THE NEURAL CODE FOR SPEECH



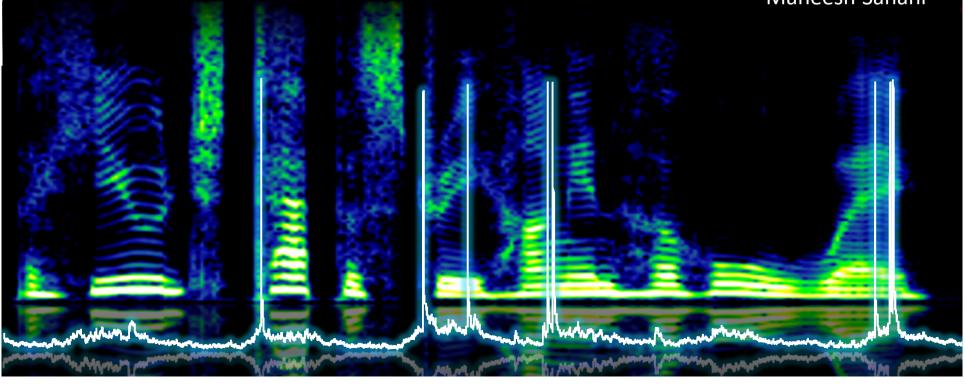
Nicholas A. Lesica Ear Institute University College London

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Collaborators

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Maneesh Sahani

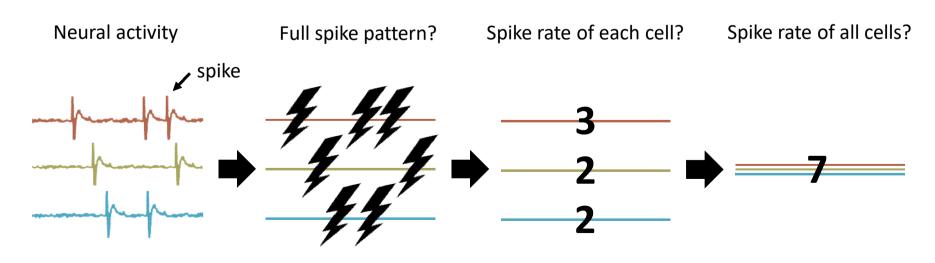


THE NEURAL CODE FOR SPEECH



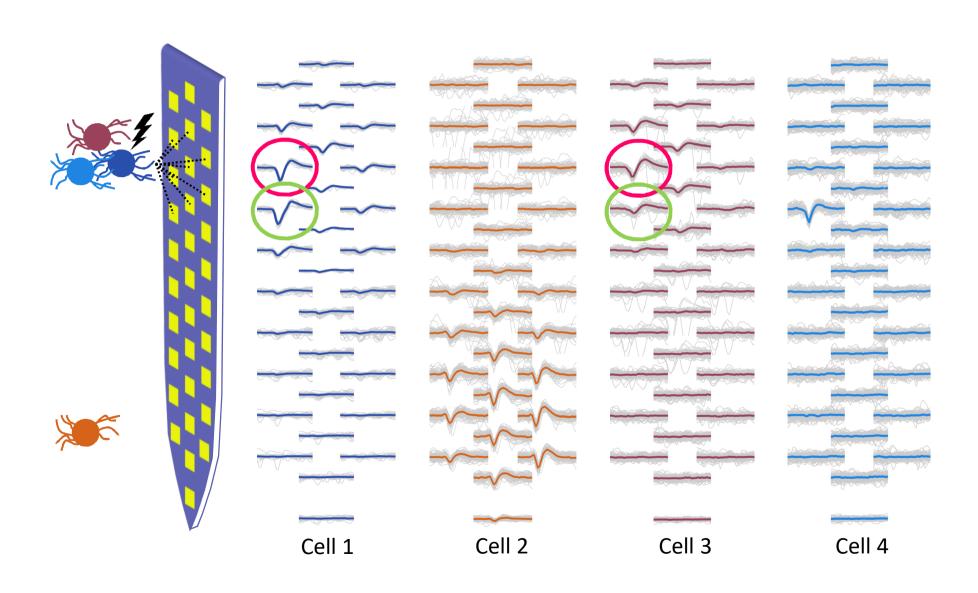


Which features of neural activity are important?



