Memory as world-brain relation: how we find and lose our way

Theoretical Master thesis in progress combining research of labs of supervisors Prof. Dr. Christian Doeller & Prof. Dr. Georg Northoff

I

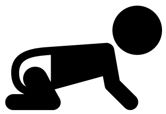
Our brains organize sensory/spatial signals from our bodies as we find our way.

In so doing, the brain forms sensory/spatial algorithms (TEM*-style) for optimal navigation.

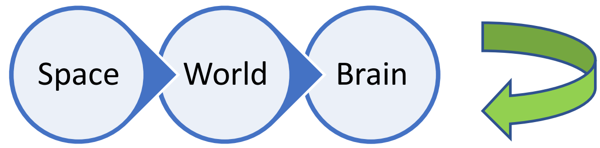
These navigational codes become the template for semantic memory formation.

Semantic memory is therefore scaffolded by spatial algorithms.

A spatiotemporal metric of semantic memory is possible.



Development is about learning to navigate. The statistics of our environment are remarkably stable: From these statistical relations, 360-degree sensory experience & our brain's positioning system establish algorithms so we can better find our way.



For the nervous system, **space** is the relation of sensory signals entering from the world and being processed by the body.

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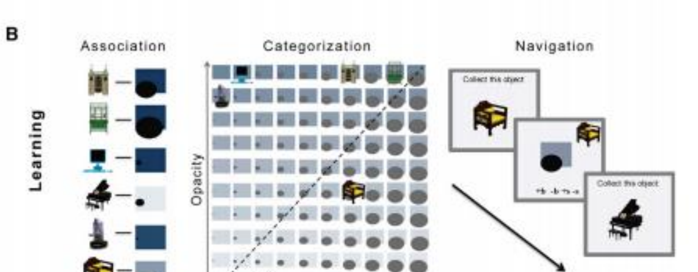
What is navigation?

A world/brain/body process of creating sensory/positional algorithms based on the statistics of what is encountered. This is true of both physical and conceptual space.



Theves et al., 2019, Current Biology 29, 1–6
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Conceptual navigation develops on the template of physical navigation

Semantic memory (conceptual knowledge) is conscious navigation that develops like meta-data upon the sensory/positional algorithms of development through shared externalized representations such as language, numbers, and symbols.

We develop semantic memory through communication as concepts add like meta-data

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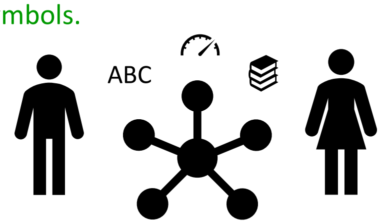

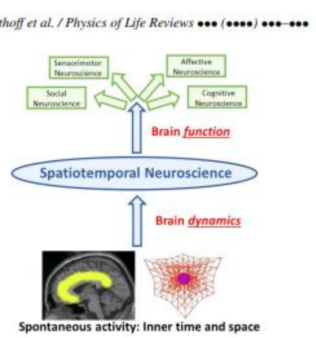

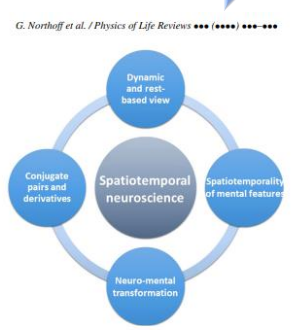

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We can apply spatiotemporal metrics (i.e. scale free) to understand how we find & lose our way, both physically & conceptually

Data of conceptual navigation and physical navigation can be compared via spatiotemporal measurements such **as scale free analysis** and **power laws** to establish the nested relationship of activity relative to sensory areas and positional cell data. The dynamics of these can also be measured in relation to the brain's **spontaneous activity**. Wearable EEG and numerous biofeedback measures can help us understand how specific sensory environments change these dynamics and how they compare with the dynamics themselves towards developing a full metric.

Affiliation of Supervisors:

uOttawa
DOELLERLAB
Centre de santé mentale Royal Ottawa Mental Health Centre

Andrea Hiott, Master student
Berlin School of Mind and Brain

Humboldt-Universität zu Berlin
Berlin School of Mind and Brain

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