Artificial Intelligence and Machine Learning, from Behavioral to Neuroimaging

(in non human primates)

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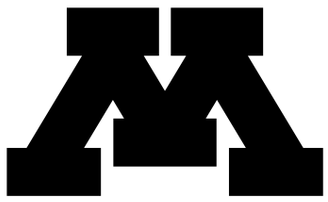
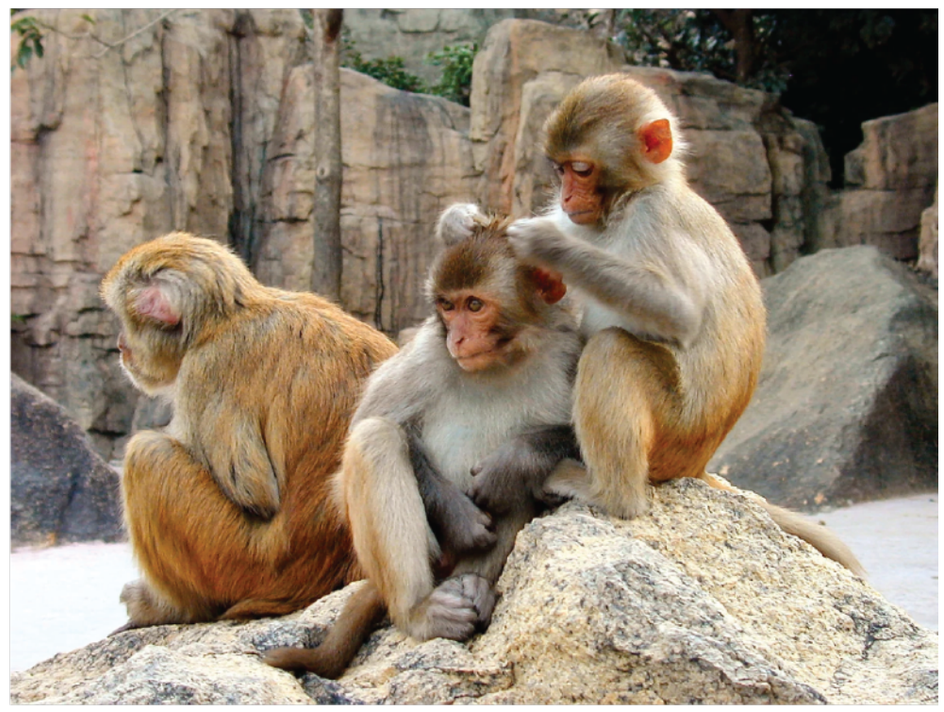


Neuroscience / CMRR

UNIVERSITY OF MINNESOTA

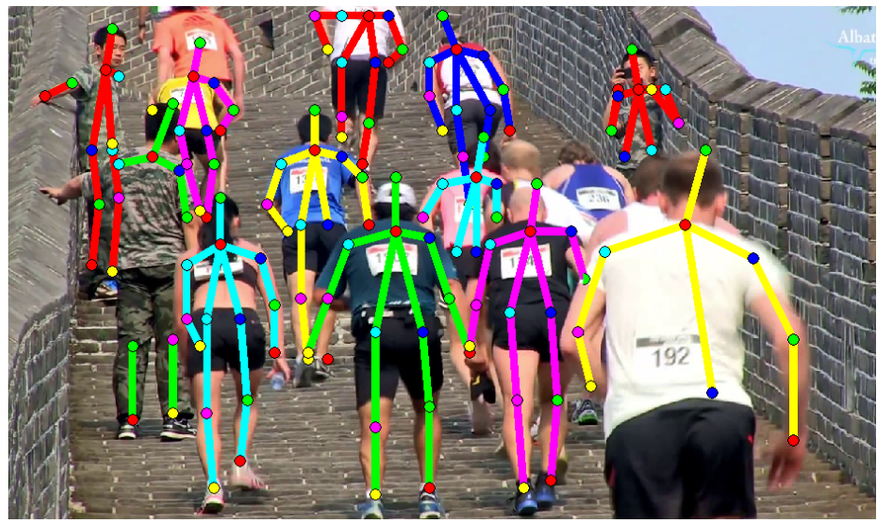
Studying natural behavior, as well as the impact pathologies have on it, unlocks the potential for broadband discovery in biomedicine through deep phenotyping.