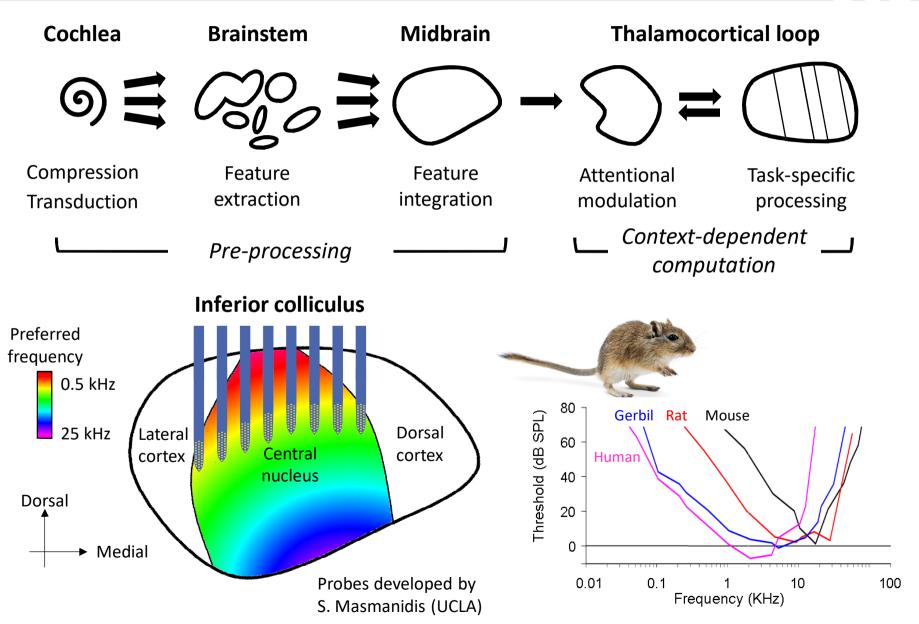
LARGE-SCALE SINGLE-CELL RECORDINGS





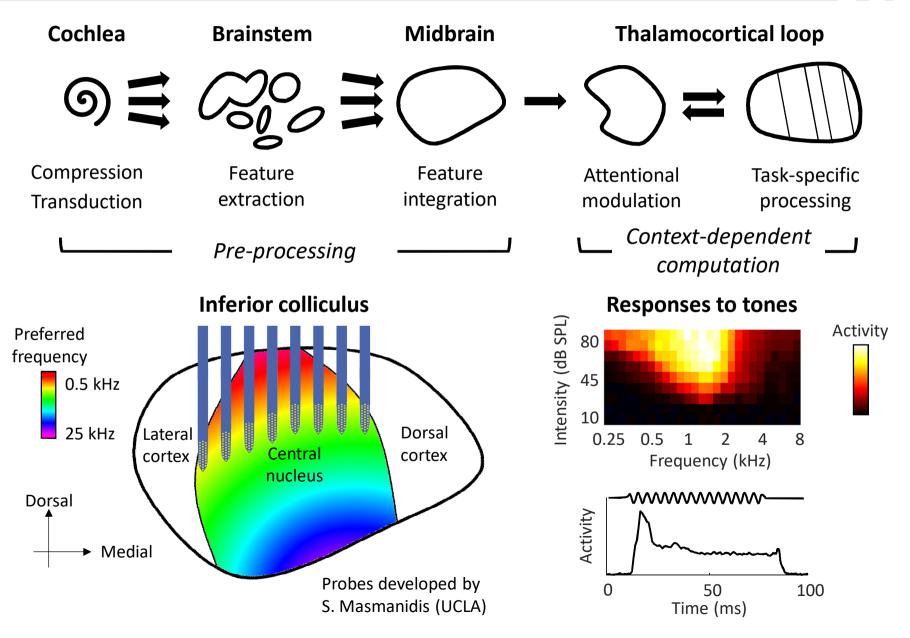
THE CENTRAL AUDITORY PATHWAY





THE CENTRAL AUDITORY PATHWAY

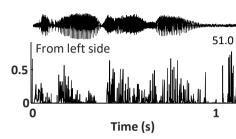


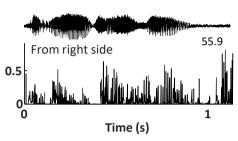




Responses to tones

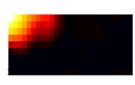
p (spike) 0.5 100 Time (ms)





Responses to speech

0.5

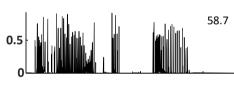


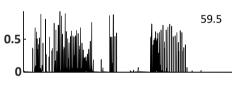
0 1 4 Frequency (kHz)

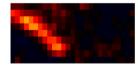
Intensity (dB SPL)

250

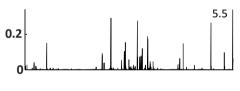


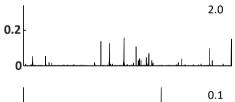




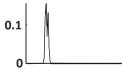




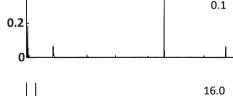


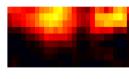


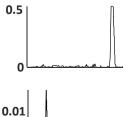


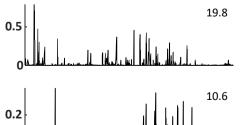


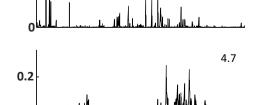


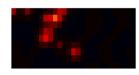


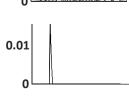






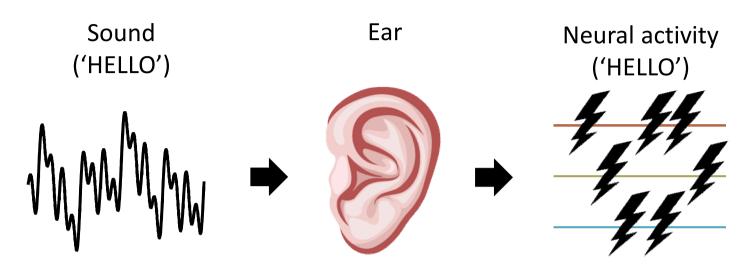






THE NEURAL CODE FOR SPEECH





Which features of neural activity are important?

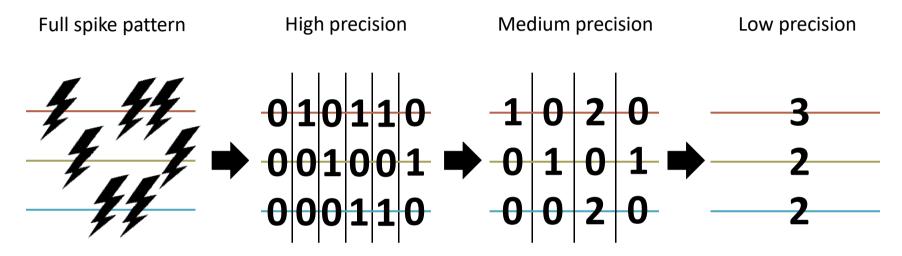
Specific questions:

What is the temporal precision of the neural code?

How much shared variability is there in the neural code?

How does the neural code depend on the feature of interest?

