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# Main Figures:	5
# Supplementary Figures:	4
# Supplementary Tables:	0
# Supplementary Videos:	0

Reporting Checklist for Nature Neuroscience

This checklist is used to ensure good reporting standards and to improve the reproducibility of published results. For more information, please read Reporting Life Sciences Research.

Please note that in the event of publication, it is mandatory that authors include all relevant methodological and statistical information in the manuscript.

▶ Statistics reporting, by figure

- Please specify the following information for each panel reporting quantitative data, and where each item is reported (section, e.g. Results, & paragraph number).
- Each figure legend should ideally contain an exact sample size (n) for each experimental group/condition, where n is an exact number and not a range, a clear definition of how n is defined (for example x cells from x slices from x animals from x litters, collected over x days), a description of the statistical test used, the results of the tests, any descriptive statistics and clearly defined error bars if applicable.
- For any experiments using custom statistics, please indicate the test used and stats obtained for each experiment.
- Each figure legend should include a statement of how many times the experiment shown was replicated in the lab; the details of sample collection should be sufficiently clear so that the replicability of the experiment is obvious to the reader.
- For experiments reported in the text but not in the figures, please use the paragraph number instead of the figure number.

Note: Mean and standard deviation are not appropriate on small samples, and plotting independent data points is usually more informative. When technical replicates are reported, error and significance measures reflect the experimental variability and not the variability of the biological process; it is misleading not to state this clearly.

	TEST USED		n			DESCRIPTIVE STATS (AVERAGE, VARIANCE)		P VALUE		DEGREES OF FREEDOM & F/t/z/R/ETC VALUE	
FIGURE NUMBER	WHICH TEST?	SECTION & PARAGRAPH #	EXACT VALUE	DEFINED?	SECTION & PARAGRAPH #	REPORTED?	SECTION & PARAGRAPH #	EXACT VALUE	SECTION & PARAGRAPH #	VALUE	SECTION & PARAGRAPH #
example 1a	one-way ANOVA	Fig. legend	9, 9, 10, 15	mice from at least 3 litters/group	Methods para 8	error bars are mean +/- SEM	Fig. legend	p = 0.044	Fig. legend	$F(3, 36) = 2.97$	Fig. legend
example results, para 6	unpaired t-test	Results para 6	15	slices from 10 mice	Results para 6	error bars are mean +/- SEM	Results para 6	p = 0.0006	Results para 6	$t(28) = 2.808$	Results para 6
1b	Pearson correlation	Fig. legend	300	Number of simulated regions	Methods para 3	N/A		N/A		See figure	1b