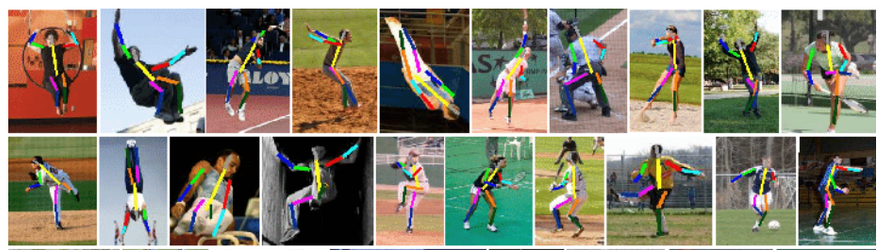
Naturalistic

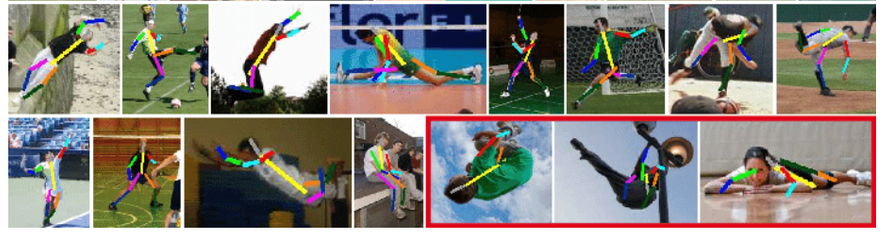


Experimental control

Deep learning for pose estimation

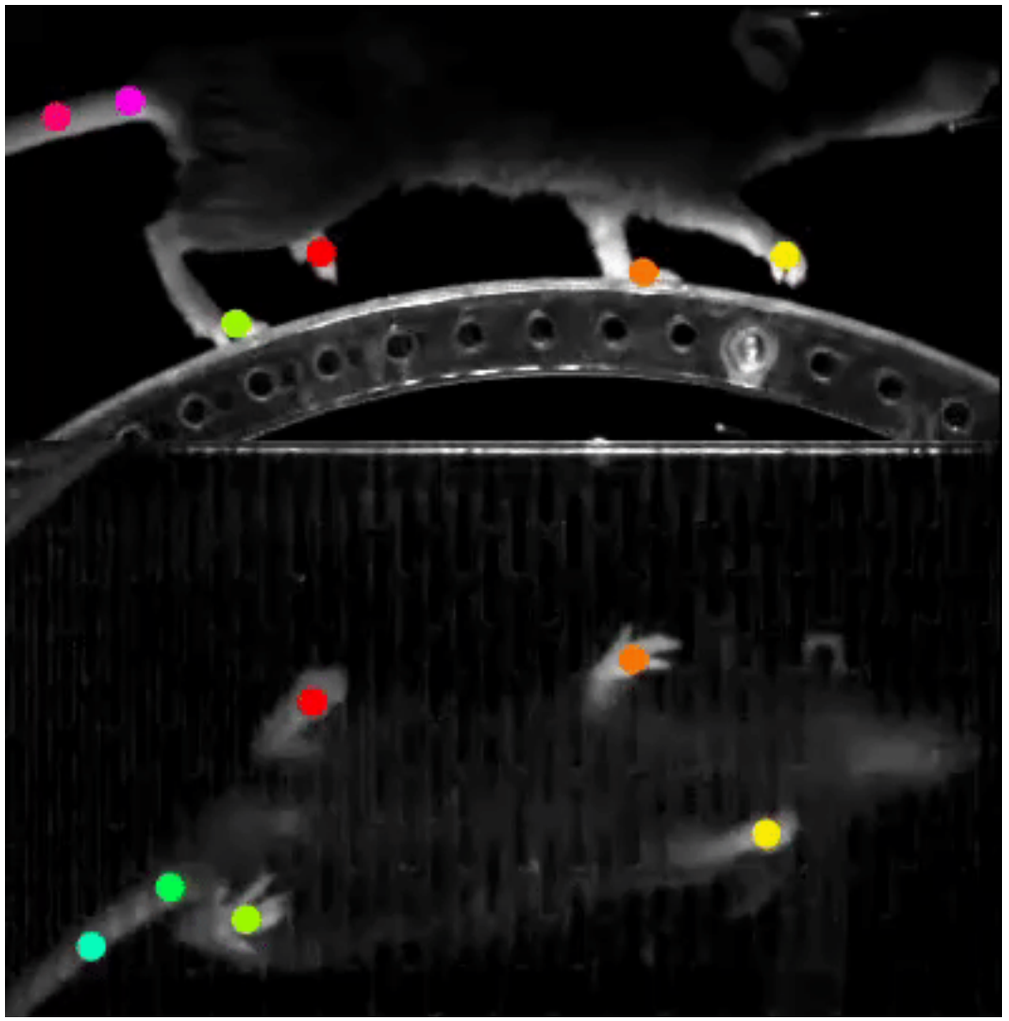






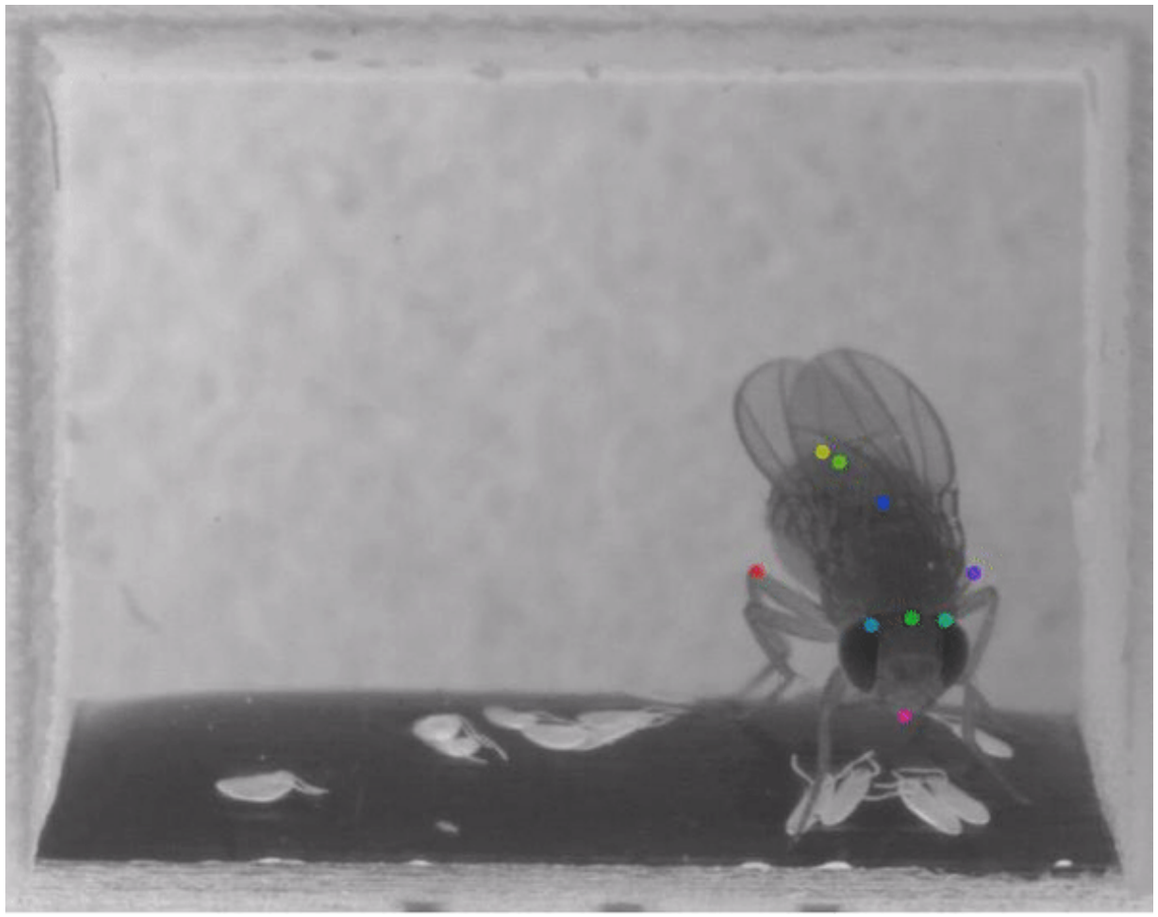
Markerless is key!
Yet for NHP large datasets are non trivial and expensive

