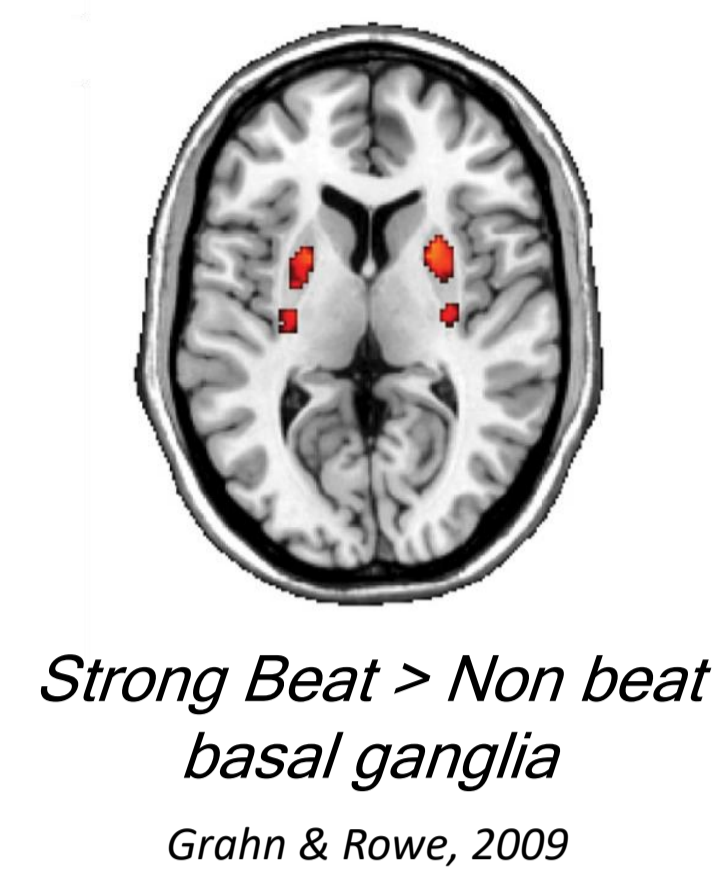
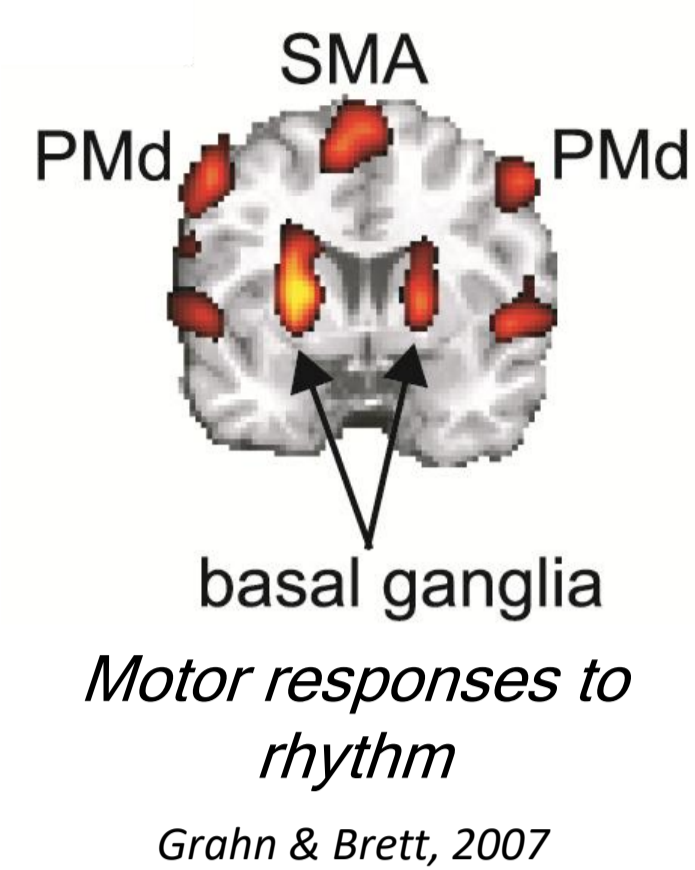


## BACKGROUND

- In humans, motor areas respond to auditory rhythmic sequences.
- Supplementary Motor Area (SMA) and basal ganglia respond more when sequences induce a beat.
- Behaviourally, non-human primates (NHP) appear insensitive to the beat, but evidence is limited.
- Neuroimaging could probe NHP motor responses to rhythm.
- If beat-specific brain responses are observed, this may indicate beat perception in NHP.



