Principles for Models of Neural Information Processing

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Presentation Abstract Summary Here we provide a perspective on models of neural information processing in cognitive neuroscience. We define what these models are, explain why they are useful, and provide criteria for evaluating models. With these principles in mind, we review past work in which we used fMRI to identify the specific information-processing operations being performed by different neural populations across human visual cortex (Kay & Yeatman, 2017; Kay et al., 2008; Kay, Weiner, & Grill-Spector, 2015; Kay et al., 2013a; Kay et al., 2013b). We show how the models developed in this line of research build upon each other and account for increasingly large ranges of experimental manipulations and brain regions. We also show how the same modeling approach can be exploited to tackle not only sensory but also cognitive (e.g. attentional) operations. Finally, we contrast our modeling approach with recently developed deep neural network models. We contend that although deep neural network models are promising, substantial work is necessary to clarify what type of explanation these models provide, to determine what specific effects they accurately account for, and to improve our understanding of how they work.

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