Investigations on bottom-up and top-down processing in early visual cortex with high-resolution fMRI

Propositions of the thesis

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1. Visual perception arises from an interplay of bottom-up and top-down processes. Cortical depth-specific fMRI has the potential to afford deeper insights into the interplay of bottom-up and top-down signals in visual cortex.

2. High-resolution fMRI can measure the neuronal processes underlying perception in the human brain at an unprecedented level of spatial detail. However, vascular artefacts pose a great challenge to this line of research.

3. Even though it is difficult to model and remove signal bias due to draining veins from the cortical depth-specific fMRI signal, it is better to model the bias with some degree of uncertainty than to ignore it.

4. Even though primary visual cortex is one of the best-studied cortical areas in humans, much remains unknown about its function. Simple experimental stimuli can reveal surprising response patterns.

5. Cognitive neuroscience should attempt to bridge the gap between cognitive science and 'classical' neuroscience. In particular, the long-term goal of fMRI research should be to integrate functional and structural levels of description.

6. The processing and analysis of fMRI data requires substantial amounts of computer code. Computer code should not only be machine-readable, but also human-readable.

7. Like natural languages, computer languages require adherence to grammatical and stylistic rules for clear and efficient communication.

8. Sharing of data, metadata, and analysis code increases transparency, facilitates the efficient use of resources, and has the potential to increase the trust in science.

9. The responses to surfaces and edges in early visual cortex are modulated by the background. The response to the background has a complex temporal pattern.

10. More research will be needed.