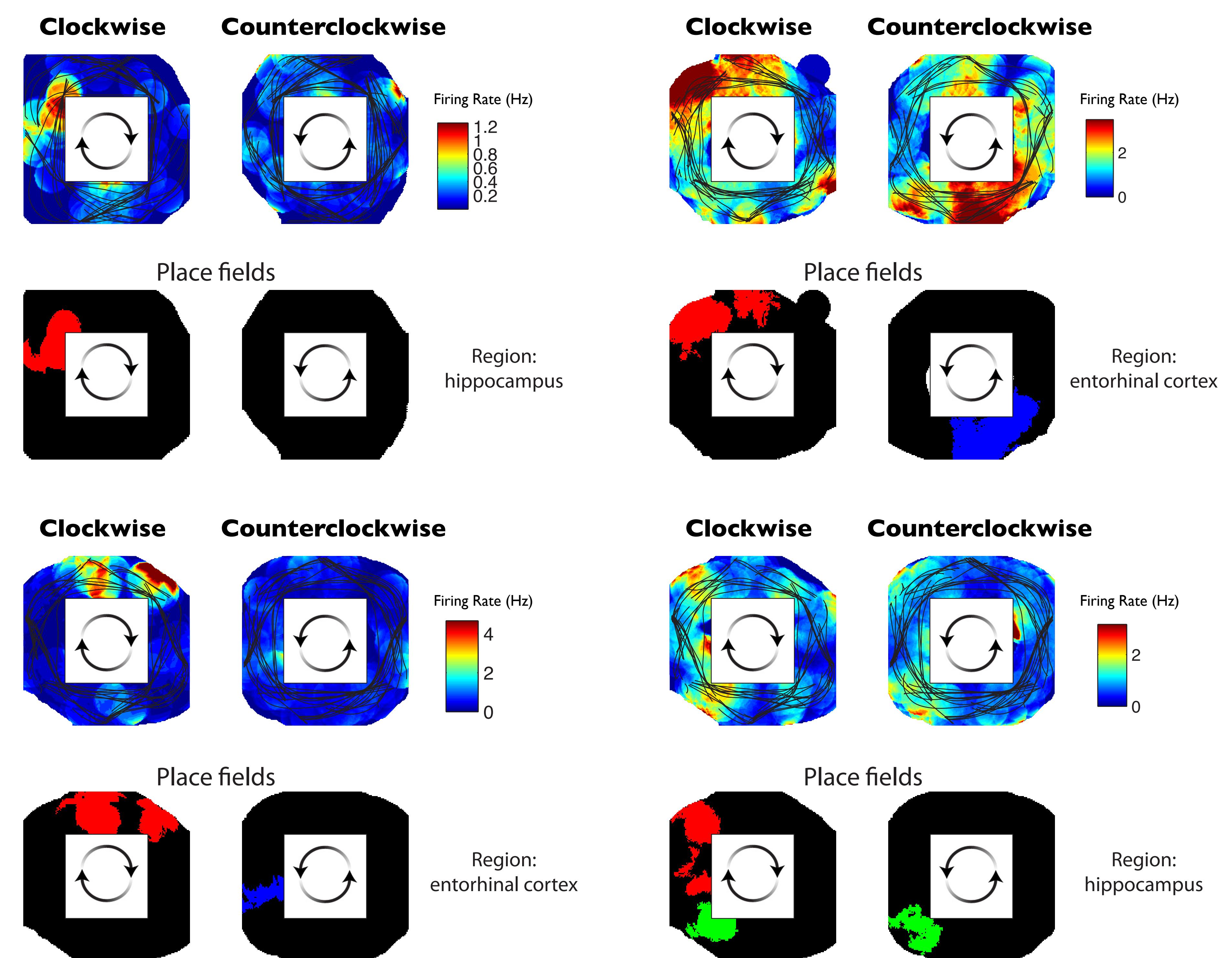


- Testing occurred during patients' spare time between clinical procedures.