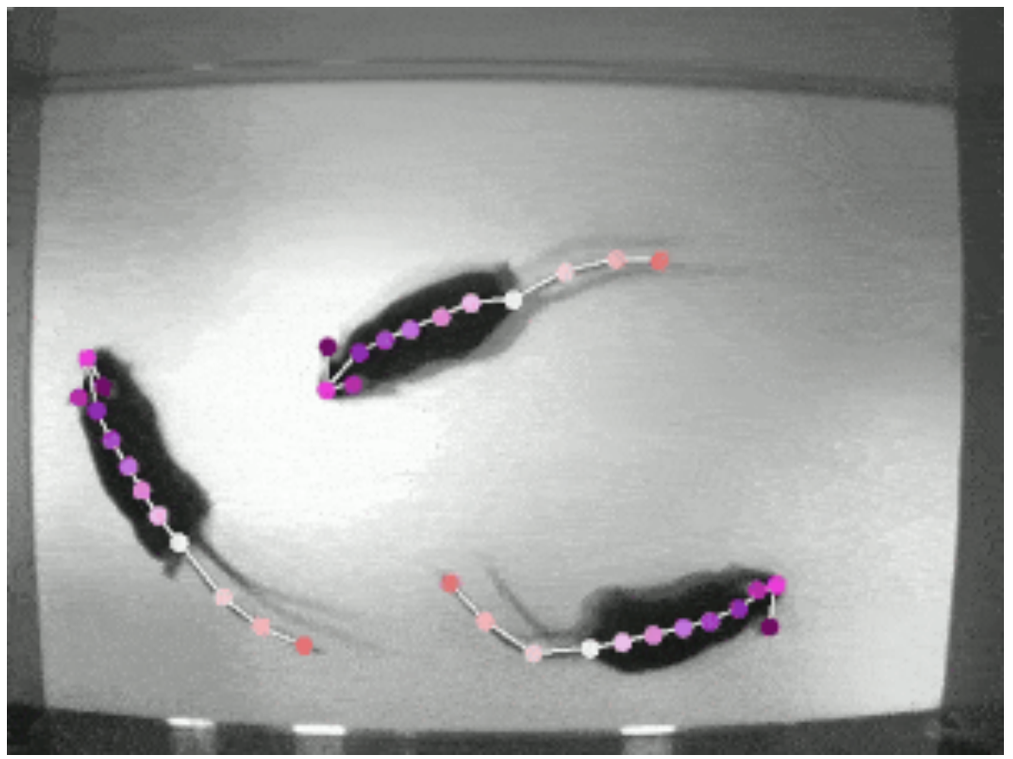
Deep learning for pose estimation in animals



Automatic pose estimation of behavior in animal models

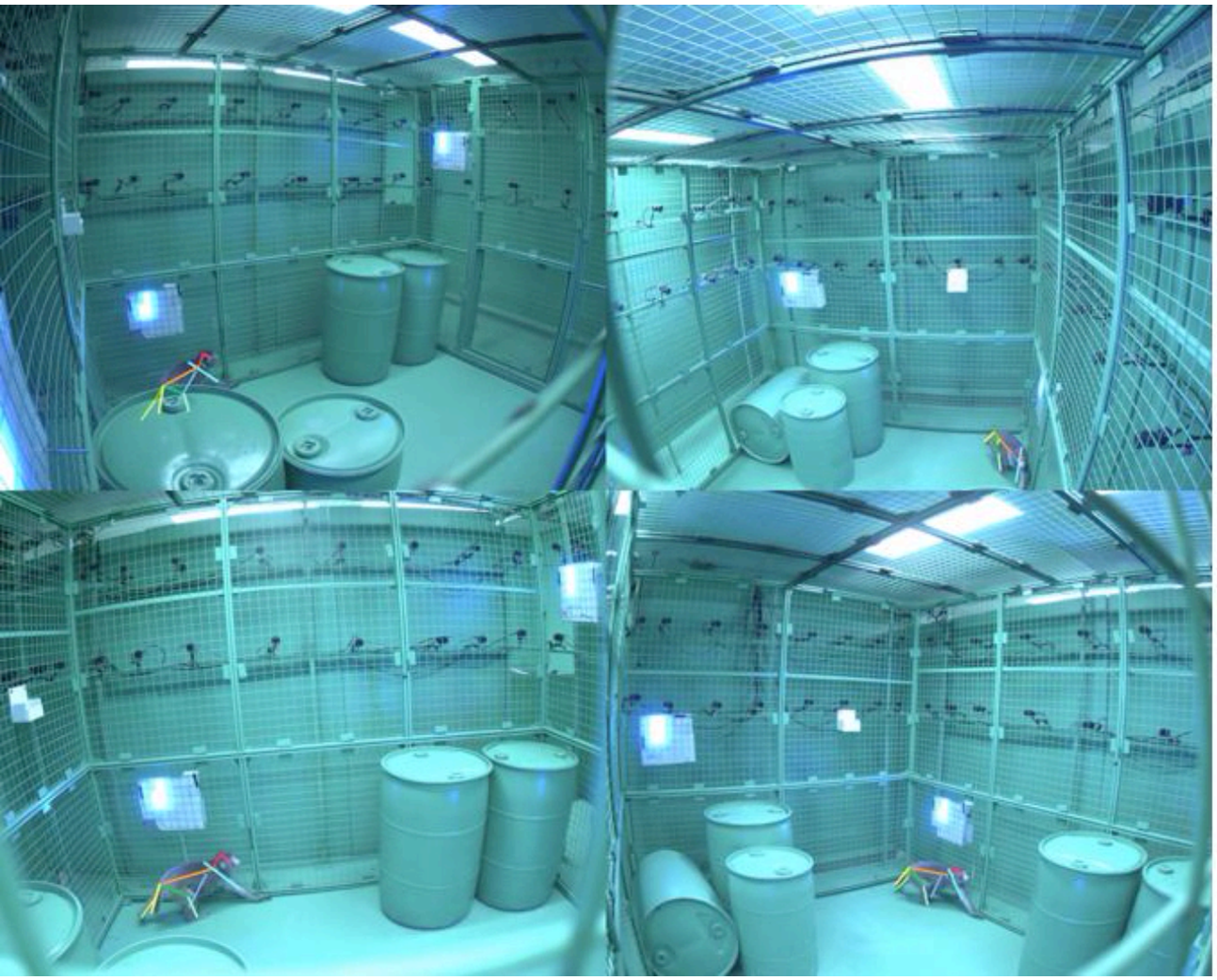
(Images courtesy of DeepLabCut)

