Dynamics of Motor Cortex: Intrinsic or Extrinsic?

Okapia Johnstoni
Jennifer Jensen, Shruti Marathe, Jiaxin Cindy Tu, Chris Versteeg

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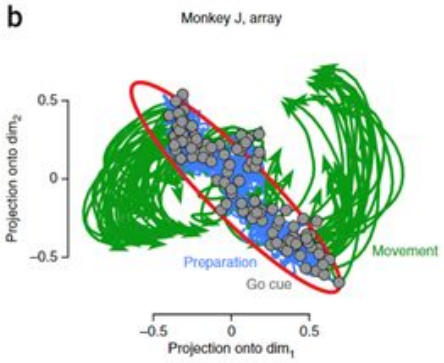
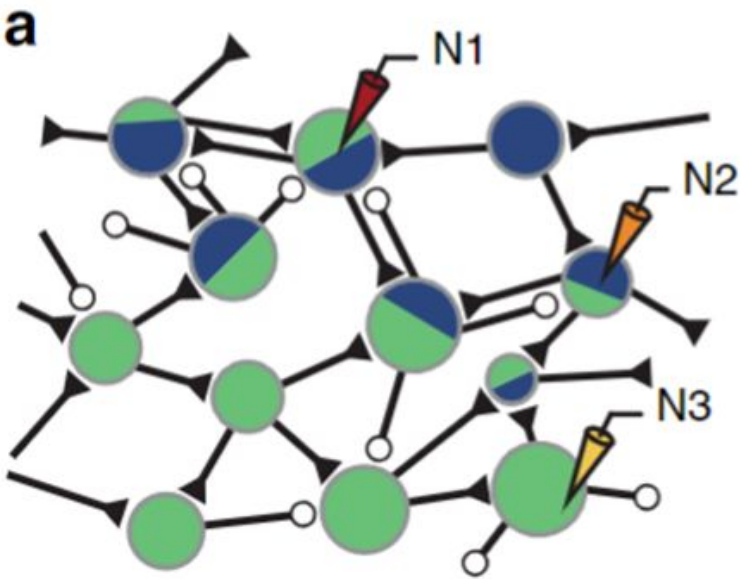
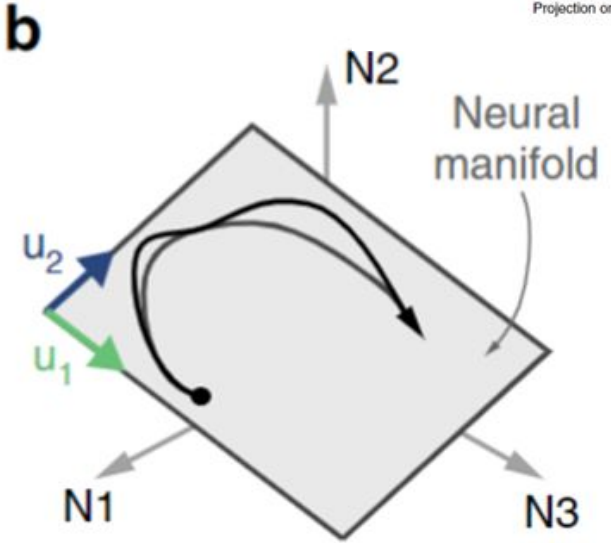
What are “Neural Dynamics”



