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Reporting Summary

Nature Research 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 Research policies, see Authors & Referees 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.

- 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: MATLAB (Mathworks) 2014b; PsychToolBox 3.0.14
- Data analysis: MATLAB (Mathworks) 2018a

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/reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research 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 list of figures that have associated raw data
- A description of any restrictions on data availability

Data will be shared upon reasonable request. Individual data are drawn on the figures.

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 these points even when the disclosure is negative.

Study description
Quantitative experimental.

Research sample
Caltech community, including students, postdocs, and staffs.

Sampling strategy
Participants were recruited through the Caltech SONA system and internal mailing lists. A total number of 20 participants in each experiment was targeted based on our 80% power calculation in our previous study (Hung & Hsieh, 2015).


Data collection
The data collection was performed with computerized MATLAB based script. Participants performed the tasks in a darkroom by themselves and were all naive to the purpose of the experiment. The first author was the experimenter and was not blind to the purpose of the experiment.

Timing
2018 April - 2019 Sep

Data exclusions
Participants that (1) had performance 3 standard deviations away from the group mean on the catch tasks or (2) failed to achieve successful calibration on prime luminance or (3) broke through suppression yet failed to indicate prime location (see experimental design and procedure) were removed before entering analysis. (see Stimuli and Procedure of each experiment; Experiment 1: n = 3; Experiment 2: n = 2; Experiment 3: n = 1; Experiment 4: n = 2; Experiment 5: n = 0; Experiment 6: n = 0; Experiment 7: n = 1; Experiment 8: 2).

Non-participation
N/A

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

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<tr>
<th>n/a</th>
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<td>Animals and other organisms</td>
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<td>X</td>
<td>Human research participants</td>
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<td>Clinical data</td>
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Methods

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<td>Flow cytometry</td>
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<td>MRI-based neuroimaging</td>
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Human research participants

Policy information about studies involving human research participants

Population characteristics
See above.

Recruitment
Participants were recruited through the Caltech SONA system and internal mailing lists.

Ethics oversight
Institutional Review Board, Caltech.

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