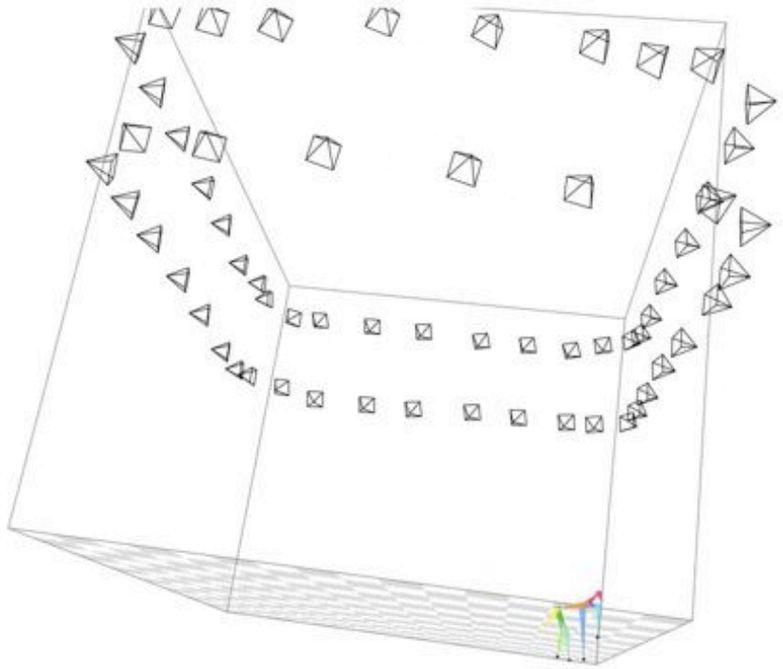




Presentation contained video imagery

OpenMonkeyStudio for non human primates

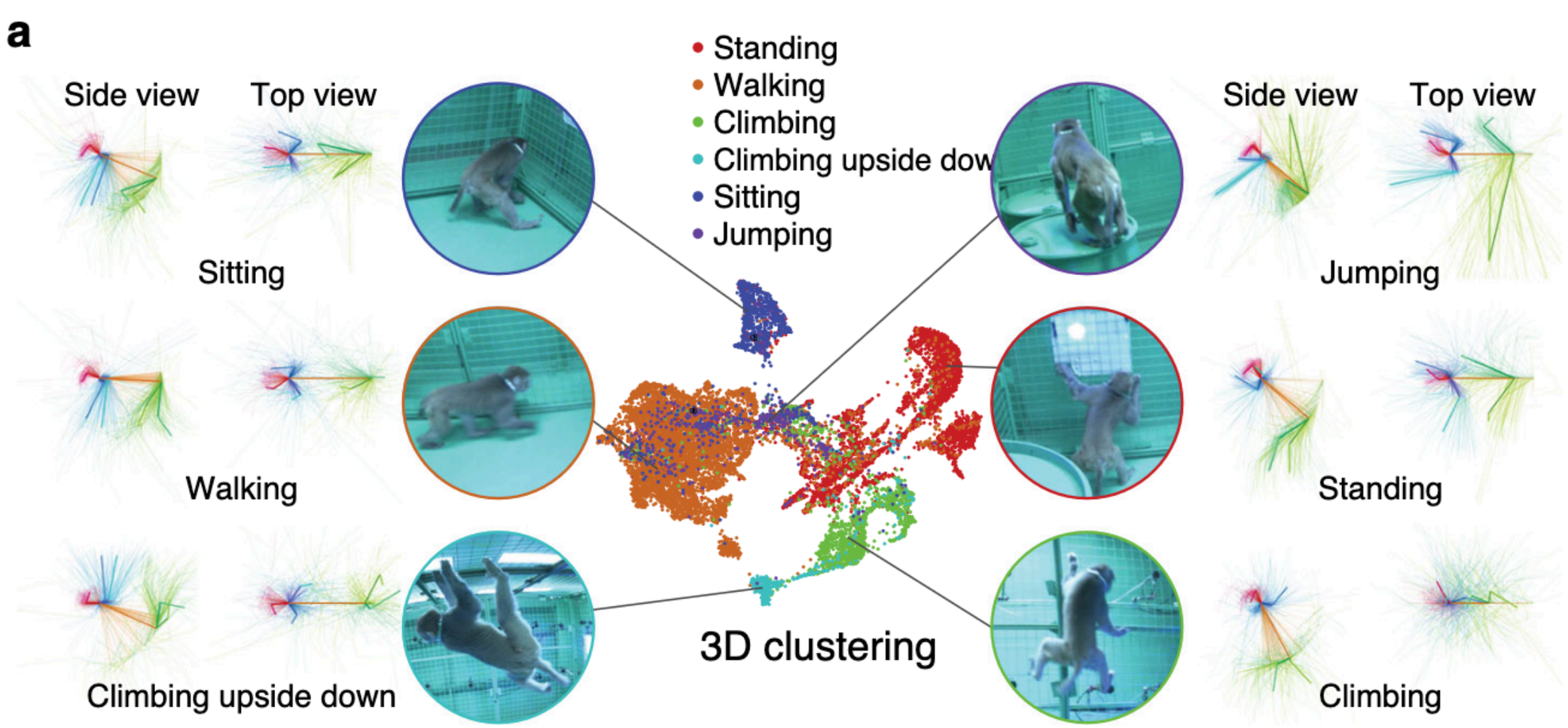


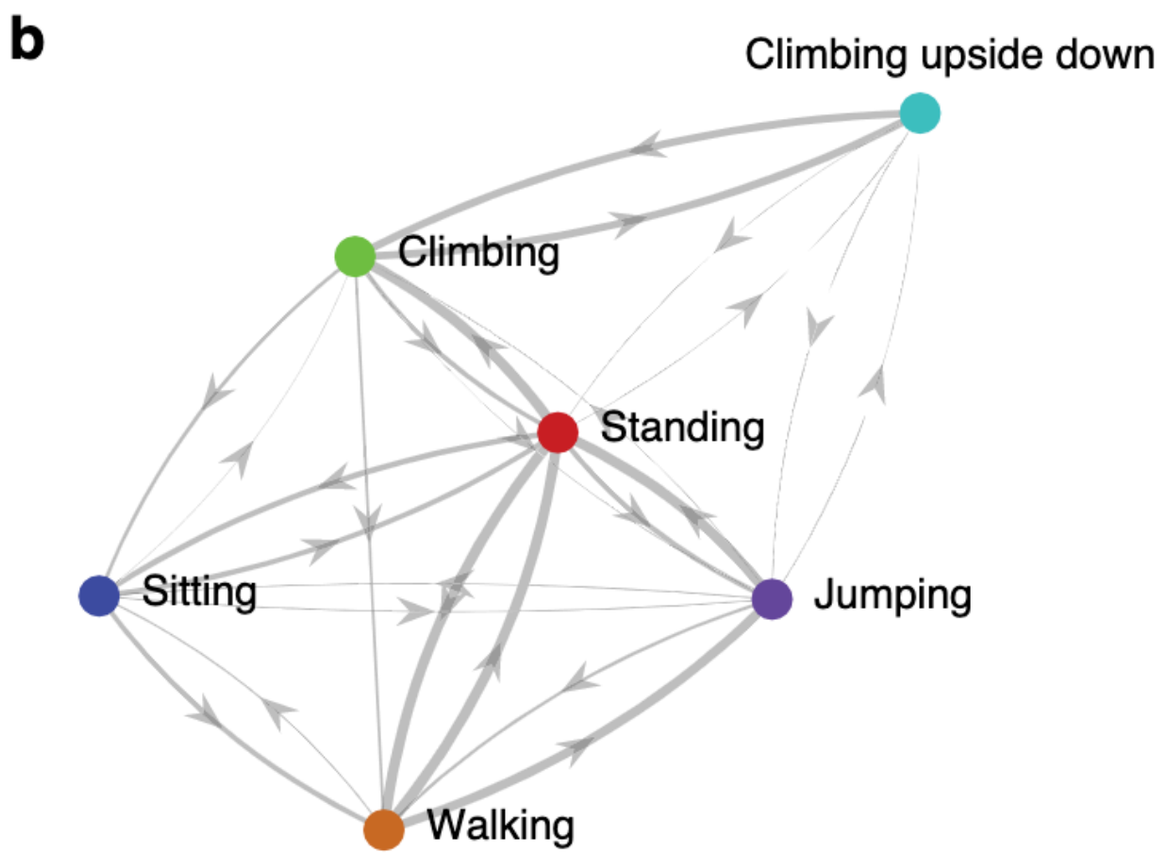


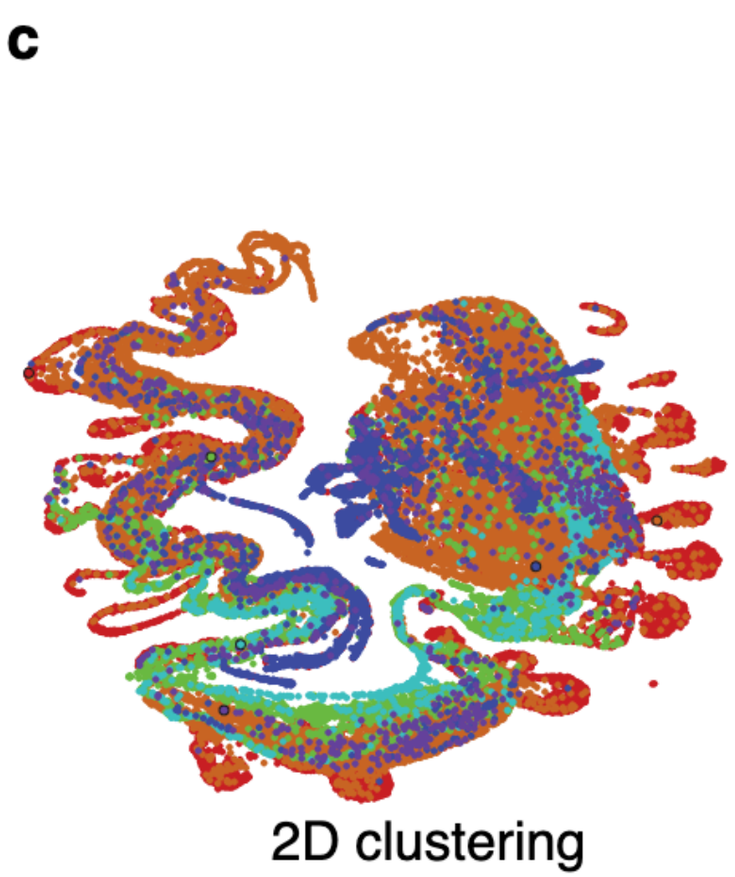
