

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 (<i>n</i>) 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 <i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i>
☒	☐ 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. <i>F</i> , <i>t</i> , <i>r</i>) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> value noted <i>Give P values as exact values whenever suitable.</i>
☒	☐ 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 <i>d</i> , Pearson's <i>r</i>), 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	Neural data collection was conducted using Plexon Omniplex Software versions 2019-2023. Behavioral data collection was conducted using MATLAB Versions 2015-2022 and NIMH Monkeylogic Libraries version 2.
Data analysis	Analyses were performed in Python (version 3.7.3) or MATLAB (versions R2019a-R2023b).

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](#)

All neuronal and behavioral data along with code for processing the data will be made publicly available prior to publication via Figshare (figshare.com).

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	N/A
Reporting on race, ethnicity, or other socially relevant groupings	N/A
Population characteristics	N/A
Recruitment	N/A
Ethics oversight	N/A

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 size of the primary dataset is 555 LIP and 605 SC neurons recorded from two adult male rhesus macaques (<i>Macaca mulatta</i>). Using data from two rhesus monkeys is standard for neurophysiological studies in macaques (e.g., McGinty, VB & Lupkin, SM. [2023]. Behavioral read-out from population value signals in primate orbitofrontal cortex. <i>Nat Neurosci</i> 26, 2203–2212)
Data exclusions	For electrophysiological recordings and inactivation experiments, we included sessions in which behavioral performance on each category for the DMC task was at least 75% (criterion applied only to control blocks for the inactivation experiments). We excluded six LIP recording sessions (four in Monkey N and two in Monkey S) from analyses due to poor behavioral performance. For the inactivation experiments, we excluded two sessions in Monkey S (one saline injection session with 66% accuracy for category 2 during the control block, and one muscimol injection session with 53% accuracy for category 2 during the control block).
Replication	All analyses were conducted separately (and all results successfully replicated) in two subjects and reported as such in the manuscript.
Randomization	All comparisons were made within subjects and each subject was therefore their own control.
Blinding	N/A: Blinding was not relevant as no group allocation was done in this 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
☒	☐ Plants

Methods

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

Animals and other research organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research, and [Sex and Gender in Research](#)

Laboratory animals	Two adult (13-15 years old) male rhesus macaques (<i>Macaca mulatta</i>) participated in the experiment (Monkey N: ?12 kg, Monkey S: ? 13 kg).
Wild animals	No wild animals were used in this study
Reporting on sex	Two adult (13-15 years old) male rhesus macaques (<i>Macaca mulatta</i>) participated in the experiment (Monkey N: ?12 kg, Monkey S: ? 13 kg). Because of the small number of subjects and scarcity of animals, it is not always possible to have both sexes represented in a study or to statistically compare results between se
Field-collected samples	No field collected samples were used in the study.
Ethics oversight	All procedures were in accordance with the University of Chicago Institutional Animal Care and Use Committee and the National Institutes of Health guidelines and policies.

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