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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	The computer task was programmed in Cogent with MATLAB.
Data analysis	The work utilized open-source algorithms from MNE-Python, MNEflow, lme4 (R), emmeans (R), and Cluster-Robust (Sandwich) Variance Estimators with Small-Sample Corrections (R).

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 cannot be made openly available according to the ethical permission and national privacy regulations at the time of the study, but the data supporting the findings of this study are available upon reasonable request from the authors and with permission of the Ethics Committee of the University of Jyväskylä. The scripts used to perform the analyses are available upon request from the authors.

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	The study included 92 neurotypical participants aged 18 to 56 years (66 females, 26 males; M = 29.33, SD = 8.94).
Reporting on race, ethnicity, or other socially relevant groupings	Inclusion criteria were as follows: age between 18 and 60 years; normal or corrected-to-normal vision; absence of any diagnosed severe psychiatric disorder (e.g., major depressive disorder); no neurological illness or use of medication affecting the central nervous system; and no metal implants incompatible with MEG recording. Individuals with severe psychiatric conditions were excluded to minimize potential risk to those with pre-existing psychological vulnerability.
Population characteristics	*Describe the covariate-relevant population characteristics of the human research participants (e.g. age, genotypic information, past and current diagnosis and treatment categories). If you filled out the behavioural & social sciences study design questions and have nothing to add here, write "See above."*
Recruitment	Data were collected between 2024 and 2025. Participants were recruited through recruitment emails distributed via university mailing lists, online advertisements posted on University of Jyväskylä (JYU) websites, and word-of-mouth referrals. Although most participants were university students, the online recruitment channels also reached individuals from across Finland.
Ethics oversight	the Ethics Committee of the University of Jyväskylä

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, within-subject repeated-measures experiment combining whole-brain source-localized MEG with concurrent electrodermal activity (EDA) recording during a dynamic "escape-game" threat paradigm, analyzed using a deep-learning decoding model (LF-CNN) followed by time-resolved linear mixed-effects modelling (LMEM).
Research sample	85 neurotypical adults (final analyzed sample; 66 female, 26 male; age range 18–56 years, M = 29.33, SD = 8.94). Initially 92 participants were tested. Most were university students, but recruitment channels reached individuals across Finland, so the sample is a convenience sample rather than one selected for demographic representativeness. Inclusion criteria: age 18–60, normal/ corrected-to-normal vision, no diagnosed severe psychiatric disorder, no CNS-affecting medication or neurological illness, no MEG-incompatible metal implants.
Sampling strategy	Participants were recruited via convenience sampling (university mailing lists, online adverts, word-of-mouth).
Data collection	MEG (306-channel Elekta TRIUX) recorded simultaneously with EDA (Ambu NEUROLINE 710 electrodes, medial plantar surface of right foot) during the escape-game task; behavioral responses collected via the game interface; subjective ratings (anxiety, intensity, valence, STAI) collected via questionnaire/scale after each round and pre/post session. Researcher was present to run the MEG session;
Timing	Data were collected between 2024 and 2025.
Data exclusions	7 of the initial 92 participants were excluded before analysis: 2 for noisy EDA recordings in >50% of runs, 2 for a technical error causing loss of final runs, and 3 for excessive MEG noise final N = 85.
Non-participation	*State how many participants dropped out/declined participation and the reason(s) given OR provide response rate OR state that no participants dropped out/declined participation.*
Randomization	there was a single sample undergoing one task, not separate experimental groups. The probabilistic outcome structure (participants were "caught" in 65% of blocks) was a fixed property of the task design rather than a per-participant randomization scheme.

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

Report on the source of all seed stocks or other plant material used. If applicable, state the seed stock centre and catalogue number. If plant specimens were collected from the field, describe the collection location, date and sampling procedures.

Novel plant genotypes

Describe the methods by which all novel plant genotypes were produced. This includes those generated by transgenic approaches, gene editing, chemical/radiation-based mutagenesis and hybridization. For transgenic lines, describe the transformation method, the number of independent lines analyzed and the generation upon which experiments were performed. For gene-edited lines, describe the editor used, the endogenous sequence targeted for editing, the targeting guide RNA sequence (if applicable) and how the editor was applied.

Authentication

Describe any authentication procedures for each seed stock used or novel genotype generated. Describe any experiments used to assess the effect of a mutation and, where applicable, how potential secondary effects (e.g. second site T-DNA insertions, mosiacism, off-target gene editing) were examined.