62 Camera system for automatic pose reconstruction in 3D

Presentation contained video imagery

Bala et al. (2020)

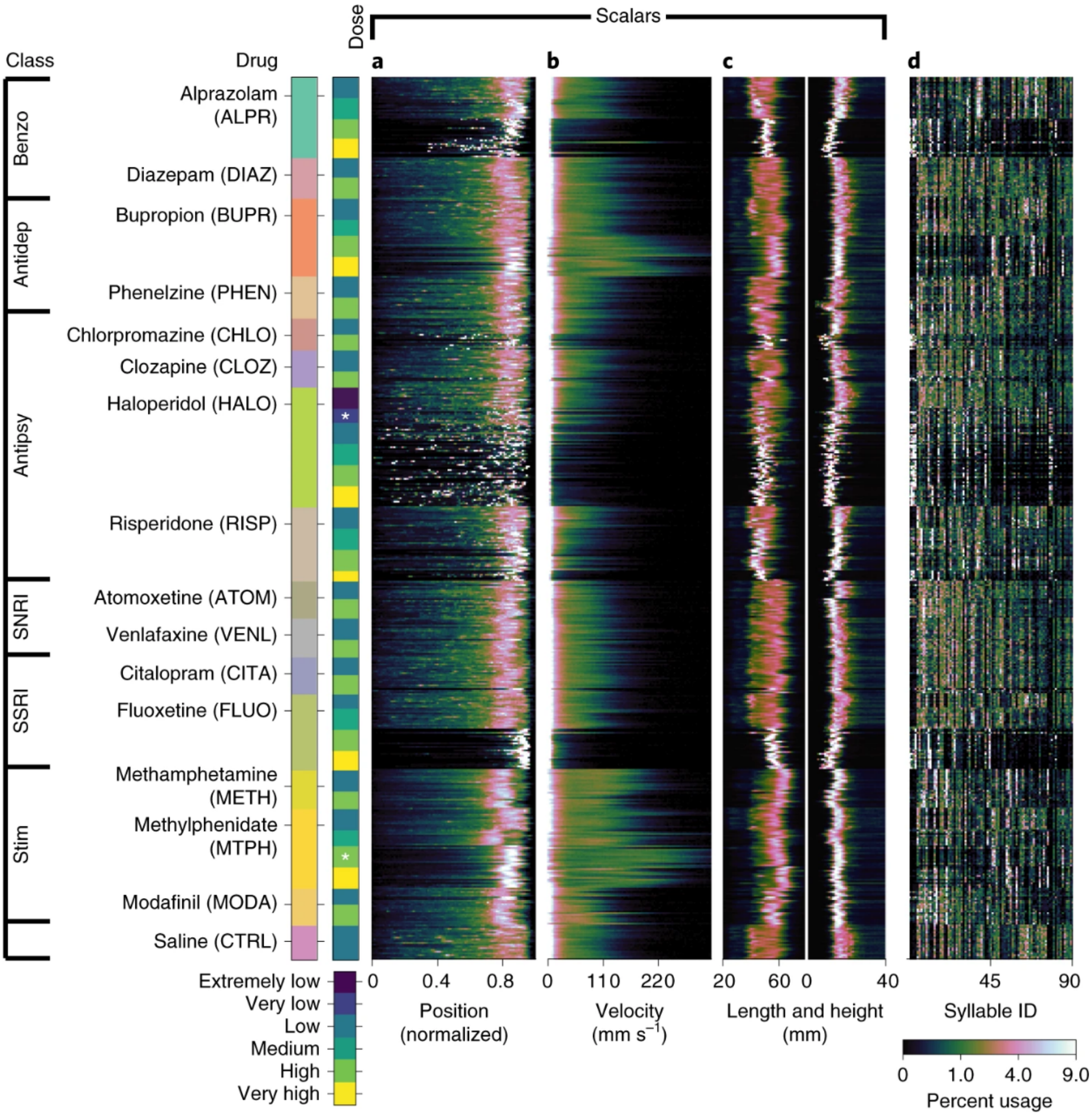






Bala et al. (2020)

Motion Sequencing reveals the structure of pharmacobehavioral space



Wiltschko et al. (2020)