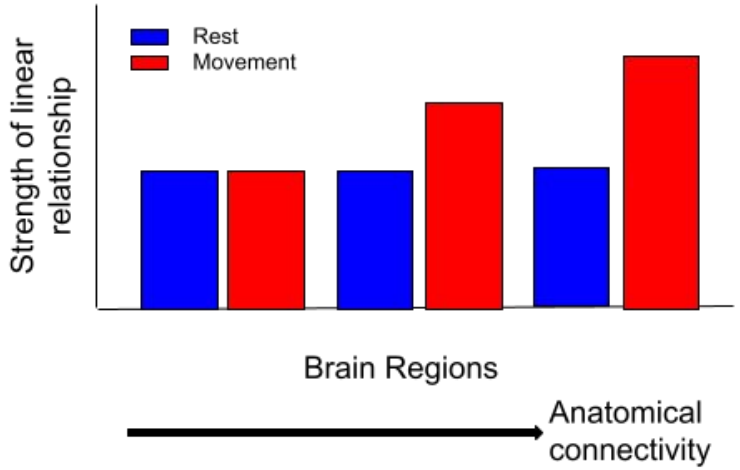




Questions

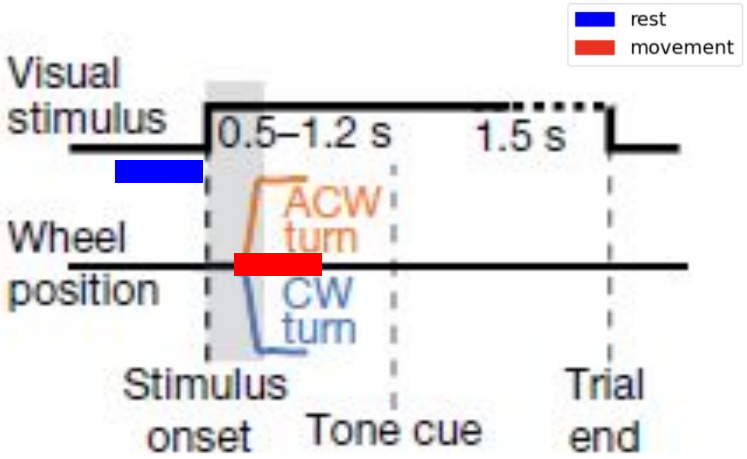
To what extent are dynamics recorded in motor cortex shared dynamics across the brain?

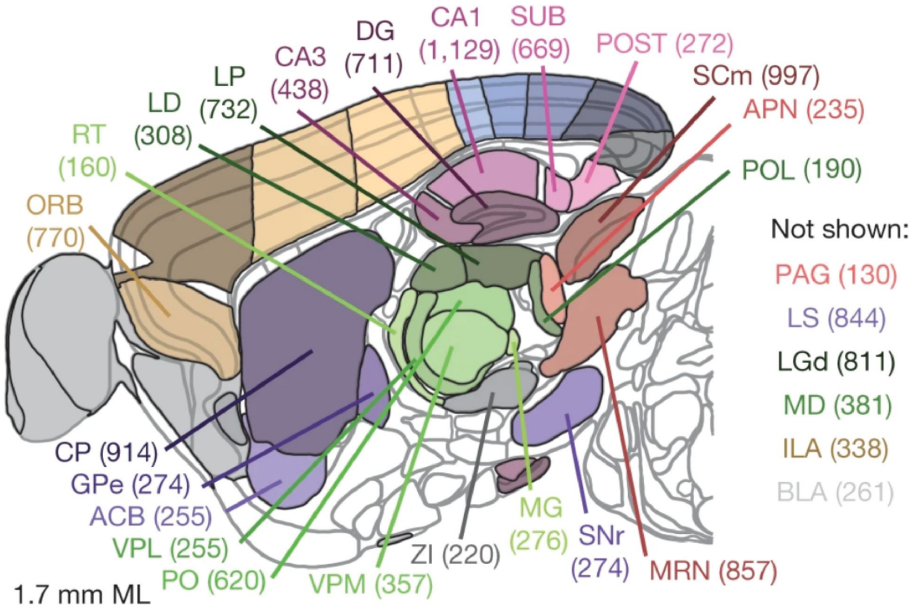
Hypothesis



At rest, neural activity of all brain regions will share few features. During movement, regions anatomically connected to motor cortex will interact more.