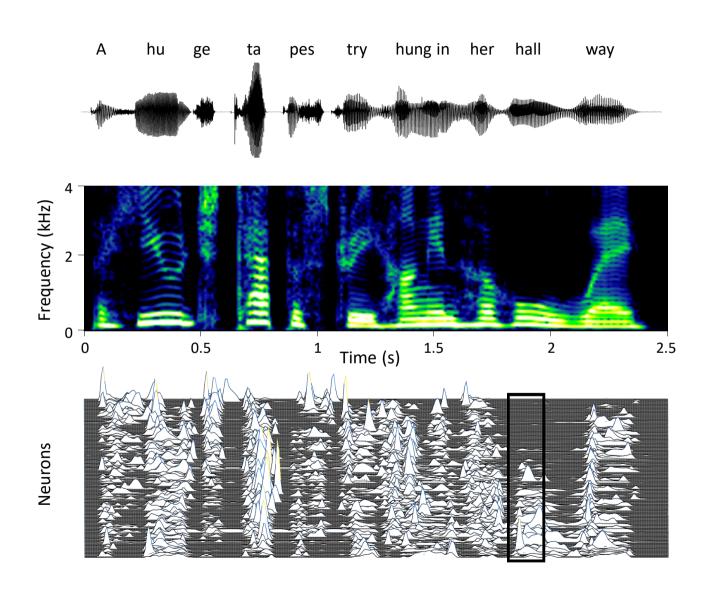
What is the temporal precision of the neural code?



If the same sound is presented again, how does the activity change?

