

Reporting Summary

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Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

- | n/a | Confirmed |
|-------------------------------------|--|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> The statistical test(s) used AND whether they are one- or two-sided
<i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i> |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> A description of all covariates tested |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals) |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted
<i>Give P values as exact values whenever suitable.</i> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> Estimates of effect sizes (e.g. Cohen's d , Pearson's r), indicating how they were calculated |

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

Data collection

We used: Matlab_R2015a and PsychoToolbox-3 to collect behavioral data and subjects' responses during the MEG session; MEG160 (Yokogawa Electric Corp., Eagle Technology Corp., Kanazawa Institute of Technology) and Syngo Software 11C (Siemens Prisma 3T MRI scanner). Amazon Mechanical Turk Platform and Otree was used to collect online behavioral data. The computer code used for the data collection is available upon request

Data analysis

Matlab_R2015a, FieldTrip toolbox, FMRIB Software Library 5.0.1, Diffusion Toolkit 0.6.2.2, FreeSurfer 6.0, TrackVis 0.6.1, JASP 0.9.0.1, Auditory Model Matlab toolbox, 3D digitizer software Source Signal Imaging, SPM8, diptest package under R software, Robust Correlation Toolbox for Matlab and custom algorithms. The computer code used for the analyses is available upon request

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors/reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

Additional data related to this paper may be requested from the authors. Correspondence and request for materials should be addressed to MFA (fassaneo@gmail.com)

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

Life sciences Behavioural & social sciences Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	No statistical methods were used to pre-determine sample sizes but our sample sizes are similar to those reported in previous publications
Data exclusions	Exclusion criteria was pre-established and the following data points were excluded for the detailed reasons. 3 participants were excluded due to artifactual MEG noise and 1 extra participant due to excessive movement during the DW-MRI. 56 subject were removed from the stable rate SSS-test Mechanical Turk protocol for non-optimal conditions in their recording. 40 subject were removed from the accelerated rate SSS-test Mechanical Turk protocol for non-optimal conditions in their recording. 7 participants were excluded from the accelerated version of the SSS-test because they spoke instead of whispering and/or stopped whispering for more than 4 seconds
Replication	The outcome from our behavioral test was replicated on four different cohort of participants. The learning differences between groups was replicated in an online version of the same task.
Randomization	Stimulus presentation order was randomized for all experiments with more than one stimulus. When comparing between groups we controlled for age, language background, gender and years of musical training.
Blinding	Data collection and analysis were performed blind to the conditions of the experiments for the behavioral tests but not for the MEG and structural analyses, as subjects had already been divided into high and low synchronizers.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

- | | |
|-------------------------------------|---|
| n/a | Included in the study |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Antibodies |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Eukaryotic cell lines |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Palaeontology |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Animals and other organisms |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> Human research participants |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Clinical data |

Methods

- | | |
|-------------------------------------|--|
| n/a | Included in the study |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> ChIP-seq |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Flow cytometry |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> MRI-based neuroimaging |

Human research participants

Policy information about [studies involving human research participants](#)

Population characteristics	84 participants completed the first behavioral test (SSStest, 32 males; mean age, 28; age range, 19 to 55). From this, a subgroup of 37 subjects (right handed; 18 males; mean age, 30; age range, 21 to 55) also underwent MEG and DW-MRI protocols. A second cohort of 44 individuals (11 males; mean age, 21; age range, 19 to 31) completed a replication of the behavioral test and a word learning task. 55 participants completed a control behavioral test (19 males; mean age, 23; age range, 18 to 36). All participants the previously mentioned cohorts were native English speakers and self-reported normal hearing and no neurological deficits. 144 native english speakers completed a first Amazon Mechanical Turk experiment (80 males; mean age,34; age range, 19 to 5) and 60 native english speakers completed a second Amazon Mechanical Turk experiment (37 males; mean age, 35; age range, 19 to 51)
Recruitment	Participants were recruited from the grater New York University community and from the Amazon Mechanical Turk pool of participants. Participants recruitment was performed blind to their demographics.
Ethics oversight	Institutional Review Board (New York University's Committee on Activities Involving Human Subjects)

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Magnetic resonance imaging

Experimental design

Design type	N/A (diffusion weighted MRI)
Design specifications	N/A (diffusion weighted MRI)
Behavioral performance measures	N/A (diffusion weighted MRI)

Acquisition

Imaging type(s)	diffusion
Field strength	3 tesla
Sequence & imaging parameters	EPI sequence (81 axial slices, TR: 4150 ms, TE: 85.2 ms, flip angle: 90°, slice thickness: 1.5 mm, acquisition matrix: 150 × 152, voxel size: 1.5 × 1.5 × 1.5 mm ³). T1 MPRAGE image (TR = 2400 ms, TE = 2.24 ms, flip angle = 8°, voxel size = 0.80 × 0.80 × 0.80 mm ³ , 256 sagittal slices, acquisition matrix = 320 × 300).
Area of acquisition	whole brain
Diffusion MRI	<input checked="" type="checkbox"/> Used <input type="checkbox"/> Not used
Parameters	128 directions, single shell, no cardiac gating, b=1500

Preprocessing

Preprocessing software	FMRIB Software Library 5.0.1, Diffusion Toolkit 0.6.2.2, FreeSurfer 6.0, TrackVis 0.6.1
Normalization	FNIRT (non-linear registration) for DW-MRI
Normalization template	FMRIB58_FA template (MNI152 space and 1×1×1 mm ³)
Noise and artifact removal	N/A
Volume censoring	N/A

Statistical modeling & inference

Model type and settings	Univariate independent samples
Effect(s) tested	Rank Biserial Correlation
Specify type of analysis:	<input type="checkbox"/> Whole brain <input checked="" type="checkbox"/> ROI-based <input type="checkbox"/> Both
Anatomical location(s)	Long, anterior, and posterior segments of the arcuate fasciculus, the inferior-fronto occipital fasciculus, the inferior longitudinal fasciculus and the uncinate fasciculus.
Statistic type for inference (See Eklund et al. 2016)	Threshold-free cluster enhancement
Correction	FWE-corrected $p < 0.05$ value using a nonparametric permutation test with 5000 permutations; FDR

Models & analysis

n/a	Involved in the study
<input checked="" type="checkbox"/>	<input type="checkbox"/> Functional and/or effective connectivity
<input checked="" type="checkbox"/>	<input type="checkbox"/> Graph analysis
<input checked="" type="checkbox"/>	<input type="checkbox"/> Multivariate modeling or predictive analysis