### Research Question: How do marmoset brains respond to auditory Strong-, Weak-, and Non- Beat rhythms?

- Greater motor activity to rhythms vs acoustic noise → motor areas play a role in perceptual auditory sequence timing across species.
- Differences between beat and non-beat rhythms → NHP may be sensitive to the beat, despite lack of behavioural evidence.

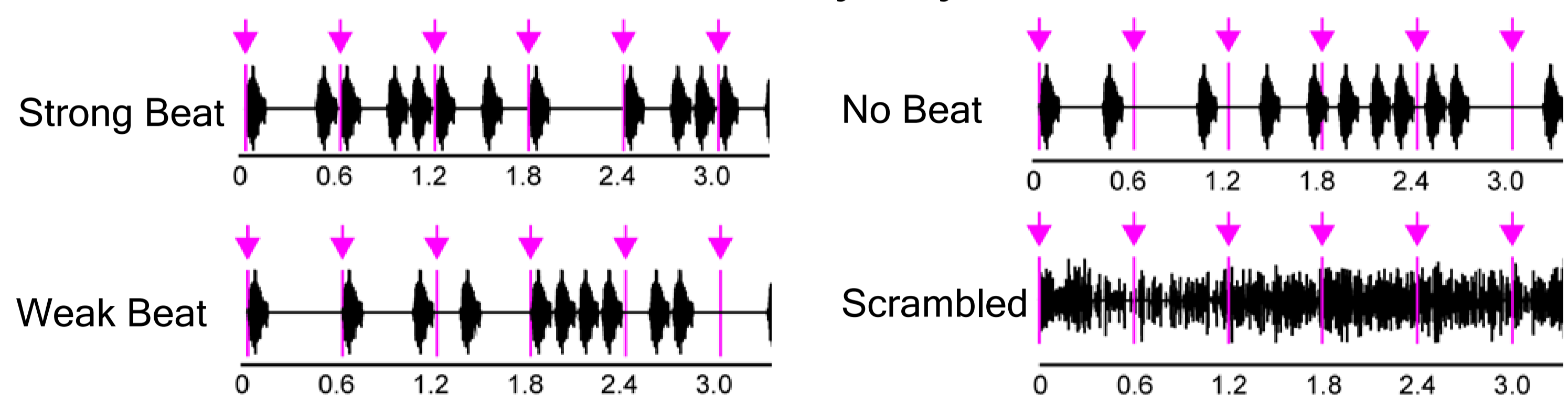
## METHODS

### Sample: Data collection is *ongoing* ...

- $N = 7$  common marmosets
- one session:  $n = 3$  monkeys
- two sessions:  $n = 4$  monkeys



