

Dagfinn Moe SINTEF
Seniorforsker atferds- og nevrovitenskap
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SCIENTIFIC AMERICAN

MYSTERY OF THE MIND

WHERE AM I? WHERE AM I GOING?



Scientists are discovering how the brain navigates
By May-Britt Moser and Edvard I. Moser

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Illustration by Viktor Kuro

THE PSYCHOLOGICAL REVIEW

COGNITIVE MAPS IN RATS AND MEN¹

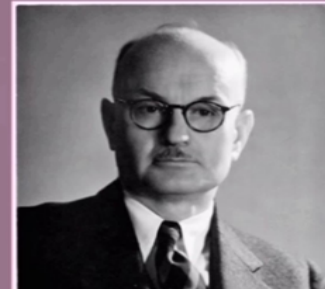
BY EDWARD C. TOLMAN
University of California

- Learning is always purposive and Goal-directed

- Cognitive map

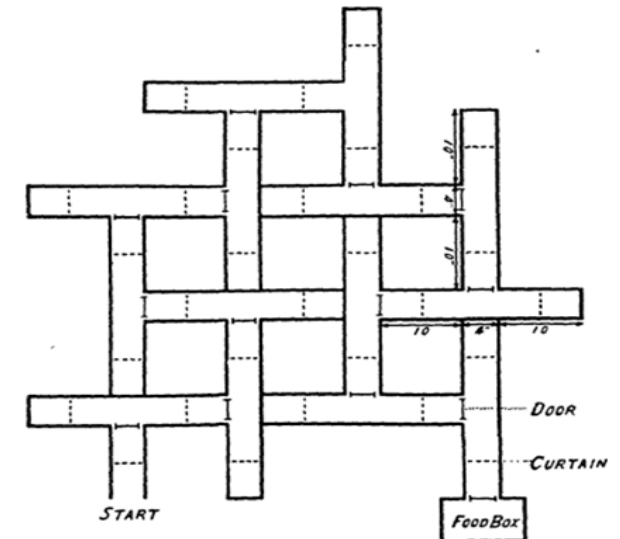
- Latent Learning

- Concepts of Intervening Variables



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EDWARD C. TOLMAN



Thus, we can imagine a process where entorhinal cortex presents a **“movie”** of ongoing experience to the hippocampus. Hippocampus is able to extract and tag memorable moments of ongoing experience and **consolidate them into memory**. (Sugar& Moser, 2019).

kognitive kart-navigering-oppmerksomhet

HVA-HVOR-NÅR-HVORDAN

The Nobel Prize in Physiology or Medicine 2014



John O'Keefe and the place in space

In 1971, John O'Keefe of University College London discovered that certain nerve cells in the brain are activated when a rat occupies a particular place in the environment. Other nerve cells are activated at other places. He proposed that these "place cells" build up an inner map of the environment. Place cells are located in a part of the brain called the hippocampus.



May-Britt and Edvard Moser find the coordinates

In 2005, May-Britt and Edvard I. Moser, of the Norwegian University of Science and Technology in Trondheim, discovered that nerve cells in the brain's entorhinal cortex are activated when a rat passes certain locations. Together, these locations form a hexagonal grid, each "grid cell" reacting in a unique spatial pattern. Collectively, these grid cells form a coordinate system that allows for spatial navigation.

Finding your way with the brain's own GPS

The Nobel Prize in Physiology or Medicine 2014 is awarded with one half to John O'Keefe, the other half jointly to May-Britt Moser and Edvard I. Moser "for their discoveries of cells that constitute a positioning system in the brain".

How do we know where we are? How can we find our way from one place to another? And how can we store this information in such a way that we can immediately find our way the next time we trace the same path? The 2014 Nobel Laureates have discovered a positioning system, an "inner GPS" in the brain that makes it possible to orient ourselves in space, demonstrating a cellular basis for higher brain functions.