Steinmetz Dataset



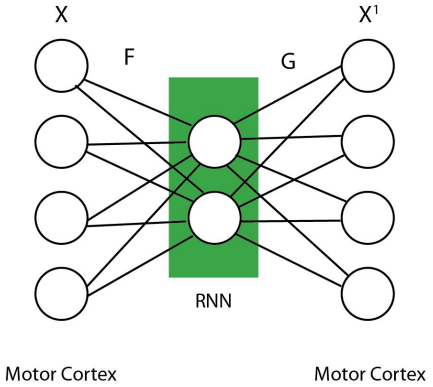


Session 31

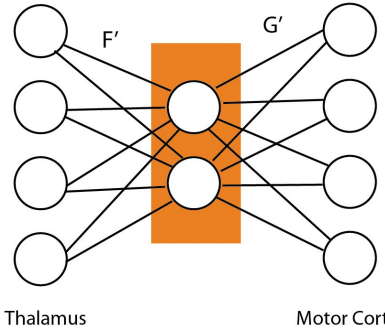
Brain Region	Secondary Motor Cortex	Thalamus	Orbital Frontal Cortex	Olfactory Bulb	Hippocampus: CA3	Postsubiculum	Superior Colliculus	Substantia Nigra
# of neurons	281	78	291	109	43	17	41	117

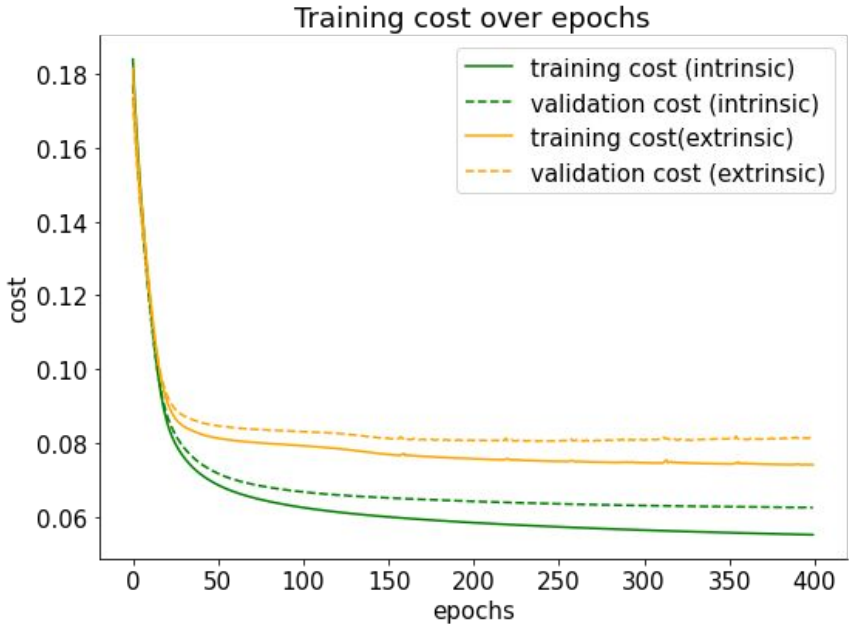
Modeling shared latent dynamics between Motor Cortex and other brain regions

