



Layer-dependent body maps in S1



Esther Kühn, PhD

What can layer-dependent imaging contribute to cognitive neuroscience?



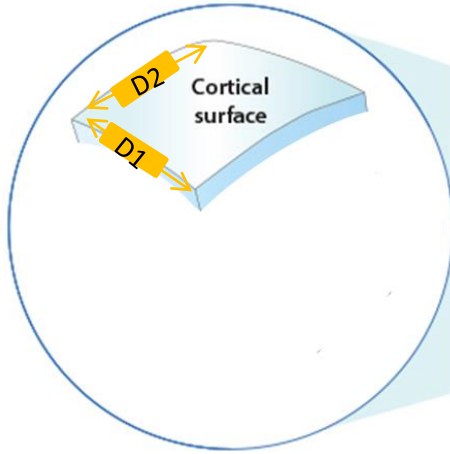
Kuehn & Sereno (*under review*) *Trends Cogn Neurosci*

The goal of cognitive neuroscience

Describe the relationship between brain function and behavior



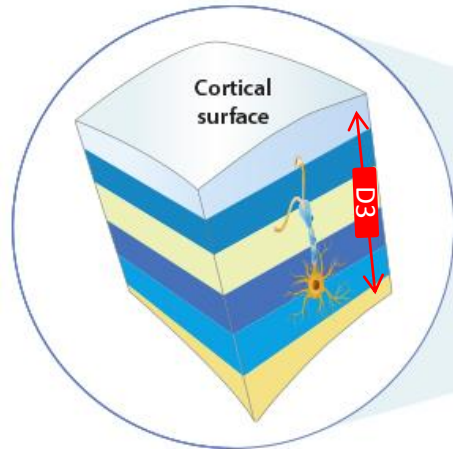
Kuehn & Sereno (*under review*) *Trends Cogn Neurosci*



Columnar units

- Brain area
- Topographic map
- Receptive field

Kuehn & Sereno (*under review*) *Trends Cogn Neurosci*

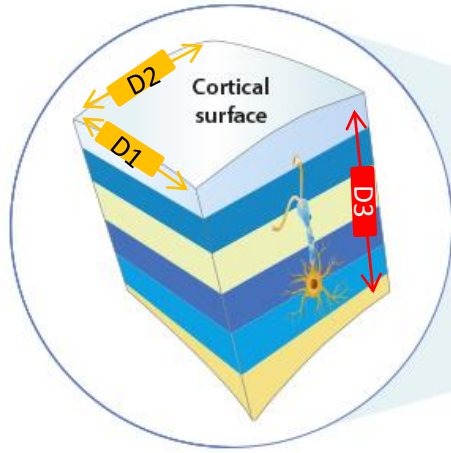


Layer units

- **Feedforward vs. Feedback**
- **Modulation vs. Encoding**
(e.g., Sherman 2016 *Nat Neurosci*)
- **Input vs. Output**
(e.g., Huber et al. 2017 *Neuron*)
- **Blood flow vs. Neuronal encoding**