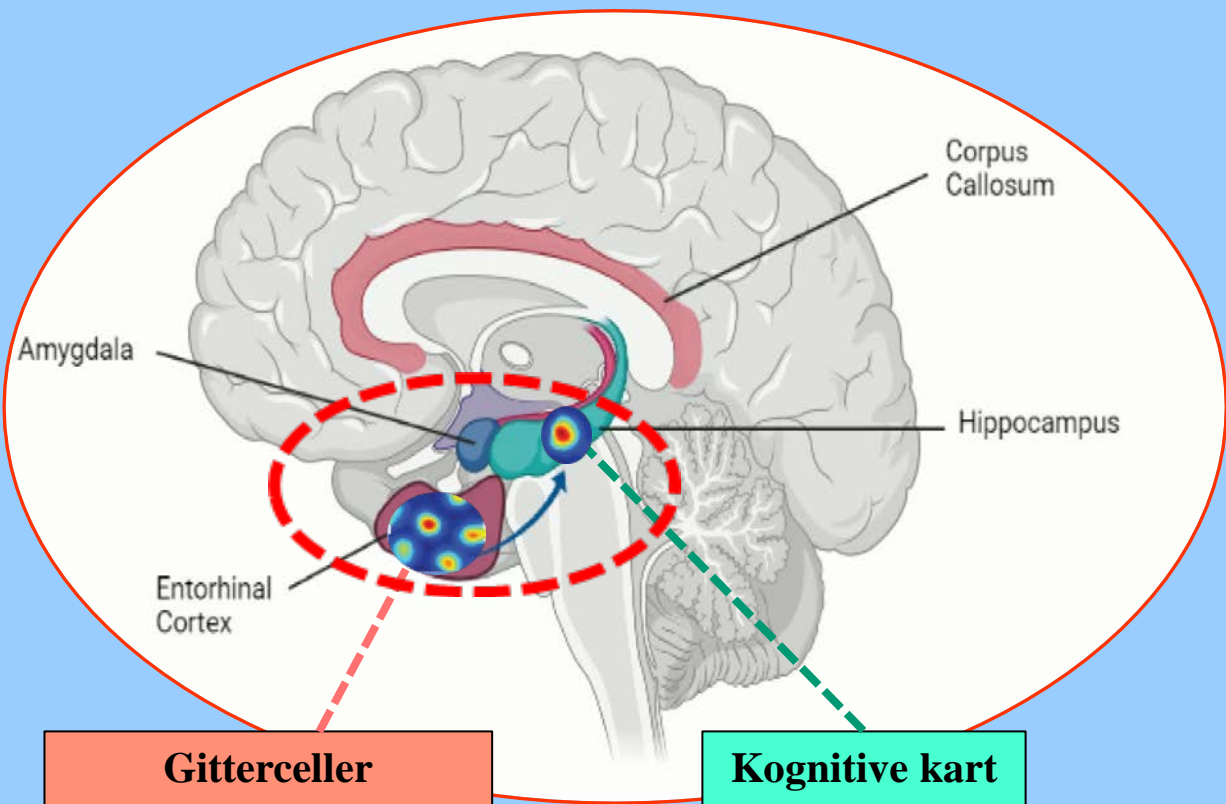
Nerve cell circuitry forms a GPS in the brain

Grid cells, together with other cells in the entorhinal cortex that recognize the direction of the head of the animal and the border of the room, form networks with the place cells in the hippocampus. This circuitry constitutes a comprehensive positioning system, an inner GPS, in the brain.



