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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 using the Central Suite software package v7.0.4 with the Neuroport System (Blackrock Microsystems). The graphical user interface (GUI) of the experimental task was developed in Python 3.9.
Data analysis	Statistical analysis were performed using MATLAB R2022a, Python 3.9, and Graphpad Prism 9. Spike sorting were performed with either Plexon Offline Spike Sorter v4 (offline analysis) or Central Suite software package v7.0.4 (online decoding).

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

Data relevant to this study are accessible under restricted access according to our clinical trial protocol. Access can be granted upon request to Dr. Yu Qi

(qiyu@zju.edu.cn). The response can be expected within three weeks. Any data provided must be kept confidential and must not be shared with others without approval. Source data to reproduce the figures in the manuscript are provided in this paper.

Human research participants

Policy information about studies involving human research participants and Sex and Gender in Research.

Reporting on sex and gender	The single participant is a right-handed male, 75-year-old at the time of data collection.
Population characteristics	This study included one participant, who is a right-handed man, 75-year-old at the time of data collection.
Recruitment	Participants were recruited through the Second Affiliated Hospital of Zhejiang University. Enrollment was entirely dependent on the specific criteria of the clinical protocol. Thus, we do not expect any significant self-selection bias in this study.
Ethics oversight	All clinical and experimental procedures conducted in this study received approval from the Medical Ethics Committee of The Second Affiliated Hospital of Zhejiang University (Ethical review number 2019-158, approved on 05/22/2019) and were registered in the Chinese Clinical Trial Registry (Ref. ChiCTR2100050705). This study used an observational design and no intervention took place that was not driven by clinical need. Informed consent was obtained verbally from the participant, along with the consent of his family members, and was duly signed by his legal representative.

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

Life sciences study design

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

Sample size	The sample sizes in this study were determined by the amount of available data with the participant, and the estimation of how much data would be required to perform statistical comparisons.
Data exclusions	Data were not excluded from the analysis.
Replication	The main experiments were carried out between June 2022 and July 2023, mostly two or three days per week. Most experimental days contained two sessions with the same characters, and the experiment sessions on different days contained different characters.
Randomization	Not relevant. Only one participant was included in the study.
Blinding	Not relevant. Only one participant was included in the study.

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

Methods

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

Clinical data

Policy information about clinical studies

All manuscripts should comply with the ICMJE guidelines for publication of clinical research and a completed CONSORT checklist must be included with all submissions.

Clinical trial registration	Ref. ChiCTR2100050705
Study protocol	A description of the study protocol can be found on the ChiCTR website at https://www.chictr.org.cn/showproj.html?proj=130829.
Data collection	Data collection was carried out in a dedicated ward of the Second Affiliated Hospital of Zhejiang University. The participant was recruited in August 2019. Data used in this study were collected between June 2022 and July 2023.
Outcomes	This clinical trial was to evaluate the potential of brain-computer interfaces for motor reconstruction and restoration. Since the clinical trial is a phase 0 exploratory clinical trial, the secondary outcomes were not predefined. The predefined primary endpoint was to enable brain-computer interface control, which would be measured to assess the efficacy of the brain-computer interface during motor control.