***eLife’s* transparent reporting form**

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**Sample-size estimation**

* You should state whether an appropriate sample size was computed when the study was being designed
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* If no explicit power analysis was used, you should describe how you decided what sample (replicate) size (number) to use

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The number of cases, sample sizes, replication numbers used in this study were according to the common standards in the field and were described in "Materials and Methods". No explicit power analysis was used.

**Replicates**

* You should report how often each experiment was performed
* You should include a definition of biological versus technical replication
* The data obtained should be provided and sufficient information should be provided to indicate the number of independent biological and/or technical replicates
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ISOI repeats was described in "Results" and Figure 2-figure supplement 3. Two-photon imaging repeats was described in "Materials and Methods". Animals and Imaging sites constituted biological replications. Stimulus repetitions and imaging sessions constituted technical replications. This information and the numbers of these repeats were described in "Materials and Methods" and "Results". No outliers were excluded. Criteria for neurons exclusion/inclusion was stated in "Materials and Methods".

**Statistical reporting**

* Statistical analysis methods should be described and justified
* Raw data should be presented in figures whenever informative to do so (typically when N per group is less than 10)
* For each experiment, you should identify the statistical tests used, exact values of N, definitions of center, methods of multiple test correction, and dispersion and precision measures (e.g., mean, median, SD, SEM, confidence intervals; and, for the major substantive results, a measure of effect size (e.g., Pearson's r, Cohen's d)
* Report exact p-values wherever possible alongside the summary statistics and 95% confidence intervals. These should be reported for all key questions and not only when the p-value is less than 0.05.

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Statistical analysis methods were described in “Materials and Methods” and “Results” in details. Raw data were presented in figures whenever appropriate. Information about statistical tests, N, p-value, error bar was clearly described.

(For large datasets, or papers with a very large number of statistical tests, you may upload a single table file with tests, Ns, etc., with reference to sections in the manuscript.)

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* Indicate how samples were allocated into experimental groups (in the case of clinical studies, please specify allocation to treatment method); if randomization was used, please also state if restricted randomization was applied
* Indicate if masking was used during group allocation, data collection and/or data analysis

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Experimental groups are not applicable for this study.

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Please indicate the figures or tables for which source data files have been provided:

Data and codes necessary to recreate all figures are available in an OSF repository as indicated in the data availability statement.