Seeing Is Believing, but Believing Is Not Paying More: A Field Experiment on Virtual Reality and Coral Reef Valuation*

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Abstract

Stated-preference valuation often requires respondents to evaluate environmental goods using information provided within the survey, yet evidence remains limited on whether immersive representation alters resulting valuations. We conducted the largest field experiment to date integrating immersive virtual reality (VR) with environmental stated-preference valuation, randomly assigning 837 participants in Brisbane, Australia, to experience Great Barrier Reef degradation through immersive VR or a text-and-image presentation. VR increased spatial presence and reduced psychological distance to reef degradation. However, we found no statistically robust effects on hypothetical willingness to pay, actual donations or immediate behavioural outcomes after adjustment for multiple testing. Mediation analysis was consistent with positive indirect effects through reduced psychological distance on behavioural intentions, support for conservation funding and newsletter subscription, although these estimates rely on sequential ignorability and were sensitive to modest violations of that assumption. Among the smaller, self-selected follow-up sample, VR participants showed greater baseline-to-follow-up reductions in psychological distance, stronger behavioural intentions at one month, and reported more conservation actions since the experiment. Overall, immersive representation changed how environmental degradation was psychologically experienced without systematically increasing elicited monetary values, highlighting the distinction between how environmental goods are experienced and how they are valued.

JEL codes: Q51, Q57, C93, D91

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1 Introduction

Policymakers regularly employ stated preference methods to elicit monetary values for non-market goods, including health outcomes and environmental improvements (Dussaux et al., 2024; Johnston et al., 2017). Many environmental goods are characterised by ecological interdependence and the absence of observable market prices, conditions under which respondents may have incomplete prior knowledge or weakly defined reference points (Freeman et al., 2014). Where non-use values, such as existence and bequest values, constitute a substantial component of total economic value (Champ et al., 2017), individuals may be unlikely to hold fully formed monetary valuations prior to elicitation. Rather than simply revealing pre-existing valuations, stated preference methods provide informational and contextual inputs through which respondents construct and express economic preferences, an insight reflected in the literature's emphasis on scenario design, information provision, and framing (Johnston et al., 2017; OECD, 2018). How environmental change is represented may therefore shape the valuations respondents express.

A small but growing stated-preference literature demonstrates that immersive VR can be incorporated directly into preference elicitation. Farooq et al. (2018), for example, compare an immersive virtual environment with text-only and visual-aid formats in a stated-preference experiment on pedestrian responses to autonomous vehicles, finding better scenario understanding and more consistent responses under the immersive format. Birenboim et al. (2019) similarly embed a conjoint experiment on cycling-environment preferences within an immersive virtual environment, finding substantially greater spatial presence than in an equivalent still-image task, although with mixed evidence on test–retest reliability. In environmental valuation, Mokas et al. (2021) use head-mounted VR in a discrete choice experiment on urban green infrastructure and examine its effects on choice certainty and willingness-to-pay estimates. Existing studies, however, have largely been conducted in controlled experimental settings, with limited evidence from large-scale field experiments.

Field evidence on immersive VR in environmental contexts remains limited and has focused primarily on charitable giving and broader conservation behaviour rather than formal economic valuation (Banerjee and Ferreira, 2024; Nelson et al., 2020; Pimentel and Kalyanaraman, 2022; Pimentel, 2025). In a field experiment in Indonesia, Nelson et al. (2020) find that immersive presentation increased donations relative to 2D media under negative framing, but not under positive framing. In another field experiment, an Amazon conservation study in Brazil finds that although both VR and 2D media increase pro-conservation behaviour relative to baseline, immersive delivery does not generate statistically distinguishable short-term effects compared with 2D presentation (Banerjee and Ferreira, 2024). These findings suggest that immersive presentation does not

consistently produce stronger pro-environmental behaviour in field settings, and neither study embeds immersive VR within a formal stated-preference valuation exercise.

The Great Barrier Reef provides a particularly relevant setting in which to bring these strands together. Its ecological and economic characteristics make it both a policy-relevant conservation good and a useful setting in which to examine whether immersive representation changes stated economic valuation. The reef is the world's largest coral reef system and supports an interdependent network of more than 410 coral species, 1,620 fish species, and thousands of other marine taxa (Kroon et al., 2016; Richards and Day, 2018). Such complexity poses a representational challenge for stated preference surveys, which necessarily describe environmental change through a limited set of attributes. The reef has undergone rapid change, including widespread coral mortality during the mass bleaching events of 2016 and 2017 (Hughes et al., 2019). The reef is also an important subject for non-market valuation because a substantial share of its value extends beyond direct use. Deloitte Access Economics (2025) estimated its total economic, social, and iconic asset value to Australians at A$95 billion, including approximately A$39 billion in non-use value, alongside an annual contribution of A$9.0 billion to the Australian economy. Its geographical remoteness and ecological sensitivity offer a further practical motivation for immersive representation, which allows people to experience aspects of the reef virtually without requiring physical visitation, which can itself impose ecological pressures through reef trampling and tourist-generated debris (Williamson et al., 2017; Wilson and Verlis, 2017).

Coral reefs have an established non-market valuation literature spanning both use and non-use values. Research on the Great Barrier Reef has used contingent valuation, discrete-choice experiments, travel-cost methods, and related approaches to value reef protection, water-quality improvements, recreation, and changes in ecological condition (Rolfe and De Valck, 2021; Rolfe and Windle, 2011; Rolfe and Windle, 2012a; Rolfe and Windle, 2012b; Rolfe and Windle, 2013; Farr et al., 2016). Related stated-preference studies have examined coral-reef conservation in other settings, including improved reef conditions among divers in Guam, reef conservation among visitors in Malaysia, and preferences for coral and reef-fish conservation across multiple countries (Grafeld et al., 2016; Kamaludin et al., 2021; Robinson et al., 2023).

Within this broader literature, a few studies suggest that respondents' perceptions of reef condition and the information used to form those perceptions can matter for valuation. McClenachan et al. (2018), for example, find higher willingness to pay among respondents who perceived greater deterioration in reef health. Most directly, Imamura et al. (2020) experimentally varied the information provided before a coral-reef choice experiment, comparing text-and-image, a video-format presentation of static images and text, and no-information conditions, and found that willingness to pay differed across presentation

formats. What remains less understood is whether immersive representation, which provides richer spatial and experiential cues than these non-immersive formats, changes the valuations respondents subsequently express.

We address this gap through the largest field experiment to date embedding immersive VR within an environmental valuation setting that combines stated and real behavioural choices. Conducted in Brisbane, Australia, the experiment randomly assigned 837 participants to experience coral reef degradation through immersive VR or a text-and-image presentation. Outcomes include hypothetical willingness to pay, actual donations, behavioural intentions, support for conservation funding, and newsletter subscription. Psychological distance is measured before and after treatment to examine whether changes in perceived proximity provide a pathway through which immersive representation may affect these responses. Prior reef experience is used to examine heterogeneity in treatment effects. A one-month follow-up examines whether treatment-related differences remain detectable and documents subsequent conservation behaviours.

The paper's central finding is a distinction between psychological distance and economic valuation. Immersive VR significantly reduced respondents' psychological distance from coral reef degradation relative to the text-and-image condition, but we find no statistically robust effects on hypothetical willingness to pay, actual donations, or immediate behavioural outcomes after adjustment for multiple testing. Under the assumptions required for causal mediation, the analysis suggests positive indirect effects through reduced psychological distance on behavioural intentions, support for conservation funding, and newsletter subscription, all of which remained significant after within-family multiple-testing adjustment. By contrast, corresponding indirect effects for the monetary valuation outcomes did not survive adjustment for multiple testing. Among the smaller, self-selected one-month follow-up sample, VR participants exhibited stronger behavioural intentions and reported more conservation actions, alongside greater baseline-to-follow-up reductions in psychological distance in an additional, non-pre-specified analysis. Taken together, the findings suggest that immersive representation can change how an environmental problem is psychologically experienced without necessarily increasing elicited monetary valuations or producing broad immediate behavioural change.

The remainder of the paper proceeds as follows. Section 2 develops the theoretical framework and derives the study's hypotheses. Section 3 describes the experimental design, data and empirical strategy. Section 4 presents the results. Section 5 discusses the findings and their implications, and Section 6 concludes.

2 Theoretical Framework and Hypotheses

2.1 Immersive Representation and Stated Preference Valuation

In conventional stated preference applications, complex ecosystems are represented through structured scenarios and policy-relevant attributes presented via text, numbers, or static images (Hynes et al., 2021; Süring and Lundhede, 2025; Chu et al., 2020). Coral reefs, for example, may be characterised through attributes such as changes in coral cover, biodiversity, or projected degradation (Schuhmann et al., 2024; Alemu I et al., 2019). For ecosystems that many respondents do not encounter regularly, valuation judgements may depend substantially on the information and attributes described within the survey instrument, together with respondents' prior knowledge and experience.

When ecosystems are represented through descriptive attributes, respondents must mentally integrate these pieces of information to form a representation of the setting. Cognitive research refers to this process as scene construction, in which individuals use memory and imagination to combine discrete information into a coherent mental model (Jajdelska et al., 2019). Immersive virtual environments, by contrast, present the setting from a first-person perspective with head tracking, stereoscopic depth cues and a wide field of view (Makransky and Petersen, 2021). More of the environment's structure is accordingly specified perceptually rather than inferred, shifting part of the representational burden from internal construction to external display (Kirsh, 2010). Consequently, description-based formats may encourage schematic or abstract representations of an unfamiliar environmental setting, whereas immersive presentation provides richer perceptual information from which a more concrete representation can be formed (Barsalou, 1999; Jajdelska et al., 2019).

Immersive VR may therefore offer a more perceptually grounded way of representing unfamiliar environmental settings than conventional text-and-image formats. It does not reproduce direct physical experience of the environment, but it can approximate some of its spatial and visual features while reducing the extent to which respondents must rely on internally constructed representations. In this sense, immersive VR occupies an intermediate position between descriptive survey representation and direct environmental experience, consistent with evidence that virtual nature experiences can generate responses similar to those arising from direct exposure to the same environment (Hofman et al., 2022). This may be particularly valuable when respondents have limited prior experience of the good being valued, because it can provide a fuller informational basis from which preferences are formed. The case for VR, however, is not that richer representation should mechanically increase willingness to pay or pro-environmental behaviour. Rather, the empirical question is whether it makes an environmental good more concrete and psychologically closer, and whether psychological distance subsequently shapes valuation and behaviour.

Building on this representational distinction, we test whether presentation format affects hypothetical willingness to pay and actual donations (H1), as well as behavioural intentions, funding support, and newsletter subscription (H2).

2.2 Psychological Distance as a Mechanism

Beyond whether immersive presentation affects valuation, we also consider how it changes respondents' mental representation of the environmental problem and influences subsequent responses. One candidate mechanism is psychological distance. Construal Level Theory (CLT) characterises psychological distance to the level of mental construal, with greater perceived distance associated with more abstract representations and psychological proximity associated with more concrete representations (Trope and Liberman, 2010). Psychological distance can arise along spatial, temporal, social, and hypothetical dimensions, each capturing a different way in which an environmental problem may feel distant from an individual's immediate experience (Trope and Liberman, 2010).

Immersive presentation changes the perceptual information available to respondents and may make unfamiliar environmental settings easier to picture. By presenting an environment from a first-person perspective, VR can generate a stronger sense of spatial presence, the feeling of "being there", than non-immersive formats (Slater, 2018). Together, these features may reduce perceived psychological distance. Existing evidence, however, is mixed. Breves and Schramm (2021) find that immersive 360° presentation reduced temporal but not other dimensions of psychological distance, while Meijers et al. (2023) report no consistent reductions across dimensions. Most directly relevant, Santoso and Bailenson (2025) find that immersive VR reduced overall psychological distance relative to static imagery, particularly for geographically distant locations. These findings suggest that the effect of immersive presentation on psychological distance depends on context and measurement. Accordingly, we hypothesise that VR reduces perceived psychological distance to coral reef degradation relative to text-and-image presentation (H3).

Whether such a reduction in psychological distance subsequently affects economic valuation is a separate and more open question. Two related explanations suggest that it could increase willingness to pay. Greater psychological distance has been associated with the discounting of environmental outcomes, whereby more distant consequences are weighted less heavily in evaluation (Sparkman et al., 2021). A reef that feels psychologically closer may also feel more personally relevant (Santoso and Bailenson, 2025), giving respondents a further reason to place greater weight on its protection when constructing a monetary valuation. Consistent with this possibility, Shi et al. (2023) find a distance-decay effect on willingness to pay for watershed ecosystem services, although their measure captures spatial proximity specifically rather than the broader, multidimensional construct of psychological

distance used here.

However, CLT also points to a potentially countervailing channel. Greater psychological distance is associated with higher-level construal, which may place greater weight to broad goals and values, whereas psychological proximity may increase attention to concrete feasibility and situational considerations (Trope and Liberman, 2010; van Valkengoed et al., 2023). This creates an important ambiguity for economic valuation. Although making an environmental problem feel psychologically closer may increase its personal relevance, it may also make the immediate costs and budgetary trade-offs involved in paying for its protection more salient. As a result, reduced psychological distance need not translate into higher willingness to pay.

The implications of reduced psychological distance for non-monetary outcomes are similarly uncertain, given that these responses involve different constraints and decision margins from monetary valuation. Existing research suggests that reducing psychological distance does not consistently increase climate-related action and may produce different effects across outcomes and contexts (Brügger et al., 2015; McDonald et al., 2015; van Valkengoed et al., 2023; Vlasceanu et al., 2024). Greater proximity may increase perceived relevance and promote engagement, but may also evoke fear, avoidance, or other defensive responses. H4 therefore examines whether changes in psychological distance constitute a mediating pathway across the monetary and non-monetary outcomes observed in the experiment.

2.3 Prior Experience, Persistence, and Additional Pathways

The effects of immersive representation may additionally depend on respondents' prior experience with the environmental good. CLT associates greater psychological distance with more abstract mental representation (Trope and Liberman, 2010), while prior direct experience may provide respondents with more concrete and readily accessible representations of reef environments, although these may not fully reflect current reef conditions. Respondents who have previously experienced coral reefs may therefore have less need to rely on the representational information supplied by VR, leaving less scope for immersive presentation to shift their valuation and behavioural responses. Conversely, respondents without prior reef experience may rely more heavily on the information supplied within the valuation scenario and respond more strongly to immersive presentation on these outcomes. This motivates examining whether the effects of immersive presentation on valuation and behavioural outcomes differ between respondents with and without prior direct experience of coral reefs (H5).

The remaining hypotheses extend the analysis beyond the main treatment, mediation, and heterogeneity tests. Immediate post-treatment responses may provide an incomplete indication of whether immersive experiences generate persistent effects, particularly as their

salience may diminish over time. Research on conservation experiences similarly suggests that immediate intentions do not necessarily translate into lasting behavioural change (Hughes, 2013). H6 therefore examines psychological-distance change and behavioural intentions at the one-month follow-up, while H7 tests whether VR increases the number of self-reported conservation actions undertaken during the subsequent month.

We also examine two exploratory questions specific to immersive experience. First, psychological distance is unlikely to be the only mechanism through which immersive presentation shapes outcomes. VR is well documented to evoke strong emotional engagement (Somarathna et al., 2023), and this emotional response could plausibly operate as a further pathway alongside psychological distance. Hofman et al. (2022), for example, find that emotional connection predicted conservation intentions in a virtual Great Barrier Reef experience but not in the corresponding real-life condition. H8 therefore explores whether the psychological-distance pathway remains when emotional engagement is allowed to operate alongside it. Second, within the VR subsample, we examine whether gaze-based visual engagement with reef content, measured as the proportion of head-gaze observations falling within predefined areas of interest and averaged across scenes, is positively associated with valuation and behavioural outcomes (H9). Greater visual attention may reflect deeper engagement with the stimulus, offering a plausible behavioural indicator of processing intensity that self-report cannot capture. This measure is, to our knowledge, rarely available in field-based environmental valuation research.

Table 1. Summary of hypotheses

Hypothesis	Test	Prediction	Status
H1	Effect of VR on hypothetical WTP and actual donations	Non-directional	Confirmatory
H2	Effect of VR on behavioural intentions, funding support, and newsletter subscription	Non-directional	Confirmatory
H3	Effect of VR on psychological distance	VR reduces psychological distance	Confirmatory
H4	Psychological distance as a mediator of treatment effects on monetary and non-monetary outcomes	Mediation pathway through psychological distance	Confirmatory
H5	Interaction between VR and prior reef experience	VR effect attenuated among reef users	Confirmatory

Continued on next page

Table 1 *(continued)*

Hypothesis	Test	Prediction	Status
H6	Psychological distance and behavioural intentions at one-month follow-up	Non-directional	Confirmatory
H7	Effect of VR on unsolicited conservation behaviour during follow-up	VR increases reported conservation actions	Confirmatory
H8	Psychological-distance mediation accounting for emotional engagement as an alternative mediator	Non-directional	Exploratory
H9	Association between gaze-based visual engagement and outcomes within VR	Positive association	Exploratory

3 Methods

The experimental protocol was reviewed and approved by the London School of Economics and Political Science Research Ethics Committee. All participants provided informed consent prior to participation, and all procedures were conducted in accordance with the approved protocol and relevant institutional guidelines.

3.1 Experimental Design and Sample

The experiment randomised the presentation mode within two strata defined by participants' prior reef experience. Reef users were defined as individuals who reported having snorkelled, dived, or observed reefs in a natural habitat. Participants were subsequently assigned within each stratum to either the VR or text-and-image condition, resulting in four experimental cells.

Treatment assignment was implemented automatically in Qualtrics, with equal allocation targeted between the VR and text-and-image conditions within each reef-experience stratum. The preregistered recruitment target was 165 participants per study cell, corresponding to a total of 660, with recruitment planned to continue throughout the fieldwork period to maximise sample size. As recruitment exceeded the initial target, cell-level quotas were adjusted proportionally to maintain the intended allocation across conditions.

After excluding seven records from individuals who did not consent or exited before

randomisation, one researcher-identified invalid response[1], and nine respondents who did not reach 95% survey completion, 859 eligible responses remained. A further 22 respondents were excluded as speeders, leaving a final sample of 837 participants (Appendix Table A9). Speeders were defined as respondents completing the survey in less than 48% of the condition-specific median completion time, following Mitchell (2014). This data-quality criterion was introduced during data cleaning and was not specified in the preregistration. Results are substantively unchanged when these respondents are retained (Appendix Table A44).

Among the 428 participants assigned to VR, 11 experienced discomfort after putting on the headset and were therefore switched to the text-and-image materials. These participants were retained according to their original treatment assignment in the primary intent-to-treat analyses. Results based on treatment actually received are reported separately as an as-treated robustness check (Appendix Section I.1.3).

This study was preregistered on the Open Science Framework.[2] A pilot conducted before the main experiment was used solely to calibrate the payment-card and bidding structures and contributed no observations to the analyses reported in this paper. Any deviations from the preregistered analysis plan are disclosed where relevant and summarised in Appendix Section A.

3.2 Experimental Setting and Procedures

The field experiment was conducted at Westfield Chermside in Brisbane, Australia, from 6 to 26 July 2026. Participants were recruited at a dedicated booth containing six participant stations (Figure 1). Individuals who agreed to participate were seated at one of the stations and accessed the survey on their own mobile device by scanning a QR code.

After providing informed consent and completing the baseline questions, participants continued through the survey to their assigned presentation condition. Those assigned to the text-and-image condition viewed the treatment materials directly on their mobile device. Participants assigned to VR instead reached a survey page instructing them to notify a researcher, who then assisted them with the headset and initiated the immersive experience. After completing the VR experience, participants removed the headset and resumed the survey on their mobile device. The overall experimental sequence, including the resulting distribution across the four study cells, is summarised in Figure 2.

In the VR condition, participants viewed an approximately five-minute 360° film depicting Norman Reef and Fitzroy Island on the Great Barrier Reef. We recorded the footage in January 2026 using an Insta360 X5 camera at 8K resolution, with access at Fitzroy

[1] The response was excluded because the survey was completed by a third party rather than the participant.
[2] The preregistration can be accessed via `https://osf.io/8bsvp/overview`.



