

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 (<i>n</i>) 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 <i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i>
☐	☒ 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. <i>F</i> , <i>t</i> , <i>r</i>) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> value noted <i>Give P values as exact values whenever suitable.</i>
☒	☐ 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 <i>d</i> , Pearson's <i>r</i>), 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	NIC2 (Neuroelectrics) software was used to collect participants' EEG signals and real-time valence keypress data during VR watching task. (https://www.neuroelectrics.com/solution/software-integrations/nic2)
Data analysis	The code to reproduce all results from this paper is available in our GitHub repository: https://github.com/jinw00-lee/ambivalent-awe .

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 four VR video stimuli used in this study are available upon request to the first author of the paper, Jinwoo Lee (adem1997@snu.ac.kr), with a document that the stimuli will be used only for research purposes. All preprocessed self-report and EEG data analyzed in this paper are freely available through our Open Science Framework repository: <https://osf.io/g7k6c>.

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	Regarding biological sex, the 43 participants included in the behavioral analysis of this study consisted of 23 biological females and 20 biological males. Among them, the 27 participants included in the EEG analysis comprised 14 biological females and 13 biological males. Within this group, the 6 participants included in the decoding analysis consisted of 3 females and 3 males. Gender information for each participant was not collected.
Reporting on race, ethnicity, or other socially relevant groupings	We did not collect any demographic information (i.e., race, ethnicity, socioeconomic status) other than biological sex and age. Instead, we measured baseline positive and negative mood states and dispositional awe as potential confounders of awe ratings for each film stimulus. Each dispositional variable was assessed using the Positive and Negative Affect Schedule (PANAS) and the Dispositional Positive Emotion Scales (DPES).
Population characteristics	Participants were excluded if they met any of the following criteria: 1) currently taking psychiatric medication, 2) history of psychiatric treatment, 3) left-handedness, 4) vestibular neuritis or balance disorder, 5) visual acuity before correction less than 0.2, 6) non-Korean native speakers, and 7) consumption of alcohol or use of hair rinse 24 hours before the experiment. Following these exclusion criteria, 43 individuals' data were included in the analyses (sex: 23 females; age: M= 20.2 years, SD = 1.7 years).
Recruitment	All participants were undergraduate students enrolled in psychology courses who voluntarily participated in the experiment. We acknowledge that this recruitment process does not encompass participants from diverse age groups or cultural backgrounds.
Ethics oversight	Participants provided written informed consent before the experiment, and all procedures were approved by the Institutional Review Board of Seoul National University.

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	A total of 50 participants were recruited, with 43 participants included in the main behavioral analysis. Among them, 27 participants were included in the EEG analysis, and a selected subset of 6 participants was used for EEG-valence decoding analysis. Our sample size aligns with those of similar affective neuroscience studies utilizing movie viewing.
Data exclusions	In the behavioral analysis, 7 out of 50 participants were excluded due to technical issues (N = 3), lack of fidelity (N = 2), and experiment interruptions (N = 2). For the EEG analysis, an additional 16 participants were excluded due to poor signal quality (N = 6) and failure to report ambivalent feelings (N = 10). This selection was essential for the analytical goal of exploring the neural representation of ambivalent feelings in EEG data. The 16 participants excluded from the EEG analysis did not show statistically significant differences from the 27 included participants in terms of key demographics or the primary independent variable, awe ratings. Finally, for the decoding analysis, data from 6 participants who reported all valence labels across all video clips were used for the multi-class classification task.
Replication	We conducted a pairwise decoding task with six participants to examine whether the representational structure of the latent neural space learned for each participant could be consistently observed in others.
Randomization	All stimuli were presented at pseudo-random order.
Blinding	All participants were introduced to the experiment under a topic unrelated to the actual study theme. This approach aimed to prevent potential bias in self-reports by avoiding prior exposure to the emotion keyword 'awe,' which might have influenced participants to frame their affective responses to the videos within the category of awe.

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, mosaicism, off-target gene editing) were examined.