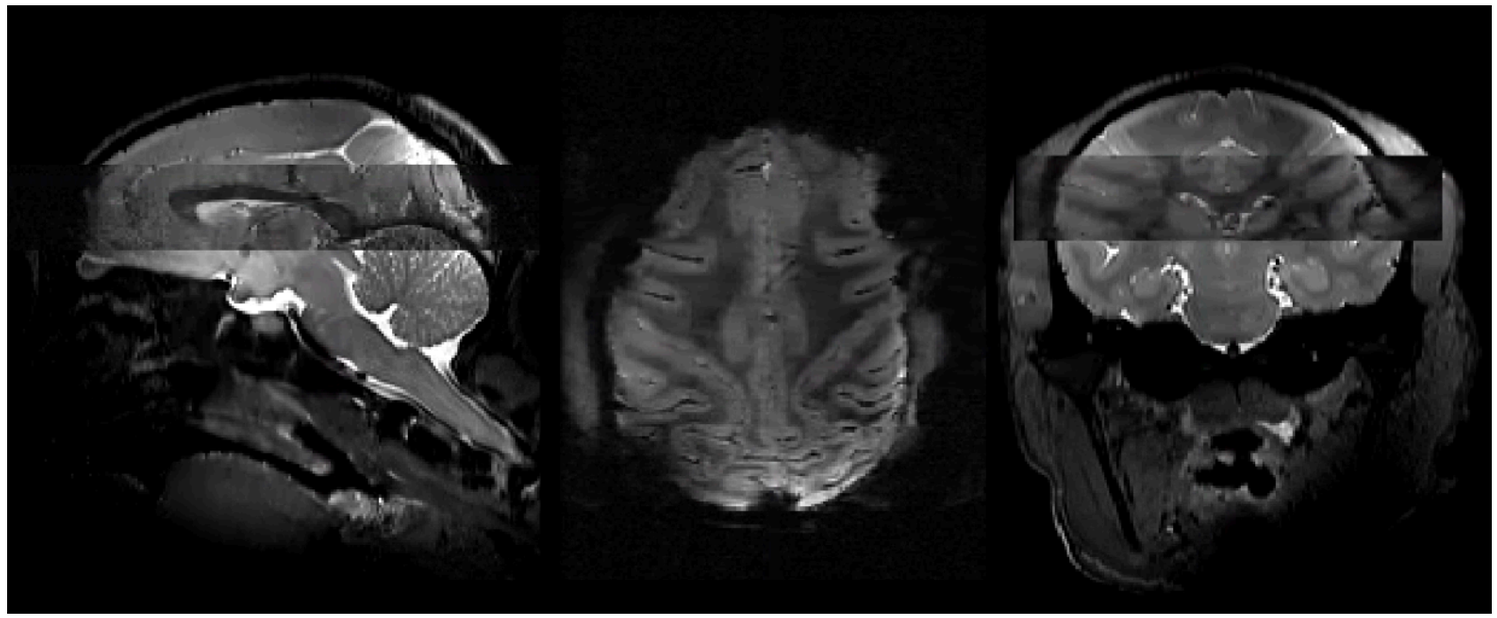
Machine learning and artificial intelligence allows us to probe behavioral neuroscience of naturally occurring behavior

One task at a time —> Variance of Natural Behavior

Julia Kuhl

Precision ultra high field imaging, affords rapid animal - human translation within modality.

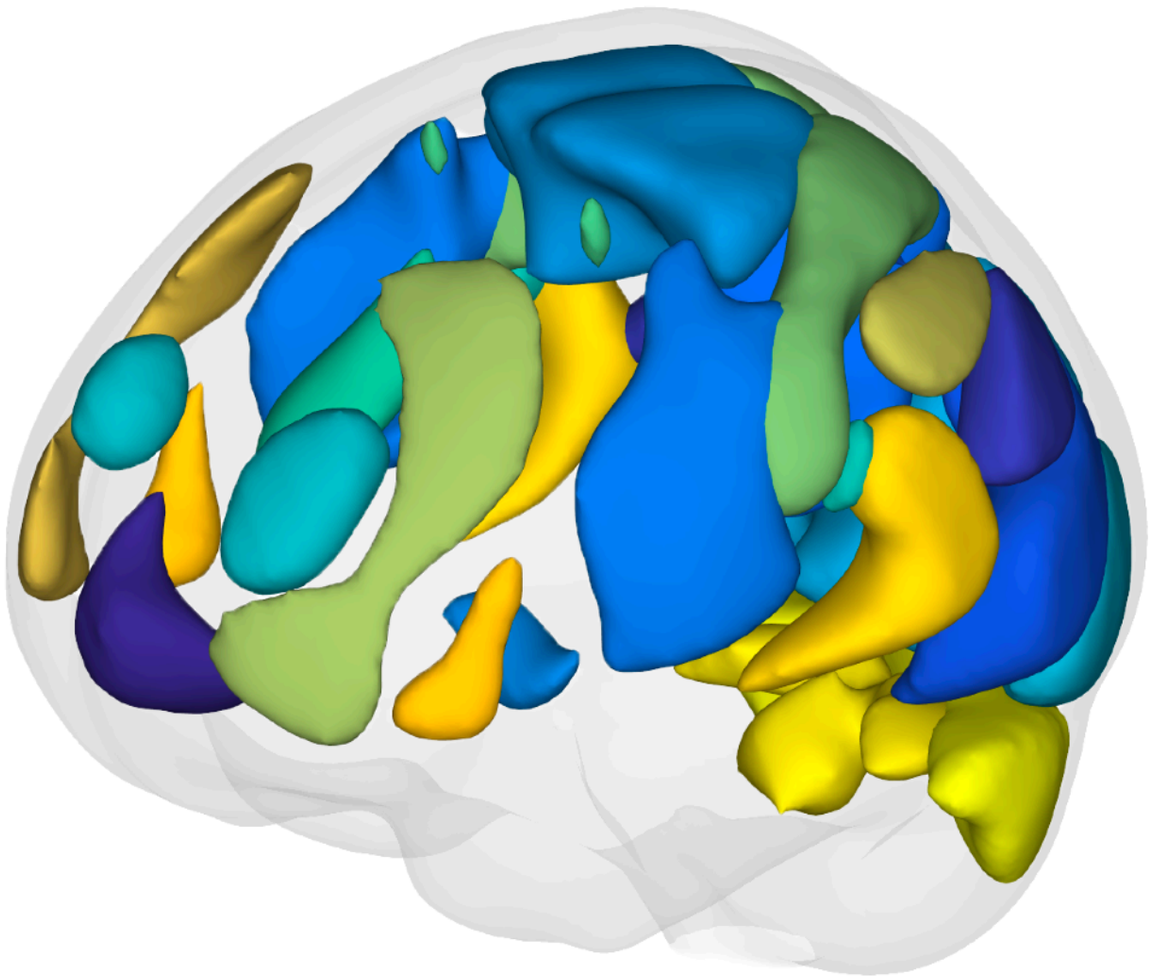
10.5 Tesla
128 receive channels
16 transmit channels



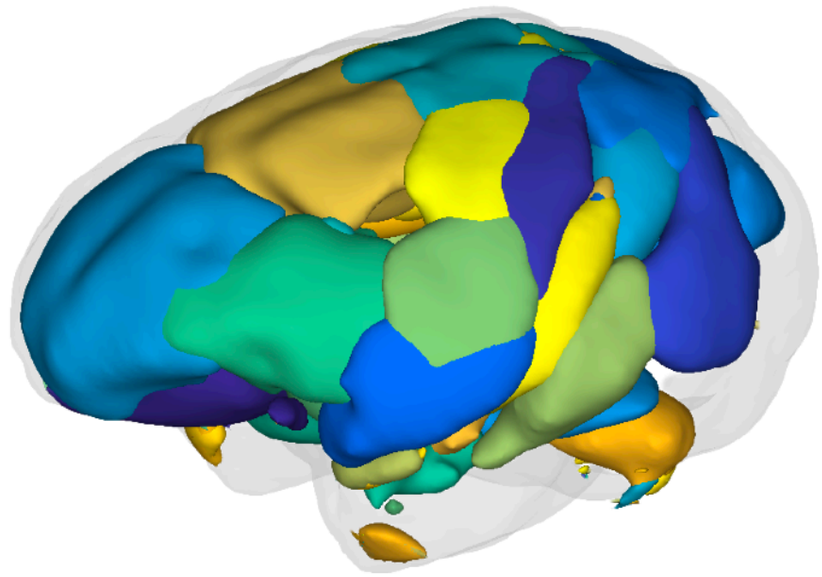
500 micron whole brain
Functional EPI

Small NHP samples (N<10) at ultra high field reconstruct fidelity of large (N>1000) human fMRI studies opening avenues for treatment discovery.