	FIGURE NUMBER	WHICH TEST?	SECTION & PARAGRAPH #	EXACT VALUE	DEFINED?	SECTION & PARAGRAPH #	REPORTED?	SECTION & PARAGRAPH #	EXACT VALUE	SECTION & PARAGRAPH #	VALUE	SECTION & PARAGRAPH #
		TEST USED		**n**			**DESCRIPTIVE STATS (AVERAGE, VARIANCE)**		**P VALUE**		**DEGREES OF FREEDOM & F/t/z/R/ETC VALUE**	
+ -	1d	Pearson correlation	Fig. legend	20,000	Number of simulated time points	Methods para 5	N/A		N/A		See figure	1d
+ -	1e	Pearson correlation	Fig. legend	300	Number of simulated regions	Methods para 3	Average	Fig. legend	p<0.00001	Fig. legend	r=0.56, t(298)=11.7	Fig. legend
+ -	2b	Pearson correlation	Fig. legend	100	Number of subjects	Methods para 7	Average	Fig. legend	N/A		N/A	
+ -	2c	Pearson correlation	Fig. legend	100	Number of subjects	Methods para 7	Average	Fig. legend	N/A		r=0.66	Results para 7
+ -	3a	Pearson correlation	Methods para 1	300	Number of simulated regions	Methods para 3	N/A		N/A		N/A	
+ -	3b	Multiple regression	Results para 7	100	Number of subjects	Methods para 7	Average	Fig. legend	N/A		N/A	
+ -	3c	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7	N/A		N/A		r=0.91	Results para 11
+ -	4a	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7	N/A		N/A		r=0.94	Results para 11
+ -	4b	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7	N/A		N/A		r=0.95	Results para 11
+ -	5b	Multiple regression	Results para 10	100	Number of subjects	Methods para 7	Average	Fig. legend	N/A		N/A	
+ -	5c	Activity flow estimation	Methods para 1	100	Number of subjects	Methods para 7	Average	Fig. legend	N/A		N/A	
+ -	1e	Spearman rank correlation	Results para 4	300	Number of simulated regions	Methods para 3	Average	Results para 4	p<0.00001	Results para 4	rho=0.51	Results para 4
+ -	Results para 6	Pearson correlation & Two-tailed one-sample t-test	Methods para 24	100	Number of subjects	Methods para 7 & 22	Average	Results para 6	p<0.00001	Results para 6	r=0.48, t(99)=39.29	Results para 6
+ -	Results para 6	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.42	Results para 6
+ -	Results para 6	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.49	Results para 6
+ -	Results para 6	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.46	Results para 6
+ -	Results para 6	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.53	Results para 6

+/-												
+ -	Results para 6	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.49	Results para 6
+ -	Results para 6	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.50	Results para 6
+ -	Results para 6	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.45	Results para 6
+ -	Results para 7	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.67	Results para 7
+ -	Results para 7	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.66	Results para 7
+ -	Results para 7	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.66	Results para 7
+ -	Results para 7	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.65	Results para 7
+ -	Results para 7	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.68	Results para 7
+ -	Results para 7	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.65	Results para 7
+ -	Results para 7	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.65	Results para 7
+ -	Results para 8	Pearson correlation & Two-tailed one-sample t-test	Methods para 22	100	Number of subjects	Methods para 7 & 22	Average	Results para 8	p<0.00001	Results para 8	r=0.50, t(99)=45.32	Results para 8
+ -	Results para 11	Pearson correlation & Two-tailed one-sample t-test	Methods para 22	100	Number of subjects	Methods para 7 & 22	Average	Results para 11	p<0.00001	Results para 11	r=0.69, t(99)=46.18	Results para 11
+ -	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.61	Results para 11
+ -	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.72	Results para 11
+ -	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.64	Results para 11

+−												
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.73	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.72	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.75	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.64	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.86	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.93	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.88	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.93	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.94	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.92	Results para 11
+ −	Results para 11	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.86	Results para 11
+ −	Results para 13	Pearson correlation & Permutation test	Methods para 22	100	Number of subjects	Methods para 7 & 22	Average	Results para 11	p<0.0001	Results para 13	r=0.69	Results para 13
+ −	Results para 14	Pearson correlation & Two-tailed one-sample t-test	Methods para 22	100	Number of subjects	Methods para 7 & 22	Average	Results para 14	p=0.20	Results para 14	r=-0.005, t(99)=-1.30	Results para 14
+ −	Results para 15	Pearson correlation & Two-tailed one-sample t-test	Methods para 22	100	Number of subjects	Methods para 7 & 22	Average	Results para 15	p=0.00002	Results para 15	r=-0.01, t(99)=-4.46	Results para 15
+ −	Results para 17	Pearson correlation & Two-tailed one-sample t-test	Methods para 22	100	Number of subjects	Methods para 7 & 22	Average	Results para 17	p<0.00001	Results para 17	r=0.63, t(99)=40.68	Results para 17