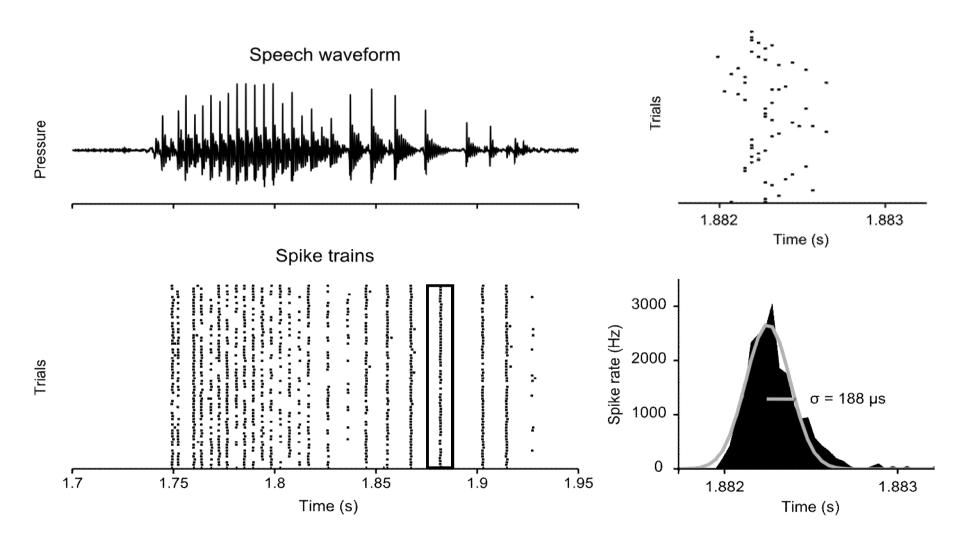
Garcia-Lazaro et al., 2013





Garcia-Lazaro et al., 2013

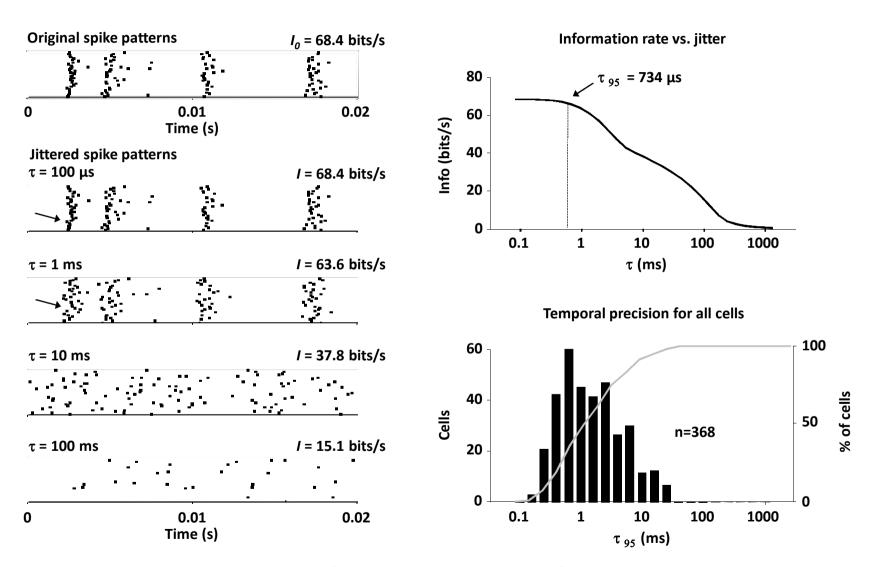




IC neurons respond to speech with high temporal precision

Garcia-Lazaro et al., 2013

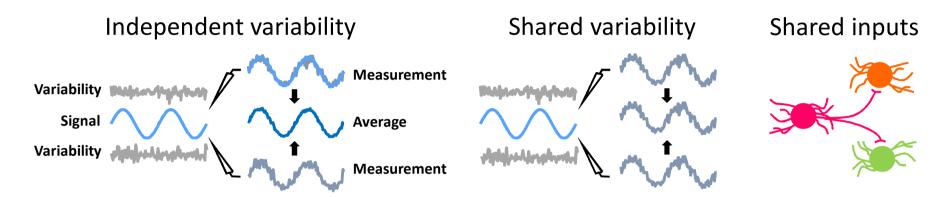




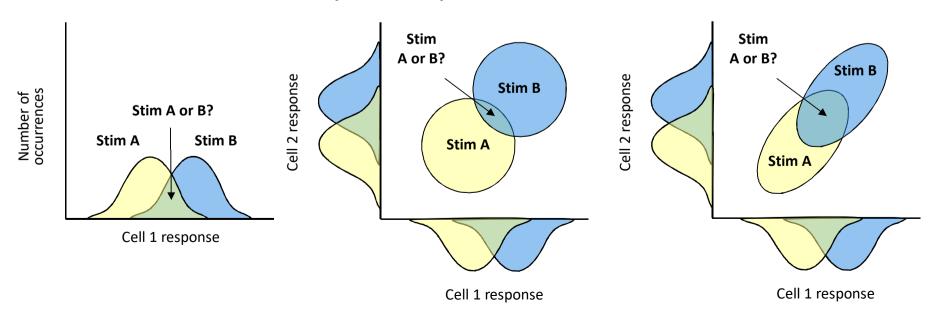