Figure 1. Experimental booth at Westfield Chermside

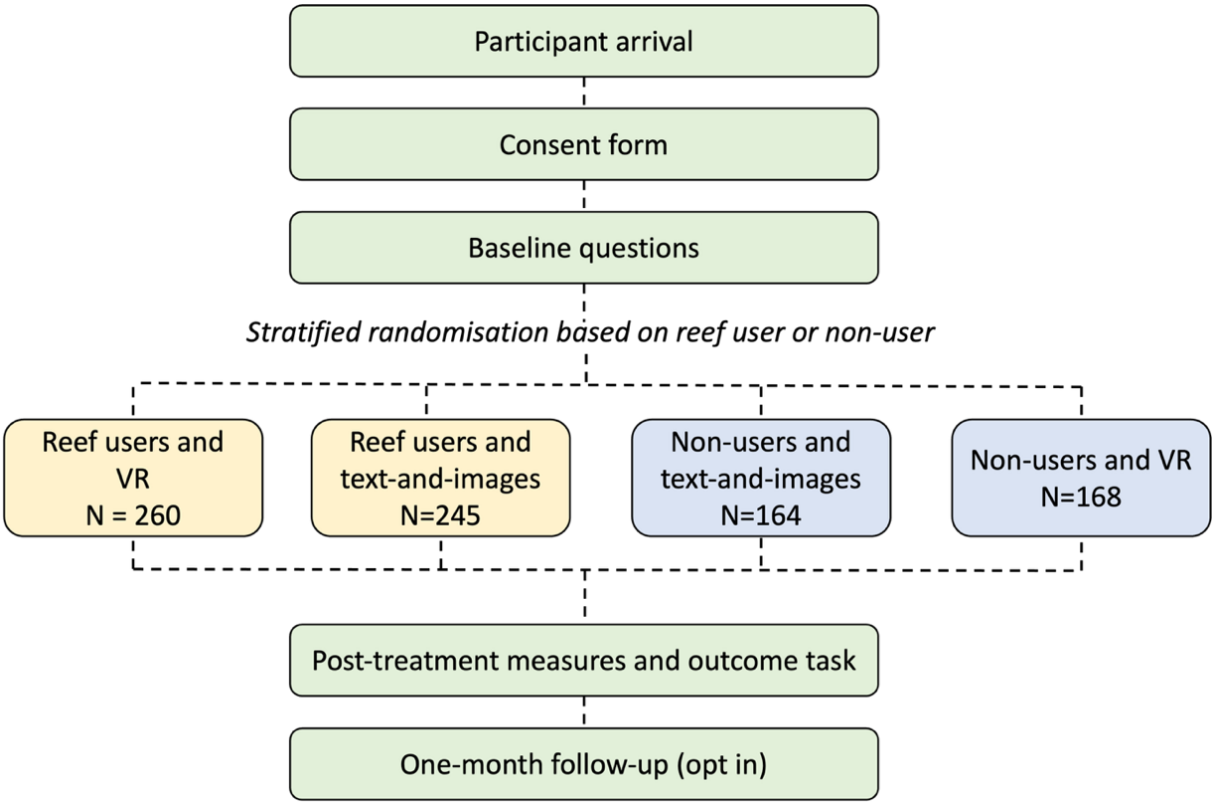


Figure 2. Experimental flow

Island facilitated by the Resilient Reefs Foundation (RRF). The footage was delivered through a customised Unity application on a Meta Quest 3 headset. We wrote and voiced the accompanying narration, which was reviewed for ecological accuracy (Appendix Section B.1). Before viewing the reef footage, participants completed a 30-second familiarisation clip of a residential area in London to acclimate to the headset. During the reef experience, participants were free to look in any direction. The narrated experience began by introducing the reef's biodiversity and ecological importance, showing healthy coral ecosystems, marine life, and interactions among reef species such as puffer fish and corals. Participants were then informed about the threats facing the reef through footage of storm-damaged and sediment-covered corals, before viewing reef-restoration activities undertaken by the RRF, including the cultivation of corals in floating nurseries.[3]

The Unity application was also designed to record participants' head-gaze direction throughout the VR experience. This data was used to measure visual engagement with predefined reef features and to generate spatial heatmaps illustrating the distribution of attention across the 360° environment (Appendix Section B.4). The construction and analysis of the gaze-based engagement measure are described in Section 3.4.3.

In the text-and-image condition, participants viewed still images extracted from the VR footage alongside written narration corresponding to the audio used in the immersive experience (Appendix Section B.1). The materials followed the same sequence and conveyed similar substantive information across conditions. Exposure duration was fixed at five minutes in the VR condition, whereas the text-and-image materials were self-paced, with exposure time recorded in the latter condition. Accordingly, the treatment effect should be interpreted as the effect of assignment to the immersive VR delivery format relative to the text-and-image delivery format, rather than as the isolated causal effect of immersion holding all other features of presentation constant.

3.3 Survey Instrument and Measures

The questionnaire proceeded in several stages. Before treatment, participants reported socio-demographic characteristics, prior reef experience, previous visits to the Great Barrier Reef, and their ease of imagining reef environments. Baseline measures also captured self-reported knowledge of climate-change impacts on coral reefs, environmental attitudes, national identity and pride relating to the Great Barrier Reef, and self-reported reef conservation behaviours. Measures of environmental attitudes and self-reported reef conservation behaviours were adapted from Hofman et al. (2022). Psychological distance to coral reef degradation was measured before treatment using the eight-item scale adapted from Duan et al. (2022), with two items corresponding to each of the spatial, temporal,

[3] A 2D version of the VR experience is available at https://youtu.be/832BMbTCkLg.

social, and hypothetical dimensions. Following treatment, participants completed the same scale again. This within-subject pre–post component allows individual-level changes in psychological distance to be measured directly, with higher scores indicating greater perceived distance.[4] Post-treatment measures also captured emotional engagement and perceived spatial presence, with the presence item adapted from Slater (2018).

Participants then completed the monetary valuation tasks, with the order of the hypothetical willingness-to-pay and actual donation exercises randomised.[5] The hypothetical valuation component presented participants with a contingent valuation scenario describing coral restoration on the Great Barrier Reef, informed by established contingent valuation guidelines (Johnston et al., 2017; OECD, 2018). Participants were first asked whether they would be willing, in principle, to make a regular monthly contribution to preserve the reef. Those willing to contribute completed a double-bounded dichotomous-choice (DBDC) valuation task. The bid structure was informed by pilot testing, and each participants was randomly assigned an initial monthly bid of A$5, A$10, A$25, A$50, or A$100, displayed alongside its annual equivalent. A higher or lower follow-up bid was then presented depending on the initial response.[6] A budget reminder and cheap-talk script were included to mitigate hypothetical bias (Johnston et al., 2017), with the full scenario and script provided in Appendix Section B.2. Follow-up questions eliciting the reasons for non-contribution were used to identify protest responses reflecting objections to the payment vehicle rather than zero valuations.

Actual donations were elicited as a separate monetary task. Participants were reminded of the RRF's coral-restoration activities, introduced earlier in the treatment materials, and were then given the opportunity to make a real donation to the organisation, with amounts selected using a payment card ranging from A$0 to A$30 and an open-ended option for larger amounts. Those selecting a positive amount were redirected at the end of the survey to a dedicated Donorbox campaign created for the study, where they could complete their donation independently.[7]

Under both orders, the non-monetary outcomes were administered between the two monetary tasks. These comprised conservation behavioural intentions and two immediate behavioural actions. Behavioural intentions were measured as the likelihood of seeking further information about the Great Barrier Reef, supporting increased conservation funding, subscribing to conservation updates, donating to conservation organisations, and discussing reef conservation with others. Each was measured on a seven-point scale. The

[4] The composite psychological-distance scale showed good internal consistency at both baseline (Cronbach's $\alpha = 0.79$) and post-treatment ($\alpha = 0.81$).
[5] Robustness to elicitation order is reported in Appendix Section I.1.5.
[6] The full DBDC bid structure, including the higher and lower follow-up bids corresponding to each initial bid, is reported in Appendix Table A3.
[7] Donation follow-through is reported in Appendix Table A18.

two immediate actions captured whether participants added their support to a collective statement calling for increased funding for coral reef restoration and whether they chose to subscribe to RRF's newsletters. Finally, respondents completed post-task debrief questions assessing whether their responses reflected real-life choices, whether the information provided was sufficient and accurate, and whether they believed the survey findings would inform policymakers and conservation organisations. They were then given the option to consent to follow-up contact.

Participants who opted into follow-up were recontacted approximately one month later. The follow-up re-administered the psychological-distance and behavioural-intentions measures and collected self-reported conservation actions undertaken since the initial experiment, including information seeking, petition signing, donations, newsletter subscription, discussion of reef conservation, and volunteering.[8]

3.4 Empirical Strategy

This section presents the estimation strategy for each hypothesis in turn, covering treatment effects on the primary outcomes (Section 3.4.1), mediation through psychological distance (Section 3.4.2), heterogeneity and additional analyses (Section 3.4.3), and robustness and sensitivity analyses (Section 3.4.4). For confirmatory analyses involving multiple outcomes, Benjamini–Hochberg-adjusted p-values are reported alongside the original test results. Adjustments are based on the p-values from each hypothesis's main specification and are applied separately within the outcome families (Appendix Table A21). For H6, psychological distance and behavioural intentions are treated as distinct single-outcome families and are therefore reported without adjustment. H8 and H9 are exploratory and are not subject to multiple-testing adjustment.

Table 2 summarises the outcome measures, their respective scales, and the estimation methods used in the analysis.

Table 2. Summary of outcome measures and estimation methods

Outcome	Measurement / Scale	Estimation method
Panel A. Psychological distance		
Change in psychological distance	Post-treatment minus baseline; eight-item composite (1–7)	OLS
Panel B. Valuation outcomes		

[8] The full survey instruments, including exact question wording, branching logic and item randomisation, are reported in Appendix Section B.5 (baseline survey) and Appendix Section B.6 (follow-up survey).

Table 2 (continued)

Outcome	Measurement / Scale	Estimation method
Hypothetical WTP	Double-bounded binary bid responses (A$/month)	Log-logistic DBDC
Donation participation	Binary (0/1)	Probit
Donation amount conditional on donating	A$	OLS
Panel C. Behavioural outcomes		
Behavioural intentions	Five-item composite (1–7)	OLS
Funding support	Binary (0/1)	Probit
Newsletter subscription	Binary (0/1)	Probit
Panel D. One-month follow-up outcomes		
Psychological distance: absolute change	Absolute post-treatment-to-follow-up change	OLS
Psychological distance: directional change	Baseline-to-follow-up change	OLS
Behavioural intentions at follow-up	Five-item composite (1–7)	OLS
Unsolicited conservation actions	Count of six behaviours	Ordered probit

Note: The table summarises the outcome measures and their primary estimation methods. Donation participation and conditional donation amount form a two-part model. The directional psychological-distance follow-up measure was not pre-specified.

3.4.1 Treatment Effects

The primary analysis estimates intent-to-treat (ITT) effects of assignment to the VR condition. For continuous outcomes Y_i, the baseline estimating equation is

$$Y_i = \alpha + \beta\,\mathrm{VR}_i + X_i'\gamma + \varepsilon_i, \tag{1}$$

where VR_i equals one for participants assigned to VR and zero for those assigned to the text-and-image condition, and X_i denotes a vector of pre-treatment covariates. The coefficient β captures the ITT effect of assignment to VR. Binary outcomes are estimated using analogous probit specifications, as described below. We report three specifications for each outcome. Model 1 includes treatment assignment only. Model 2 adds a reduced set of socio-demographic controls comprising gender, age, education, and income. Model 3—used as the main specification for interpretation—adds reef-user status, together with the broader set of baseline covariates including reef familiarity, marine-biology background, environmental attitudes and behaviours, national identity, trust in the Great Barrier Reef

Marine Park Authority, and knowledge of reef degradation.[9]

One deviation from the preregistered analysis plan concerns missing income. As listwise deletion would have excluded 127 respondents from the covariate-adjusted specifications, missing income was imputed using an OLS regression based on age, gender, education, and Australian residency, consistent with approaches used in previous OECD stated-preference studies (Mourato et al., 2023; Contu et al., 2026). The resulting observed-and-imputed income measure was log-transformed and used in the covariate-adjusted analyses, with the five observations for which income could not be imputed excluded. Complete-case results reported as robustness checks in Appendix Section I.1.1.

The estimation approach varies with the scale and distribution of each outcome. Changes in psychological distance and the behavioural-intentions index are estimated using OLS. Funding support, newsletter subscription, and whether a participant makes a positive actual donation are estimated using probit models,

$$\Pr\left(Y_i = 1 \mid \mathrm{VR}_i, X_i\right) = \Phi\left(\alpha + \beta\,\mathrm{VR}_i + X_i'\gamma\right), \tag{2}$$

where $\Phi(\cdot)$ denotes the standard normal cumulative distribution function. Coefficients are on the probit-index scale. For the probit outcomes, the main treatment-effect results are reported as average marginal effects, which give the average change in the predicted probability of the outcome when assignment switches from text-and-image to VR. For actual donations, this participation model forms the first part of a two-part specification that accounts for the mass at zero. The second part estimates the amount donated conditional on a positive donation using OLS.

Hypothetical WTP is estimated using the DBDC responses of participants who expressed willingness to contribute in principle, either definitely or depending on the amount.[10] Building on the random-utility framework for dichotomous-choice contingent valuation (Hanemann, 1984), the model follows Hanemann et al. (1991) and is estimated by maximum likelihood under a log-logistic specification. The probability that respondent i accepts bid B_{ij} is then

$$\Pr\left(Y_{ij} = 1 \mid B_{ij}, \mathrm{VR}_i, X_i\right) = \Lambda\left(\alpha + \beta\,\mathrm{VR}_i + X_i'\gamma + \delta \ln B_{ij}\right), \tag{3}$$

where j indexes the bid question, $\Lambda(\cdot)$ denotes the logistic cumulative distribution function, and δ is the coefficient on the log bid. The two bid responses jointly provide an interval for each respondent's latent WTP. Let B_i denote the initial bid, with B_i^H and B_i^L denoting

[9] Full covariate definitions are reported in Appendix Section C.1.

[10] Assignment to VR did not significantly affect willingness to contribute in principle (48.1% in VR versus 50.1% in the text-and-image condition, $p = 0.612$).

the higher and lower follow-up bids, respectively. The four response patterns identify the following WTP intervals:

$$\text{WTP}_i \in \begin{cases} [B_i^H, \infty), & \text{Yes–Yes}, \\ [B_i, B_i^H), & \text{Yes–No}, \\ [B_i^L, B_i), & \text{No–Yes}, \\ [0, B_i^L), & \text{No–No}. \end{cases}$$

The joint probabilities of these response patterns define the likelihood function, and the fitted WTP distribution is used to derive conditional median and truncated mean WTP. Protest responses are excluded from the primary WTP specification.[11] To estimate unconditional mean WTP while incorporating genuine zero valuations, we additionally use a double-bounded spike model that treats respondents unwilling to contribute in principle as having zero WTP. For inference, OLS and probit models use HC1 heteroskedasticity-robust standard errors, whereas the DBDC models use the covariance matrix implied by the maximum-likelihood estimator.

3.4.2 Mediation Analysis

The primary mediator is the individual-level change in psychological distance from baseline to immediately after treatment,

$$\Delta PD_i = \text{PD}_{post,i} - \text{PD}_{0,i} \tag{4}$$

with negative values indicating a reduction in psychological distance. Baseline psychological distance, $\text{PD}_{0,i}$, is included as a pre-treatment covariate.

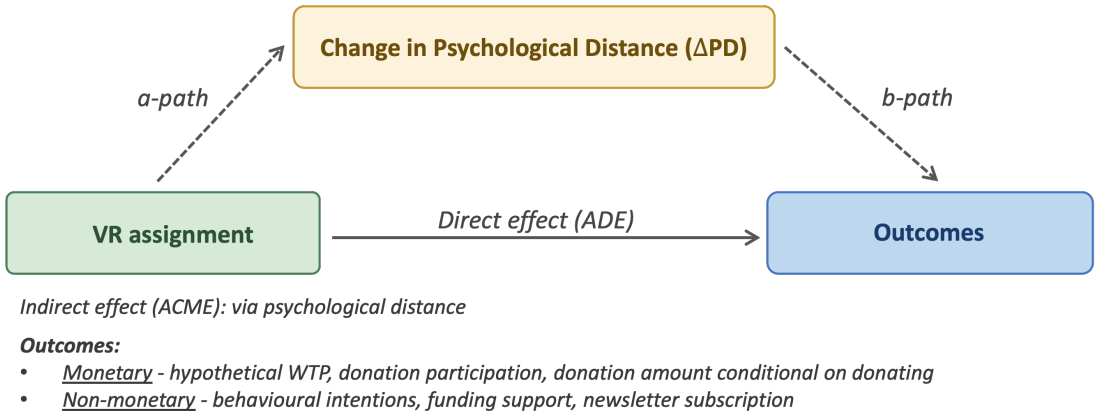


Figure 3. Mediation framework

[11] In total, 39 participants (4.7% of the full analytic sample) were classified as protest respondents. Reasons for zero WTP are tabulated in Appendix Table A17.

Following Imai et al. (2010), mediation effects are estimated using the following mediator model

$$\Delta \mathrm{PD}_i = \alpha_M + a\,\mathrm{VR}_i + \varphi_M \mathrm{PD}_{0,i} + \eta_M \mathrm{ReefUser}_i + X_i'\gamma_M + \varepsilon_{Mi}, \tag{5}$$

and the corresponding outcome model is

$$Y_i^* = \alpha_Y + c'\,\mathrm{VR}_i + b\,\Delta \mathrm{PD}_i + \varphi_Y \mathrm{PD}_{0,i} + \eta_Y \mathrm{ReefUser}_i + X_i'\gamma_Y + \varepsilon_{Yi}, \tag{6}$$

where $Y_i^* = Y_i$ for continuous outcomes and Y_i^* denotes the latent index for binary outcomes estimated by probit. For OLS and probit outcomes, the total treatment effect (Figure 3) is decomposed into the average causal mediation effect (ACME), capturing the indirect effect operating through psychological distance, and the average direct effect (ADE). Actual donation follows the same two-part structure as in the treatment-effect analysis, with donation participation estimated by probit and donation amount by OLS conditional on a positive donation. For donation amount, both the mediator and outcome models are estimated within the positive-donor subsample. As in the treatment-effect analysis, we report three pre-specified models with progressively broader sets of controls. Model A includes the reduced socio-demographic controls, reef-user status, and baseline psychological distance. Model B additionally includes the broader set of baseline familiarity, attitudinal, behavioural, and knowledge covariates and is used as the main specification for interpretation. Model C further adds household financial role, state of residence, and marital status.[12]

As the mediator is not randomly assigned, identification of the mediation effects relies on the sequential ignorability assumption. Random assignment identifies the effect of VR on psychological distance, while causal interpretation of the mediator–outcome relationship additionally requires that, conditional on treatment and the included pre-treatment covariates, there are no unobserved factors jointly affecting psychological distance and the outcome. Following Imai et al. (2010), sensitivity analysis assesses robustness to violations of this assumption using ρ, the assumed correlation between the mediator- and outcome-model error terms that captures potential unobserved confounding. The value of ρ at which the estimated ACME is reduced to approximately zero is reported, with larger absolute values indicating that a stronger departure from sequential ignorability would be required to eliminate the estimated indirect effect. As a robustness check, we additionally re-estimate the outcome model including a $\mathrm{VR}_i \times \Delta \mathrm{PD}_i$ interaction, allowing the association between psychological distance change and the outcome to differ by treatment assignment (List, 2026).

[12] For the OLS and probit mediation outcomes, inference uses 5,000 quasi-Bayesian simulations. Models A and B use HC1-robust covariance matrices, while Model C uses conventional model-based covariance because its additional controls create very small subgroups that make the robust covariance estimate unstable.

For hypothetical WTP, mediation is estimated among respondents willing to contribute in principle using a separate procedure to account for the interval-censored nature of the outcome. The indirect effect is estimated using the product-of-coefficients method, $a \times b$ (MacKinnon et al., 2002). The a-path is estimated by OLS and the b-path by Gaussian interval regression on the WTP bounds implied by the double-bounded responses, with both models estimated on the same WTP-eligible sample. Both paths are re-estimated in each of 5,000 bootstrap replications, and bias-corrected and accelerated (BCa) 95% confidence intervals are reported (Preacher and Hayes, 2008).[13]

3.4.3 Heterogeneity and Additional Analyses

Heterogeneity by prior reef experience is examined by adding an interaction between VR assignment and reef-user status to each of the outcome models described in Section 3.4.1,

$$Y_i = \alpha + \beta\,\mathrm{VR}_i + \eta\,\mathrm{ReefUser}_i + \lambda\,(\mathrm{VR}_i \times \mathrm{ReefUser}_i) + X_i'\gamma + \varepsilon_i, \tag{7}$$

where λ captures the interaction between VR assignment and prior reef experience Two preregistered specifications are reported. Model 6 includes the reduced socio-demographic controls together with reef-user status and the $\mathrm{VR}_i \times \mathrm{ReefUser}_i$ interaction, while Model 7 additionally includes the same broader set of baseline covariates as Model 3 and is used as the main specification for interpretation. Estimation otherwise follows the outcome-specific procedures described in Section 3.4.1, including the two-part specification for actual donations and the DBDC model for hypothetical WTP. For binary outcomes, interaction coefficients are reported on the probit-index scale, rather than as differences in marginal effects on the probability scale. We additionally examined whether the effect of VR on psychological-distance change differed by prior reef experience, using the same interaction specification in a non-pre-specified analysis.

