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Reporting Summary

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Statistical parameters

When statistical analyses are reported, confirm that the following items are present in the relevant location (e.g. 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
☐	☒	An indication of 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 statistics 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
☐	☒	Clearly defined error bars *State explicitly what error bars represent (e.g. SD, SE, CI)*

Our web collection on statistics for biologists may be useful.

Software and code

Policy information about availability of computer code

Data collection	Behavioural data were collected using Psychtoolbox 3.0 implemented on Matlab (version 8.6; The Mathworks Inc., Natick, MA, USA). In Experiment 1 and Experiment 2, eye tracking data were extracted using the open source eye tracking software MrGaze (https://github.com/jmtyszka/mrgaze/) and the EyeMMV toolbox (Krassanakis et al., 2014) In Experiment 3 and Experiment4 , eye tracking data were collected with an EyeLink 1000 Plus desktop-mounted eye tracker.
Data analysis	All statistical analyses were conducted using the RStudio software 1.0.36 with R 3.4.3 (2009-2016 RStudio, Inc)

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 upon request. 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

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 from the four studies reported in this manuscript are available through the Open Science Framework repository: https://osf.io/rve2p/

Field-specific reporting

Please select 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/authors/policies/ReportingSummary-flat.pdf](#)

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	The planned sample size was motivated by a power analysis conducted with G*power. The effect sizes of interest we focused on was the Pavlovian influence on pupil dilation. For Experiment 1 to 3, these effects were extracted from a previous study and from an independent pilot study (n = 11) using a paradigm similar to the one we used in Experiment 1 (dz = .62, dz = .57). The analysis revealed that sample size of 20 participants per group was required to obtain a power of 80%. For Experiment 4, we averaged the previous effect sizes with the effect size we obtained in Experiment 1 and Experiment 2 (dz = .33, dz = .39). The analysis revealed that a sample size of 34 participants was required to obtain a power of 80%.
Data exclusions	In Experiment 4 data from one participant was excluded from the analysis for not liking any of the snack options proposed (the most liked option for that participant was rated 3 out of 10).
Replication	We ran 4 variations of the same task and replicated the main finding each time. These 4studies are reported in the main text.
Randomization	Allocation to experimental conditions was either randomized, counterbalanced or sequential.
Blinding	Blinding was not possible: The experimenter administered the devaluation procedure and therefore was aware of the outcome stimulus that was being devalued.

Reporting for specific materials, systems and methods

Materials & experimental systems

n/a	Involved in the study
☒	☐ Unique biological materials
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology
☒	☐ Animals and other organisms
☐	☒ Human research participants

Methods

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

Human research participants

Population characteristics	Forty participants (24 females) with a mean age of 26 years (SD = 6.95 years) were recruited for Experiment 1, which was a between subjects design. Twenty participants (14 females, 1 agender) with a mean age of 25.1 years (SD = 9 years) were recruited for Experiment 2, which was a within subjects design. Forty-two participants (23 females) with a mean age of 25.7 years (SD = 8.6 years) were recruited for Experiment 3, which was a between subjects design. Thirty-four participants (23 females) with a mean age of 28 years (SD = 10.57 years) were recruited for Experiment 4.

Recruitment

Participants were recruited through flyers posted on campus and librarie. Note that while Experiments 1 to 3 were conducted at the California Institute of Technology in Pasadena, CA, Experiment 4 was conducted at the University of Geneva, Switzerland.