Kuehn & Sereno (*under review*) *Trends Cogn Neurosci*

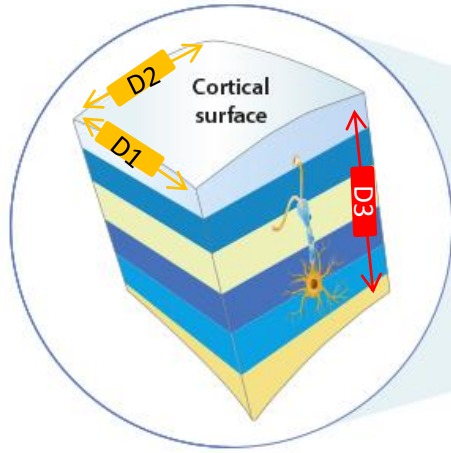
3D Cognition



1. In order to relate brain function to behavior, the cortex has to be modelled in three dimensions.

Kuehn & Sereno (*under review*) *Trends Cogn Neurosci*

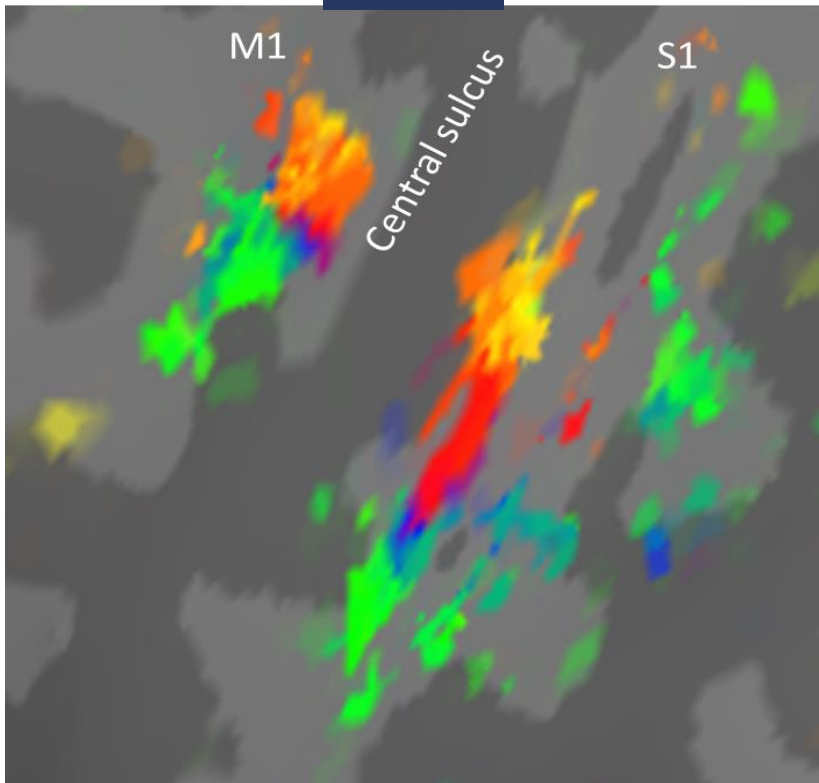
3D Cognition



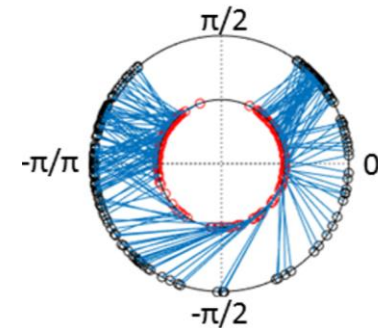
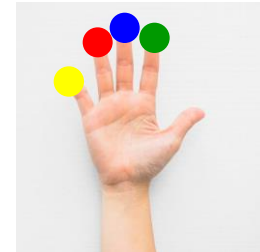
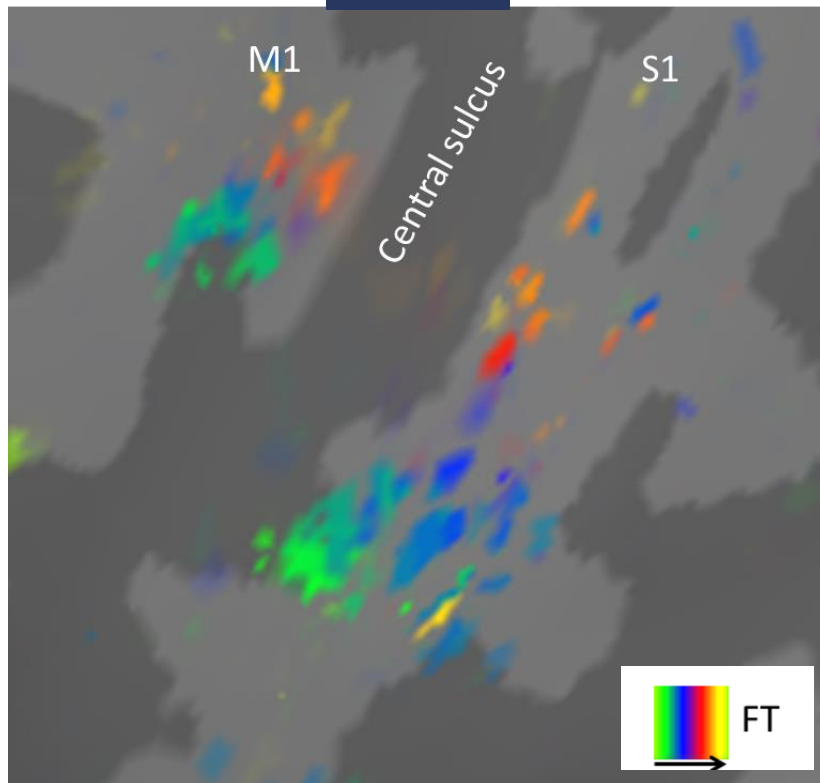
2. Columnar overlap is not equivalent to computational similarity.