To examine the potential persistence of treatment effects, we use data collected approximately one month after the initial experiment. For psychological distance, the pre-specified analysis uses the absolute difference between the immediate post-treatment and one-month scores. As this measure does not preserve the direction of change, we additionally assess psychological-distance change from baseline to the one-month follow-up to examine whether the between-condition difference remains detectable in a directional specification. Behavioural intentions are reassessed using the same composite measure as in the initial experiment. These outcomes are analysed using the same treatment-assignment and covariate structure as the main treatment-effect models and are restricted to participants

[13] For this mediation analysis only, the double-bounded responses are represented as WTP intervals, and the b-path is estimated using Gaussian interval regression to accommodate the zero-bounded intervals in this implementation. This mediation-specific specification differs from, and does not replace, the primary log-logistic DBDC specification in Section 3.4.1. The ρ-based sensitivity analysis used for the other mediation outcomes is not available for this manually estimated indirect effect.

who completed the follow-up survey.[14]

Unsolicited conservation behaviour undertaken between the initial experiment and follow-up is assessed using the six pre-specified conservation actions described in Section 3.3. Each behaviour is coded as binary indicator, and the indicators are summed into an overall count, which is treated as an ordered outcome and estimated using ordered probit. The primary specification uses the uncollapsed count. As a robustness check, the sparsely populated upper categories are pooled into a single 3+ category.

Two further analyses are exploratory. Emotional engagement is examined alongside psychological distance using the multiple-mediator framework of Imai and Yamamoto (2013). Psychological-distance change remains the focal mediator, while each measured emotion is entered separately as a second mediator. The analysis examines whether theindirect pathway through psychological distance remains when dependence between psychological distance and emotion is allowed; it does not identify a separate emotion-specific indirect effect. Sensitivity to violations of the homogeneous-interaction-effect assumption is assessed using the parameter σ, reporting the value at which the estimated ACME bounds first include zero (Imai and Yamamoto, 2013). The Model B covariate specification is used throughout.[15]

Finally, visual engagement within the VR condition is examined using head-gaze data. Head-gaze direction was recorded at approximately one-second intervals and mapped onto predefined, time-varying areas of interest corresponding to salient features within each scene, including healthy coral structures, marine species, degraded reef areas, and restoration activity. For each participant, the proportion of head-gaze observations falling within these areas of interest was calculated at the scene level and averaged across scenes to construct an overall visual-engagement measure. Outcome-specific models mirror the Model 1–3 structure used for the main treatment effects, with gaze engagement replacing VR assignment as the predictor of interest. Because gaze behaviour is not experimentally assigned, these estimates are interpreted as within-VR associations rather than causal effects.

3.4.4 Robustness and Sensitivity Analyses

A series of pre-specified and additional robustness checks assess sensitivity to alternative sample definitions, outcome constructions, and model specifications. For hypothetical WTP, we examine the inclusion of protest responses, a population-level spike specification,

[14] Follow-up opt-in rates were 45.6% in VR and 49.3% in the text-and-image condition ($p = 0.284$). Among opt-ins, completion rates were 23.1% and 30.3%, respectively ($p = 0.102$). Overall follow-up completion rates were 10.5% in VR and 14.9% in the text-and-image condition ($p = 0.056$).

[15] The multiple-mediator estimator uses a linear structural-equation framework, so binary outcomes are coded 0–1 and hypothetical WTP is approximated from the elicited interval for this exploratory analysis only. Primary specifications remain unchanged.

and alternative distributional assumptions. Other checks consider alternative constructions of behavioural intentions and psychological distance, different definitions of prior reef experience, additional covariate adjustments, as-treated estimates, alternative approaches to missing income, and the combined mediator–moderator specifications described in the preregistration. Full results are reported in Appendix Section I.

4 Results

4.1 Sample Characteristics, Balance, and Survey Checks

The final analytic sample comprised 837 participants, of whom 60.3% were reef users. Participants were on average 37 years old, 51.0% were female, and 89.8% were Australian residents. Among all participants, 62.4% held at least a bachelor's degree, while 46.3% of those reporting income had annual personal pre-tax income of at least A$65,000. Compared with Queensland and Australian adults, the sample has a similar gender composition but is younger, more highly educated, and has higher reported incomes (Appendix Table A11). Full demographic characteristics are reported in Appendix Table A10.

Baseline characteristics were broadly balanced across treatment conditions on the full set of 19 pre-treatment covariates (Appendix Table A12). Reef conservation behaviour was higher among participants assigned to VR ($p = 0.024$), while no other baseline covariate differed at the 5% level. As a manipulation check, participants assigned to VR reported substantially greater spatial presence than those assigned to the text-and-image condition ($d = 0.60$, $p < 0.001$), indicating that the manipulation successfully elicited the expected difference in spatial presence.

Responses to the post-survey debrief questions were also favourable and did not differ between conditions. Between 76% and 90% agreed that their survey responses reflected what they would do in real life, that the information provided was sufficient and accurate, and that the findings could inform policymakers and conservation organisations (Appendix Figure A6).

4.2 Immediate Effects of Immersive Representation

4.2.1 Psychological Distance

Within the first round of the survey, psychological distance decreased between baseline and post-treatment in both conditions, but the reduction was larger among participants assigned to VR. Mean psychological distance fell by 0.39 points in the VR condition, compared with 0.23 points in the text-and-image condition, representing a reduction approximately 70% larger. This pattern is also reflected in Table 3. In Model 3, assignment to VR produced

an additional 0.161-point reduction in psychological distance relative to the text-and-image condition ($p < 0.001$), equivalent to approximately 0.23 standard deviations of the change measure. The estimate is stable across specifications, providing support for H3. Effects on each of the four dimensions of psychological distance are reported in Appendix Table A23.

Table 3. Effects of VR on change in psychological distance (H3)

	(1)	**(2)**	**(3)**
VR	-0.165^{***}	-0.141^{***}	-0.161^{***}
	(0.047)	(0.048)	(0.047)
Demographic controls	No	Yes	Yes
Extended controls	No	No	Yes
Observations	837	826	826
R^2	0.014	0.020	0.064
Adjusted R^2	0.013	0.012	0.046

Note: The dependent variable is change in psychological distance (ΔPD) from baseline to post-treatment; negative values indicate a reduction in psychological distance. The VR coefficient reports the ITT effect of assignment to VR relative to the text-and-image condition. HC1 heteroskedasticity-robust standard errors are reported in parentheses. Demographic controls: gender, age, education, log(income). Extended controls: reef-user status, reef familiarity, marine biology background, environmental attitude, national identity, trust in GBRMPA, reef conservation behaviour, general pro-environmental behaviour, reef knowledge. Full regression estimates, including covariates, are reported in Table A22. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.2.2 Valuation and Behavioural Outcomes

In contrast to the reduction in psychological distance, none of the valuation outcomes is statistically significant after the multiple-testing adjustment. The estimated effect on hypothetical WTP is negative across all three specifications and becomes slightly more negative with the inclusion of additional baseline controls. In Model 3 (Table 4), the VR coefficient is -0.371 and significant at the 10% level, but does not survive the multiple-testing adjustment.[16] Retaining the 17 protest respondents in the DBDC sample did not alter the direction of the estimate and produced a somewhat larger negative VR coefficient that was significant at the 5% level (Appendix Table A16). Assignment to VR did not significantly affect the likelihood of real donations (Model 3 average marginal effect = 0.009, or 0.9 percentage points). Among positive donors, the estimated difference in donation amount was A$1.52 and was also not statistically significant. These results provide no evidence of systematic treatment effects on the monetary valuation outcomes

[16] Inference is somewhat sensitive to the covariance estimator, with alternative sandwich inference yielding slightly larger standard errors and no significance at the 10% level (Appendix Table A40, Panel E).

and thus do not support H1. Descriptive statistics for all outcomes by condition are reported in Appendix Table A13.

Table 4. Effects of VR on valuation and behavioural outcomes

Outcome	**(1)**	**(2)**	**(3)**	**BH** q	**N**
Valuation outcomes					
Hypothetical WTP	−0.293	−0.307	−0.371*	0.280	388
	(0.212)	(0.218)	(0.221)		
Donation participation	0.023	0.015	0.009	0.728	826
	(0.026)	(0.026)	(0.026)		
Donation amount | donating	3.676	1.415	1.523	0.573	144
	(2.304)	(1.831)	(1.736)		
Behavioural outcomes					
Behavioural intentions	0.236**	0.199**	0.089	0.280	826
	(0.100)	(0.099)	(0.083)		
Funding support	−0.037	−0.035	−0.044	0.280	826
	(0.034)	(0.034)	(0.034)		
Newsletter subscription	−0.025	−0.031	−0.042	0.280	826
	(0.030)	(0.030)	(0.029)		
Demographic controls	No	Yes	Yes		
Extended controls	No	No	Yes		

Note: Entries report the estimated effect of assignment to VR on each outcome. Hypothetical WTP is estimated using a log-logistic DBDC model, conditional on willingness to contribute in principle and excluding protest responses. Its coefficient reflects the log odds of bid acceptance, not a monetary change in WTP. Donation participation, funding support, and newsletter subscription are estimated using probit, with average marginal effects on the probability of the outcome reported (e.g., 0.023 represents 2.3 percentage points). Donation amounts conditional on donating and behavioural intentions are estimated using OLS. Standard errors are HC1 heteroskedasticity-robust, with delta-method standard errors for the probit average marginal effects; the DBDC model uses its maximum-likelihood covariance matrix. Sample sizes correspond to Model 3. BH q-values are based on the original Model 3 treatment-effect tests and adjusted separately within the valuation and behavioural outcome families. Covariate specifications are described in Section 3.4.1. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

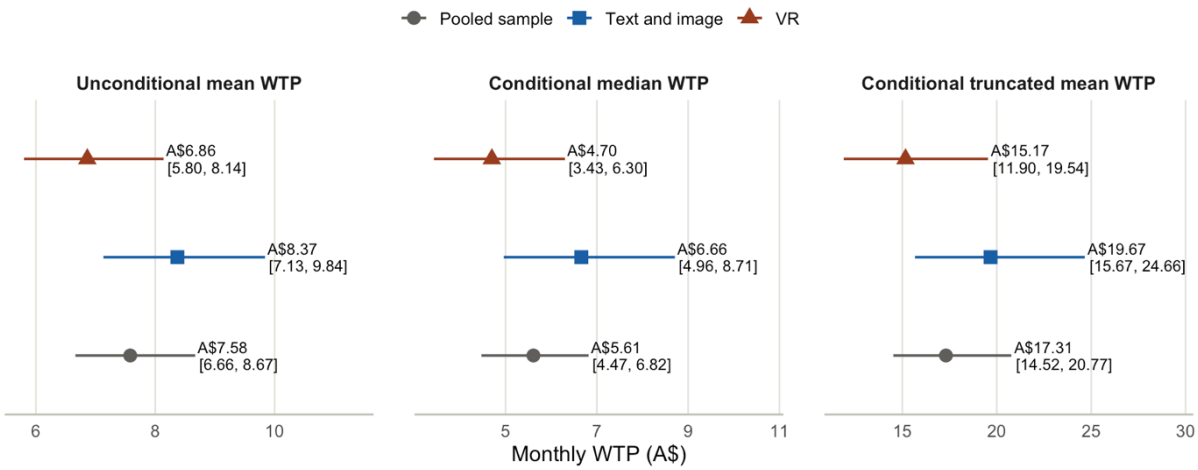


Figure 4. Implied WTP by treatment condition

Note: The unconditional mean incorporates genuine zero-WTP responses, including respondents unwilling to contribute in principle, excluding protest responses. Conditional median and truncated mean WTP are estimated among respondents willing to contribute in principle. The truncated mean limits the estimated WTP distribution at the maximum bid offered in the survey, avoiding extrapolation beyond the observed bid range. Brackets report 95% confidence intervals; Table A19 reports a robustness check averaging individual predicted WTP.

The model-implied WTP estimates further illustrate the magnitude of these differences. In Model 3, estimated unconditional mean monthly WTP is A$7.58 in the pooled sample, A$8.37 under the text-and-image condition, and A$6.86 in the VR condition (Figure 4).

Conditional median and truncated mean WTP likewise yield lower point estimates under VR than under text and images. Using Model 3, the estimated difference in unconditional mean WTP between VR and text-and-image was −A$1.51 per month (95% CI [−A$3.09, A$0.05]).[17] To illustrate the economic magnitude of these estimates, the pooled unconditional mean WTP of approximately A$7.58 per month corresponds to around A$91 per adult annually.[18]

Turning to the behavioural outcomes, assignment to VR increases behavioural intentions in Models 1 and 2, with estimated effects of 0.236 and 0.199, respectively, but the estimate falls to 0.089 and is no longer statistically significant in Model 3. Assignment to VR also has no statistically significant effect on funding support or newsletter subscription, with Model 3 average marginal effects of −4.4 and −4.2 percentage points, respectively. None of the behavioural outcomes remains statistically significant after the multiple-testing adjustment, therefore providing no support for H2.

Beyond the treatment effects, several baseline covariates show meaningful associations

[17] Confidence intervals are based on 5,000 Krinsky–Robb draws for the model-implied welfare measures, evaluated with covariates held at their sample means and expressed as VR minus text-and-image. Corresponding intervals for Models 1 and 2 are reported in Appendix Table A19.

[18] For an illustrative aggregation of WTP using demographic weights calibrated to the 2021 Australian Census, see Appendix Section D.4.

in theoretically expected directions (Appendix Table A15). Notably, higher income is associated with larger donation amounts among donors, while stronger environmental attitudes are positively associated with behavioural intentions, funding support, and newsletter subscription. Female respondents also exhibit higher behavioural intentions and a greater likelihood of newsletter subscription, while prior reef-conservation behaviour is positively associated with both outcomes.

4.3 Psychological Distance as a Mediating Pathway

Table 5 reports the primary Model B estimates of the indirect effects of VR through changes in psychological distance on behavioural and valuation outcomes.

Table 5. Indirect effects through psychological distance

Outcome	Indirect effect	95% CI	BH (q)	Sensitivity (ρ)	N
Panel A. Behavioural outcomes					
Behavioural intentions	0.045	[0.016, 0.083]	< 0.001	-0.15	826
Funding support	0.008	[< 0.001, 0.019]	0.042	-0.08	826
Newsletter subscription	0.008	[0.001, 0.018]	0.042	-0.10	826
Panel B. Valuation outcomes					
Donation participation	0.008	[0.001, 0.018]	0.065	-0.12	826
Donation amount | donating	0.482	[-0.305, 1.570]	0.351	—	144
Hypothetical WTP	-0.227	[-2.122, 0.543]	0.658	—	388

Note: Entries report indirect effects through changes in psychological distance from the primary Model B specification (covariates described in Section 3.4.2). For all outcomes except hypothetical WTP, estimates are average causal mediation effects (ACMEs), with 95% confidence intervals from 5,000 quasi-Bayesian simulations using HC1 robust covariance matrices. Hypothetical WTP uses the product-of-coefficients method with bootstrap BCa confidence intervals. Behavioural intentions are reported on the 1–7 composite scale; binary-outcome ACMEs are on the probability scale; donation amounts are in A$ among positive donors; and hypothetical WTP is in A$ per month. BH q-values are adjusted separately within the behavioural and valuation families. Sensitivity (ρ) denotes the assumed residual correlation between the mediator and outcome models at which the estimated ACME approaches zero; it is reported where the unadjusted 95% confidence interval excludes zero. Full ACME, ADE, and total-effect estimates for Models A–C are reported in Appendix Table A24.

The ACME is positive for behavioural intentions (0.045), funding support (0.008), and newsletter subscription (0.008). All three remain statistically significant after adjustment

for multiple testing within the behavioural-outcome family.[19] By contrast, donation participation exhibits a positive indirect effect (ACME = 0.008), but this does not survive adjustment for multiple testing. There is no evidence of an indirect effect on donation amounts conditional on donating or on hypothetical WTP. These mediation estimates rely on the sequential-ignorability assumption. Sensitivity analysis indicates that, in the primary specification, the behavioural-intentions ACME is reduced to approximately zero at $\rho = -0.15$, compared with $\rho = -0.08$ for funding support and $\rho = -0.10$ for newsletter subscription (see Appendix Figure A7). The results therefore provide evidence consistent with H4, with the clearest evidence of psychological-distance-mediated effects arising for behavioural rather than monetary outcomes.

4.4 Heterogeneity by Prior Reef Experience

We next examine whether the effects of VR differ according to participants' prior reef experience. Table 6 reports the VR × Reef User interaction from the primary Model 7 specification.

There is little evidence that prior reef experience systematically moderates the effects of VR. The interaction is not statistically significant for behavioural intentions or newsletter subscription. For funding support, the interaction is positive and marginally significant before adjustment for multiple testing, but does not survive adjustment within the behavioural-outcome family.

Table 6. Heterogeneity by prior reef experience

Outcome	VR × Reef User	*p*	BH (q)	N
Panel A. Behavioural outcomes				
Behavioural intentions	0.115	0.496	0.496	826
	(0.169)			
Funding support	0.318*	0.098	0.295	826
	(0.192)			
Newsletter subscription	0.146	0.480	0.496	826
	(0.207)			
Panel B. Valuation outcomes				

Continued on next page

[19] As a robustness check, the outcome models for behavioural intentions, funding support and newsletter subscription were re-estimated allowing a VR × ΔPD interaction. The interaction was not statistically significant in any specification ($p = 0.35$–0.87), and the estimated average indirect effects were substantively unchanged (Appendix Table A25).

Table 6 *(continued)*

Outcome	VR × Reef User	p	BH (q)	N
Donation participation	0.062	0.783	0.783	826
	(0.224)			
Donation amount | donating	2.659	0.497	0.745	144
	(3.901)			
Hypothetical WTP	0.663	0.144	0.431	388
	(0.453)			

Note: Entries report the VR × Reef User interaction coefficients, with standard errors in parentheses, from the primary Model 7 specification, including the pre-treatment covariates described in Section 3.4.3. Binary-outcome interactions are reported on the probit-index scale; corresponding differences in the VR treatment effect between reef users and non-users are 11.1 percentage points ($p = 0.104$) for funding support, 3.8 ($p = 0.519$) for newsletter subscription, and 1.5 ($p = 0.783$) for donation participation. Behavioural intentions and donation amounts are estimated by OLS; hypothetical WTP uses the DBDC model. BH q-values adjust the interaction tests separately within the behavioural and valuation families. Full Models 6–7 are reported in Appendix Table A26. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The same pattern holds for the valuation outcomes. The VR × Reef User interaction is not statistically significant for donation participation, donation amounts conditional on donating, or hypothetical WTP. The robustness analysis distinguishing the recency of prior reef experience yields the same qualitative conclusion, with joint tests of the VR × recency terms not statistically significant for any outcome (Appendix Table A27).[20] Overall, these results provide little support for H5, with no systematic evidence that the effect of VR on valuation or behavioural outcomes differs by prior reef experience.

Beyond these downstream outcomes, an additional non-pre-specified analysis examined heterogeneity in the more proximal psychological-distance response. The estimated reduction in psychological distance under VR was larger among non-users (−0.31 scale points) than among reef users (−0.06 scale points), with a VR × Reef User interaction of 0.247 in Model 7 (SE = 0.094, $p = 0.009$). Full estimates and alternative specifications are reported in Appendix Table A28.

4.5 Persistence and Downstream Behaviour

To assess whether treatment-related differences remain detectable approximately one month after the experiment, Figure 5 reports two specifications for psychological distance. The pre-specified specification uses the absolute post-treatment-to-follow-up change and finds no significant difference between conditions in the magnitude of drift. Because this measure

[20] The pre-specified combined mediator–moderator specifications (Models 8–10), which additionally include baseline and change in psychological distance, yield the same qualitative conclusion. Results are reported in Appendix Table A29.

does not capture the direction of change, we additionally examine psychological-distance change from the pre-treatment baseline to follow-up. In this non-pre-specified specification, participants assigned to VR show a greater reduction in psychological distance relative to baseline than those assigned to the text-and-image condition, with the Model 3 estimate statistically significant at the 5% level.

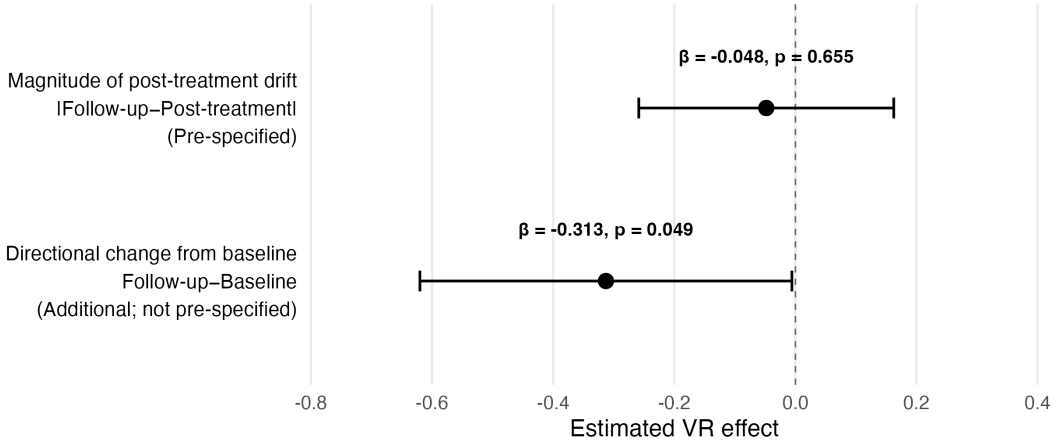


Figure 5. Effects of VR on psychological distance at one-month follow-up

Note: Points report Model 3 estimates of the effect of assignment to VR, with 95% confidence intervals based on HC1 heteroskedasticity-robust standard errors. The preregistered specification measures the absolute post-treatment-to-follow-up change; the additional specification measures directional change from baseline to follow-up. Negative coefficients indicate less absolute post-treatment drift under VR in the preregistered specification and a greater baseline-to-follow-up reduction in psychological distance under VR in the directional specification. The two coefficients represent different outcomes and are not directly comparable in magnitude. Reported p-values are unadjusted (Section 3.4).