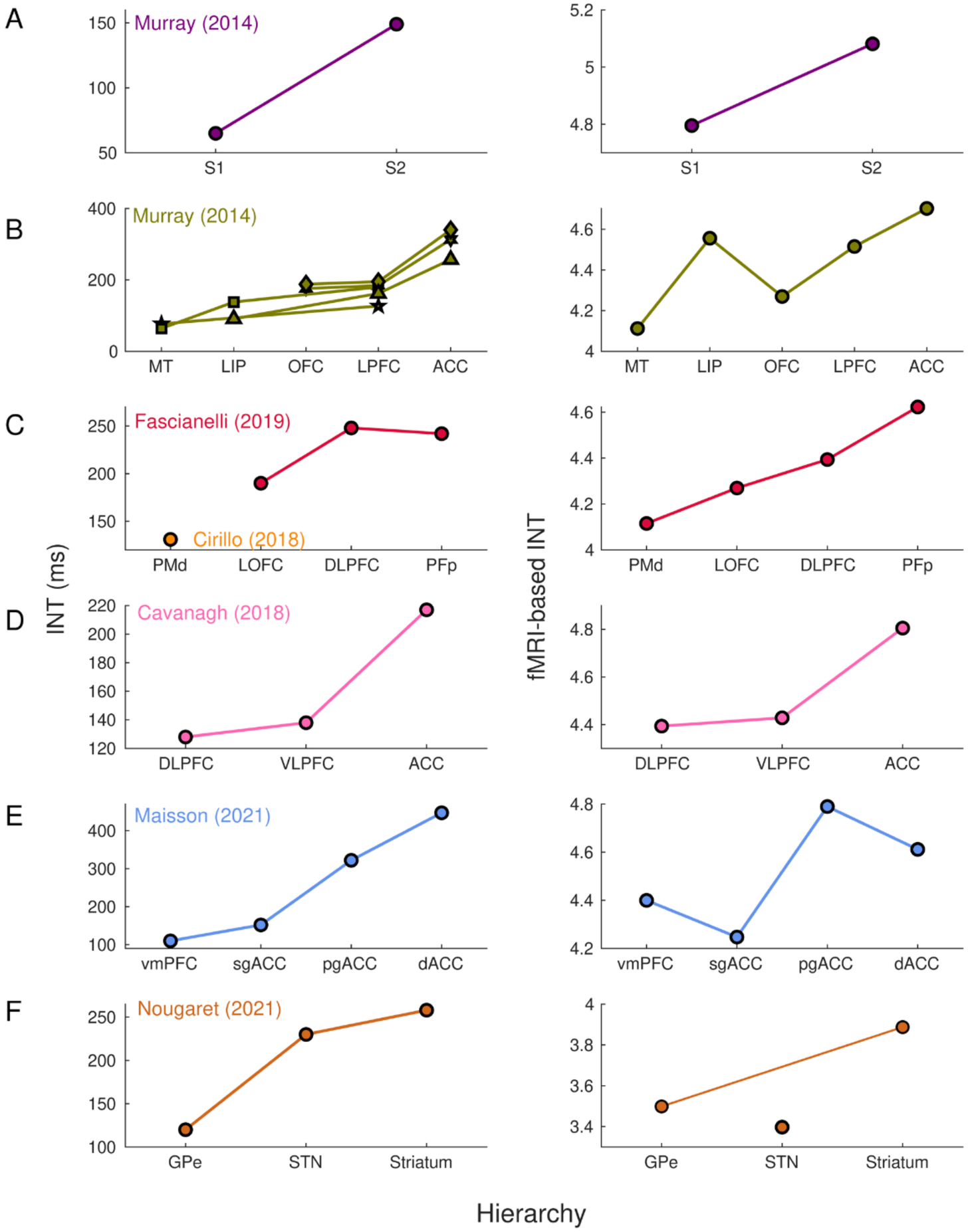
Human Connectome Project
Resting State Networks



Macaque 10.5 Tesla
Resting State Networks



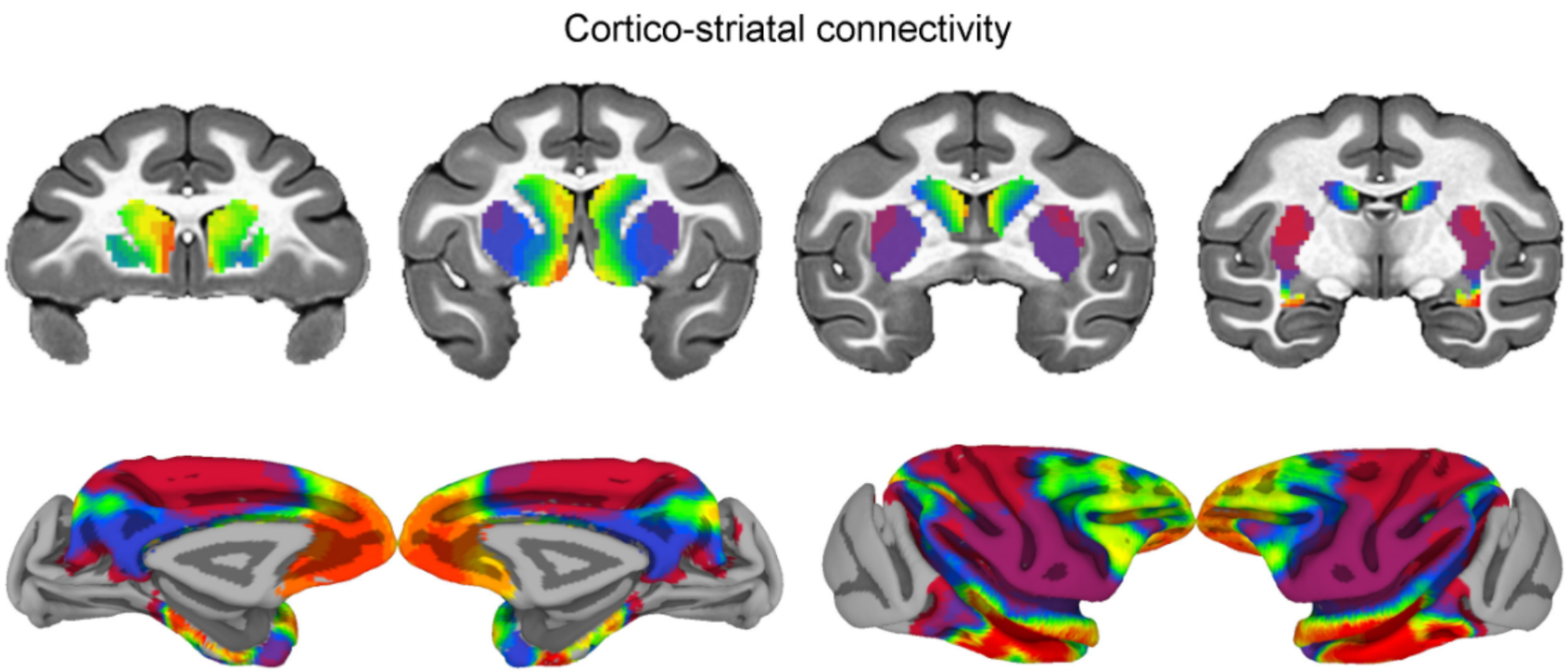
Yacoub et al. (2020)