Kuehn & Sereno (*under review*) *Trends Cogn Neurosci*

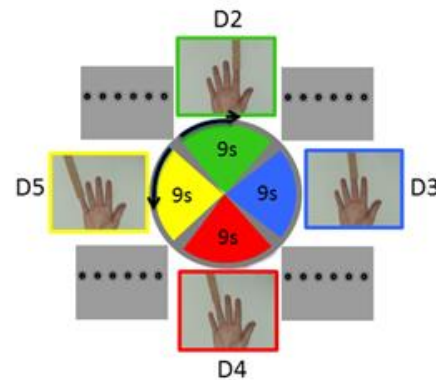
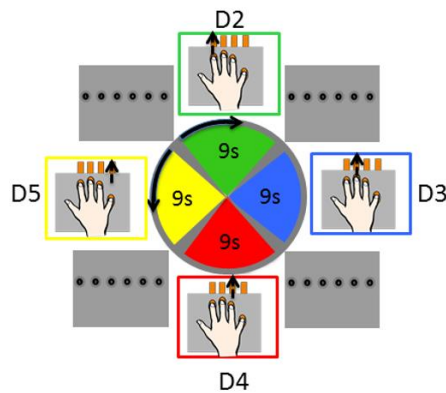
Touch



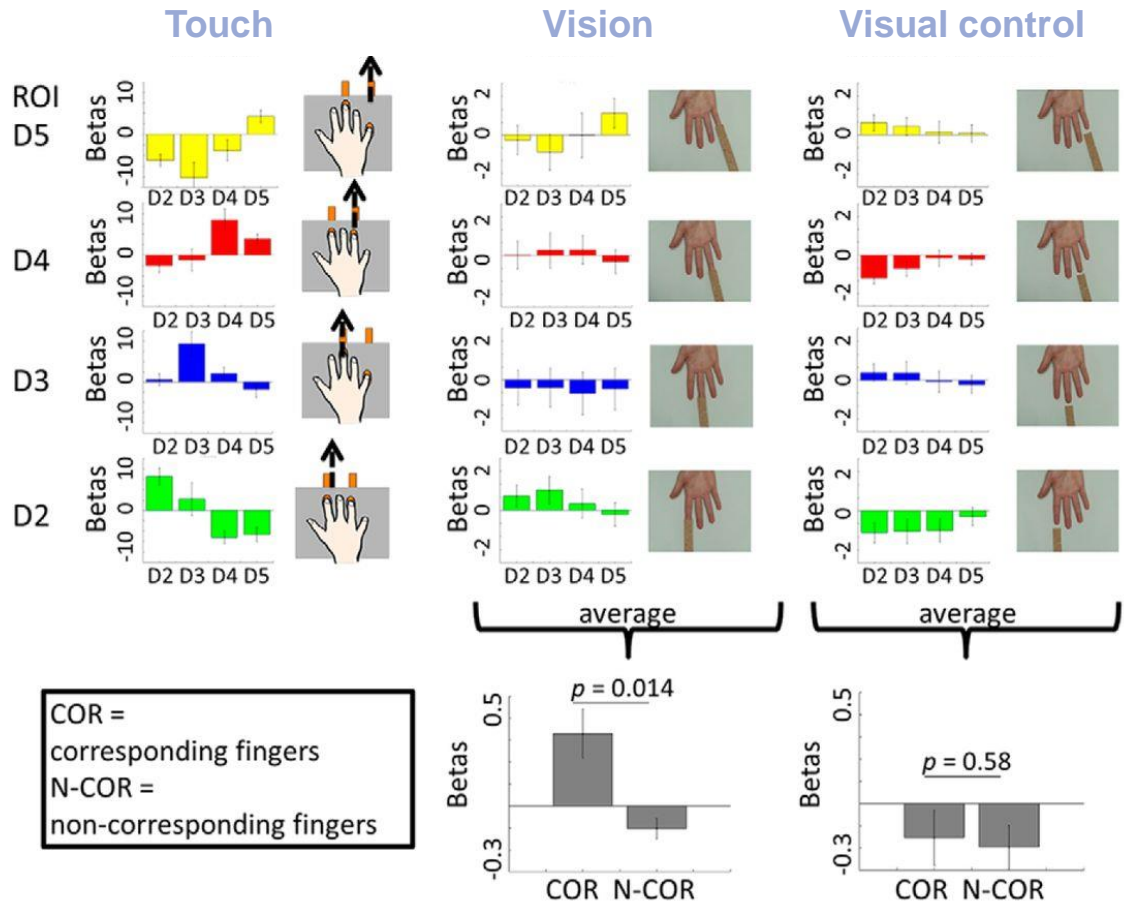
Vision



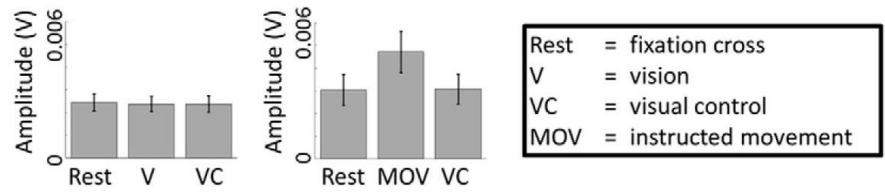
- Polar angles touch
- Polar angles vision



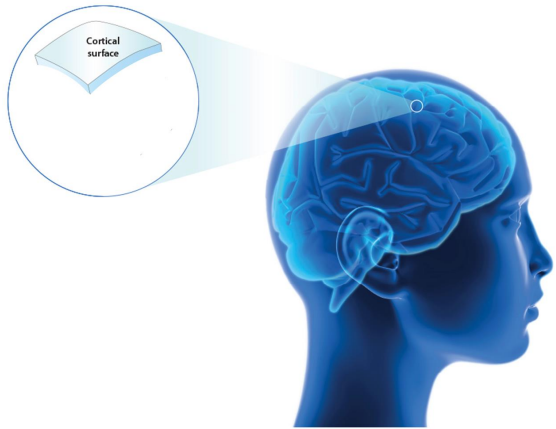
Kuehn, Haggard, Villringer, Pleger*, Sereno (2018) *J Neurosci*



Mean EMG amplitudes



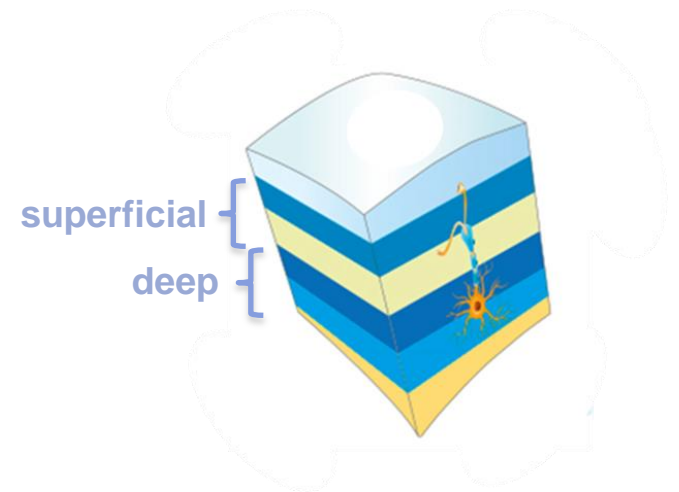
Kuehn, Haggard, Villringer, Pleger*, Sereno (2018) *J Neurosci*



- **S1 “mirrors“ touch: you feel touch when you see it -> social brain**
- **S1 is “amodal“ or “metamodal“ because it responds similarly to different input modalities (not modality-specific)**