Intrinsic



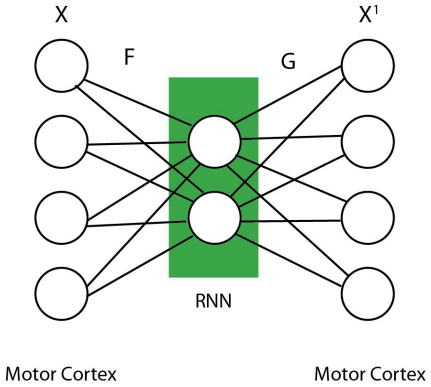
Extrinsic



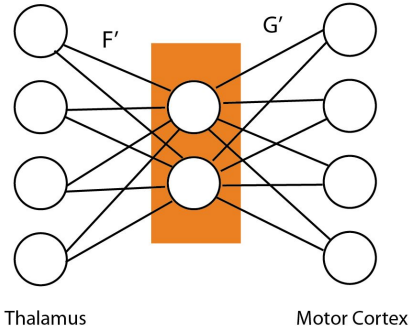


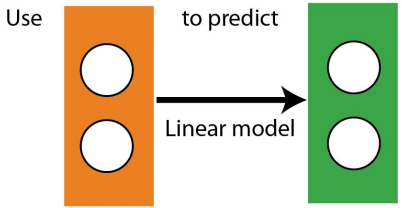
Modeling shared latent dynamics between Motor Cortex and other brain regions