The temporal precision of the neural code for speech is ~ 1ms



How much shared variability is there in the neural code?

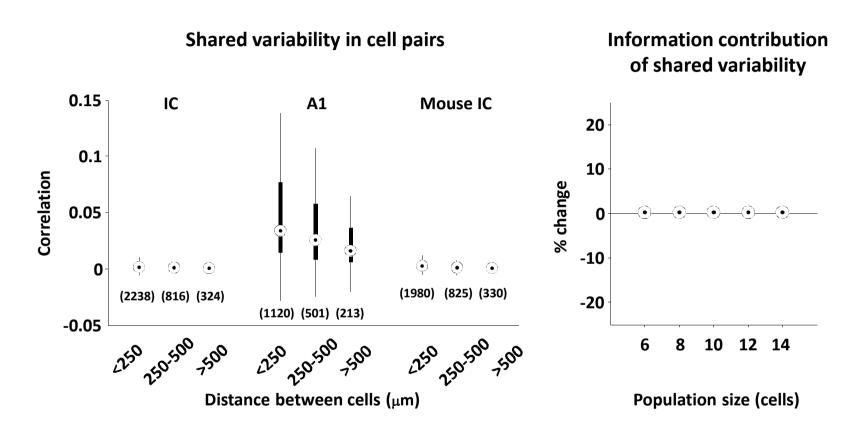


Shared variability can impact information transmission



Garcia-Lazaro et al., 2013; Pachitariu et al., 2015





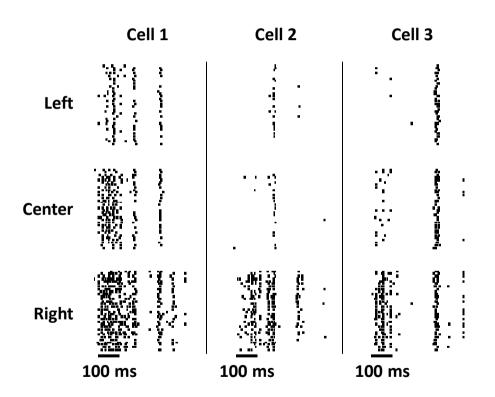
Individual IC neurons are (conditionally) independent coders