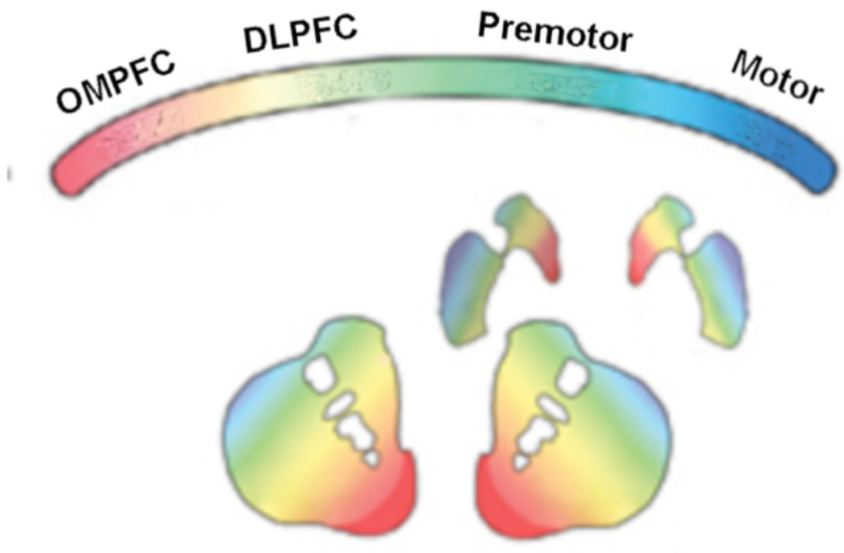
Non invasive imaging at ultra high fields validates and translates findings of hierarchies of timescales across cortical areas

Manea et al. (2022)

Non invasive imaging at ultra high fields captures the whole brain fidelity of invasive neuroanatomical ground truth discovery.

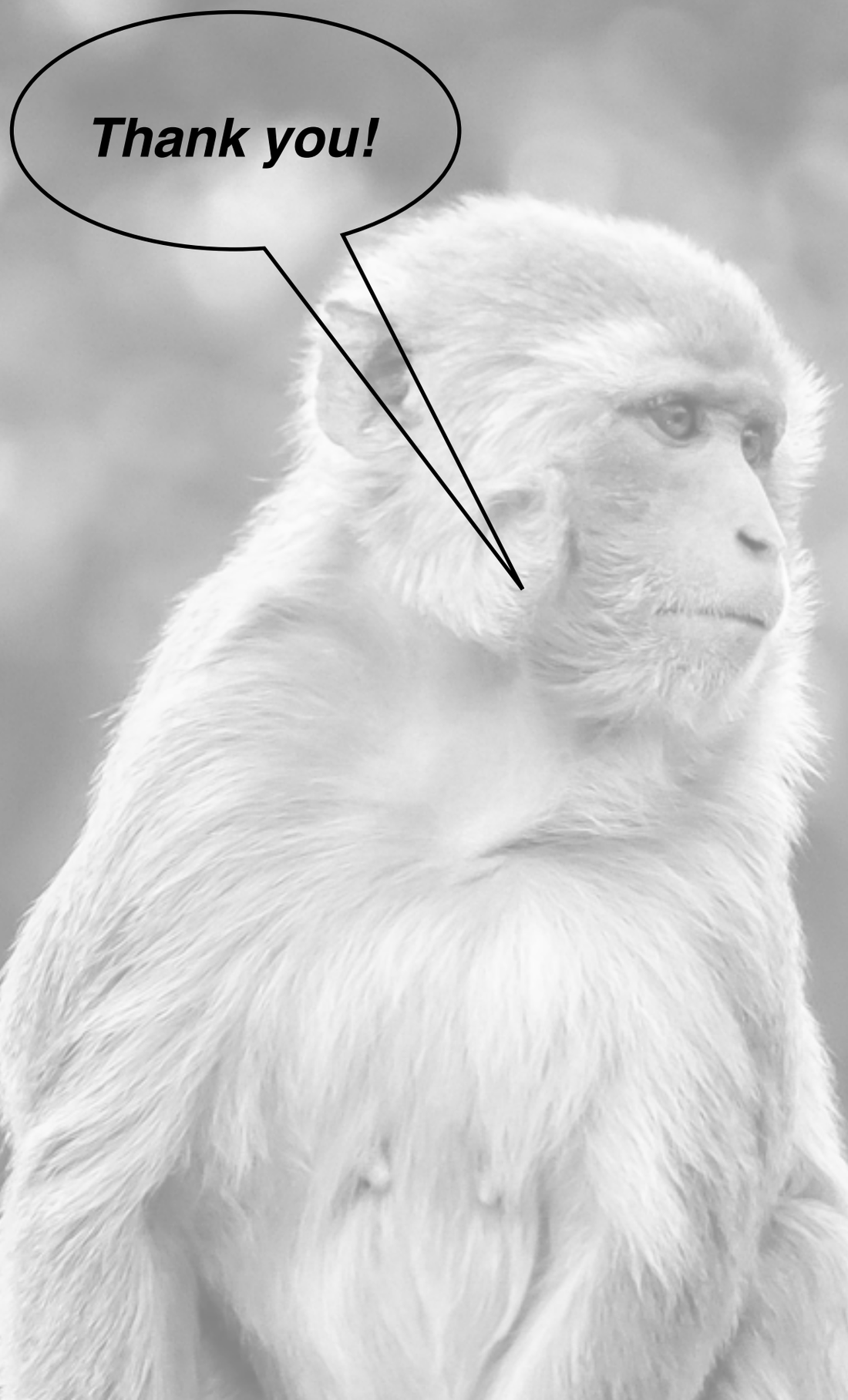


Manea et al. (2022)



Haber (2003)

Advances in non invasive high field imaging allow us to bridge translational findings directly from NHP -> Human populations



Acknowledgements

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