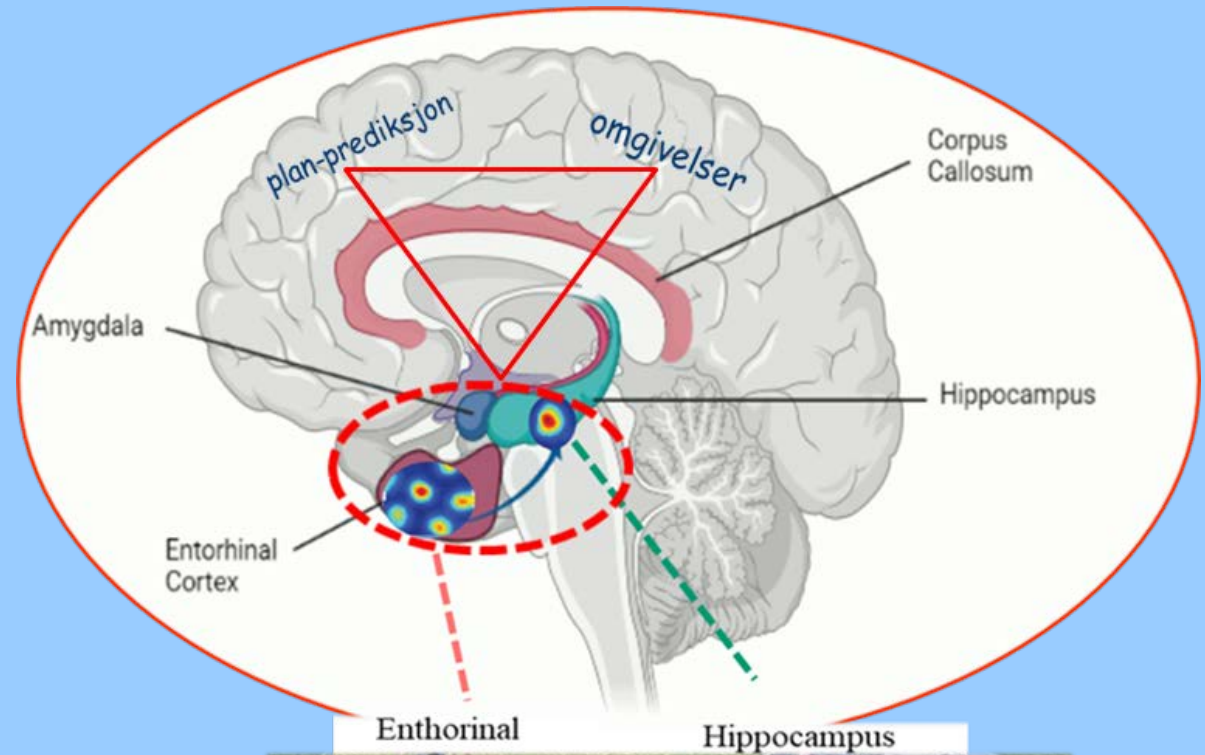
A place for maps in the human brain

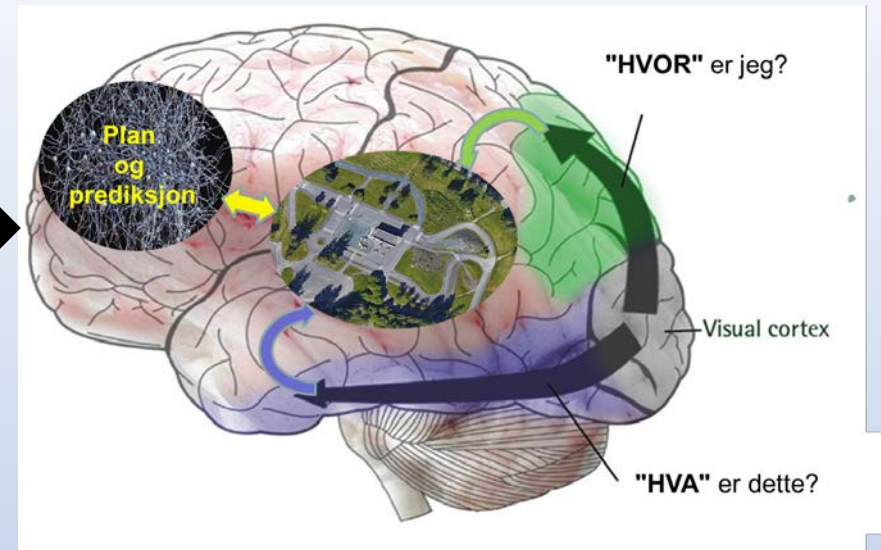
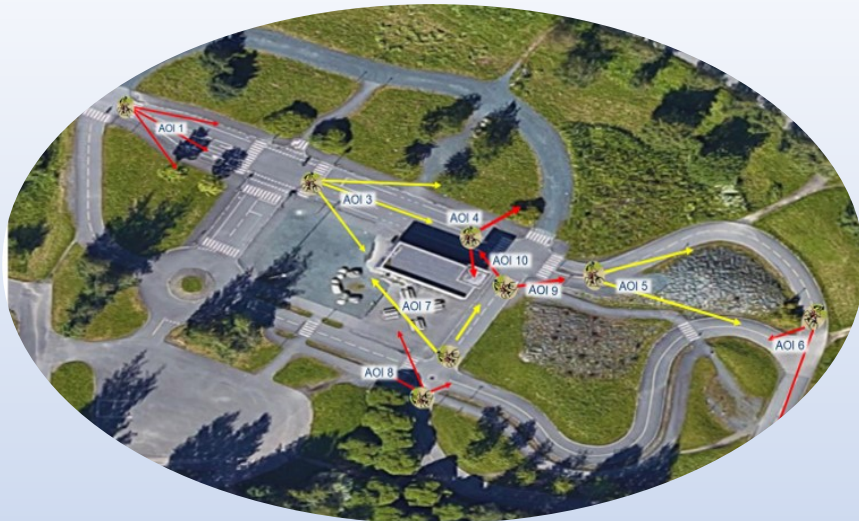
Recent studies have identified grid- and place-like cells in the human brain. In patients with Alzheimer's disease, the hippocampus and entorhinal cortex are frequently affected at an early stage, and these individuals often lose their way and cannot recognize the environment. Knowledge about the brain's positioning system may help us understand the mechanism underpinning the devastating spatial memory loss that affects people with this disease.



