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## Speech synthesis from neural decoding of spoken sentences

Gopala K. Anumanchipalli, Josh Chartier & Edward F. Chang 

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### Abstract

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## Data availability

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## Code availability

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## **Acknowledgements**

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## **Reviewer information**

*Nature*

## **Author information**

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Josh Chartier & Edward F. Chang

**Contributions**

**Corresponding author**

**Ethics declarations**

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**Competing interests**

**Additional information**

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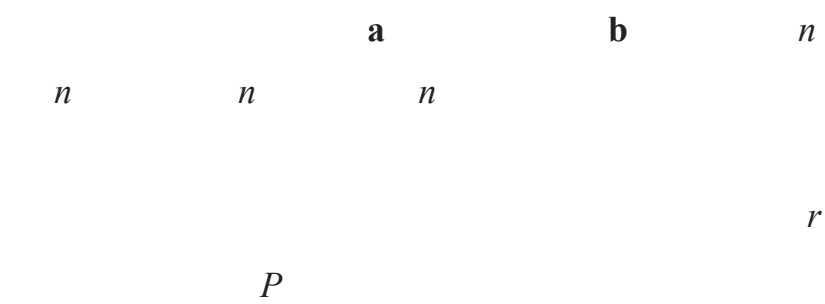
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# Extended data figures and tables

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Extended Data Fig. 1 Median original and decoded spectrograms.

**a** **b**



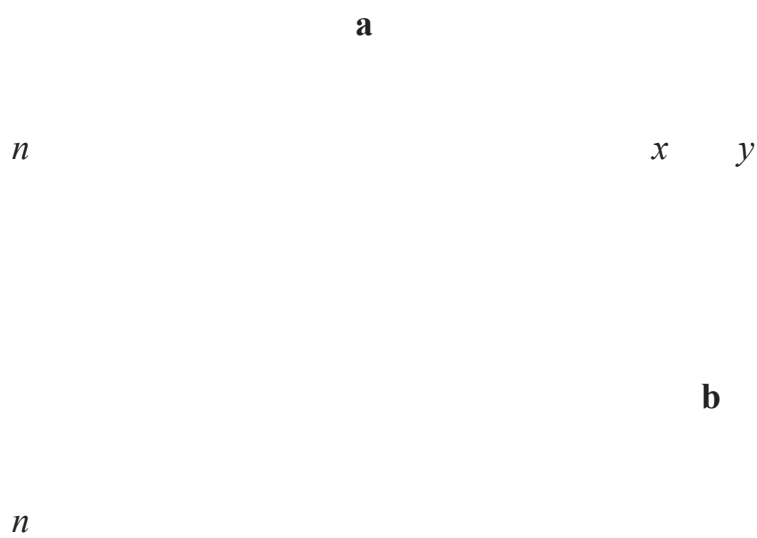
Extended Data Fig. 2 Transcription WER for individual trials.

**a** **b**



Extended Data Fig. 3 Electrode array locations for participants.

Extended Data Fig. 4 Decoding performance of kinematic and spectral features.