In Model 3, behavioural intentions were also significantly higher among participants assigned to VR at follow-up (Table 7). Overall follow-up completion was lower under VR (10.5% versus 14.9%; unadjusted $p = 0.056$), although baseline patterns of selection into follow-up were generally similar across conditions (Appendix Tables A30 and A31).

Inverse-probability-of-response weighting based on observed baseline characteristics yields similar estimates for the directional psychological-distance and behavioural-intentions outcomes but with larger standard errors. Both Model 3 estimates remain significant at the 10% rather than the 5% level (Appendix Table A33). Taken together, these results provide suggestive evidence that treatment-related differences remain detectable approximately one month after the experiment, consistent with H6.

Among follow-up respondents, participants assigned to VR reported more unsolicited conservation actions during the month following the experiment (Table 7), providing evidence consistent with H7. Because the upper categories of the pre-specified action count (observed range 0–5) are sparsely populated, we additionally collapse counts of three or more actions into a single 3+ category. The result is similar under this alternative

specification (Appendix Table A34).[21]

Table 7. Effects of VR on psychological distance and conservation outcomes at one-month follow-up

Outcome	(1)	(2)	(3)	N
Persistence				
PD: Absolute post-treatment drift *(pre-specified)*	−0.061	−0.088	−0.048	105
	(0.096)	(0.101)	(0.107)	
PD: Change from baseline *(not pre-specified)*	−0.173	−0.190	−0.313**	105
	(0.157)	(0.155)	(0.157)	
Behavioural intentions at follow-up	0.579*	0.582*	0.541**	105
	(0.293)	(0.300)	(0.269)	
Subsequent conservation actions				
Unsolicited conservation action count (six behaviours)	0.595***	0.597***	0.708***	105
	(0.212)	(0.221)	(0.243)	
Demographic controls	No	Yes	Yes	
Extended controls	No	No	Yes	

Note: Entries report ITT effects among follow-up respondents. The pre-specified psychological-distance outcome is absolute change from post-treatment to follow-up; the additional directional measure is change from baseline to follow-up. Psychological-distance outcomes and behavioural intentions are estimated by OLS; the unsolicited conservation-action count (six behaviours; scale 0–5) is estimated by ordered probit. Its coefficient is on the latent-index scale; the corresponding Model 3 marginal effect is approximately 0.60 additional predicted actions under VR. Standard errors are HC1 robust for OLS and maximum-likelihood based for ordered probit. Model 3 uses $N = 105$. Reported p-values are unadjusted because H6 spans distinct psychological-distance and behavioural-intention families and H7 contains a single outcome. Full regression estimates, including covariates, are reported in Table A32. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.6 Exploratory Mechanisms and Additional Analyses

As an exploratory extension, we examine whether the psychological-distance-mediated pathway remains when emotional engagement is allowed to operate alongside it. Effects of VR on the individual emotion items are reported in Appendix Table A36. For behavioural intentions, the estimated indirect effect through psychological distance remains positive, with confidence intervals excluding zero in six of seven emotion specifications. When emotional connection—the emotion most strongly affected by VR—is included as the

[21] An additional exploratory analysis found that immediate behavioural intentions were positively associated with subsequent conservation actions. The positive VR coefficient remained statistically significant after adjusting for these intentions (Appendix Table A35).

alternative mediator, the estimated indirect effect through psychological distance is 0.030 (95% CI [0.001, 0.060]). The confidence interval includes zero only when concern is introduced as the alternative mediator. For funding support and newsletter subscription, by contrast, the corresponding confidence intervals include zero across all seven emotion specifications. The psychological-distance pathway therefore appears more robust to the inclusion of emotional engagement for behavioural intentions than for funding support or newsletter subscription. The valuation outcomes similarly provide no clear evidence of a psychological-distance-mediated pathway once emotion is introduced. Full results are reported in Appendix Table A37.

Finally, we examine visual engagement using head-gaze data within the VR condition. Given that gaze behaviour is not experimentally assigned, these estimates are interpreted as within-VR associations rather than causal effects. Gaze engagement is not systematically associated with the principal behavioural or valuation outcomes. Across specifications, the gaze-engagement coefficient is not statistically significant for behavioural intentions, funding support, newsletter subscription, donation participation, donation amount conditional on donating, or hypothetical WTP (Appendix Table A38).

5 Discussion

5.1 Main Findings

The findings reveal an important distinction between how environmental degradation is psychologically represented and how the protection of the affected environmental good is subsequently valued and acted upon. Immersive VR generated a stronger sense of presence and reduced psychological distance to Great Barrier Reef degradation relative to conventional text-and-image presentation. Under the assumptions required for causal mediation, the analysis is consistent with positive indirect effects through reduced psychological distance on conservation-oriented behavioural intentions and actionable non-monetary engagement outcomes, including support for conservation funding and newsletter subscription. These estimates were sensitive to modest violations of the sequential-ignorability assumption. Importantly, these mediated effects coexist with an absence of robust overall immediate treatment effects on the behavioural outcomes. By contrast, neither hypothetical willingness to pay nor actual donations show robust indirect effects through psychological distance, and neither outcome exhibits a robust overall immediate treatment effect.

Perhaps more strikingly, the follow-up results suggest that the influence of immersive representation may extend beyond the immediate experimental encounter. Approximately one month later, respondents assigned to VR exhibited greater baseline-to-follow-up reductions

in psychological distance and stronger behavioural intentions, while also reporting more conservation actions undertaken since the initial experiment than those assigned to text and images. The convergence of these findings across perceptions, intentions, and subsequent actions is particularly noteworthy given the absence of robust immediate treatment effects on monetary valuation and behavioural outcomes. For conservation organisations and policymakers, these findings suggest that evaluating immersive communication solely through immediate donations or stated willingness to pay may overlook its potential to foster conservation engagement beyond the initial encounter.

5.2 Implications for Stated Preference Valuation

The contrast between VR's effects on psychological engagement and its lack of robust effects on monetary valuation is particularly informative for stated preference valuation because the greater presence and psychological proximity generated by VR were not accompanied by a systematic upward shift in monetary responses. This null pattern matters because one concern with immersive presentation is that its vividness and emotional engagement could artificially raise elicited values through affective responses or other potential mechanisms, such as warm-glow motives or heightened moral salience, rather than through changes in the underlying valuation of the environmental good. Existing evidence on whether immersive VR systematically increases actual giving is mixed (Nelson et al., 2020; Sooter and Ugazio, 2023; Banerjee and Ferreira, 2024). More broadly, longstanding debates in contingent valuation have highlighted the possibility that stated values may reflect framing, embedding, or moral satisfaction associated with contributing (Kahneman and Knetsch, 1992), although experimental evidence suggests that incidental emotional states need not systematically affect environmental WTP (Hanley et al., 2017; Xu et al., 2025). Against this background, the estimated effect of VR on hypothetical WTP, if anything, ran in the opposite direction, although neither this nor the corresponding donation-amount estimate is statistically distinguishable from zero after adjustment for multiple testing. Even at the upper end of the 95% confidence interval for the spike-model estimate, the implied increase in unconditional mean WTP under VR is less than 1% relative to text-and-image.

For stated preference applications, VR offers a means of bringing more of the environmental setting into the valuation task. It does not reproduce direct experience, but it can convey spatial, visual, and contextual features of the good that conventional description may leave respondents to infer. In this sense, VR functions as a representational tool, enriching the informational and perceptual cues on which preferences are constructed, without evidence that it systematically increases elicited monetary values. This is not to say that richer representation is without consequence. The mediation results are consistent with a positive pathway through reduced psychological distance to conservation-oriented behavioural responses, even in the absence of a robust change in monetary valuation. The

value of richer representation may therefore lie less in raising elicited values than in giving respondents a fuller basis on which to form their judgement of the good being valued.

In addition to estimating the effect of VR on stated preferences and behaviours, the survey provides direct evidence of the economic magnitude of stated valuations for reef conservation. Aggregating the Census-weighted mean of individual predicted WTP over the ten-year horizon of our valuation scenario yields an illustrative present value of approximately A$15.2 billion at a 2% social discount rate (Appendix Section D.4.1). This estimate may understate the broader economic value of reef conservation for several reasons. First, the aggregation is based on the Australian adult population at the time of the 2021 Census and does not account for future population growth or demographic changes. Second, the Great Barrier Reef's recognition as a UNESCO World Heritage Site reflects its international significance, suggesting that non-use values may also be held by populations outside Australia that are not captured in the aggregation. Third, the ten-year valuation horizon may exclude conservation benefits extending beyond the period considered, given the considerably longer lifespan of the reef ecosystem. Differences in valuation scenarios, time horizons and sampling approaches preclude a direct welfare comparison with the A$39 billion non-use valuation over 26 years reported by Deloitte Access Economics (2025).

5.3 Psychological Proximity and Decision Margins

VR reduced psychological distance, with positive estimated indirect effects on behavioural intentions, funding support, and newsletter subscription, but no robust corresponding effects on monetary outcomes after adjustment for multiple testing. One possible explanation lies in the different commitments these responses entail. Greater proximity may increase the personal relevance of reef protection, which can be expressed through conservation-oriented intentions or support without an immediate financial payment.

Monetary valuation, by contrast, requires respondents to weigh a specific financial contribution against their own budget, with actual donations requiring them to incur that cost. This split maps onto the two pathways implied by CLT. The outcomes for which a mediated effect emerges each require no direct financial trade-off, whereas monetary valuation is precisely where having to weigh a financial contribution could bring competing considerations into sharper focus (Brügger et al., 2015). Neither channel, however, is measured directly in the present design. Making reef degradation feel closer may therefore strengthen certain forms of conservation-oriented engagement without necessarily increasing willingness to contribute financially. In this respect, the present study extends prior evidence on outcome-dependent effects of psychological distance (Vlasceanu et al., 2024) to an immersive environmental valuation setting, where a comparable pattern across lower-commitment and more demanding outcomes emerges within a single design.

Whether immersive representation changes psychological proximity may also depend on respondents' prior experience of the environmental good. Those who have previously experienced coral reefs may already hold more concrete representations of the environment, leaving less scope for VR to reduce psychological distance. Consistent with this possibility, an additional, non-pre-specified analysis showed a larger VR-induced reduction in psychological distance among respondents without prior reef experience than among reef users. However, this difference in psychological response was not accompanied by detectable heterogeneity in valuation or behavioural outcomes. One possibility is that neither the binary reef-user classification nor the recency-based measure fully captures the nature and extent of respondents' prior reef experience, which may differ in frequency, location, and ecological conditions encountered. Nevertheless, the downstream interaction estimates were imprecise, making small between-group differences difficult to detect.

5.4 Persistence and Subsequent Conservation Behaviours

The follow-up findings suggest that VR's influence may extend beyond the initial encounter. Approximately one month later, respondents assigned to VR exhibited greater baseline-to-follow-up reductions in psychological distance, alongside stronger behavioural intentions and a greater number of reported conservation actions than those assigned to the text-and-images condition.

The contrast between immediate and follow-up behavioural outcomes may partly reflect the different behavioural margins and time horizons captured by these measures. Behavioural intentions were elicited both immediately after treatment and at follow-up, whereas the follow-up survey additionally recorded conservation actions undertaken during the month following the initial experiment. An exploratory analysis suggests some consistency between immediate intentions and subsequent engagement, with stronger intentions associated with more reported conservation actions. At the same time, the greater number of conservation actions reported by VR participants remained evident after adjusting for these intentions (Appendix Table A35), suggesting that immediate stated intentions alone do not fully account for the differences in engagement observed one month later.

One possibility, consistent with evidence that events experienced in immersive VR can remain retrievable approximately one month later (Lenormand et al., 2024), is that participants retained a vivid and personally meaningful memory of virtually experiencing reef degradation, even without a robust immediate effect on stated intentions. Complementing this evidence, immersive VR experiences may also engage autobiographical memory-retrieval processes resembling those involved in recalling personally experienced events, potentially facilitating more direct and less effortful retrieval (Kisker et al., 2021). Such accessibility could have helped sustain the salience of reef degradation over time,

encouraging participants to seek further information, discuss conservation, or undertake other conservation-related actions. The greater emotional connection and hopefulness reported by VR participants in the immediate survey (Appendix Table A36) may also have contributed to subsequent engagement. These interpretations, however, remain speculative, as neither memory accessibility nor respondents reasons for subsequent actions were directly measured. The small, self-selected follow-up sample, differential completion rates, and reliance on self-reported actions further limit the strength of the follow-up evidence.

5.5 Limitations

Several limitations qualify these findings. The mediation results rest on the sequential-ignorability assumption. Random assignment identifies the effect of VR on psychological distance, but the association between changes in psychological distance and outcomes is not experimentally identified and could be confounded by unobserved factors. Sensitivity analyses indicate that the indirect effects for behavioural intentions, funding support, and newsletter subscription would be reduced to approximately zero under modest assumed correlations between the mediator and outcome errors, particularly for funding support and newsletter subscription. These pathways are therefore best interpreted as suggestive evidence of a mediated pathway rather than robust causal evidence.

VR is also a bundle of features, including presence, a first-person perspective, audio, and immersive visual presentation, and psychological distance was measured rather than independently manipulated. Exploratory multiple-mediator analyses provide some reassurance that the psychological-distance pathway is not simply subsumed by measured emotional responses. For behavioural intentions, the indirect effect through psychological distance remained positive and statistically distinguishable from zero across six of seven specifications that additionally incorporated individual emotions as alternative mediators. These analyses do not, however, isolate psychological distance as the sole mechanism or rule out parallel pathways through other features of the immersive experience.

A related question is whether the effects of VR partly reflect novelty. Within the VR condition, prior VR experience was associated with a smaller reduction in psychological distance in less-adjusted specifications, although this association attenuated in the fully adjusted model. Valuation and behavioural outcomes showed no consistent association with prior VR experience (Appendix Table A39). Moreover, the treatment-related differences at follow-up are less consistent with a purely short-lived novelty response, although the design cannot separately identify novelty effects. In addition, the text-and-image condition was self-paced, whereas VR exposure was fixed at five minutes, so the comparison reflects two realistic delivery formats rather than tightly matched exposure times. This choice

better reflects how the two formats would typically be experienced in field applications, but limits the ability to separate the effect of immersive presentation from exposure duration. Exposure times in the text-and-image condition are reported in Appendix Table A47.

The null results should also be read alongside the study's statistical precision. At 80% power, the minimum detectable effects for continuous outcomes ranged from 0.16 to 0.34 standard deviations, providing reasonable power to detect moderate effects for these outcomes while leaving smaller effects difficult to detect (Appendix Table A14). For hypothetical WTP, the upper bound of the 95% confidence interval for the spike-model difference in unconditional mean WTP (Section 4.2.2) is just A$0.05 per month, providing little support for a substantial upward shift under VR, although the same interval remains compatible with sizeable reductions. Precision varied across the remaining outcomes, particularly for analyses based on smaller subsamples such as positive donors and follow-up respondents.

Finally, conducting the experiment in a real-world public setting strengthens the ecological validity of the treatment comparison, although recruitment from a single shopping centre in Brisbane means that the sample was not designed to be representative of the wider population. The visible VR equipment may also have influenced willingness to participate, and extrapolation to other populations, settings, or environmental goods therefore warrants caution.

6 Conclusion

This paper examines how immersive representation shapes stated-preference environmental valuation. In a large field experiment on Great Barrier Reef conservation, immersive VR reduced psychological distance to coral-reef degradation relative to text-and-image presentation, but we found no statistically robust effects on hypothetical willingness to pay or actual donations. Under the sequential-ignorability assumptions required for causal mediation, the results are consistent with positive indirect pathways through reduced psychological distance for behavioural intentions, support for a funding statement, and newsletter subscription, while overall immediate treatment effects on behavioural outcomes were not robust to multiple-testing adjustment. The central finding is therefore a dissociation between psychological representation and immediate valuation and behavioural responses. This suggests that richer, more immersive representations can change how an environmental problem is experienced without necessarily increasing elicited values or producing broad immediate behavioural change. Evidence from the one-month follow-up further suggests that VR's influence may extend beyond the initial encounter, with greater baseline-to-follow-up reductions in psychological distance in a non-pre-specified analysis, stronger behavioural intentions at follow-up, and more reported conservation actions

among VR participants.

The results make three contributions. First, they provide the first field experimental evidence on the use of immersive VR in environmental stated-preference valuation, incorporating both hypothetical willingness-to-pay decisions and real donations. Second, they show that immersive presentation did not systematically shift willingness to pay upward, addressing concerns that vivid or emotionally engaging formats may inflate stated values through affective or moral-satisfaction channels. Third, they suggest that the behavioural relevance of reduced psychological distance depends on the outcome, with evidence of indirect pathways for some forms of non-monetary engagement but no robust evidence of corresponding pathways for monetary valuation or actual donations.

For stated-preference practice, the value of immersive representation may therefore lie less in changing the level of elicited values than in broadening the informational basis on which respondents form judgements about the good being valued. For conservation and environmental communication, the findings suggest that changes in psychological proximity may have greater relevance for some forms of engagement than for monetary contributions, while the exploratory follow-up evidence highlights the potential importance of examining conservation behaviour beyond the immediate experimental encounter. More broadly, the findings highlight the importance of distinguishing how environmental goods are represented, how they are valued, and how people act on those representations.

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Appendix

The appendix follows the order of the main text. It begins with the preregistration and study materials, then the sample and its description, and then the additional results for each section of the analysis.

A Preregistration and Deviations

Table A1. Deviations from the preregistered analysis plan

Item	Preregistered plan	What was done	Where
1. Post-hoc exclusions	No exclusion based on survey completion speed was specified.	22 respondents completing the survey in less than half the condition-specific median completion time were excluded as speeders. One additional response was excluded after being identified as having been completed by a third party.	Main text; Table A9
2. Missing income	Covariates with missing values are handled by listwise deletion.	Income was missing for 127 respondents ("prefer not to say"), 15% of the sample, and was imputed by OLS from age, gender, education and Australian residency, then log-transformed. Complete-case results are reported for comparison.	Main text; Table A41
3. Psychological distance at follow-up	The pre-specified follow-up outcome was the absolute difference between post-treatment and follow-up psychological distance.	The pre-specified absolute-change outcome is reported. A directional change from baseline to follow-up was additionally analysed and is labelled as non-pre-specified.	Main text; Tables 7 and A33
4. Psychological-distance heterogeneity	Moderation by reef-user status was specified for the valuation and behavioural outcomes (H5).	The VR × reef-user interaction was additionally estimated for the change in psychological distance as a non-pre-specified analysis.	Main text; Table A28

Continued on next page

Table A1 *(continued)*

Item	Preregistered plan	What was done	Where
5. Preregistered outcomes not reported	A hypothetical 1% donation among respondents unwilling to pay, and willingness to contribute time (ordinal).	These outcomes were estimated as preregistered but are not reported in the paper; estimates remain available in the analysis code.	Analysis code

Note: The preregistration is available on the Open Science Framework (see the main text). The table reports departures from the confirmatory preregistered analysis plan and preregistered outcomes not reported in the paper. Exploratory analyses and additional robustness checks are labelled as such where reported and are not listed here. Participant counts follow Table A9.

B Study Materials

B.1 Treatment Materials

Film production. Vincent Chung (lead author) recorded the 360° footage in January 2026 at Norman Reef and Fitzroy Island, using an Insta360 X5 camera at 8K resolution. At Fitzroy Island, the Resilient Reefs Foundation (RRF) provided access to its coral nursery and demonstrated how the corals are cleaned and the nursery maintained, which forms the final scene of the film. The same author wrote and voiced the narration. An ecologist reviewed the script and the recorded narration, and RRF checked that the descriptions were accurate. RRF had no role in the design of the study, in the content of the narration beyond these accuracy checks, or in the outcome measures.

Narration. Table A2 reports the narration script by scene. Scene numbers and time windows follow Table A5, and the final column gives the page of the text-and-image condition that carried the corresponding content.

Figures A1 and A2 show the four pages of the text-and-image condition, and Figure A3 shows a still from the VR footage.