+/-												
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.54	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.65	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.57	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.67	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.66	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.72	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.58	Results para 17
+ -	Results para 17	Pearson correlation & Two-tailed one-sample t-test	Methods para 22	100	Number of subjects	Methods para 7 & 22	Average	Results para 17	N/A		r=0.92	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 17	N/A		r=0.84	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 17	N/A		r=0.93	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 17	N/A		r=0.90	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 17	N/A		r=0.94	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 17	N/A		r=0.95	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 17	N/A		r=0.94	Results para 17
+ -	Results para 17	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 17	N/A		r=0.86	Results para 17
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.89	Results para 19

+/-											
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.91	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.95	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.93	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.92	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.98	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.93	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.93	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.93	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.67	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.94	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.96	Results para 19
+ -	Results para 19	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Results para 19	N/A		r=0.84	Results para 19
+ -	Results para 22	Pearson correlation & Two-tailed one-sample t-test	Methods para 24	100	Number of subjects	Methods para 7 & 22	Average	Results para 22	p<0.00001	Results para 22	r=0.45, t(99)=25.15	Results para 22
+ -	Results para 22	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.23	Results para 22
+ -	Results para 22	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.48	Results para 22
+ -	Results para 22	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.37	Results para 22

+ −	Results para 22	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.54	Results para 22
+ −	Results para 22	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.52	Results para 22
+ −	Results para 22	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.58	Results para 22
+ −	Results para 22	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.40	Results para 22
+ −	Results para 23	Pearson correlation	Results para 23	100	Number of subjects	Methods para 7 & 22	Average	Results para 23	N/A		r=0.20	Results para 23
+ −	Results para 23	Pearson correlation	Results para 23	100	Number of subjects	Methods para 7 & 22	Average	Results para 23	N/A		r=−0.01	Results para 23
+ −	Results para 23	Pearson correlation & Two-tailed one-sample t-test	Results para 23	100	Number of subjects	Methods para 7 & 22	Average	Results para 23	p<0.00001	Results para 23	r=0.59, t(99)=25.15	Results para 23
+ −	Results para 23	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.66	Results para 23
+ −	Results para 23	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.56	Results para 23
+ −	Results para 23	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.59	Results para 23
+ −	Results para 23	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.54	Results para 23
+ −	Results para 23	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.65	Results para 23
+ −	Results para 23	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.58	Results para 23
+ −	Results para 23	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		r=0.51	Results para 23
+ −	Supp Fig. 1A	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Supp Fig. 1A	N/A		r=0.54	Supp Fig. 1A
+ −	Supp Fig. 2A	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Supp Fig. 2A	N/A		r=0.002	Supp Fig. 2A

+ -	Supp Fig. 2B	Pearson correlation	Methods para 1	100 / 10,000	Number of subjects / Number of permutations	Methods para 7 & 22 / Supp Fig. 2B	Average	Supp Fig. 2B	N/A		Maximum r=0.024	Supp Fig. 2B
+ -	Supp Fig. 3	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	N/A		N/A		See figure	Supp Fig. 3
+ -	Supp Fig. 4	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Supp Fig. 4	N/A		See figure	Results para 17
+ -	Methods para 27	Pearson correlation	Methods para 1	100	Number of subjects	Methods para 7 & 22	Average	Methods para 27	N/A		r=0.73	Methods para 27

▶ Representative figures

1. Are any representative images shown (including Western blots and immunohistochemistry/staining) in the paper?

   If so, what figure(s)?

   > N/A

2. For each representative image, is there a clear statement of how many times this experiment was successfully repeated and a discussion of any limitations in repeatability?

   If so, where is this reported (section, paragraph #)?

   > N/A

▶ Statistics and general methods

1. Is there a justification of the sample size?

   If so, how was it justified?

   Where (section, paragraph #)?

   Even if no sample size calculation was performed, authors should report why the sample size is adequate to measure their effect size.

   > Yes, it was justified based on a power analysis. Methods paragraph 8.

2. Are statistical tests justified as appropriate for every figure?

   Where (section, paragraph #)?

