



# Using multi-voxel pattern analysis of fMRI data to interpret overlapping functional activations

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Norman *et al.* [1] recently reviewed the use of multi-voxel pattern analysis (MVPA) of fMRI data. They provided examples that showed that patterns of activation across a set of voxels can contain far more information about mental states than the more typically used univariate approach. Patterns of fMRI activation can be used to discriminate cognitive states (sometimes called ‘mind reading’), to relate brain activity to behaviour and to clarify the structure of neural representations. Here, we point out an additional use of MVPA: its ability to interpret overlapping functional activations.

A general issue that arises in fMRI studies concerns the interpretation of overlapping activity from independent contrasts. When a set of voxels is commonly activated by two (or more) contrasts of experimental conditions, two interpretations are possible. In a common-coding interpretation, the shared region is thought to contain neurons that are engaged in a common computational process, which is shared by the two experimental conditions (but not the respective controls). For example, this interpretation has been the favoured account for brain areas that are activated by both observed and performed manual actions [2] and, in this case, has been taken as evidence for ‘mirror neuron’ [3] systems in the human brain. Alternatively, in a functional-independence interpretation, two overlapping but functionally independent neural populations are thought to be engaged within the common region.

We have recently presented several examples of functional independence in overlapping extrastriate

cortical regions using MVPA [4,5]. For example, we found highly overlapping activations in response to motion and human bodies in lateral occipitotemporal cortex. Univariate analysis showed that most voxels in this region were selective for both motion and bodies, which suggests engagement of common neural mechanisms. By contrast, MVPA revealed that the patterns of activation in response to bodies and motion were unrelated, which favours a functional-independence account [5].

Thus, in addition to ‘mind reading’, MVPA can assess the functional significance of overlap between fMRI activations. This issue is relevant for fMRI studies in all areas of cognitive neuroscience because overlapping activations anywhere in the brain cannot be assumed to reflect shared neural processing. We expect that future experiments that are designed for MVPA should help to support or reject claims about neural mechanisms that are shared across multiple tasks or stimuli.

## References

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