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Corresponding author(s): Rony Paz

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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	Blackrock Neural Signal Processor (NSP) software, Psychophysics Toolbox extensions (Matlab).
Data analysis	Pre processing: offline sorter, Plexon Inc, Neural Processing MATLAB Kit, national instruments Data Acquisition System (DAQ) matlab extension, Custom code written in matlab

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 reported in this study cannot be deposited in a public repository because it was derived from human patients and is subject to controlled access. To request access, please contact the lead authors: Rony Paz or Ido Strauss. The timeframe for response is 12 months and conditioned on randomization of the data across subjects, de-identification protocols, and restrictions imposed by data use agreements between the requesting institute and Sourasky medical center.

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 sex of the patients involved in the study is reported in the methods section, as classified by hospital standards. Gender was not examined.
Reporting on race, ethnicity, or other socially relevant groupings	Not reported and was not examined in the study. Participants were adult Israeli citizens.
Population characteristics	Seventeen (17) patients, ages 23-48, 13 males, all with with medically intractable focal epilepsy (placement of electrodes can be seen in Table 1). All patients were treated for seizure reduction before and during the experiment. All patients were Israeli adults. Specific demographic information is not a factor in this study, because: 1. performance in the behavioral task matched the behavior in the pilot study that was prefromed with healthy adults from various socio-economic backgrounds; 2. the neural analyses were fitted to the individual behavior. Therefore, while we cannot conclude that there could be subtle differences in behavior across different demographic populations, this is not the focus of the study and the main results are independent of this.
Recruitment	Subjects in the main study were recruited from the patient population undergoing the described clinical procedure and were willing to participate in the behavioral paradigm. Subjects in the pilot study were recruited via a Facebook ad. The patient population may be subject to bias, as it represents a specific subgroup of the general population with Intractable epilepsy. However, the main behavioral result was consistent between patients and healthy participants in the pilot study, supporting the generalizability of the findings. Both the pilot and patient samples are subject to self-selection bias, as participation was voluntary. Nonetheless, the high participation rate among patients (>90%) indicates that this bias is minimal and not relevant for the neural findings.
Ethics oversight	Helsinki protocol 0008-12-TLV, Tel-Aviv Sourasky medical center (Ichilov)

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 minimum sample size was estimated at 12 patients, based on prior similar studies, the complexity of our experimental design, the typical number of neurons recorded per session, and the number of trials a patient can complete within a 30-minute session. The final number of patients in this study was 17, about 40% above the minimal number. The pilot study was used to assess the number of trials required for stable learning and to ensure that sufficient exploration and exploitation trials could be obtained for each participant. Due to the high variability in the number of neurons recorded across patients, a prior power analysis was not feasible, and sample size estimates remained approximate. Mormann, F., Bausch, M., Knieling, S. & Fried, I. Neurons in the Human Left Amygdala Automatically Encode Subjective Value Irrespective of Task. Cereb Cortex 29, 265-272 (2017). Misra, A. et al. Methods for implantation of micro-wire bundles and optimization of single/multi-unit recordings from human mesial temporal lobe. J Neural Eng 11, 026013 (2014).
Data exclusions	The data of one subject was excluded from the study because the patient reported that her behavior was not based on the task feedback, but only on the shapes that she liked.
Replication	For the behavioral findings, the paradigm was first tested in a pilot study of healthy participants (reported in the manuscript), and the findings were replicated in the patient population. For neural findings, we replicated analyses after each patient was added to the initial 12 (see sample size section) and validated that the results were only strengthened by the addition of subjects, using appropriate statistical methods and train-test approaches as a proxy for replication.
Randomization	The location of shapes on the screen were randomly counter balanced, the order of trials was pseudo-randomly chosen, insuring less than 3 consecutive trial of the same valence, and electrode locations were chosen according to clinical criteria. Participants were not randomized to different conditions as the stimuli were counter-balanced within each participant.
Blinding	Spike sorting was blind to the behavior of the subjects and electrodes were localized according to clinical criteria and hence blind to the purpose of 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
☒	☐ 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.