   > Yes, statistical tests are described and justified in the Methods section.

   a. If there is a section summarizing the statistical methods in the methods, is the statistical test for each experiment clearly defined?

   > Yes, statistical approaches are described throughout the Methods and Results sections. A separate Statistics section is included as Methods paragraph 22.

   b. Do the data meet the assumptions of the specific statistical test you chose (e.g. normality for a parametric test)?

   Where is this described (section, paragraph #)?

   > Yes, Methods paragraph 1. A separate Statistics section is included as Methods paragraph 22.

c. Is there any estimate of variance within each group of data?

Is the variance similar between groups that are being statistically compared?

Where is this described (section, paragraph #)?

> N/A

d. Are tests specified as one- or two-sided?

> Two-sided

e. Are there adjustments for multiple comparisons?

> Not necessary because only a small number of p-values were calculated per analysis (see below). Nonetheless, an overall correction for all comparisons was included in Methods paragraph 25.

3. To promote transparency, *Nature Neuroscience* has stopped allowing bar graphs to report statistics in the papers it publishes. If you have bar graphs in your paper, please make sure to switch them to dot-plots (with central and dispersion statistics displayed) or to box-and-whisker plots to show data distributions.

> We do not use bar plots. Note, however, that we use a histogram in Figure 3B. This shows the distribution of the underlying data, so this plot does not have the same issues as bar graphs.

4. Are criteria for excluding data points reported?

Was this criterion established prior to data collection?

Where is this described (section, paragraph #)?

> We excluded no data points. See Methods paragraph 23.

5. Define the method of randomization used to assign subjects (or samples) to the experimental groups and to collect and process data.

If no randomization was used, state so.

Where does this appear (section, paragraph #)?

> This is included through a reference to the publication that reported the many details regarding this publicly available dataset. Methods paragraph 8.

6. Is a statement of the extent to which investigator knew the group allocation during the experiment and in assessing outcome included?

If no blinding was done, state so.

Where (section, paragraph #)?

> No blinding was done. Methods paragraph 23.

7. For experiments in live vertebrates, is a statement of compliance with ethical guidelines/regulations included?

Where (section, paragraph #)?

> Yes. Methods paragraph 8

8. Is the species of the animals used reported?

Where (section, paragraph #)?

> Yes. Methods paragraph 8

9. Is the strain of the animals (including background strains of KO/transgenic animals used) reported?

Where (section, paragraph #)?

> N/A

10. Is the sex of the animals/subjects used reported?

Where (section, paragraph #)?

Yes. Methods paragraph 8

11. Is the age of the animals/subjects reported?

Where (section, paragraph #)?

Yes. Methods paragraph 8

12. For animals housed in a vivarium, is the light/dark cycle reported?

Where (section, paragraph #)?

N/A

13. For animals housed in a vivarium, is the housing group (i.e. number of animals per cage) reported?

Where (section, paragraph #)?

N/A

14. For behavioral experiments, is the time of day reported (e.g. light or dark cycle)?

Where (section, paragraph #)?

N/A

15. Is the previous history of the animals/subjects (e.g. prior drug administration, surgery, behavioral testing) reported?

Where (section, paragraph #)?

N/A

    a. If multiple behavioral tests were conducted in the same group of animals, is this reported?

Where (section, paragraph #)?

N/A

16. If any animals/subjects were excluded from analysis, is this reported?

Where (section, paragraph #)?

Yes, Methods paragraph 8

    a. How were the criteria for exclusion defined?

Where is this described (section, paragraph #)?

Subjects with family relations were excluded, "given that a subset of unrelated individuals is more appropriate for statistical analyses intended to represent the general population". Methods paragraph 8

    b. Specify reasons for any discrepancy between the number of animals at the beginning and end of the study.

Where is this described (section, paragraph #)?

N/A

▶ Reagents

1. Have antibodies been validated for use in the system under study (assay and species)?

N/A

a. Is antibody catalog number given?

