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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	Data were collected from three distinct sources: (1) outputs from the gamified implicit rhythmic task programmed in PsychoPy v2021.2.3, (2) tablet-based data from the BAASTA battery assessing explicit rhythmic abilities, and (3) paper-and-pencil records for neuropsychological assessments and demographic information.
Data analysis	Data were analyzed using R version 4.4.0. Data manipulation and statistical analyses were conducted using the packages tidyverse, lmerTest, effectsize, and performance. Figures were generated using ggplot2 and cowplot.

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

To ensure reproducibility, all data and analysis code will be made publicly available in a dedicated GitHub repository associated with this article.

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	We did not group participants by sex, nor were any analyses conducted on this variable, as sex differences were not central to our theoretical framework or hypotheses. We report the overall proportion of female and male participants based on parent-reported child sex in the demographic questionnaire.
Reporting on race, ethnicity, or other socially relevant groupings	Formal musical experience (i.e., years of music lessons outside of school) was reported by parents and included in the analyses to examine the effect of musical practice on distinct rhythmic abilities. Participants were not grouped based on race, ethnicity, or other socially relevant variables, as such information was not collected and was not relevant to the study's objectives. To inform the representativeness of the sample, parental occupational categories were reported based on self-declared professional activity.
Population characteristics	The study population consisted of French-speaking children aged 7 to 13 years, recruited in France (Lille region) and Canada (Montreal region)
Recruitment	Participants were recruited through two distinct channels: schools and laboratory settings. School-based testing involved distributing information to parents, obtaining signed informed consent, and subsequently testing children who volunteered. Laboratory testing was conducted with participants recruited via the BRAMS lab mailing list as well as social media and in-town announcements. This mixed recruitment strategy aimed to enhance the diversity of the sample and mitigate potential self-selection biases associated with lab-based testing.
Ethics oversight	The study was approved by the ethics committees of the University of Montreal (CEREP-22-052-D) and the University of Lille (CER-2021-563-S101).

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	This study is a cross-sectional quantitative design, in which implicit and explicit rhythmic abilities were assessed within subjects
Research sample	The final sample consisted of 98 children aged 7 to 13 years (M = 10.1, SD = 1.6), including 62 children from France and 36 from Canada, with 58% identified as female. Among them, 35 had at least one year of formal musical experience (overall group: M = 0.95 years, SD = 1.5, range = 0-5 years). Recruitment was conducted through diverse methods to obtain a heterogeneous and as representative a sample as possible. Only children without reported neuropsychiatric disorders and with no reported hearing or uncorrected vision deficits were included in the study.
Sampling strategy	Sample size was determined a priori using G*Power for paired-sample t-tests. To detect a small effect size (d = 0.20) with 80% power and α = .05, 90 participants were required. To detect a medium effect size (d = 0.50), only 34 participants were needed. Our final sample of 98 children thus provides adequate power for detecting small to medium within-subject effects. This sample size is also appropriate for multiple regression analyses involving up to four predictors, and is in line with a previous developmental research using implicit rhythmic tasks.
Data collection	Data were collected either in the child's school or at the BRAMS laboratory. Each child was individually tested by an experimenter. While experimenters were not blind to the study hypotheses, any potential influence on the results is likely minimal. Rhythmic tasks and their outcome measures were standardized and largely automated. In the implicit task, feedback was identical across conditions, which were interleaved within blocks, further limiting experimenter-driven bias.Cognitive test data were recorded using paper-and-pencil materials, explicit rhythmic abilities were assessed using tablet-based tasks from the BAASTA battery, and implicit rhythmic abilities were measured through computerized tasks programmed in PsychoPy.
Timing	Participant recruitment began in February 2023 in both Montreal and Lille. Data collection ended in May 2023 in Lille and in August 2023 in Montreal
Data exclusions	A total of 106 French-speaking children aged 7 to 13 participated in the study. Data from eight children were excluded. Six were excluded based on predefined criteria: two due to low performance on one of the control tasks, and four because they did not meet the quality standards for the implicit rhythmic task. Two additional children were excluded post hoc: one due to behavioral issues during testing, and the other due to technical problems.

Non-participation	No participant dropped out the study
Randomization	Participants were not allocated into experimental groups.

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	n/a
Novel plant genotypes	n/a
Authentication	n/a