### Stimuli: Auditory Rhythms



### 9.4 T fMRI



Gradient strength:  
1.5 mT/m/A  
Coil:  
8-channel receive  
coil

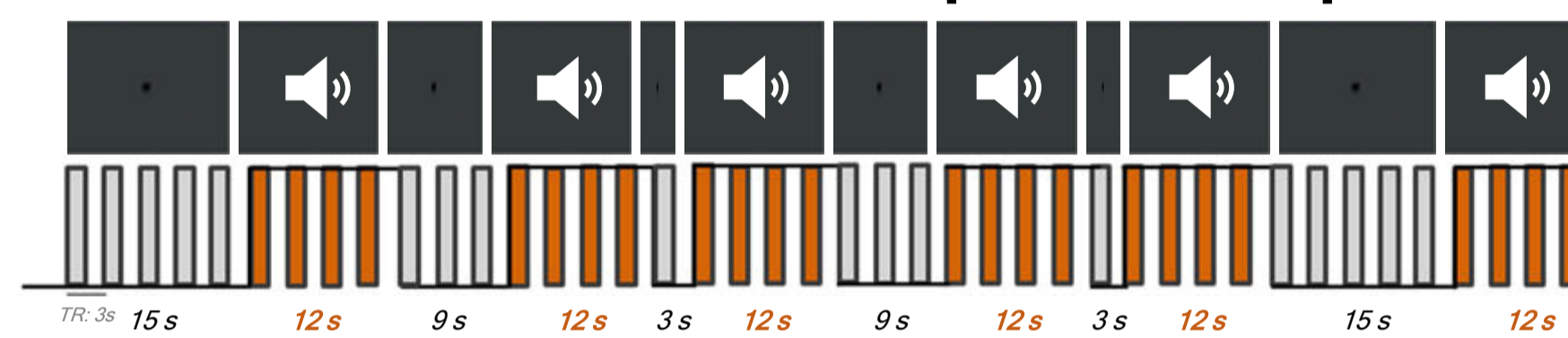
### Head-mounted restraint system



→ Head secured using a head post  
→ MRI-compatible auditory tubes

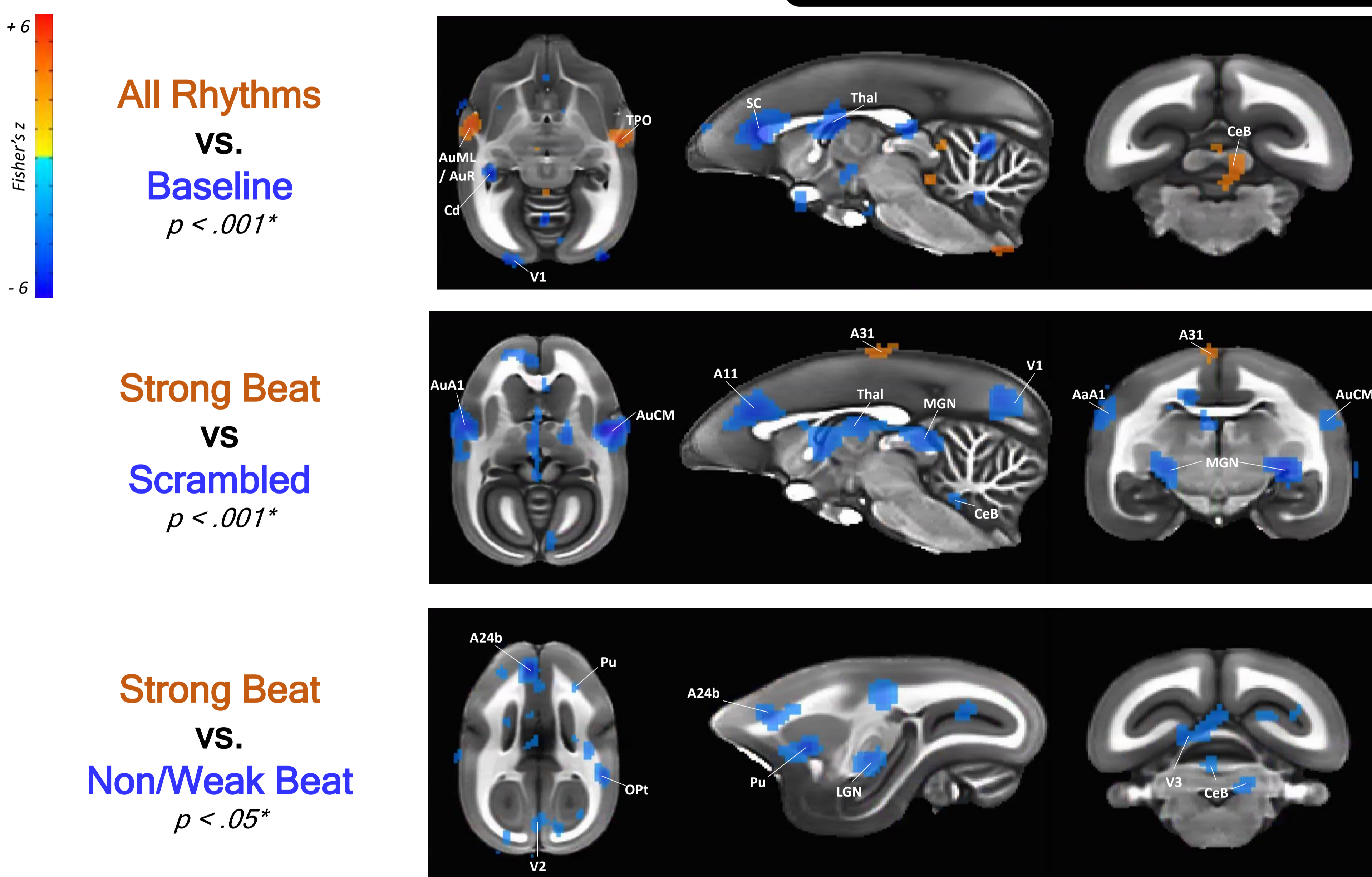
Dureux, Zanini, & Everling (2024)