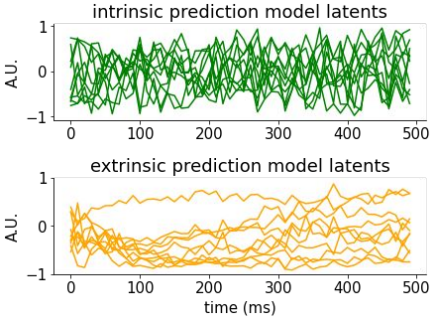
Intrinsic



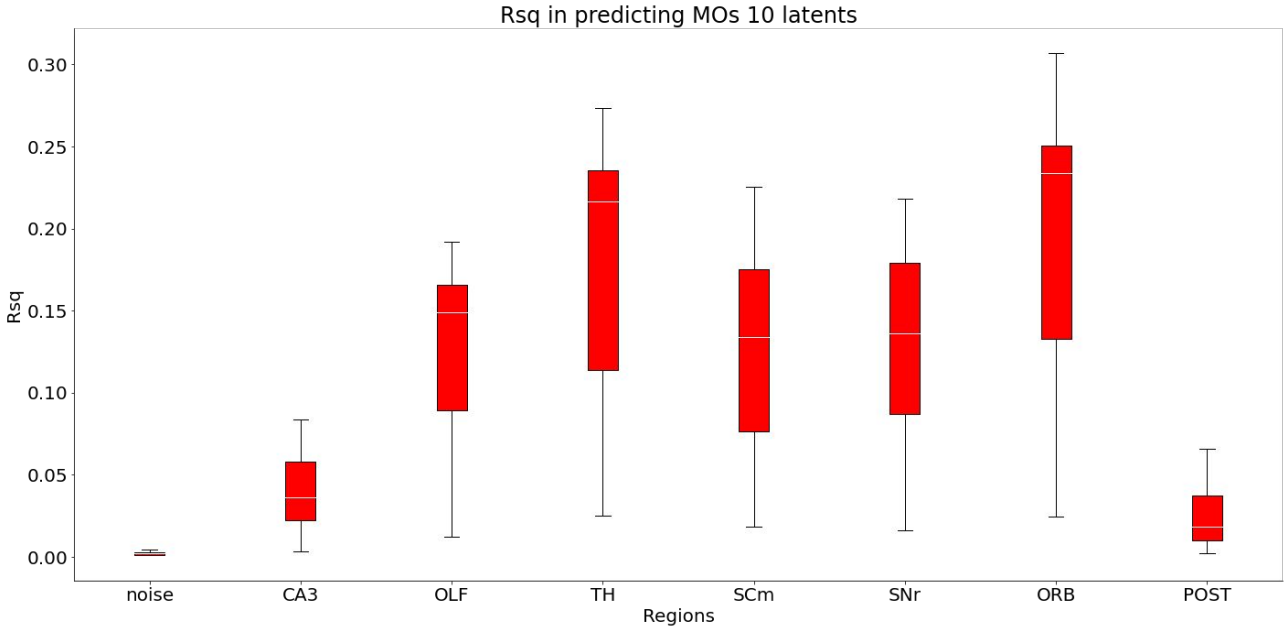
Extrinsic

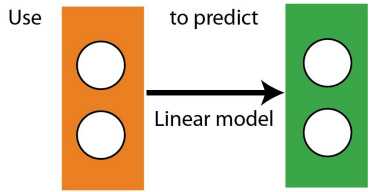




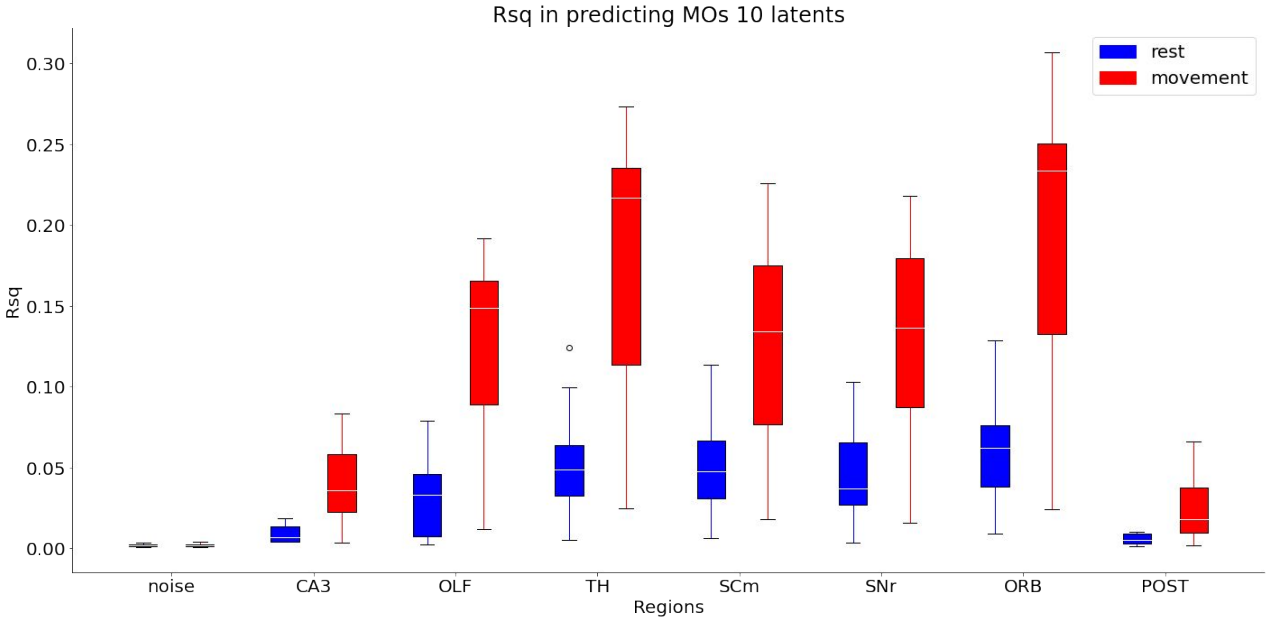


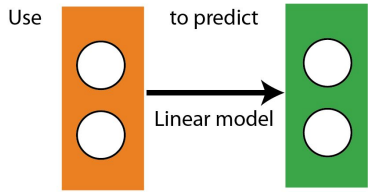
Alignment of latent spaces during movement is stronger than the noise control and varies across regions





Alignment of latent spaces is stronger during movement compared to at rest





Limitations and future directions

- The number of neurons in each region is not the same -> varies by a lot
  - Can systematically explore the effect of number of neurons in the “shared latents”
- Only one session from one mice
  - Extend to other sessions/more mice
- Examine different tasks/behavior states of the animal

Conclusion

- We used dynamic systems to estimate the correlations between brain regions across behavioral states.
- We found that during movement, motor cortex shares more common dynamics with other brain regions.

Thanks!

- TA:
  - Naga Karthik
- Advisor:
  - Aakash Agrawal
- Data Source
  - Nicolas Steinmetz
- Neuromatch Community!