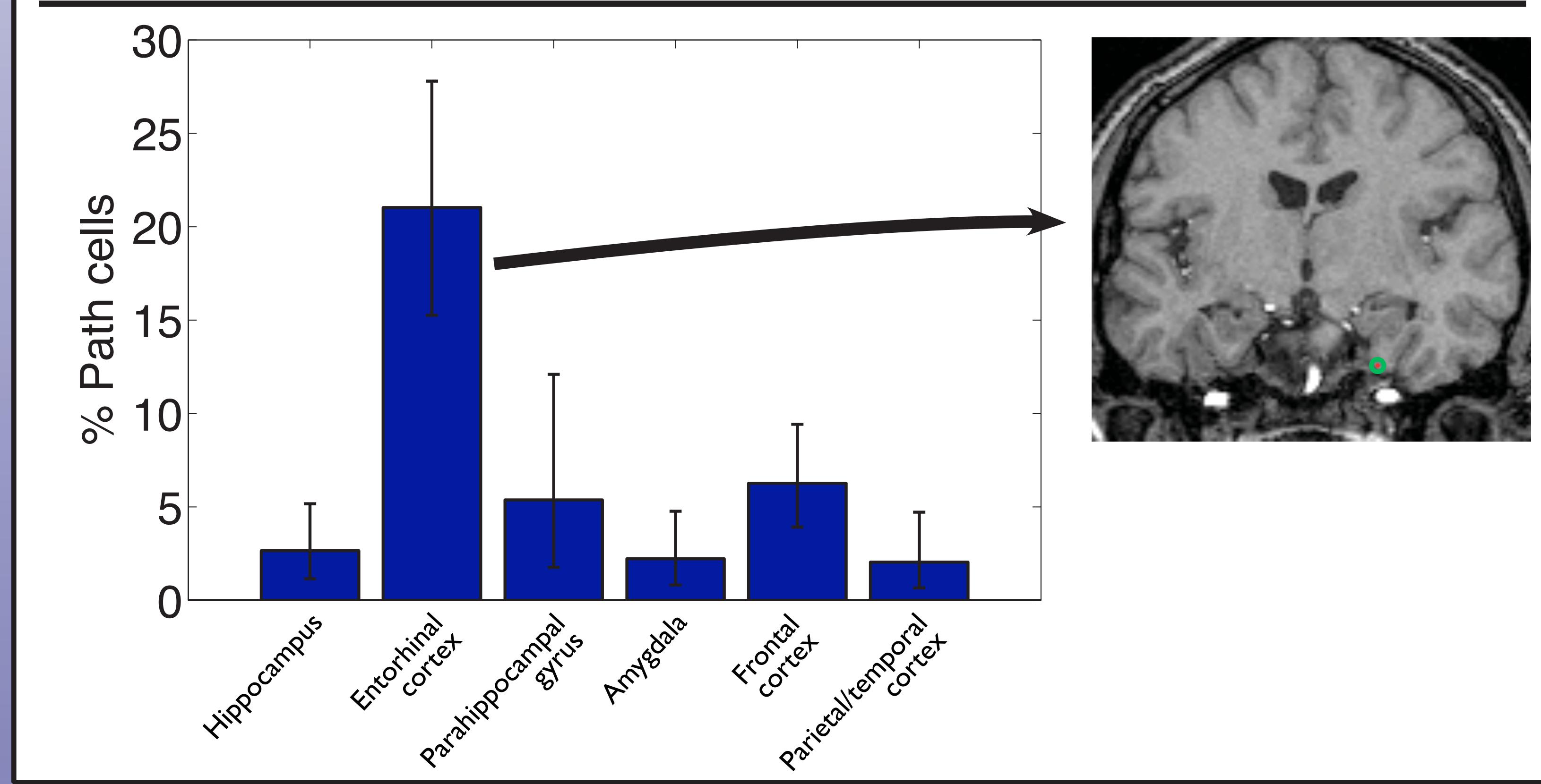
Path cells



Directional place cells

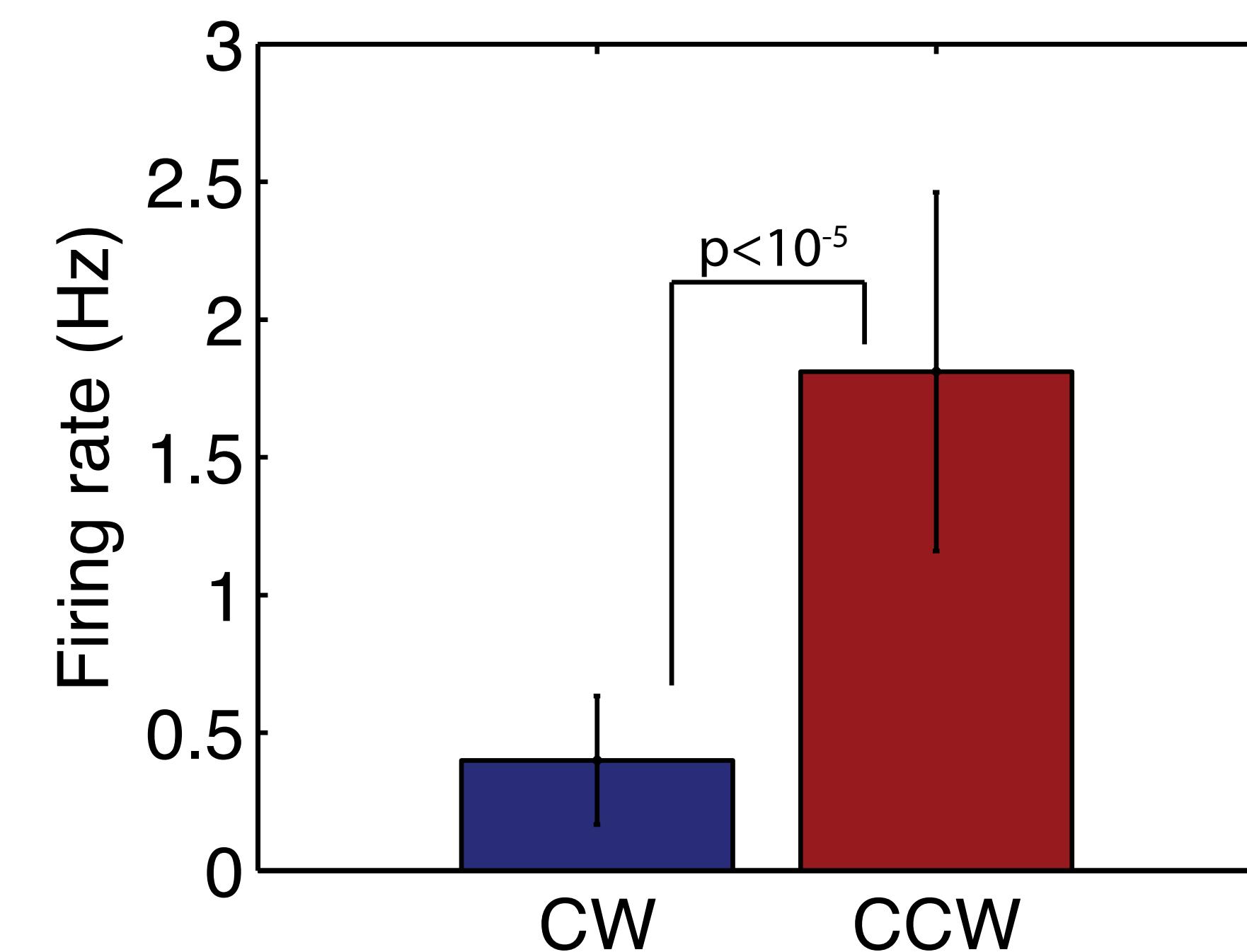


Path-cell distribution



Final approach

This result was still present when we separately analyzed the final, **straight** approach to the destination. Thus, this phenomenon is not *prospective coding* of an upcoming turn (Frank et al., 2000).



Conclusions

- Direction-related spatial responses are widespread in humans.
- More broadly, the presence of path cells suggests that entorhinal cortex encodes general features of an environment (Fyhn et al., 2004).
- It is unclear how this relates to other cell types in entorhinal cortex such as grid cells (McNaughton et al., 2006).