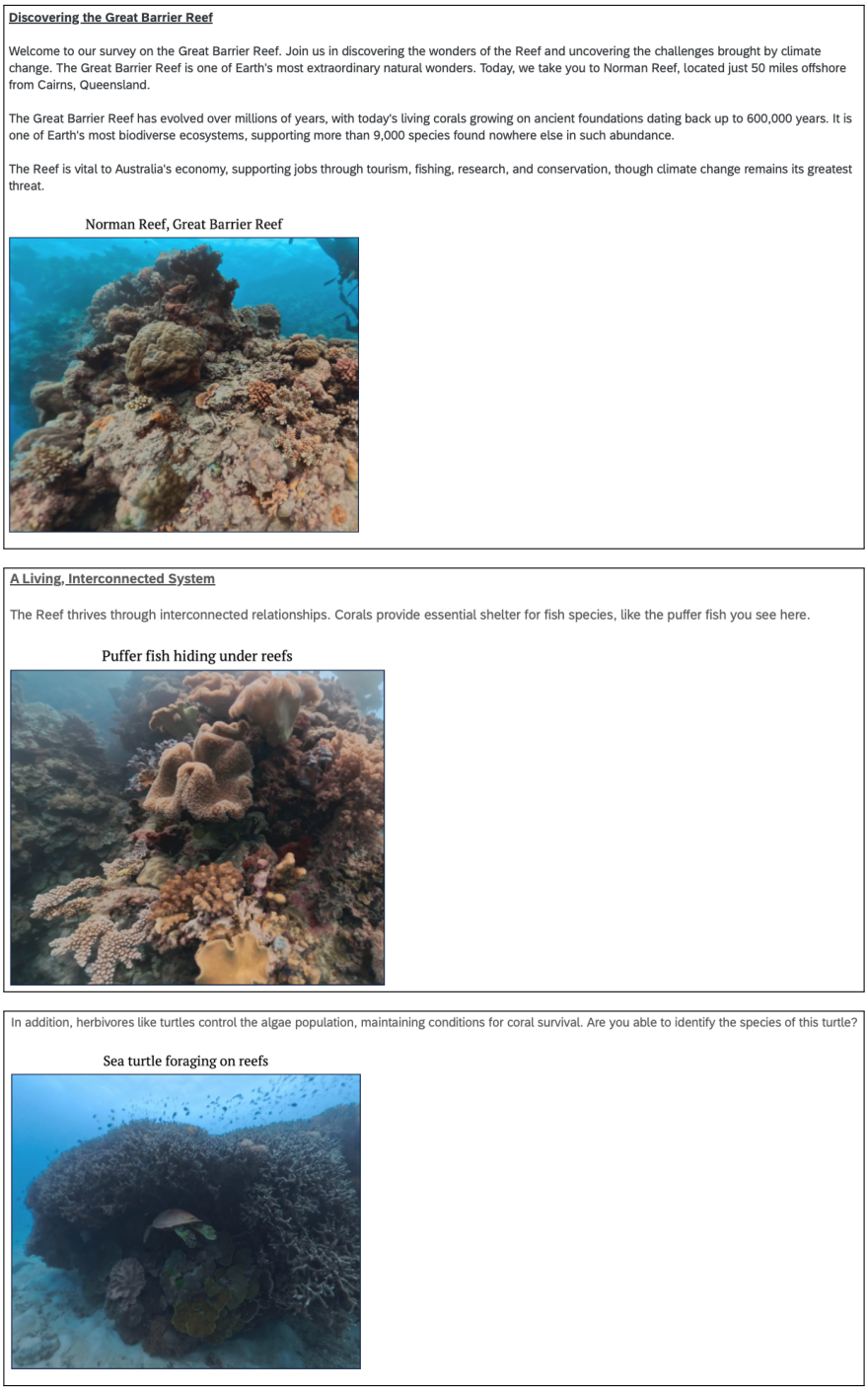


Figure A1. Text-and-image treatment materials, pages 1 and 2

Note: The text-and-image condition consisted of four self-paced pages. Each page combined still images extracted from the VR footage with written narration corresponding to the audio of the immersive experience. The first panel is page 1 ("Discovering the Great Barrier Reef"). The second and third panels are two screenshots of page 2 ("A Living, Interconnected System").

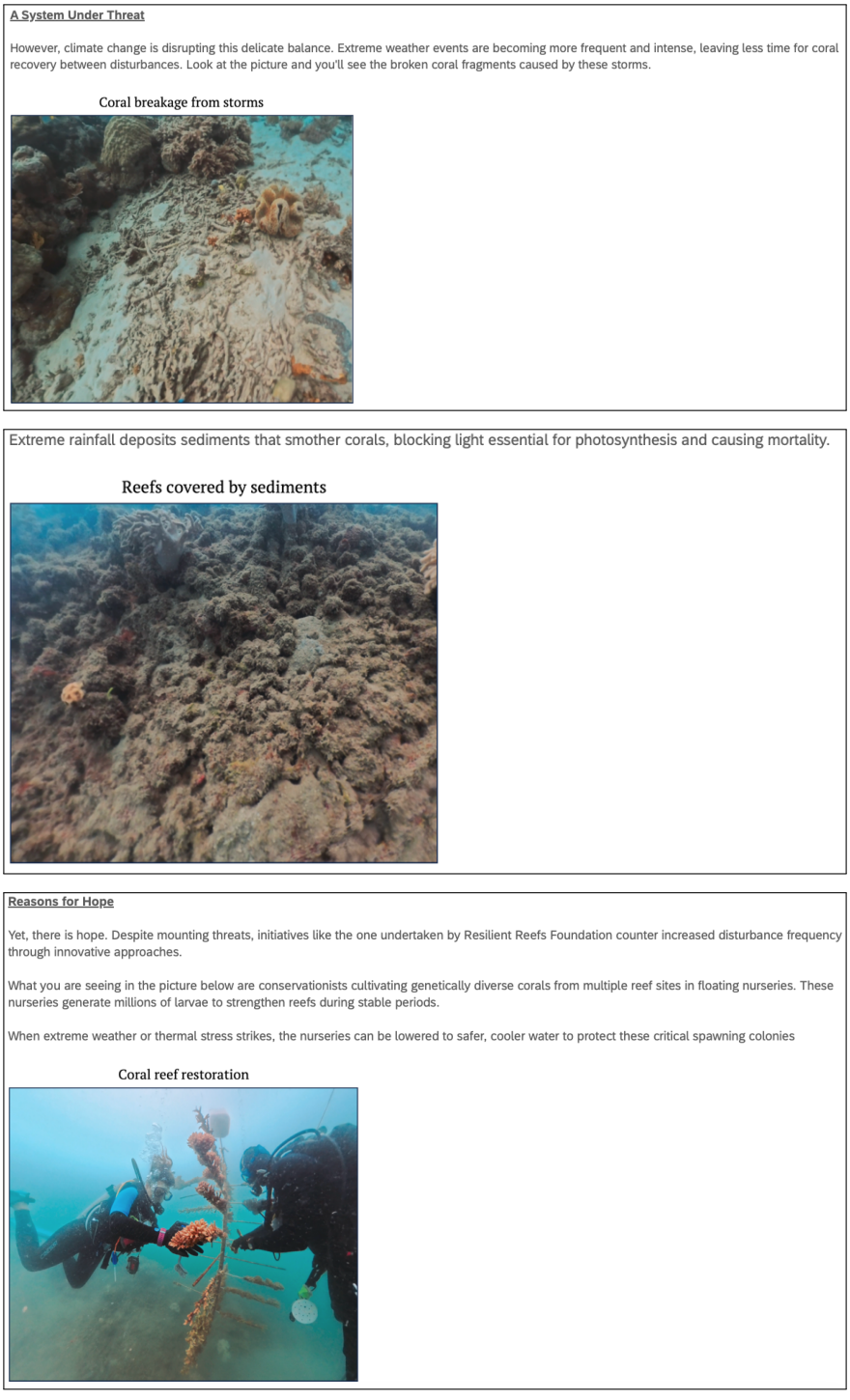


Figure A2. Text-and-image treatment materials, pages 3 and 4

Note: The first and second panels are two screenshots of page 3 ("A System Under Threat"), and the third panel is page 4 ("Reasons for Hope").



Figure A3. Screenshot from the VR footage (restoration scene)

Note: The scene shows Resilient Reefs Foundation divers attending a floating coral nursery, which concluded the VR experience.

Table A2. Narration script by scene

Scene	Time	Narration	Text page
2	0:30–0:54	Welcome to the Great Barrier Reef Virtual Reality Experience. Join us in discovering the wonders of the Reef and uncovering the challenges brought by climate change. Please remain seated throughout the experience, and don't forget—you can look in every direction.	1
3	0:55–1:10	Today we will be exploring the Norman Reef, located just 50 miles offshore from Cairns.	1
4	1:11–1:29	The Great Barrier Reef has evolved over millions of years, with today's living corals growing on ancient foundations dating back up to 600,000 years.	1
5	1:30–1:50	It is one of Earth's most biodiverse ecosystems, supporting more than 9,000 species found nowhere else in such abundance.	1
6	1:51–2:04	The Reef is vital to Australia's economy, supporting jobs through tourism, fishing, research, and conservation, though climate change remains its greatest threat.	1

Scene	Time	Narration	Text page
7	2:05–2:18	The Reef thrives through interconnected relationships. Corals provide essential shelter for fish species, like the puffer fish you see here.	2
8	2:19–2:42	In addition, herbivores like turtles control the algae population, maintaining conditions for coral survival. Are you able to identify the species of this turtle?	2
9	2:43–3:05	However, climate change is disrupting this delicate balance. Extreme weather events are becoming more frequent and intense, leaving less time for coral recovery between disturbances. Look down and you'll see the broken coral fragments caused by these storms.	3
10	3:06–3:26	Extreme rainfall deposits sediments that smother corals, blocking light essential for photosynthesis and causing mortality.	3
11	3:27–4:13	Yet, there is hope. Despite mounting threats, initiatives like the one undertaken by Resilient Reefs Foundation counter increased disturbance frequency through innovative approaches. What you are seeing are conservationists cultivating genetically diverse corals from multiple reef sites in floating nurseries. These nurseries generate millions of larvae to strengthen reefs during stable periods. When extreme weather or thermal stress strikes, the nurseries can be lowered to safer, cooler water to protect these critical spawning colonies.	4
12	4:14–4:30	Thank you for joining us on the Great Barrier Reef VR experience with us today. Please remove your headset and continue with the survey.	—

Note: Scene 1 (familiarisation clip of a residential area in London) had no narration. Phrases that refer to the headset or to looking around in the VR experience ("you can look in every direction", "Look down and you'll see", "Please remove your headset") were omitted in the text-and-image condition.

B.2 Valuation Scenario and Cheap-Talk Wording

Table A6 reports the full questionnaire. This subsection reports the valuation wording in full. All respondents saw the information passage first, followed by the actual donation and hypothetical valuation tasks in randomised order (Section B.5).

Information passage shown before both valuation tasks.

The Great Barrier Reef is one of the world's largest and most biodiverse coral reef systems. In recent decades, it has experienced significant decline. Before the 1990s, mass coral bleaching events were relatively rare. Since 2016, multiple mass bleaching events have occurred, including a widespread event in 2024 that affected reefs across all three regions of the Great Barrier Reef. This event had the largest spatial footprint ever recorded.

These events, along with cyclones, pollution, and crown-of-thorns starfish outbreaks, have contributed to reductions in coral cover across the Reef. One approach to supporting reef recovery involves coral restoration and conservation efforts, such as floating nurseries that cultivate corals and produce larvae during spawning events.

While these efforts cannot fully offset the effects of climate change, they are intended to support reef recovery and resilience. However, without additional funding, these efforts would remain limited in scale.

Hypothetical scenario and in-principle question.

Now consider the following **hypothetical scenario**.

Suppose that expanding coral conservation efforts, in addition to ongoing efforts by the government, could contribute to limiting further decline and maintain the reef at approximately its current condition over the next 10 years, and that the Australian Government could collect donations and ensure that these efforts are maximised in impact.

Considering your own financial situation, would you be willing, **in principle**, to contribute to supporting the Reef through a regular contribution?

Yes, definitely / Yes, but it depends on how much / No

Cheap-talk script and budget reminder. Shown to respondents who did not answer "No" to the in-principle question, immediately before the first bid.

Before the next question, please consider in surveys like this, people often say they would pay more than they actually would in real life.

Please don't agree to pay an amount if you cannot afford to pay it, or if you feel that there are more important things to spend your money on. Try to think about where any additional money might come from and if your budget allows the expense.

Double-bounded bid questions. The bid amounts are those in Table A3. The second question was shown after the first, with the higher bid following a "Yes" and the lower bid following a "No".

Would you be willing to pay an extra $[bid] per month (equivalent to $[annual bid] per year) to support the restoration of the Great Barrier Reef?

Yes / No

Follow-up questions on reasons.

Respondents who accepted at least one bid (select all that apply): Which of the following best describe your reasons for contributing? I visit or plan to visit the reefs personally; I want coral reefs to exist even if I never visit them; I want coral reefs preserved for future generations; I want others to be able to experience coral reefs; It is the right thing to do to protect the natural environment; Others (please specify).

Respondents who answered "No" to the in-principle question or rejected both bids (select all that apply): Which of the following best describe your reasons for not contributing? I cannot afford to contribute right now; I have other charitable priorities; I object to being asked to pay for something that should be publicly funded; I don't think coral reef conservation is a priority for me; I feel that individual contributions make little difference; Others (please specify).

Respondents who objected to public funding, or who answered "No" to the in-principle question or rejected both bids: Even if you chose not to make a financial contribution earlier, would you be willing to contribute 1% of your household income every month to help prevent reef degradation, if everyone else in Australia also contributed 1% of their income? *Yes / No*

Actual donation task.

We would now like to give you a **real opportunity** to support reef conservation.

As presented earlier, the Resilient Reefs Foundation works to restore coral reefs through initiatives such as floating coral nurseries and depends on public donations.

You may choose to make a **voluntary, one-time donation** to the Foundation.

Please consider carefully before selecting an amount — the amount you select represents a **real financial commitment.**

Please think about your current financial situation and choose an amount you would genuinely follow through on.

If you choose to donate, selecting an amount below will not charge you immediately. At the end of the survey, you will be provided with a secure link where you can complete your donation. You are under no obligation to donate.

How much would you like to donate (in AUD) to the Resilient Reefs Foundation?

A$0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, 20, 25, 30, or "More than 30" with an open text box.

B.3 Double-Bounded Bid Structure and Acceptance

Table A3 reports the initial, higher and lower follow-up bids. Each respondent was randomly assigned to one of five bid groups. Table A4 reports how respondents answered the bid questions in each group.

Table A3. Double-bounded dichotomous-choice bid structure (A$)

	Initial bid		Higher follow-up		Lower follow-up	
Bid group	Monthly	Annual	Monthly	Annual	Monthly	Annual
1	5	60	10	120	1	12
2	10	120	25	300	5	60
3	25	300	50	600	10	120
4	50	600	100	1,200	25	300
5	100	1,200	150	1,800	50	600

Note: The higher follow-up bid was shown after a "yes" to the initial bid and the lower follow-up bid after a "no". Annual amounts were displayed alongside the monthly amounts.

Table A4. Acceptance of the double-bounded bids by bid group

	Initial bid		Accepted	Response pattern (%)			
Bid group	(A$ per month)	N	initial bid (%)	Yes–yes	Yes–no	No–yes	No–no
1	5	82	36.6	15.9	20.7	35.4	28.0
2	10	74	29.7	6.8	23.0	17.6	52.7
3	25	73	12.3	1.4	11.0	34.2	53.4
4	50	72	12.5	1.4	11.1	26.4	61.1
5	100	87	6.9	2.3	4.6	14.9	78.2
All	–	388	19.6	5.7	13.9	25.5	54.9

Note: The sample is the primary DBDC estimation sample ($N = 388$): respondents willing to contribute in principle, excluding protest responses and observations with incomplete covariates. Response patterns list the answer to the initial bid followed by the follow-up bid; for example, "yes–no" denotes acceptance of the initial bid and rejection of the higher follow-up bid. Percentages are within bid group.

B.4 Head-Gaze Areas of Interest

Figure A4 shows the head-gaze heatmap on the 360° footage, and Figure A5 shows an example of an area of interest defined in the Unity application.

Table A5. Head-gaze areas of interest by scene

Scene	Content	Time window	Seconds	Area of interest
1	Familiarisation (London residential area)	0:00–0:30	30	–
2	Underwater familiarisation, with narration encouraging participants to look around	0:30–0:54	24	–
3	Coral infrastructure 1	0:55–1:10	15	Main coral area (not the divers)
4	Coral infrastructure 2	1:11–1:29	18	Main coral area (not the divers)
5	Coral infrastructure 3	1:30–1:50	20	Main coral area (not the divers)
6	Coral diversity (hard and soft corals)	1:51–2:04	13	Main coral area (not the divers)
7	Interdependency: puffer fish	2:05–2:18	13	Main corals and puffer fish
8	Interdependency: turtle	2:19–2:42	23	Sea turtle and surrounding corals
9	Broken corals	2:43–3:05	22	Broken corals on the seabed
10	Heavily sedimented corals	3:06–3:26	20	Sedimented corals (not the divers)
11	Coral restoration	3:27–4:13	46	General area of the coral restoration tree
12	Closing narration (thanks and headset instruction)	4:14–4:30	16	–

Note: Time windows refer to the 360° film timeline. Head-gaze direction was recorded at approximately one-second intervals. For scenes with a defined area of interest (AOI), the scene-level engagement score is the share of gaze observations within the AOI, and the participant-level measure averages these shares across scenes. A dash indicates that no AOI was defined. Areas of interest are time-varying regions defined in the Unity application (Figure A5).

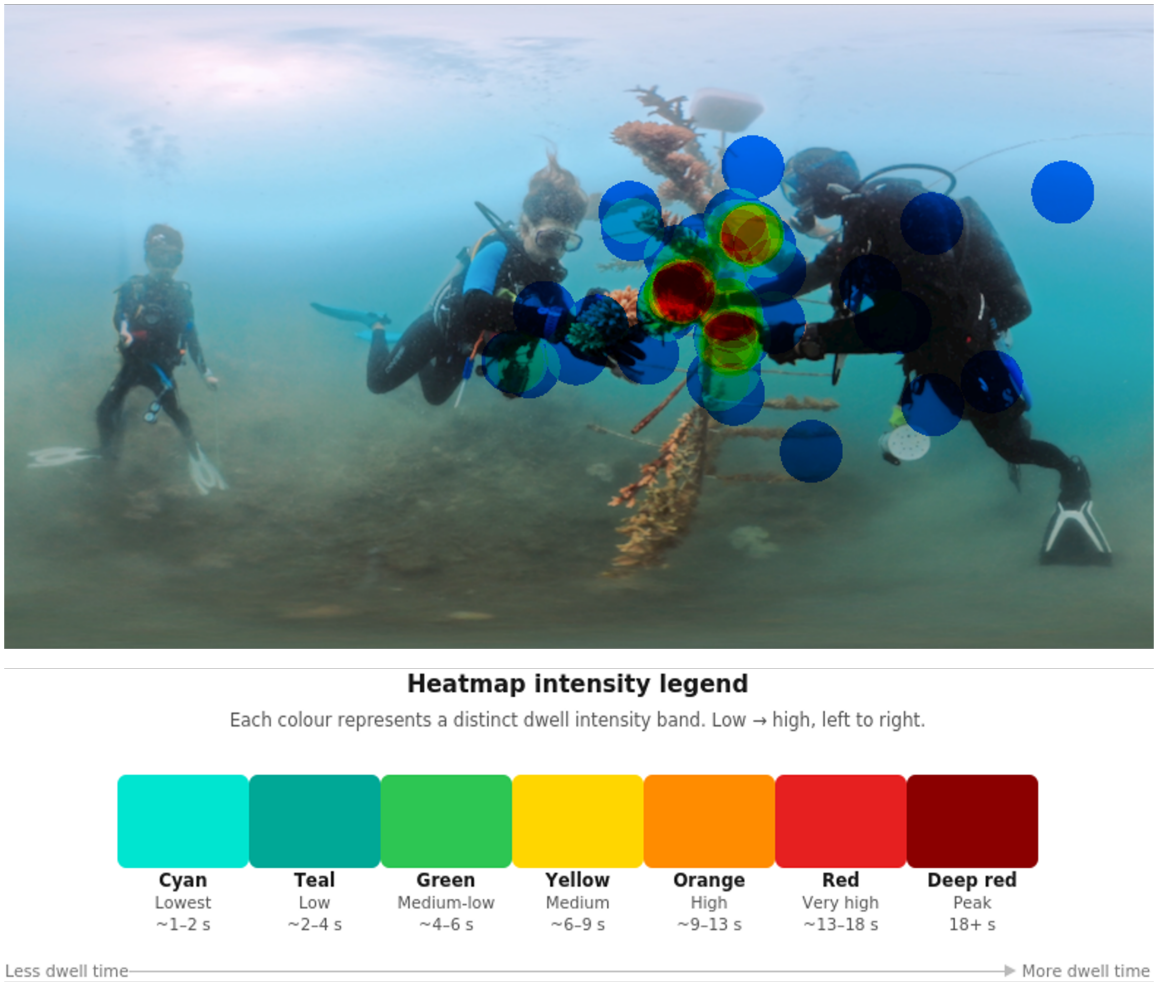


Figure A4. Head-gaze attention heatmap on the 360° footage

Note: The background is an equirectangular frame from the 360° footage. Colours indicate dwell-time bands, from about 1–2 seconds (cyan) to more than 18 seconds (deep red).