- **S1 integrates visual and tactile cues and is therefore multisensory**

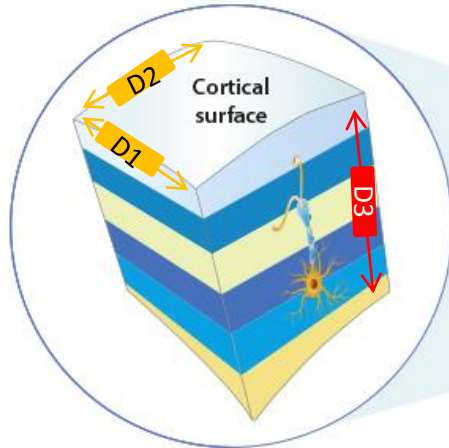
Sorry, I cannot show these unpublished results here.

But this slide showed data that indicate that tactile maps and visual maps in S1 are activated in different cortical depth.



Kuehn, Trampel, Guidi, Villringer, Pleger, Weiskopf,
Sereno (*unpublished results*)

3D Cognition



Topographic maps do not serve the same functions when activated by different modalities

Mirror neurons?

“Amodal brain“?



Multisensory integration?

Sensory substitution?



Dr. Robert Trampel



Prof. Dr. Burkhard Pleger



Prof. Dr. Arno Villringer



Dr. Maria Guidi

Thanks!



Prof. Dr. Patrick Haggard



Prof. Dr. Martin Sereno



Prof. Dr. Nikolaus Weiskopf