**Extended Data Fig. 5 Comparison of cumulative variance explained in kinematic and acoustic state-spaces.**

**Extended Data Fig. 6 Decoded phoneme acoustic similarity matrix.**

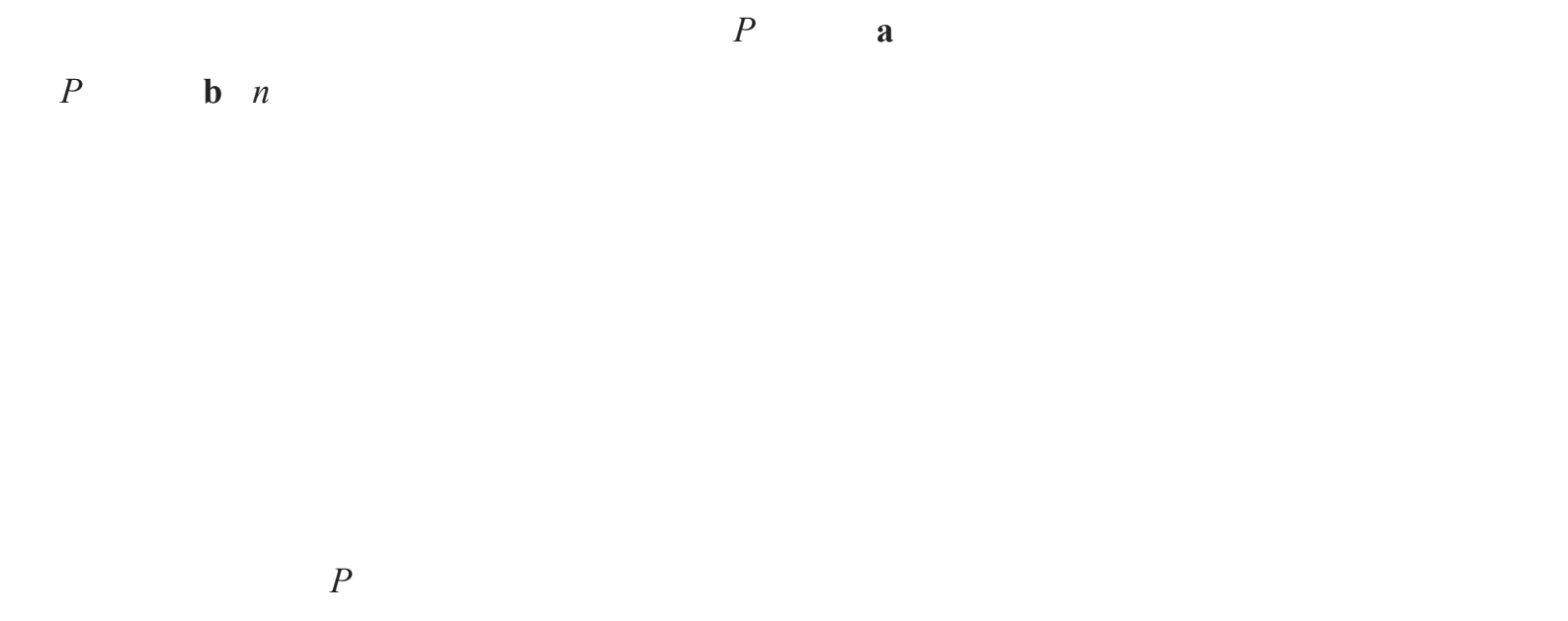
**Extended Data Fig. 7 Ground-truth acoustic similarity matrix.**