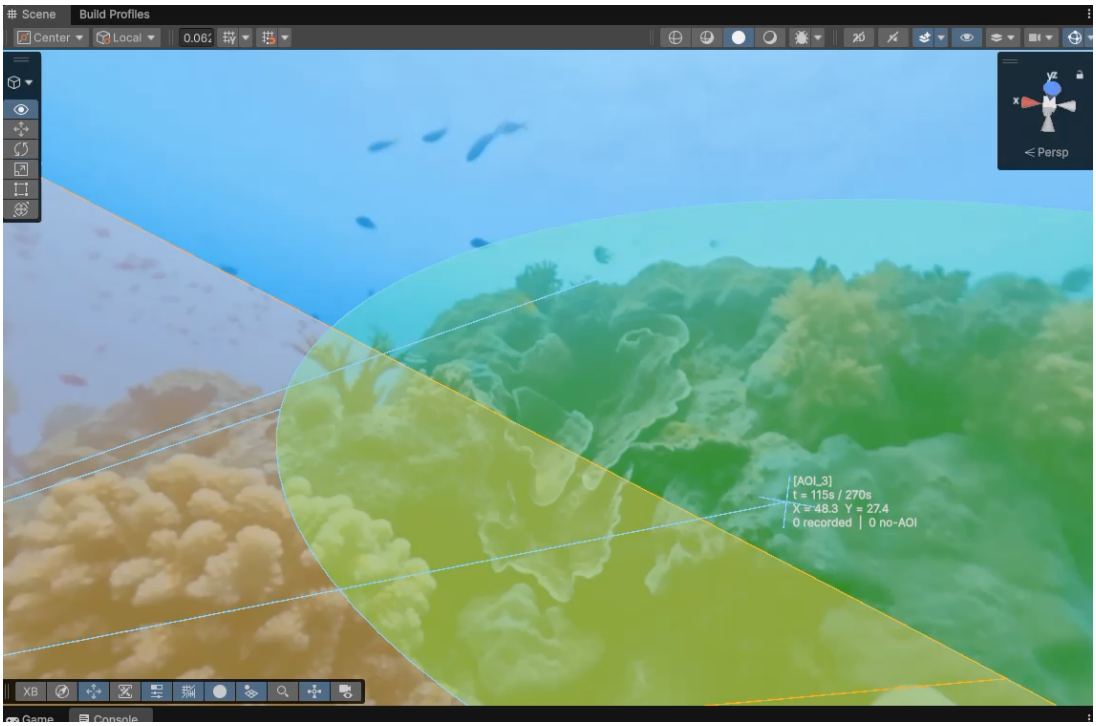


Figure A5. Example of an area of interest defined in the Unity application

Note: The orange overlay marks a predefined area of interest (AOI_2) on the 360° footage at 115 seconds of 270 seconds (scene 6, coral biodiversity), shown in the Unity editor. Areas of interest are time-varying regions attached to salient features in each scene.

B.5 Survey Instrument

Table A6 lists the questionnaire in the order respondents saw it, as programmed in Qualtrics. The first block was completed by the research team rather than the participant. Response scales are defined in the note below the table. The one-month follow-up survey is reported separately in Section B.6.

Table A6. Survey instrument in order of administration

Item	Wording	Response format
Block 1. Administration (completed by the researcher)		
Q1	Participant ID.	Free text.
Q2	Researcher.	Thomas, Chiara, Vincent, Danna.
Q20	Have you dived, snorkelled, or seen coral reefs in a natural habitat before (i.e. not in an aquarium)?	Yes / No.
Q101	When was the most recent time you snorkelled or dived on a coral reef?	Within 12 months; 1–2 years; more than 2 years; not a reef user.

Continued on next page

Table A6 *(continued)*

Item	Wording	Response format
Q74	Have you ever studied marine biology or a related field, or do you have a strong personal interest in coral reef conservation?	Yes / No.
Block 2. Consent		
Q3	Information sheet describing the study, the voluntary donation and the $20 Amazon voucher, the right to withdraw up to two weeks after the experiment, data confidentiality, email use for the voucher, follow-up and the newsletter, and contact details. The declaration covers age (18 or over), understanding of the information, voluntary participation, anonymised reporting, the voluntary donation, the absence of neurological or psychiatric conditions, the absence of medication that could cause adverse reactions, the absence of severe motion sickness, vertigo or vestibular conditions, and recording of engagement data.	Yes, I agree / No, I do not agree. "No" ends the survey.
Block 3. Socio-demographics and prior reef experience		
Q4	What is your gender?	Male; female; non-binary; other (specify); prefer not to say.
Q8	Which year were you born?	Drop-down, 1930–2008.
Q10	What is the highest level of education you have completed or are currently pursuing?	Ten levels from Year 9 or below to postgraduate degree; prefer not to say.
Q11	What is your current marital status?	Never married; married (registered); married (de facto); separated; divorced; widowed; prefer not to say.
Q13	What is your total annual personal pre-tax income (before tax and deductions)?	Nine brackets from negative income to A$156,000 or more; prefer not to say.
Q83	Which of the following best describes your role in your household's finances?	Sole income earner; primary income earner; secondary income earner; not currently earning; prefer not to say.
–	What is your usual country of residence?	Drop-down list of countries.
Q16	Which Australian state or territory do you usually live in? *(Australian residents only)*	Eight states and territories.
Q21	I can vividly picture what (1) coral reefs, (2) everyday objects (e.g., a coffee cup or a chair), and (3) natural landscapes like mountains or deserts look like.	Agree-7.
Q53	Have you ever visited the Great Barrier Reef?	Yes / No.

Continued on next page

Table A6 *(continued)*

Item	Wording	Response format
Q73	During your visit, did you dive or snorkel? *(if Q53 = Yes)*	Dived; snorkelled; both; neither.
Block 4. Baseline psychological distance (eight items)		
Q19†	(1) Many negative effects of coral reef degradation are geographically close to me. (2) The worst effects of coral reef degradation are felt more by faraway places or countries rather than where I live. (3) Coral reef degradation is an urgent threat for my generation. (4) I will be able to experience the negative effects of coral reef degradation within my lifetime. (5) People generally similar to me can experience the negative impacts of coral reef degradation. (6) My chances of experiencing the negative effects of coral reef degradation are lower than those of most other people. (7) The likelihood that I will personally see the effects of coral reef degradation is high. (8) It is certain that coral reef degradation will have a large negative impact on me.	Agree-7. Items 1–2 spatial, 3–4 temporal, 5–6 social, 7–8 hypothetical.
Block 5. Attitudes, trust, national identity and behaviour		
Q18	(1) Coral reefs are important for the environment. (2) I am concerned about the health of coral reefs. (3) The loss of coral reefs would not be a serious problem. (4) Coral reefs are economically valuable to local communities.	Agree-7.
Q82	The Great Barrier Reef Marine Park Authority (GBRMPA) is the Australian government agency responsible for managing and protecting the Great Barrier Reef. How much do you trust the GBRMPA to manage coral reef conservation effectively?	1 = do not trust at all, 7 = trust completely.
Q84	(1) The Great Barrier Reef is an important part of Australia's national identity. (2) I feel a sense of pride knowing the Great Barrier Reef exists. (3) Protecting the Great Barrier Reef is a matter of national importance to me.	Agree-7.
Q25†	How frequently do you engage in each of the following behaviours? (1) I educate myself on issues affecting the coral reefs. (2) I donate to coral reef conservation organisations. (3) I sign petitions to help protect the coral reefs.	Frequency-7.
Q75†	How frequently do you engage in each of the following behaviours? (1) I actively try to reduce waste in my daily life (e.g. recycling, composting). (2) I actively reduce my energy consumption at home (e.g. turning off lights, reducing heating). (3) I reduce my use of single-use plastics in daily life.	Frequency-7.

Continued on next page

Table A6 *(continued)*

Item	Wording	Response format
Q28†	The statements below reflect what the majority of researchers in this area agree on. How confident are you that the following statement is true? (1) Elevated ocean temperatures are the primary cause of coral bleaching. (2) Mass coral bleaching events have become more frequent worldwide over the past decades. (3) Ocean acidification can weaken coral reef growth. (4) The Great Barrier Reef has experienced multiple mass bleaching events since 2016. (5) Coral reefs support approximately 25% of all marine species.	Confidence-7.
Block 6. Randomisation and treatment		
–	*No respondent-facing question.* Qualtrics drew a random number (1 or 2) that set the order in which the cell quotas were checked. Each respondent was then assigned to VR or text-and-image within their reef-experience stratum (Q20), subject to the cell quotas not yet being met.	–
Q30	*(VR only)* As part of this study, you will now use the Meta Quest 3 headset to explore a 360-degree virtual experience of the Great Barrier Reef, one of the 235 UNESCO World Heritage Natural Sites… The experience takes approximately 5 minutes to complete. Please let a researcher know when you have reached this page and they will assist you with getting set up.	Information page.
Q71	*(VR only)* Prior to today, have you had any experience with VR?	Yes / No.
Q31	*(Text-and-image only)* As part of this study, you will now read information about the Great Barrier Reef, one of the 235 UNESCO World Heritage Natural Sites… Please read the following pages carefully at your own pace… The reading takes approximately 5 minutes to complete.	Information page.
Q59–Q62	*(Text-and-image only)* Four timed pages titled "Discovering the Great Barrier Reef", "A Living, Interconnected System", "A System Under Threat" and "Reasons for Hope" (Figures A1 and A2). Page 2 asks whether respondents can identify the species of a turtle shown in the image.	Information pages with click timing recorded.
Block 7. Post-treatment measures		
Q68†	The same eight psychological-distance items as Q19.	Agree-7.
Q41†	Following the presentation of information, (1) I felt an emotional connection with the coral reefs. (2) I felt like I was really there at the Great Barrier Reef.	Agree-7. Item 2 is the spatial-presence measure.

Continued on next page

Table A6 *(continued)*

Item	Wording	Response format
Q90†	Following the presentation of information, to what extent did you feel each of the following? Sad; concerned; sympathetic; hopeful; hopelessness; anger.	Intensity-7.
Q102	Were there any other emotions that you have experienced but not listed?	Free text.
Block 8. Valuation and behavioural outcomes		
–	*No respondent-facing question.* Qualtrics assigned each respondent to one of five bid groups (Table A3) and drew a random payment order (1 or 2).	–
Q42	Information passage on the state of the Great Barrier Reef and coral restoration (Section B.2).	Information page.
Order 1: hypothetical valuation, behavioural outcomes, policy preferences, actual donation. Order 2: actual donation, behavioural outcomes, policy preferences, hypothetical valuation.		
Q85	Hypothetical scenario and in-principle willingness to contribute (Section B.2).	Yes, definitely; yes, but it depends on how much; no.
Q88	Cheap-talk script and budget reminder (Section B.2). *(if Q85 is not "No")*	Information page.
Q80, Q86, Q87	Double-bounded bid questions (Section B.2). *(if Q85 is not "No"; Q86 after "Yes" to Q80, Q87 after "No")*	Yes / No.
Q43	Reasons for contributing (Section B.2). *(if any bid accepted)*	Multiple response.
Q44†	Reasons for not contributing (Section B.2). *(if Q85 = No, or both bids rejected)*	Multiple response.
Q103	Willingness to contribute 1% of household income if everyone else in Australia also contributed (Section B.2). *(if Q44 includes objection to public funding, or Q85 = No, or both bids rejected)*	Yes / No.
Q81	Separately from any financial contribution, how many hours per month would you be willing to volunteer for coral reef conservation activities (e.g., beach clean-ups, citizen science, community events)? *(if Q85 = No, or both bids rejected)*	0 hours; 30 minutes–1 hour; 1–2; 2–3; 3–5; more than 5 hours.
Q46	Actual donation task (Section B.2).	Payment card, A$0–30 or more than A$30.

Continued on next page

Table A6 *(continued)*

Item	Wording	Response format
Q45†	After what you have just learned, please indicate how likely are you to take the following actions to support coral reef conservation. (1) I intend to educate myself further on issues affecting the Great Barrier Reef. (2) I intend to support efforts to increase funding for the Great Barrier Reef. (3) I intend to sign up for newsletters from a coral reef conservation organisation. (4) I intend to donate to coral reef conservation organisations in the future. (5) I intend to discuss coral reef conservation with friends, family, or colleagues.	Likelihood-7.
Q47	You now have the option to indicate your support for increased funding for coral reef restoration. Aggregate responses from this study will be shared with the Great Barrier Reef Marine Park Authority. If you choose to indicate your support, you may provide a brief reason below. Your individual response will be recorded anonymously and used for research purposes only.	Yes, I would like to add my support (with optional text); no thank you.
Q48	You also have the option to become a supporter of the Resilient Reefs Foundation, a non-profit organisation dedicated to restoring and protecting coral reefs through innovative approaches such as floating coral nurseries. Supporters receive monthly updates on coral reef conservation efforts, restoration progress, and opportunities to get involved. By selecting yes, the research team will use the email address you provide at the end of this survey to subscribe you to the Resilient Reefs Foundation mailing list.	Yes, I would like to become a supporter; no thank you.
Block 9. End of survey		
Q50	How much do you agree or disagree with the following statements? (1) My survey responses reflect what I would have done in real life. (2) The survey provided me with enough information to make informed choices. (3) I find the survey's description of coral reefs and the impacts of climate change on them to be accurate. (4) The results of this survey will help inform policymakers and conservation organisations about coral reef protection.	Agree-5.
Q76	How confident are you that the information that has been provided in this survey is correct?	Very doubtful to very confident (5 points).
Q77	How would you rate your level of knowledge regarding coral reefs and the impacts of climate change on them **before** having taken this survey?	Very poor to excellent (5 points).

Continued on next page

Table A6 *(continued)*

Item	Wording	Response format
Q78	The same question, asked about knowledge **after** having taken this survey.	Very poor to excellent (5 points).
Q49	If you opted in for newsletter updates earlier, please kindly enter your email below. The research team will use this email to subscribe you to the Resilient Reefs Foundation mailing list.	Email address (removed before analysis).
Q67	If you would like to be contacted for a short follow-up survey in approximately one month, please tick the box below. Participants who complete the follow-up will be entered into a prize draw to win a $500 Amazon voucher.	Yes, I agree to be contacted (with email); no.
Q91	*(if a positive donation was chosen)* You indicated that you would like to donate the selected amount to the Resilient Reefs Foundation. Please enter your Participant ID so we can match your donation to your response… Please do not click Next page until your donation has been completed.	Link to the study-specific Donorbox campaign.

Note: Agree-7: 1 = strongly disagree to 7 = strongly agree. The psychological-distance items (Q19, Q68) and the national identity items (Q84) were labelled with seven verbal categories from strongly disagree to strongly agree. Agree-5: strongly disagree, somewhat disagree, neither, somewhat agree, strongly agree. Frequency-7: 1 = never to 7 = always. Confidence-7: 1 = not at all confident to 7 = completely confident. Intensity-7: 1 = not at all to 7 = very strongly. Likelihood-7: 1 = very unlikely to 7 = very likely. Items marked in italics were shown only to the respondents described. † The order of the items (or, for Q44, of the response options) was randomised across respondents. The one-month follow-up survey is described in Section 3.3 and reported in Section B.6.

B.6 Follow-Up Survey Instrument

Table A7 lists the one-month follow-up survey in the order respondents saw it, as programmed in Qualtrics. Item labels are the survey's Qualtrics export tags with a prefix F, to distinguish them from the baseline survey. Response scales are those defined in the note to Table A6.

Table A7. Follow-up survey instrument in order of administration

Item	Wording	Response format
Block 1. Linking and consent		
–	*No respondent-facing question.* The baseline response ID and email address of each invited participant were passed to the survey as embedded data, and were used to link follow-up responses to the baseline survey.	–

Continued on next page

Table A7 *(continued)*

Item	Wording	Response format
F1	Information sheet describing the follow-up survey (current attitudes towards coral reef conservation and conservation-related actions since the earlier study, about 2–3 minutes), the prize draw for a $500 Amazon voucher (one winner selected at random and notified by email within two weeks of the survey closing), voluntary participation and withdrawal, data confidentiality (responses linked to earlier responses through a study reference code, email addresses excluded from analysis and reporting, anonymised and aggregated reporting), and contact details. The declaration covers age (18 or over), understanding of the information, voluntary participation, and linkage of the responses to the earlier survey.	Yes, I agree / No, I do not agree. "No" ends the survey.
Block 2. Psychological distance (eight items)		
F3†	We would now like to ask you a few questions about how you currently relate to coral reef degradation. There are no right or wrong answers. We are interested in your personal perceptions at this point in time. (1) Many negative effects of coral reef degradation are geographically close to me. (2) The worst effects of coral reef degradation are felt more by faraway places or countries rather than where I live. (3) Coral reef degradation is an urgent threat for my generation. (4) I will be able to experience the negative effects of coral reef degradation within my lifetime. (5) People generally similar to me can experience the negative impacts of coral reef degradation. (6) My chances of experiencing the negative effects of coral reef degradation are lower than those of most other people. (7) The likelihood that I will personally see the effects of coral reef degradation is high. (8) It is certain that coral reef degradation will have a large negative impact on me.	Agree-7. Items 1–2 spatial, 3–4 temporal, 5–6 social, 7–8 hypothetical. (Table A6).
Block 3. Behavioural intentions		

Continued on next page

Table A7 *(continued)*

Item	Wording	Response format
F5†	Please indicate how likely you are to take the following actions in the future. (1) I intend to educate myself further on issues affecting the Great Barrier Reef. (2) I intend to support efforts to increase funding for the Great Barrier Reef. (3) I intend to sign up for newsletters from a coral reef conservation organisation. (4) I intend to donate to coral reef conservation organisations in the future. (5) I intend to discuss coral reef conservation with friends, family, or colleagues.	Likelihood-7.
Block 4. Conservation actions since the earlier study		
F8	Since after participating in the earlier study, have you done any of the following? Sought more information about coral reefs or coral reef conservation (e.g. online, articles, videos); signed a petition related to coral reef conservation; donated money to a coral reef or marine conservation organisation; subscribed to a newsletter or followed an organisation related to coral reef conservation; discussed coral reef conservation or climate change with friends, family, or colleagues; volunteered in coral reef conservation activities (e.g., beach clean-ups, citizen science, community events); others (not listed above); none of the above.	Multiple response. "Others" requires a text entry, and "none of the above" is exclusive.
Block 5. End of survey		
F10	We have now come to the end of the follow-up survey. Thank you for your time. Your responses have been recorded and you have automatically been entered into the prize draw for a $500 Amazon voucher. Winners will be contacted via email within 2 weeks of the survey closing.	Information page.

Note: Items F2, F4, F6, F7 and F9 in the Qualtrics export are page-timer items and are omitted. Responses were required for every question except the closing message. † The order of the items was randomised across respondents. The action count used in the analysis sums the six actions in F8 (information seeking, petition, donation, newsletter, discussion and volunteering).

C Variables and Sample

C.1 Covariate Definitions

Table A8. Definitions of pre-treatment covariates

Variable	Scale	Definition
Demographics (X_i)		
Gender	Categorical	Male, female, or another gender (non-binary or other).
Age	Years	Age at the time of the survey, derived from birth year.
Education	1–10 ordinal	Highest level completed or currently being pursued, from Year 9 or below (1) to postgraduate degree (10).
Log income	Continuous	Natural log of personal annual pre-tax income in A$, using midpoints of the reported brackets and OLS-imputed values where income was not reported. Observations with unresolved income were excluded from models using this covariate.
Extended controls (Z_i)		
Reef user	0/1	Prior experience diving, snorkelling or observing reefs in a natural habitat.
Reef familiarity	0–4 ordinal	0 = never visited the Great Barrier Reef, 1 = visited without diving or snorkelling, 2 = visited and snorkelled, 3 = visited and dived, 4 = visited and both dived and snorkelled.
Marine biology background	0/1	Has studied marine biology or a related field, or has a strong personal interest in coral reef conservation.
Environmental attitude	1–7	Mean of four items on the importance of coral reefs, concern for reef health, the seriousness of reef loss (reverse-coded) and the economic value of reefs to local communities.
National identity	1–7	Mean of three items on the Great Barrier Reef as part of Australia's national identity, pride in its existence and the national importance of protecting it.
Trust in GBRMPA	1–7	Single item on trust in the Great Barrier Reef Marine Park Authority.

