Stimuli-specific subspaces communicate bottom-up cognitive processes

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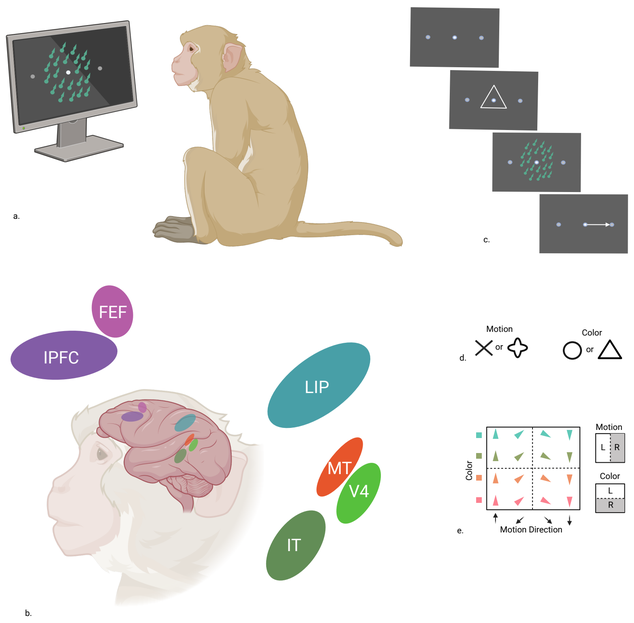
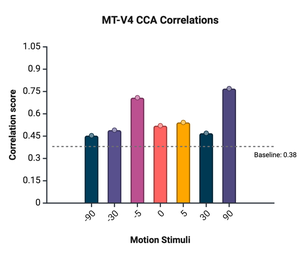
INTRODUCTION

The visual system's ability to process a deluge of sensory information with astounding speed and precision is one of the marvels of cognitive neuroscience. This capability underpins everything from basic perception to complex decision-making. But how does the brain manage this feat? Here we uncover a crucial aspect of this mechanism: the compartmentalization of information into feature-specific subspaces during bottom-up communication. We demonstrate that motion features are processed within distinct subspaces, facilitating communication from the middle temporal (MT) area to the V4 and lateral intraparietal (LIP) regions. Simultaneously, color features are handled in separate subspaces, enabling communication from the MT to the V4 and inferior temporal (IT) regions. Furthermore, the geometry of network activity corresponds to unique stimuli-specific representations, revealing a sophisticated organizational structure. These findings provide a deeper understanding of how bottom-up cognitive processes are supported by the visual system's architecture, highlighting the efficiency and specialization of pathways and subspaces in managing and utilizing vast sensory inputs for cognitive processing.

METHODS

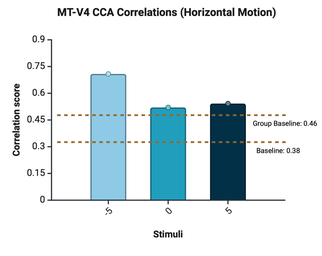


RESULTS



Canonical dimensions of individual motion stimuli. Each individual stimuli had a greater correlation score than the unstructured set

RESULTS



Canonical dimensions of individual motion stimuli that were closely clustered together ('horizontal stimuli'). When grouping all 3 horizontal stimuli together, a new baseline was obtained that was higher than the unstructured baseline, however, the individual stimuli each outperformed the new baseline.

CONCLUSION

ACKNOWLEDGEMENTS

We thank Antonio J. Fontenelle for helpful discussions. Research was supported by Bernstein Network Computational Neuroscience travel grant.