Belliveau et al., 2014



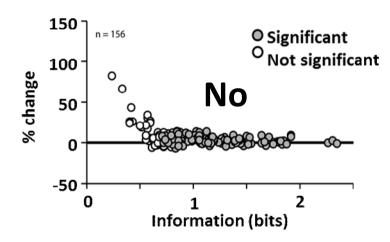
How does the neural code depend on the feature of interest?

Responses to speech from different locations

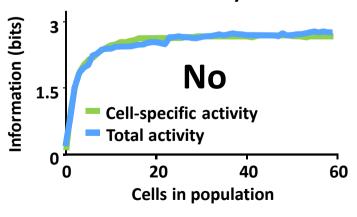


Different codes for different features allows 'multiplexing'

Does spike timing matter?

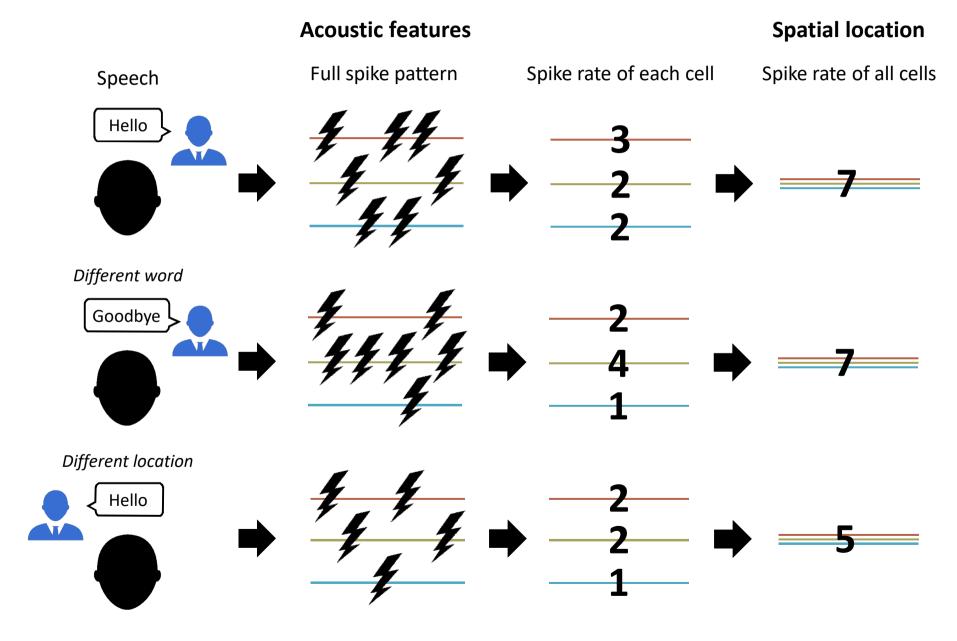


Does cell identity matter?



MULTIPLEXING





Which features of neural activity are important?

Specific questions:

What is the temporal precision of the neural code?

~ 1 ms

How much shared variability is there in the neural code?

None

How does the neural code depend on the feature of interest?

Acoustics and location multiplexed at different temporal and spatial scales

The answers to these questions in A1 are completely different

ACKNOWLEDGEMENTS

≜UCL

Collaborators

Jose Garcia-Lazaro Lucile Belliveau Dmitry Lyamzin Marius Pachitariu Carsen Stringer Brian Lam

Funding

Wellcome Trust Royal Society German Science Foundation (DFG)

Publications etc.

www.lesicalab.com

Thanks for listening!

