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Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our Editorial Policies and the Editorial Policy Checklist.

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
☐	☒ The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒ A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒ The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☒	☐ A description of all covariates tested
☐	☒ A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒ 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)
☐	☒ For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐ For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐ For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☐	☒ 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	fNIRS data acquisition : NIRScout system (NIRx Medical Technologies, Germany), Polaris stereotaxic system (Northern Digital Inc., Canada) and Brainsight Frameless 39 software (Rogue Research Inc., Canada)
Data analysis	LIONirs toolbox (Tremblay et al., 2022)

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 and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio 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 description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our policy

The data supporting the findings of this study are available as a supplementary Excel data sheet.

Research involving human participants, their data, or biological material

Policy information about studies with human participants or human data. See also policy information about sex, gender (identity/presentation), and sexual orientation and race, ethnicity and racism.

Reporting on sex and gender	Sex of participants is reported in Table 1. Sex was not included in analysis.
Reporting on race, ethnicity, or other socially relevant groupings	As a way to consider the level of education for the pregnant person and their partner, we reported the number of university degrees. Furthermore, we used a Canadian adaptation of the Nam-Powers-Boyd occupational scale (Boyd Scale) to report the parental socioeconomic status. Parents filed out self-reported questionnaires during the recording.
Population characteristics	Age of participants at testing, gestational age, APGAR at 5 and 10 minutes, birth weight, N of first child, pregnant person's age, partner's age, and Number of completed prenatal sessions were reported in Table 1.
Recruitment	Participants were recruited during the third trimester of pregnancy at one of their antenatal visits to the obstetrical and gynecology clinic at Sainte-Justine University Hospital. Inclusion criteria were being from French speaking parents and from a unilingual familial context. As Sainte-Justine University Hospital is located in a more wealthy and educated region of Montreal, and participants recruited were only French speakers in order to control for linguistic exposure, data collection was biaised.
Ethics oversight	Research Ethics Committee of Sainte-Justine University Hospital

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

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

Behavioural & social sciences study design

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

Study description	Quantitative experimental
Research sample	Seventy-seven healthy pregnant people and their future newborns were recruited during the third trimester of pregnancy at one of their antenatal visits to the obstetrical and gynecology clinic at Sainte-Justine University Hospital. Data was recruited between 0 to 3 days of life. This study is part of a longitudinal project which aims to investigate the developmental trajectories of language brain networks in young children. To do so, healthy infants were followed from birth to three years of age.
Sampling strategy	An a priori power analysis was conducted using G power version 3.1.9.7 to obtain 80 % power and detect a medium effect size (f = 0.25). A significance criterion of α=0.05 as used in the case where there was no correlation among repeated measures, and a non-sphericity correction epsilon=0.8 was applied. In this case, the power analysis showed repeated measures ANOVA required a minimal sample size of 36. 77 participants were recruited in total.
Data collection	Newborns underwent an fNIRS recording within their first three days of life before being discharged from the postpartum unit at Sainte-Justine University Hospital. A pediatric nurse was always present to ensure participants' well-being and to make sure that the newborns were adequately positioned to hear the stimuli with their head centred between the two speakers and no objects or cushion close to the ears. Research assistants and/or senior fNIRS technicians were present during the recording. Stimuli were delivered through two speakers placed bilaterally at 70 cm from the newborns' heads, with the intensity reaching approximately 70 dB SPL as measured by a sound meter. fNIRS data acquisition was performed using a continuous-wave NIRScout system (NIRx Medical Technologies, Germany). Participants were filmed during data acquisition to better find movement artefacts during data preprocessing.
Timing	data collection started in May 2018 until May 2020. A break in recrutment was taken because of the Covid-19 Pandemic. One final participant was then recruited in April 2022.
Data exclusions	From all 77 recruited participants, 17 were excluded due to one or more of the following reasons: neonatal complications (N=9), cancellation of the laboratory visits after birth due to the Covid pandemic (N=5), withdrawal of their participation after delivery (N=2) and incomplete data due to a technical problem during the fNIRS recording (N=1). Data from the remaining 60 newborns were subsequently analyzed.
Non-participation	no participants dropped out.
Randomization	39 participants recruited at 35 weeks of GA or less were randomly assigned to one of the prenatal linguistic exposure groups: German (N=20) or Hebrew (N=19), to balance prenatal linguistic exposure and to control variability due to language phonetics. In

addition to participants who underwent prenatal exposure, an additional 21 participants were recruited after 35 weeks of GA and were not exposed prenatally to linguistic stimuli.

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	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☒	☐ Clinical data
☒	☐ Dual use research of concern
☒	☐ Plants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Plants

Seed stocks	NA
Novel plant genotypes	NA
Authentication	NA