### Block Sparse-Sample Design



- TR (3s) is sparsely sampled:
  - 0 – 1.5s = scanner "ON"
  - 1.5s – 3s = scanner "OFF"
- Stimulus block = 12s (4 TRs)
- Baseline = 3s, 9s, or 15s

## PRELIMINARY RESULTS



### Rhythms > Baseline

- TPO: temporo-parieto-occipital association area
- AuML: auditory cortex middle lateral area
- AuR: auditory cortex rostral area
- CeB: cerebellum

### Baseline > Rhythms

- Thal: thalamus
- SC: superior colliculus
- Cd: caudate
- V1: primary visual area

### Strong Beat > Scrambled

- A31: area 31 of cortex

### Scrambled > Strong Beat

- AuA1: primary auditory cortex
- AuCM: auditory cortex caudomedial area
- CeB: cerebellum
- A11: area 11
- V1: primary visual cortex
- MGN: medial geniculate nucleus
- Thal: thalamus

### Strong > Non/Weak Beat

- None

### Non/Weak > Strong Beat

- A24b: area 24b of cortex
- Pu: putamen
- V2 / V3: visual area 2 / 3
- CeB: cerebellum
- Opt: occipito-parietal transitional area of cortex
- LGN: lateral geniculate nucleus

\* Group-level Z-maps were corrected for multiple comparisons using a clustering method with AFNI's ClustSim (10,000 Monte Carlo simulations, cluster-forming threshold  $p < 0.01$ , and FWE correction at  $p < 0.05$ ).

## REFERENCES

1. Dureux, A., Zanini, A., & Everling, S. (2024). Mapping of facial and vocal processing in common marmosets with ultra-high field fMRI. *Communications Biology*, 7(1), 317, doi: 10.1038/s42003-024-06002-1.
2. Grahn, J. A., & Brett, M. (2007). Rhythm and beat perception in motor areas of the brain. *Journal of cognitive neuroscience*, 19(5), 893-906. doi: 10.1162/jocn.2007.19.5.893
3. Grahn, J. A., & Rowe, J. B. (2009). Feeling the beat: premotor and striatal interactions in musicians and nonmusicians during beat perception. *Journal of Neuroscience*, 29(23), 7540-7548, doi: 10.1523/JNEUROSCI.2018-08.2009.

## DISCUSSION

### Preliminary Findings:

- Auditory activation is greater for rhythms compared to silent intervals, suggesting the sparse-sampling method can be used to acquire auditory responses.
- Motor responses in baseline and non/weak-beat rhythms, counter to predictions. Need to examine behaviour during the different rhythm types.

### Future Steps

- Data checks
- Region of interest analyses on motor areas, in addition to auditory areas.
- Functional connectivity analyses between auditory and motor areas.