Continued on next page

Table A8 *(continued)*

Variable	Scale	Definition
Reef conservation behaviour	1–7	Mean of three items on how often respondents educate themselves about reef issues, donate to reef conservation organisations and sign petitions to protect reefs.
General pro-environmental behaviour	1–7	Mean of three items on waste, energy and plastic use.
Reef knowledge	1–7	Mean confidence that five statements reflecting scientific consensus are true (causes and frequency of bleaching, ocean acidification, recent Great Barrier Reef bleaching events and the share of marine species supported).
Additional covariates		
Marital status	Categorical	Six categories, from never married to widowed.
Household financial role	Categorical	Primary, secondary or sole income earner, or not currently earning.
State of residence	Categorical	Australian state or territory of usual residence, with respondents living outside Australia in a separate category.
Residency	0/1	Usual country of residence is Australia (1) or elsewhere (0).
Ease of imaginability	1–7	Mean of three items on how vividly respondents can picture coral reefs, everyday objects and natural landscapes.
Baseline psychological distance	1–7	Mean of eight items across spatial, temporal, social and hypothetical distance, measured before treatment.
Variables used only in robustness analyses		
Recency of reef experience	Categorical	Time since the respondent last dived or snorkelled on a reef: not a reef user, more than 2 years ago, 1–2 years ago, or within the last 12 months.
Income brackets	Categorical	The nine personal income brackets in the survey, entered as categories in place of log income in the alternative income specification.

Continued on next page

Table A8 *(continued)*

Variable	Scale	Definition
Item-level controls	1–7 items	In Model 10, each composite in Z_i is replaced by its constituent items (four environmental attitude, three national identity, three reef conservation behaviour, three general pro-environmental behaviour and five knowledge items). Reef familiarity, marine biology background and trust in GBRMPA are unchanged.

Note: X_i denotes the demographic controls and Z_i the extended controls used in Models 2 and 3. The wider set, A_i, additionally includes household financial role, state of residence and marital status and is used in mediation Model C and Model 10. Item wording is reported in Table A6; scales run from 1 to 7 unless stated otherwise. Ease of imaginability is used only in robustness analysis, and the full balance check is reported in Table A12.

C.2 Participant Flow

Table A9. Participant flow from recruitment to the analytic sample

	Excluded	**Remaining**
Raw survey records		876
Did not consent or exited before randomisation	−7	869
Invalid response identified by the researcher	−1	868
Did not reach 95% survey completion	−9	859
Eligible responses		859
Speeders (completed in under half the condition-specific median time)	−22	837
Final analytic sample		**837**
Final sample by cell	**Text-and-image**	**VR**
Reef users (target 165 per cell)	245	260
Non-users (target 165 per cell)	164	168
Total	409	428

Note: Exclusion counts are those reported in the Methods section, since the public data file contains only the final analytic sample. The raw record count is the sum of the eligible responses and the three pre-analysis exclusions. Speeder exclusion was introduced during data cleaning and was not preregistered (Section A). Eleven participants assigned to VR were switched to the text-and-image materials because of discomfort and are retained in their assigned condition.

C.3 Sample Characteristics and Balance

Table A10. Sample demographic characteristics

Characteristic	N	%
Gender		
Male	392	46.8
Female	427	51.0
Another gender	14	1.7
Prefer not to say	4	0.5
Age (years)	Mean 37.4 (SD 17.1), range 18–93	
Highest level of education		
Year 9 or below	6	0.7
Year 10	24	2.9
Year 11	10	1.2
Year 12 or equivalent	109	13.0
Certificate I/II	14	1.7
Certificate III/IV	74	8.8
Advanced Diploma/Diploma	70	8.4
Bachelor degree	289	34.5
Graduate degree/Graduate certificate	45	5.4
Postgraduate degree	188	22.5
Prefer not to say	8	1.0
Annual personal income (A$)		
Negative income	5	0.6
$0 or nil income	53	6.3
$1–$15,599	83	9.9
$15,600–$25,999	61	7.3
$26,000–$41,599	65	7.8
$41,600–$64,999	114	13.6
$65,000–$103,999	158	18.9
$104,000–$155,999	102	12.2
$156,000 or more	69	8.2
Prefer not to say	127	15.2
Marital status		

Continued on next page

Table A10 *(continued)*

Characteristic	N	%
Never married	390	46.6
Divorced	41	4.9
Married (registered)	279	33.3
Married (de facto)	67	8.0
Separated	10	1.2
Widowed	13	1.6
Prefer not to say	37	4.4
Household financial role		
Primary income earner	177	21.1
Secondary income earner	224	26.8
Not currently earning	145	17.3
Sole income earner	178	21.3
Prefer not to say	113	13.5
Residency		
Australian	752	89.8
International	85	10.2
Reef user		
No	332	39.7
Yes	505	60.3
Reef familiarity		
Never visited the Great Barrier Reef	406	48.5
Visited, no diving or snorkelling	77	9.2
Visited and snorkelled	263	31.4
Visited and dived	34	4.1
Visited, dived and snorkelled	57	6.8
Marine biology background or strong interest		
No	587	70.1
Yes	250	29.9

Note: The table reports the full analytic sample ($N = 837$), pooled across conditions. Percentages are shares of the full sample. "Prefer not to say" is shown as its own category. Missing values on these items arise only from that response, and for income they were later imputed for the analysis (see Section A).

Table A11. Sample characteristics compared with Queensland and Australian adults

	Sample	**Queensland**		**Australia**	
	%	%	Diff.	%	Diff.
Panel A. Gender (men and women only)					
Female	52.1	51.4	+0.8	51.2	+0.9
Respondents (N)	819				
Goodness-of-fit test, p		0.657		0.603	
Panel B. Age (adults)					
18–24	30.0	11.1	+18.9	10.8	+19.2
25–34	24.6	17.5	+7.1	18.2	+6.4
35–44	14.7	17.2	−2.5	17.5	−2.8
45–54	12.1	16.9	−4.8	16.3	−4.3
55–64	9.1	15.4	−6.3	15.1	−6.0
65 and over	9.6	21.9	−12.3	22.0	−12.4
Respondents (N)	837				
Goodness-of-fit test, p		<0.001		<0.001	
Panel C. Highest educational attainment					
Year 9 or below	0.7	6.3	−5.6	6.8	−6.0
Year 10–12	17.2	34.1	−16.9	32.1	−14.8
Certificate I/II	1.7	0.1	+1.6	0.1	+1.6
Certificate III/IV	8.9	22.3	−13.4	18.9	−10.0
Advanced diploma/diploma	8.4	11.2	−2.7	11.1	−2.6
Bachelor degree	34.9	17.8	+17.0	20.5	+14.3
Graduate diploma/certificate	5.4	2.6	+2.8	2.8	+2.6
Postgraduate degree	22.7	5.6	+17.1	7.7	+14.9
Respondents (N)	829				
Goodness-of-fit test, p		<0.001		<0.001	
Panel D. Annual personal income (A$)					
Negative income	0.7	0.6	+0.1	0.6	+0.1
$0 or nil income	7.5	5.8	+1.7	6.5	+0.9
$1–$15,599	11.7	7.3	+4.4	7.5	+4.2
$15,600–$25,999	8.6	17.5	−9.0	16.9	−8.4

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Table A11 *(continued)*

	Sample	Queensland		Australia	
	%	%	Diff.	%	Diff.
$26,000–$41,599	9.2	17.0	−7.8	15.9	−6.8
$41,600–$64,999	16.1	20.2	−4.2	19.2	−3.1
$65,000–$103,999	22.3	19.0	+3.2	19.2	+3.1
$104,000–$155,999	14.4	7.9	+6.5	8.5	+5.8
$156,000 or more	9.7	4.6	+5.1	5.6	+4.1
Respondents (N)	710				
Goodness-of-fit test, p		<0.001		<0.001	

Note: Entries are percentages. The sample is the final analytic sample of 837 participants recruited by mall intercept at Westfield Chermside, Brisbane, and is not a probability sample. Benchmarks are for persons aged 18 and over from the 2021 Census of Population and Housing (Australian Bureau of Statistics, TableBuilder). Diff. is the sample percentage minus the benchmark percentage, in percentage points. Panel A uses the 819 respondents who reported being male or female; the 14 respondents who reported another gender and the 4 who preferred not to say have no counterpart in the Census extract. Panels C and D exclude respondents who preferred not to say (8 for education, 127 for income) and Census persons whose attainment or income was not stated or could not be classified (11.7% and 7.9% of Queensland adults; 11.6% and 7.2% of Australian adults), and rescale the remaining categories to sum to 100. Year 10–12 combines the survey categories Year 10, Year 11 and Year 12 because the Census reports Year 10 and above as one category; all other categories are those of the survey. Census weekly personal income brackets are converted to annual brackets that coincide with those of the survey. The goodness-of-fit p-value is from a chi-squared test of the sample counts against the benchmark shares, treating the benchmark as known. Source: Australian Bureau of Statistics, 2021 Census of Population and Housing, TableBuilder (persons aged 18 and over).

Table A12. Baseline balance across treatment conditions

	Text (n = 409)	VR (n = 428)	p-value
Gender (%)			0.066
Male	49.4	44.8	
Another gender	0.7	2.6	
Female	49.9	52.6	
Age	38.11 (17.36)	36.67 (16.89)	0.225
Education (1–10 ordinal)	7.42 (2.17)	7.35 (2.30)	0.689
Log income (missing-indicator method)	10.21 (2.97)	10.02 (3.12)	0.365
Income not resolved (0/1)	0.00 (0.07)	0.01 (0.08)	0.690

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Table A12 *(continued)*

	Text (n = 409)	**VR (n = 428)**	***p*-value**
Reef user (%)			0.858
No	40.1	39.3	
Yes	59.9	60.7	
Baseline psychological distance	3.05 (0.96)	3.01 (0.96)	0.556
Marital status (%)			0.501
Never married	49.2	48.3	
Divorced	4.6	5.7	
Married (registered)	36.5	33.3	
Married (de facto)	6.9	9.9	
Separated	1.5	1.0	
Widowed	1.3	2.0	
Household financial role (%)			0.323
Primary income earner	26.2	22.7	
Secondary income earner	27.9	34.0	
Not currently earning	20.2	19.9	
Sole income earner	25.7	23.5	
Residency (%)			0.364
Australian	88.8	90.9	
International	11.2	9.1	
Reef familiarity (0–4)	1.17 (1.30)	1.06 (1.20)	0.223
Marine biology background (%)			0.614
No	69.2	71.0	
Yes	30.8	29.0	
Ease of imaginability	6.19 (1.03)	6.16 (1.06)	0.700
Environmental attitude	6.01 (0.89)	5.96 (0.87)	0.428
National identity	6.04 (1.18)	6.11 (1.02)	0.377
Trust in GBRMPA	4.67 (1.29)	4.59 (1.27)	0.374
Reef conservation behaviour	2.97 (1.58)	3.21 (1.58)	0.024
General pro-environmental behaviour	5.44 (1.22)	5.55 (1.13)	0.181
Reef knowledge	4.91 (1.36)	5.06 (1.25)	0.090

Note: Continuous variables show means with standard deviations in parentheses, and p-values are from Welch two-sample t-tests. Categorical variables show the percentage in each category by condition, and p-values are from chi-square tests of independence. The table covers the 19 pre-treatment covariates. Respondents who selected "Prefer not to say" for gender, education, marital status or household financial

role are excluded from the corresponding test. Variable definitions are in Table A8.

C.4 Outcome Descriptive Statistics

Table A13. Descriptive statistics of the outcomes by treatment condition

	Text-and-image		VR	
	N	Mean (SD) or %	N	Mean (SD) or %
Manipulation check and psychological distance				
Spatial presence (1–7)	409	4.50 (1.70)	428	5.45 (1.47)
Baseline psychological distance (1–7)	409	3.05 (0.96)	428	3.01 (0.96)
Post-treatment psychological distance (1–7)	409	2.82 (0.95)	428	2.62 (0.93)
Change in psychological distance	409	−0.23 (0.63)	428	−0.39 (0.74)
Behavioural outcomes				
Behavioural intentions (1–7)	409	4.22 (1.50)	428	4.46 (1.39)
Supported the funding statement (%)	409	40.3%	428	36.7%
Subscribed to the newsletter (%)	409	25.7%	428	23.1%
Valuation outcomes				
Willing to pay in principle (%)	409	50.1%	428	48.1%
Classified as a protest response (%)	409	4.9%	428	4.4%
Accepted the initial bid (%)	198	22.7%	196	16.3%
Made a donation (%)	409	16.1%	428	18.5%
Donation amount, all participants (A$)	409	1.90 (6.20)	428	2.85 (9.26)
Donation amount, positive donors only (A$)	66	11.78 (11.10)	79	15.45 (16.49)

Note: Entries are unadjusted means with standard deviations in parentheses for continuous measures, or percentages for binary outcomes. The DBDC sample consists of respondents willing to pay in principle who were not classified as protest responses. Donation amounts are in Australian dollars. The change in psychological distance is post-treatment minus baseline, so negative values indicate a reduction in distance.

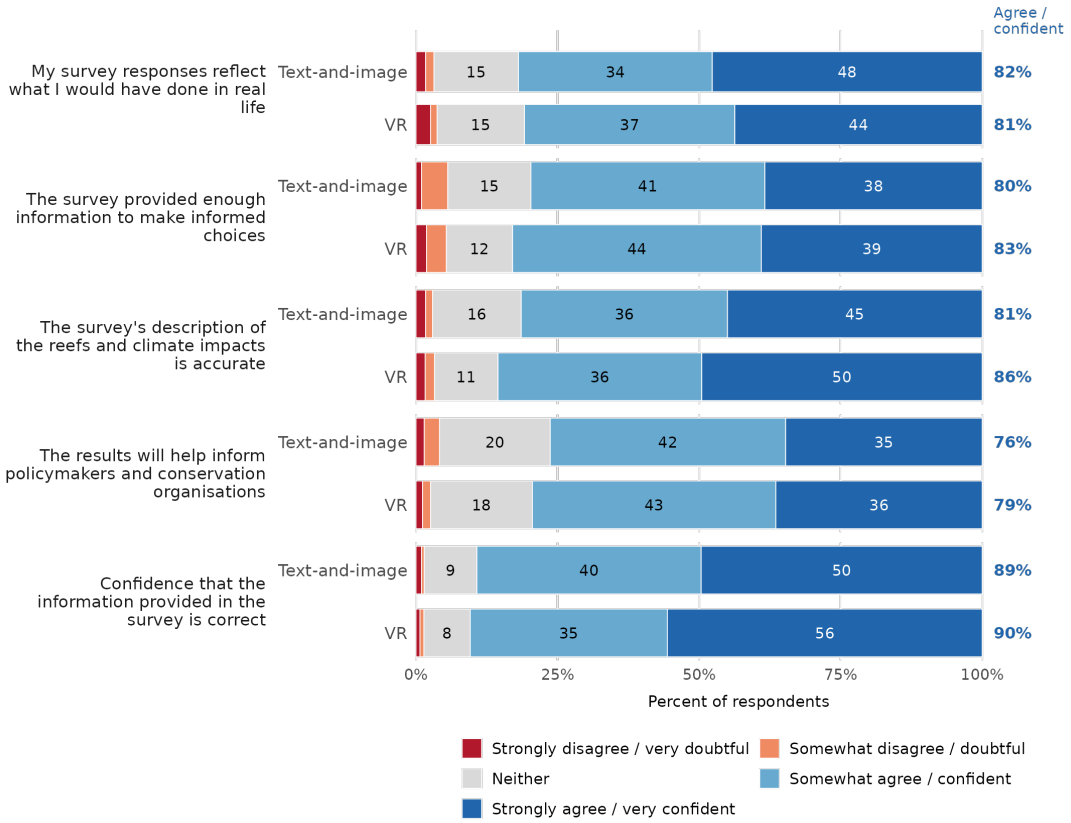


Figure A6. Perceived realism and credibility of the survey, by treatment condition

Note: Bars show the distribution of responses to the post-treatment survey-experience questions by condition (409 text-and-image and 428 VR respondents); each bar sums to 100 percent. The first four items (Q50) are agreement statements on a five-point scale from strongly disagree to strongly agree; the last item (Q76) asks how confident respondents are that the information provided in the survey is correct, from very doubtful to very confident. Numbers inside the segments are percentages (shown when at least 6 percent), and the bold figure at the right of each bar is the share who somewhat or strongly agreed, or were somewhat or very confident. Differences between conditions are small and not statistically significant at the 5% level (Wilcoxon rank-sum tests, $p = 0.10$ to 0.53).

C.5 Minimum Detectable Effects

Table A14. Outcome-specific minimum detectable effects at 80% power

Outcome	N	SE	MDE	MDE (SD)	Scale
Panel A. Main treatment effect (VR)					
Behavioural intentions	826	0.083	0.232	0.160	1–7 scale
Supported the funding statement	826	0.034	0.094	–	Average marginal effect
Subscribed to the newsletter	826	0.029	0.082	–	Average marginal effect
Donation participation	826	0.026	0.074	–	Average marginal effect
Donation amount, positive donors	144	1.736	4.863	0.339	A$
Change in psychological distance	826	0.047	0.133	0.191	PD points
Hypothetical WTP (DBDC)	388	0.221	0.620	–	Log-odds of bid acceptance
Panel B. VR × reef-user interaction					
Behavioural intentions	826	0.169	0.473	0.327	1–7 scale
Supported the funding statement	826	0.192	0.539	–	Probit index
Subscribed to the newsletter	826	0.207	0.580	–	Probit index
Donation participation	826	0.224	0.629	–	Probit index
Donation amount, positive donors	144	3.901	10.928	0.761	A$
Hypothetical WTP (DBDC)	388	0.453	1.270	–	Log-odds of bid acceptance

Note: The minimum detectable effect (MDE) is $(z_{0.975} + z_{0.80}) \times SE$, using the standard error from the fully adjusted specification at a two-sided 5% significance level and 80% power. Panel A uses the Model 3 VR effect; for binary outcomes this is the average marginal effect and the MDE is therefore in probability units. Panel B uses the Model 7 VR × reef-user interaction, reported on the probit-index scale for binary outcomes. MDE (SD) standardises continuous outcomes by their sample standard deviation. OLS and probit specifications use HC1 robust standard errors (delta method for marginal effects), and DBDC uses its maximum-likelihood standard error. Fully adjusted samples contain 826 observations, or 144 positive donors for donation amount. Panel B omits psychological distance because that interaction analysis was not pre-specified.

