In Sync

Propositions of the thesis

In Sync:

Neural Oscillations and their Relation to Visual Perception and Learning

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- Brain oscillations occur in a wide range of frequency bands and may become synchronized. Coordinated collaboration of oscillations in different frequency bands is essential for information processing, as in perception and learning.

- Understanding the role of brain oscillations and their synchronization opens new avenues for the development of pathology in mental diseases and brain-inspired technologies.

- Myelination exhibits adaptive changes during the whole life span. Thus, learning occurs as the result of the interplay between activity-dependent synaptic and myelin plasticity.

- Gamma oscillations are highly stimulus-dependent. Similarity and physical distance between components in visual stimuli control the detuning between gamma oscillations and strength of horizontal connections, hence, determining the success or failure of the gamma synchronization in V1.

- Gamma synchronization in V1 constitutes a part of the mechanisms that underlie figure-ground segregation.

- Learning, by changing the strength of horizontal connections, allows for synchrony among gamma oscillations with higher detuning. As such, learning-induced changes in low-level neural synchrony may contribute to the enhancement of accuracy in figure-ground segregation over training.

- Models are often used to represent a specific target system, allowing scientists to convert facts obtained from the model into hypotheses about the target system.

- Removing excessive details from a model may be as important as including relevant factors. Therefore, idealization is a substantial aspect in generating models.

- The phase oscillator model is a minimalist idealized model of neural networks, which only involves the core causal factors that make a difference in the occurrence of the target phenomenon.