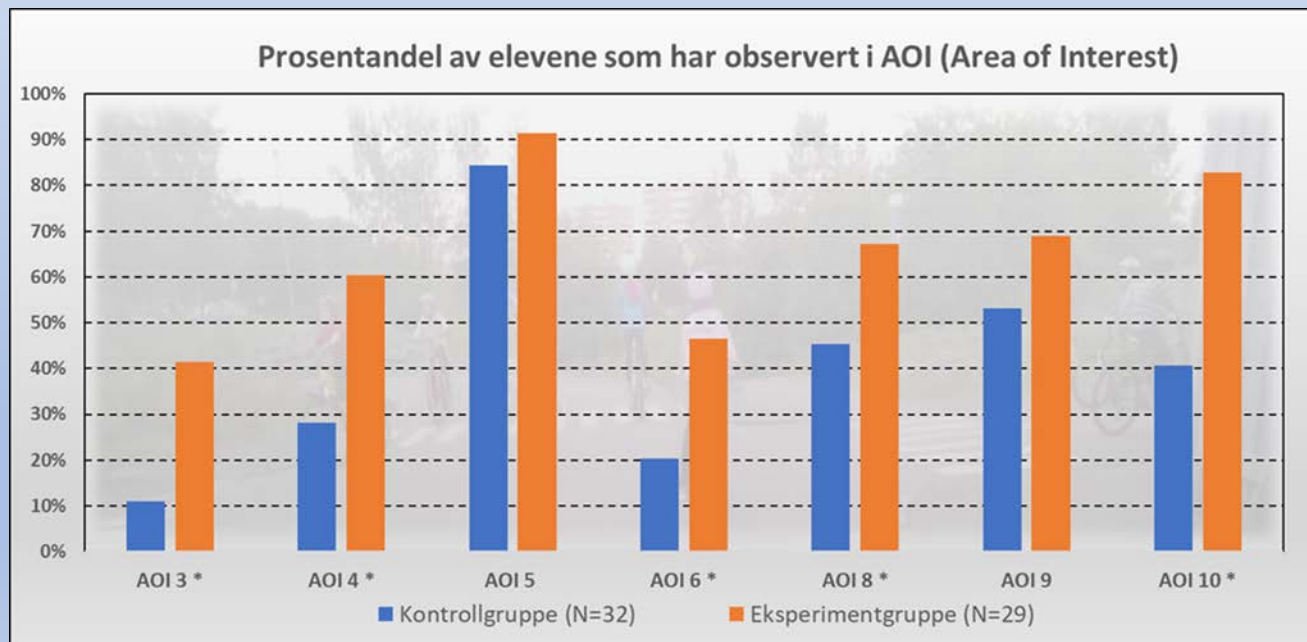
- Gitterceller**
- kantceller
 - fartsceller
 - hoderetningsceller

- Kognitive kart (stedceller)**
- landskap
 - hendelser





39%



65%

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WAYFINDERS

“avoid surprises and last longer”

Teknologi for et bedre samfunn