N/A

Where does this appear (section, paragraph #)?

b. Where were the validation data reported (citation, supplementary information, Antibodypedia)?

N/A

Where does this appear (section, paragraph #)?

2. Cell line identity

N/A

a. Are any cell lines used in this paper listed in the database of commonly misidentified cell lines maintained by ICLAC and NCBI Biosample?

Where (section, paragraph #)?

b. If yes, include in the Methods section a scientific justification of their use--indicate here in which section and paragraph the justification can be found.

N/A

c. For each cell line, include in the Methods section a statement that specifies:

N/A

- the source of the cell lines

- have the cell lines been authenticated? If so, by which method?

- have the cell lines been tested for mycoplasma contamination?

Where (section, paragraph #)?

▶ Data availability

Provide a Data availability statement in the Methods section under "Data availability", which should include, where applicable:
- Accession codes for deposited data
- Other unique identifiers (such as DOIs and hyperlinks for any other datasets)
- At a minimum, a statement confirming that all relevant data are available from the authors
- Formal citations of datasets that are assigned DOIs
- A statement regarding data available in the manuscript as source data
- A statement regarding data available with restrictions

See our data availability and data citations policy page for more information.

Data deposition in a public repository is mandatory for:

    a. Protein, DNA and RNA sequences
      b. Macromolecular structures
      c. Crystallographic data for small molecules
      d. Microarray data

Deposition is strongly recommended for many other datasets for which structured public repositories exist; more details on our data policy are available here. We encourage the provision of other source data in supplementary information or in unstructured repositories such as Figshare and Dryad.

We encourage publication of Data Descriptors (see Scientific Data) to maximize data reuse.

Where is the Data Availability statement provided (section, paragraph #)?

> This section is included. Last paragraph of Discussion section.

▶ Computer code/software

Any custom algorithm/software that is central to the methods must be supplied by the authors in a usable and readable form for readers at the time of publication. However, referees may ask for this information at any time during the review process.

1. Identify all custom software or scripts that were required to conduct the study and where in the procedures each was used.

> The activity flow mapping algorithm is described in the Methods section and is available upon request.

2. If computer code was used to generate results that are central to the paper's conclusions, include a statement in the Methods section under "**Code availability**" to indicate whether and how the code can be accessed. Include version information as necessary and any restrictions on availability.

> This section is included. Last paragraph of the Methods section.

▶ Human subjects

1. Which IRB approved the protocol?

    Where is this stated (section, paragraph #)?

    > Washington University IRB. Methods paragraph 8

2. Is demographic information on all subjects provided?

    Where (section, paragraph #)?

    > Yes, Methods paragraph 8

3. Is the number of human subjects, their age and sex clearly defined?

    Where (section, paragraph #)?

    > Yes, Methods paragraph 8

4. Are the inclusion and exclusion criteria (if any) clearly specified?

    Where (section, paragraph #)?

    > Yes, through a reference to the publication that reported the many details regarding this publicly available dataset. Methods paragraph 8

5. How well were the groups matched?

    Where is this information described (section, paragraph #)?

    > N/A

6. Is a statement included confirming that informed consent was obtained from all subjects?

    Where (section, paragraph #)?

    > Yes, Methods paragraph 8

7. For publication of patient photos, is a statement included confirming that consent to publish was obtained?

    Where (section, paragraph #)?

    > N/A

▶ fMRI studies

For papers reporting functional imaging (fMRI) results please ensure that these minimal reporting guidelines are met and that all this information is clearly provided in the methods:

1. Were any subjects scanned but then rejected for the analysis after the data was collected?

    > Subjects with family relations were excluded, "given that a subset of unrelated individuals is more appropriate for statistical analyses intended to represent the general population". Methods paragraph 8

    a. If yes, is the number rejected and reasons for rejection described?

        Where (section, paragraph #)?