**Extended Data Fig. 8 Comparison between decoding novel and repeated sentences.**

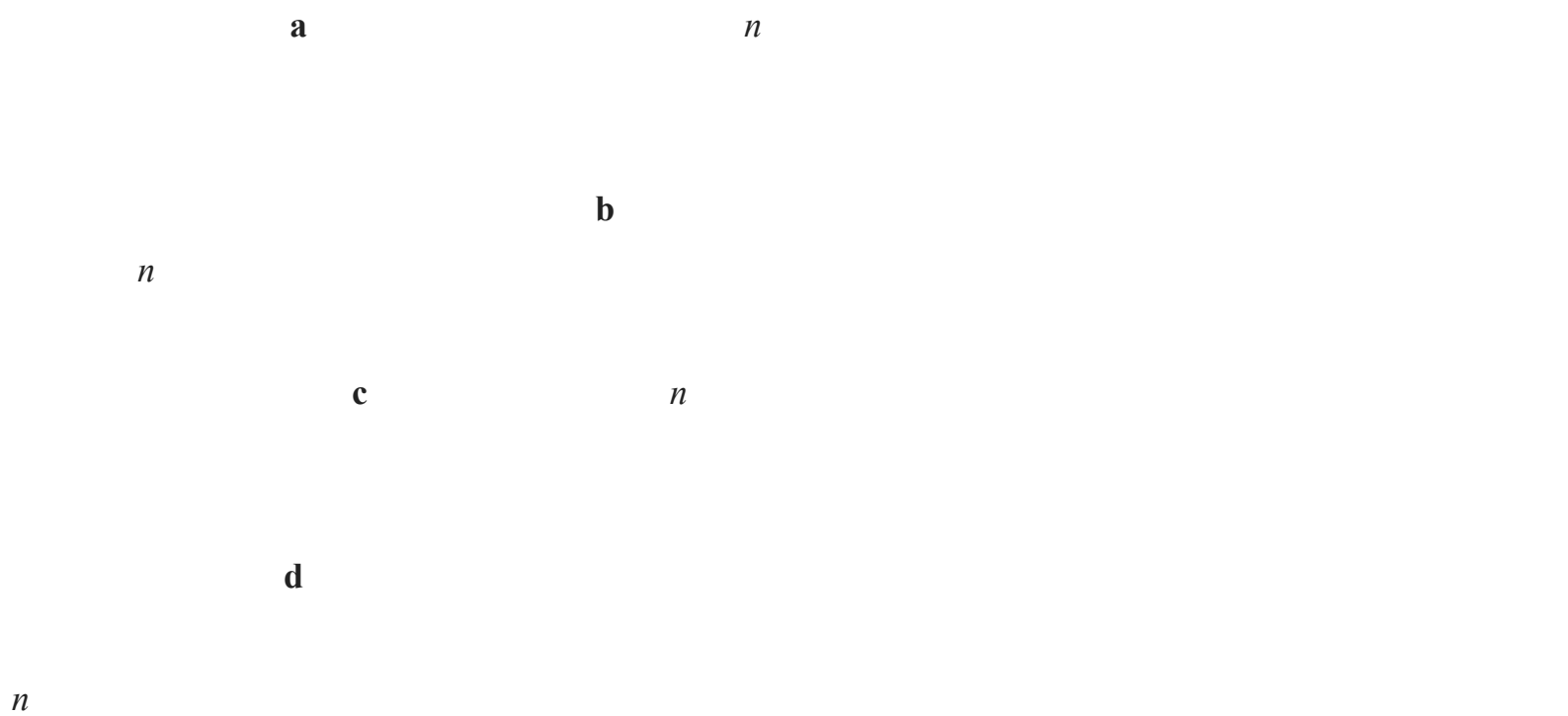
**a b**

**a**

**b**



**Extended Data Fig. 9 Kinematic state–space trajectories for phoneme-specific vowel–consonant transitions.**



**Supplementary information**

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**41586\_2019\_1119\_MOESM3\_ESM.mp4**

## **Supplementary Information**

### **Reporting Summary**

**Supplemental Video 1: Examples of decoded kinematics and synthesized speech production**

### **Rights and permissions**

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*Nature* **568**,

**Subjects** [Brain–machine interface](#) • [Sensorimotor processing](#)

## Further reading

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- **[Speech-related dorsal motor cortex activity does not interfere with iBCI cursor control](#)**

Sergey D Stavisky, Francis R Willett[...] & Jaimie M Henderson

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- **[Revisiting the Functional Anatomy of the Human Brain: Toward a Meta-Networking Theory of Cerebral Functions](#)**

Guillaume Herbet & Hugues Duffau

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- **[Decoding Imagined and Spoken Phrases From Non-invasive Neural \(MEG\) Signals](#)**

Debadatta Dash, Paul Ferrari & Jun Wang

*Frontiers in Neuroscience*

- **Classification of Vowels from Imagined Speech with Convolutional Neural Networks**

Markus-Oliver Tamm, Yar Muhammad & Naveed Muhammad

*Computers*

- **Toward a Speech Neuroprosthesis**

Edward F. Chang & Gopala K. Anumanchipalli

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## Comments

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