        > Yes, Methods paragraphs 8 and 23

2. Is the number of blocks, trials or experimental units per session and/ or subjects specified?

    Where (section, paragraph #)?

    > Yes, through a reference to the publication that reported the many details regarding this publicly available dataset. Methods paragraph 8

3. Is the length of each trial and interval between trials specified?

    > Yes, through a reference to the publication that reported the many details regarding this publicly available dataset.

4. Is a blocked, event-related, or mixed design being used? If applicable, please specify the block length or how the event-related or mixed design was optimized.

Blocked design.

5. Is the task design clearly described?

Where (section, paragraph #)?

Yes, through a reference to the publication that reported the many details regarding this publicly available dataset. Methods paragraph 8

6. How was behavioral performance measured?

N/A

7. Is an ANOVA or factorial design being used?

No

8. For data acquisition, is a whole brain scan used?

If not, state area of acquisition.

Yes

   a. How was this region determined?

N/A

9. Is the field strength (in Tesla) of the MRI system stated?

Yes

   a. Is the pulse sequence type (gradient/spin echo, EPI/spiral) stated?

Yes

   b. Are the field-of-view, matrix size, slice thickness, and TE/TR/flip angle clearly stated?

Yes

10. Are the software and specific parameters (model/functions, smoothing kernel size if applicable, etc.) used for data processing and pre-processing clearly stated?

Yes

11. Is the coordinate space for the anatomical/functional imaging data clearly defined as subject/native space or standardized stereotaxic space, e.g., original Talairach, MNI305, ICBM152, etc? Where (section, paragraph #)?

This is part of the standard HCP minimal preprocessing pipeline described in a referenced publication in Methods paragraph 8.

12. If there was data normalization/standardization to a specific space template, are the type of transformation (linear vs. nonlinear) used and image types being transformed clearly described? Where (section, paragraph #)?

This is part of the standard HCP minimal preprocessing pipeline described in a referenced publication in Methods paragraph 8.

13. How were anatomical locations determined, e.g., via an automated labeling algorithm (AAL), standardized coordinate database (Talairach daemon), probabilistic atlases, etc.?

We used a standard functionally defined set of brain regions derived from Power et al., 2011.

14. Were any additional regressors (behavioral covariates, motion etc) used?

Yes, motion, white matter signal, CSF signal, as described.

15. Is the contrast construction clearly defined?

N/A

16. Is a mixed/random effects or fixed inference used?

Yes, primarily random effects inferences are used.

a. If fixed effects inference used, is this justified?

Fixed effects (comparing predicted and actual activation patterns after averaging across subjects) are not used for p-values, just effect sizes (% variance explained), as justified in the text.

17. Were repeated measures used (multiple measurements per subject)?

Multiple measurements were combined through fitting single correlations or regressions.

a. If so, are the method to account for within subject correlation and the assumptions made about variance clearly stated?

N/A

18. If the threshold used for inference and visualization in figures varies, is this clearly stated?

N/A

19. Are statistical inferences corrected for multiple comparisons?

Only a small number of comparisons are made per analysis (e.g., one for each of the 7 tasks). No thresholding was used for the voxelwise analyses. Thus, correcting for multiple comparisons was not necessary.

a. If not, is this labeled as uncorrected?

N/A

20. Are the results based on an ROI (region of interest) analysis?

Yes

a. If so, is the rationale clearly described?

Yes

b. How were the ROI's defined (functional vs anatomical localization)?

We used a standard functionally defined set of brain regions from Power et al., 2011.

21. Is there correction for multiple comparisons within each voxel?

N/A

22. For cluster-wise significance, is the cluster-defining threshold and the corrected significance level defined?

N/A

▸ Additional comments

Additional Comments

Note that p-values below 0.00001 were reported as p<0.00001 based on the convention that typical data analysis approaches likely do not have that level of precision, suggesting that such small values would be misleading. Exact p-values can be calculated based on the reported t-values.