D Additional Treatment-Effect Results

D.1 Full Estimates

Table A15. Full treatment-effect estimates including covariates

Panel A

	Hypothetical WTP			**Donation participation**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
VR	−0.293	−0.307	−0.371*	0.091	0.058	0.038
	(0.212)	(0.218)	(0.221)	(0.102)	(0.106)	(0.110)
Gender: Female		0.132	0.071		0.258**	0.224*
		(0.224)	(0.229)		(0.107)	(0.115)
Gender: Another gender		0.607	0.352		1.322***	1.284***
		(0.599)	(0.621)		(0.345)	(0.324)
Age		0.007	0.006		0.002	0.003
		(0.007)	(0.008)		(0.003)	(0.004)
Education		0.039	0.025		0.000	−0.011
		(0.054)	(0.055)		(0.025)	(0.027)
Log income		−0.011	−0.019		0.023	0.025
		(0.041)	(0.042)		(0.022)	(0.022)
Reef user			0.039			0.013
			(0.281)			(0.138)
Reef familiarity			−0.084			−0.082
			(0.109)			(0.056)
Marine biology background			−0.212			0.024
			(0.263)			(0.130)
Environmental attitudes			0.097			0.108
			(0.152)			(0.075)
National identity			0.048			0.084
			(0.114)			(0.067)
GBRMPA trust			−0.141			−0.019
			(0.089)			(0.040)
Reef behaviour			0.059			0.023
			(0.080)			(0.039)
Green behaviour			0.121			−0.062
			(0.111)			(0.047)
Reef knowledge			0.163			0.149***

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Table A15 *(continued)*

			(0.103)			(0.055)
Log bid	−1.007***	−1.033***	−1.061***			
	(0.064)	(0.067)	(0.068)			
Constant	1.860***	1.427***	−0.027	−0.989***	−1.445***	−2.892***
	(0.212)	(0.536)	(1.087)	(0.074)	(0.282)	(0.534)
Observations	394	388	388	837	826	826
R^2 or pseudo-R^2	0.002	0.006	0.018	0.001	0.026	0.064
Estimator	DBDC	DBDC	DBDC	Probit	Probit	Probit

Panel B

	Donation amount			**Behavioural intentions**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
VR	3.676	1.415	1.523	0.236**	0.199**	0.089
	(2.304)	(1.831)	(1.736)	(0.100)	(0.099)	(0.083)
Gender: Female		−0.045	0.359		0.589***	0.358***
		(1.813)	(1.793)		(0.100)	(0.086)
Gender: Another gender		2.248	1.358		0.384	0.191
		(3.230)	(3.539)		(0.250)	(0.198)
Age		0.310***	0.329***		−0.005	−0.009***
		(0.084)	(0.090)		(0.003)	(0.003)
Education		−0.758	−0.764		0.047**	0.024
		(0.777)	(0.737)		(0.023)	(0.021)
Log income		0.892***	0.935***		−0.018	−0.016
		(0.298)	(0.324)		(0.016)	(0.014)
Reef user			−3.672*			−0.178*
			(2.183)			(0.106)
Reef familiarity			0.649			−0.091**
			(0.751)			(0.041)
Marine biology background			2.938*			0.150
			(1.748)			(0.097)
Environmental attitudes			−1.335			0.202***
			(1.359)			(0.054)
National identity			1.470			0.066

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Table A15 *(continued)*

			(1.275)			(0.046)
GBRMPA trust			−1.527*			0.056
			(0.823)			(0.040)
Reef behaviour			0.041			0.361***
			(0.535)			(0.033)
Green behaviour			−1.715*			0.146***
			(0.898)			(0.041)
Reef knowledge			0.193			0.060
			(1.033)			(0.043)
Constant	11.777***	−3.205	10.191	4.223***	3.931***	0.498
	(1.365)	(3.504)	(9.431)	(0.074)	(0.224)	(0.397)
Observations	145	144	144	837	826	826
R^2 or pseudo-R^2	0.016	0.233	0.307	0.007	0.055	0.350
Estimator	OLS	OLS	OLS	OLS	OLS	OLS

Panel C

	Funding support			**Newsletter subscription**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
VR	−0.096	−0.093	−0.122	−0.081	−0.101	−0.144
	(0.088)	(0.090)	(0.093)	(0.095)	(0.098)	(0.100)
Gender: Female		0.073	0.005		0.334***	0.269***
		(0.091)	(0.094)		(0.099)	(0.104)
Gender: Another gender		0.285	0.115		0.658*	0.553*
		(0.330)	(0.318)		(0.357)	(0.326)
Age		0.000	−0.001		0.002	0.001
		(0.003)	(0.003)		(0.003)	(0.003)
Education		0.050**	0.031		0.055**	0.041
		(0.021)	(0.023)		(0.024)	(0.025)
Log income		0.035**	0.036**		0.004	−0.001
		(0.018)	(0.018)		(0.018)	(0.019)
Reef user			−0.029			0.005
			(0.117)			(0.128)
Reef familiarity			0.020			0.001

Continued on next page

Table A15 *(continued)*

			(0.046)			(0.051)
Marine biology background			0.021			0.061
			(0.105)			(0.113)
Environmental attitudes			0.122**			0.138**
			(0.060)			(0.067)
National identity			0.056			0.035
			(0.056)			(0.059)
GBRMPA trust			−0.037			−0.063
			(0.037)			(0.039)
Reef behaviour			−0.019			0.135***
			(0.034)			(0.037)
Green behaviour			0.031			0.002
			(0.044)			(0.046)
Reef knowledge			0.175***			0.042
			(0.046)			(0.050)
Constant	−0.244***	−1.018***	−2.703***	−0.653***	−1.354***	−2.551***
	(0.063)	(0.225)	(0.459)	(0.067)	(0.239)	(0.509)
Observations	837	826	826	837	826	826
R^2 or pseudo-R^2	0.001	0.014	0.056	0.001	0.024	0.067
Estimator	Probit	Probit	Probit	Probit	Probit	Probit

Note: Entries are coefficients with standard errors in parentheses. Columns (1)–(3) follow the specifications of Table 4: treatment only; demographic controls; and the extended control set. Hypothetical WTP is estimated by the log-logistic DBDC model among respondents willing to contribute in principle, excluding protest responses, with coefficients on the log-odds scale of bid acceptance and log bid included. For the binary outcomes, coefficients are reported on the probit-index scale rather than as the average marginal effects presented in Table 4. Donation participation, funding support and newsletter subscription are probit models; donation amount is OLS among positive donors; and behavioural intentions are OLS on the 1–7 composite scale. OLS and probit models use HC1 robust standard errors and DBDC uses its maximum-likelihood covariance matrix. Sample sizes vary only with missing covariates. Covariate definitions are in Table A8. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

D.2 Protest Responses

Table A16. Hypothetical WTP including protest responses

Specification	N	VR coefficient	SE	*p*
Panel A. Protest responses excluded (primary specification)				
Model 1	394	−0.293	(0.212)	0.166
Model 2	388	−0.307	(0.218)	0.158
Model 3	388	−0.371*	(0.221)	0.093
Panel B. Protest responses retained				
Model 1	411	−0.345*	(0.210)	0.100
Model 2	405	−0.376*	(0.215)	0.081
Model 3	405	−0.439**	(0.219)	0.045

Note: Entries are the VR coefficient from the log-logistic DBDC model of hypothetical WTP among respondents willing to contribute in principle. Panel A excludes protest responses and reproduces Table 4; Panel B retains them. Models 1–3 follow the specifications of Table 4. Protest-response classification is described in Table A17. Standard errors are from the maximum-likelihood covariance matrix. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A17. Reasons for zero WTP and identification of protest respondents

Panel A. Reasons for zero WTP, respondents unwilling to contribute in principle (N = 426)			
Reason (more than one could be selected), n (%)	**All**	**Text-and-image**	**VR**
Cannot afford to contribute right now	249 (58.5)	115 (56.4)	134 (60.4)
Other charitable priorities	131 (30.8)	60 (29.4)	71 (32.0)
Object to paying for something that should be publicly funded	74 (17.4)	40 (19.6)	34 (15.3)
Individual contributions make little difference	40 (9.4)	21 (10.3)	19 (8.6)
Reef conservation is not a priority	37 (8.7)	20 (9.8)	17 (7.7)
Other reason (free text)	47 (11.0)	20 (9.8)	27 (12.2)
Respondents (N)	426	204	222
Panel B. How protest respondents are identified, n			
Step	**All**	**Text-and-image**	**VR**
Analytic sample	837	409	428
Asked for reasons against contributing (said no in principle, or rejected both bids)	659	314	345
Selected the objection to public funding, alone or with other reasons	125	65	60

Continued on next page

Table A17 *(continued)*

Objection was the only reason selected	37	19	18
Objection selected with other reasons, reclassified after reading the free text	2	1	1
Protest respondents	**39**	**20**	**19**
Unwilling to contribute in principle (not in the WTP model)	22	13	9
Willing in principle (added in Panel B of Table A16)	17	7	10

Note: Reasons against contributing were asked of respondents who were unwilling to contribute in principle or rejected both follow-up bids; the 178 respondents who accepted at least one bid were not asked and are not classified as protest respondents. Protest responses are those for which the public-funding objection was the sole reason, plus two cases in which the free-text response identified another payer (the government or polluting businesses). Seven other free-text cases were reviewed and retained as non-protests. Percentages in Panel A are within column.

D.3 Donation Follow-Through

Table A18. Chosen and completed donations by treatment condition

	Text-and-image	**VR**	***p***
Respondents (N)	409	428	
Chose a positive donation amount, n (%)	113 (27.6)	106 (24.8)	0.388
Completed a donation, n (%)	66 (16.1)	79 (18.5)	0.426

Note: Participants chose a donation amount from a payment card (A$0 to A$30, with an open-ended option for larger amounts), and those choosing a positive amount were redirected to a donation page to complete the payment independently. A donation is counted as completed if the payment platform recorded a positive amount; this is the outcome analysed as donation participation in Table 4. p-values are from tests of equal proportions across conditions.

D.4 Welfare Estimates

Table A19. Implied unconditional mean WTP by treatment condition and model (A$ per month)

Specification	**N**	**Text-and-image**	**VR**	**Difference**	**95% CI**
Model 1	798	8.44	7.65	−0.79	[−2.35, 0.77]
Model 2	787	8.45	7.15	−1.30	[−2.87, 0.26]

Continued on next page

Table A19 *(continued)*

Specification	N	Text-and-image	VR	Difference	95% CI
Model 3	787	8.37	6.86	−1.51	[−3.09, 0.05]

Note: Entries are unconditional mean monthly WTP (A$) from the double-bounded spike model, treating respondents unwilling to contribute in principle as having zero WTP and excluding protest responses. Estimates are evaluated at mean covariates, with differences calculated as VR minus text-and-image. The 95% confidence intervals are based on 5,000 Krinsky–Robb draws, using the same coefficient draws for both conditions. Models 1–3 follow the specifications in Table 4; sample sizes vary due to missing covariates. As a robustness check, averaging individual predicted WTP across respondents, assigning all respondents to each treatment condition in turn, yields A$8.83 under text-and-image and A$7.30 under VR for Model 3. The resulting difference of −A$1.52 (95% CI [−3.13, 0.05]) is virtually identical to the estimate evaluated at mean covariates (−A$1.51).

Table A20. Unconditional mean WTP reweighted to Census benchmarks (A$ per month)

Weights to	Raked on	Effective N	WTP at mean covariates (95% CI)	Mean of individual predicted WTP (95% CI)
Unweighted	–	787	7.58 [6.66, 8.67]	8.03 [7.19, 9.27]
Queensland adults	Gender, age, education, income	218	6.47 [4.97, 8.83]	7.11 [5.77, 10.14]
Australian adults	Gender, age, education, income	240	6.50 [5.06, 8.85]	7.10 [5.75, 9.94]

Note: Entries are pooled unconditional mean monthly WTP (A$) from the double-bounded spike model (Table A19, Model 3; $N = 787$). The first estimate evaluates WTP at (weighted) mean covariates, including the treatment share, consistent with Figure 4. The second averages individual predicted WTP using the corresponding weights and is used for the illustrative aggregation. Weighted estimates use iterative proportional fitting (raking) to calibrate the sample to the 2021 Census margins for Queensland or Australian adults by gender, age, education and income (Table A11). Education categories are harmonised with the Census, and income includes imputed brackets where necessary (Section A). Respondents without corresponding Census categories retain their sample shares. Weights are not trimmed; effective N is $(\sum w)^2 / \sum w^2$. The spike model is re-estimated using a weighted likelihood, reproducing the unweighted estimates with unit weights. The 95% confidence intervals are based on 5,000 Krinsky–Robb draws, using the maximum-likelihood covariance matrix for the unweighted estimates and a robust sandwich covariance matrix for the weighted estimates. Census calibration adjusts for observed demographic characteristics only and does not make the non-probability sample nationally representative.

D.4.1 Illustrative aggregate

The Census-weighted average of individual predicted monthly WTP is A$7.10 (Table A20). Applying this estimate to the approximately 19.9 million Australian adults counted in the

2021 Census gives:

$$\begin{aligned} \overline{\mathrm{WTP}}_{\mathrm{annual}} &= 12 \times 7.10 = \text{A\$85.20}, \\ \mathrm{Agg} &= 19.9 \times 10^6 \times 85.20 \approx \text{A\$1.70 billion}, \\ \mathrm{PV}_{10} &= \mathrm{Agg} \times \frac{1-(1.02)^{-10}}{0.02} \approx \text{A\$15.2 billion}. \end{aligned} \tag{8}$$

The present value assumes a constant annual WTP over the ten-year horizon of our valuation scenario, with payments occurring at the end of each year and a 2% social discount rate. For context, Deloitte Access Economics (2025) report an estimated A$39 billion in non-use value over 26 years. Given differences in valuation scenarios, time horizons, population benchmarks and sampling approaches, these figures are not directly comparable and should be interpreted as order-of-magnitude illustrations rather than population welfare estimates.

D.5 Multiple-Testing Adjustment

Table A21. Outcome families with unadjusted p-values and Benjamini–Hochberg q-values

Outcome	**Unadjusted p**	**BH q**
H1 and H2: treatment effects (Model 3)		
Valuation outcomes		
Hypothetical WTP	0.093	0.280
Donation participation	0.728	0.728
Donation amount | donating	0.382	0.573
Behavioural outcomes		
Behavioural intentions	0.280	0.280
Funding support	0.192	0.280
Newsletter subscription	0.149	0.280
H4: indirect effects through psychological distance (Model B)		
Valuation outcomes		
Hypothetical WTP	0.658	0.658
Donation participation	0.022	0.065
Donation amount | donating	0.234	0.351
Behavioural outcomes		
Behavioural intentions	<0.001	<0.001

Continued on next page

Table A21 *(continued)*

Outcome	Unadjusted p	BH q
Funding support	0.042	0.042
Newsletter subscription	0.032	0.042
H5: VR × reef-user interaction (Model 7)		
Valuation outcomes		
Hypothetical WTP	0.144	0.431
Donation participation	0.783	0.783
Donation amount | donating	0.497	0.745
Behavioural outcomes		
Behavioural intentions	0.496	0.496
Funding support	0.098	0.295
Newsletter subscription	0.480	0.496

Note: Benjamini–Hochberg adjustments are applied separately within each family of three outcomes using the main-specification p-value: the Model 3 VR coefficient for H1 and H2, the Model 7 VR × reef-user interaction for H5, and the Model B ACME for H4. Mediation p-values use 5,000 quasi-Bayesian simulations for the OLS and probit outcomes and a 5,000-replicate null-centred bootstrap for hypothetical WTP. Donation participation and conditional donation amount are treated as separate outcomes. H8 and H9 are exploratory and unadjusted.

E Psychological Distance and Mediation

E.1 Psychological-Distance Estimates and Scale Reliability

Table A22. Full estimates of the effect of VR on change in psychological distance, including covariates

	(1)	(2)	(3)
VR	-0.165^{***}	-0.141^{***}	-0.161^{***}
	(0.047)	(0.048)	(0.047)
Gender: Female		-0.076	-0.084^{*}
		(0.049)	(0.049)
Gender: Another gender		-0.046	-0.069
		(0.119)	(0.110)
Age		-0.002	-0.002

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Table A22 *(continued)*

	(1)	(2)	(3)
		(0.002)	(0.002)
Education		0.001	−0.004
		(0.011)	(0.011)
Log income		0.012	0.010
		(0.011)	(0.011)
Reef user			0.074
			(0.060)
Reef familiarity			−0.015
			(0.024)
Marine biology background			0.074
			(0.055)
Environmental attitudes			0.011
			(0.035)
National identity			−0.062
			(0.038)
GBRMPA trust			−0.032
			(0.019)
Reef behaviour			0.066***
			(0.018)
Green behaviour			0.018
			(0.022)
Reef knowledge			0.016
			(0.023)
Constant	−0.227***	−0.230*	−0.149
	(0.031)	(0.128)	(0.229)
Observations	837	826	826
R^2	0.014	0.020	0.064
Adjusted R^2	0.013	0.012	0.046

Note: The dependent variable is the change in psychological distance from baseline to post-treatment (post-treatment minus baseline), so negative values indicate a reduction in distance. Entries are OLS coefficients with HC1 heteroskedasticity-robust standard errors in parentheses, with significance based on t distributions with the residual degrees of freedom. Columns (1)–(3) are the specifications of Table 3: Model 1 includes treatment assignment only, Model 2 adds gender, age, education and log income, and Model 3 adds reef-user status and the extended controls. Rows are shown for the covariates included in

each specification, and the VR row reproduces Table 3. Sample sizes differ across specifications only where covariates are missing. Covariate definitions are in Table A8. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A23. Effects of VR on each dimension of psychological distance, with scale reliability

Dimension	**(1)**	**(2)**	**(3)**	**α, baseline**	**α, post**
Overall (eight items)	−0.165***	−0.141***	−0.161***	0.79	0.81
	(0.047)	(0.048)	(0.047)		
Spatial	−0.199***	−0.198***	−0.227***	0.21	0.33
	(0.074)	(0.075)	(0.074)		
Temporal	−0.086	−0.063	−0.078	0.72	0.79
	(0.067)	(0.067)	(0.067)		
Social	−0.188***	−0.154**	−0.175**	0.17	0.20
	(0.073)	(0.073)	(0.075)		
Hypothetical	−0.185**	−0.151**	−0.164**	0.69	0.80
	(0.076)	(0.076)	(0.076)		
Observations	837	826	826		

Note: Entries are the effects of VR on the change in psychological distance (post-treatment minus baseline), overall and by dimension, with HC1 robust standard errors in parentheses. Negative values indicate a larger reduction under VR. Models 1–3 follow the specifications of Table 3; each dimension is the mean of two items and the overall measure is the mean of the four dimensions. The final columns report Cronbach's α at baseline and post-treatment. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

E.2 Full Mediation Estimates

Table A24. Full ACME, ADE and total-effect estimates, Models A–C

	Model A	**Model B**	**Model C**
Panel A. Behavioural intentions			
ACME (indirect effect)	0.038***	0.045***	0.041***
	[0.008, 0.079]	[0.016, 0.083]	[0.012, 0.079]
ADE (direct effect)	0.146	0.048	0.033
	[−0.040, 0.334]	[−0.114, 0.210]	[−0.141, 0.211]
Total effect	0.184**	0.093	0.074
	[0.005, 0.365]	[−0.071, 0.256]	[−0.104, 0.250]
Observations	826	826	700

Continued on next page

Table A24 *(continued)*

	Model A	Model B	Model C
Panel B. Funding support			
ACME (indirect effect)	0.011***	0.008**	0.005
	[0.002, 0.021]	[0.000, 0.019]	[−0.003, 0.015]
ADE (direct effect)	−0.049	−0.048	−0.030
	[−0.112, 0.014]	[−0.113, 0.018]	[−0.098, 0.039]
Total effect	−0.038	−0.040	−0.025
	[−0.102, 0.025]	[−0.104, 0.026]	[−0.093, 0.044]
Observations	826	826	700
Panel C. Newsletter subscription			
ACME (indirect effect)	0.008**	0.008**	0.009**
	[0.000, 0.018]	[0.001, 0.018]	[0.001, 0.020]
ADE (direct effect)	−0.040	−0.048*	−0.062**
	[−0.098, 0.018]	[−0.105, 0.009]	[−0.125, −0.001]
Total effect	−0.033	−0.040	−0.054*
	[−0.090, 0.025]	[−0.097, 0.016]	[−0.116, 0.008]
Observations	826	826	700
Panel D. Donation participation			
ACME (indirect effect)	0.009***	0.008**	0.005
	[0.002, 0.019]	[0.001, 0.018]	[−0.002, 0.014]
ADE (direct effect)	0.004	0.001	0.023
	[−0.046, 0.054]	[−0.050, 0.053]	[−0.032, 0.078]
Total effect	0.013	0.009	0.028
	[−0.038, 0.064]	[−0.043, 0.062]	[−0.027, 0.083]
Observations	826	826	700
Panel E. Donation amount			
ACME (indirect effect)	0.358	0.482	0.975*
	[−0.426, 1.312]	[−0.305, 1.570]	[−0.090, 2.631]
ADE (direct effect)	1.316	1.154	0.499
	[−2.480, 5.139]	[−2.468, 4.815]	[−3.835, 4.753]
Total effect	1.674	1.636	1.475
	[−1.988, 5.260]	[−1.845, 5.115]	[−2.805, 5.770]

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Table A24 *(continued)*

	Model A	Model B	Model C
Observations	144	144	126
Panel F. Hypothetical WTP			
ACME (indirect effect)	−0.332	−0.227	0.445
	[−2.192, 0.457]	[−2.122, 0.543]	[−0.022, 1.589]
Observations	388	388	337

Note: Entries are average causal mediation effects (ACME), average direct effects (ADE) and total effects of VR through the change in psychological distance, with 95% confidence intervals from 5,000 quasi-Bayesian simulations. Model A includes the demographic controls, reef-user status and baseline psychological distance; Model B adds the extended controls and is the primary specification (Table 5); Model C adds the wider demographic set and has a smaller estimation sample. Models A and B use HC1 robust covariance matrices; Model C uses the conventional model-based covariance because of a singleton state category. Behavioural intentions are on the 1–7 scale, binary outcomes on the probability scale, donation amount in A$ among positive donors, and hypothetical WTP in A$ per month. For hypothetical WTP, the indirect effect is a product-of-coefficients estimate with a BCa bootstrap interval; direct and total effects are not estimated. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

E.3 Treatment–Mediator Interaction

Table A25. Mediation estimates allowing a treatment–mediator interaction

	Model A	Model B	Model C
Panel A. Behavioural intentions			
VR × ΔPD	0.145	0.118	0.071
	(0.156)	(0.126)	(0.135)
	$p = 0.352$	$p = 0.350$	$p = 0.600$
ACME, interaction allowed	0.040***	0.047***	0.041***
	[0.010, 0.080]	[0.017, 0.085]	[0.012, 0.079]
ACME, no interaction	0.038	0.045	0.041
Observations	826	826	700
Panel B. Funding support			
VR × ΔPD	0.077	0.104	0.110
	(0.133)	(0.133)	(0.160)
	$p = 0.560$	$p = 0.435$	$p = 0.492$
ACME, interaction allowed	0.011***	0.008**	0.005

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Table A25 *(continued)*

	Model A	Model B	Model C
	[0.003, 0.022]	[0.000, 0.019]	[−0.003, 0.016]
ACME, no interaction	0.011	0.008	0.005
Observations	826	826	700
Panel C. Newsletter subscription			
VR × ΔPD	0.111	0.119	0.028
	(0.149)	(0.145)	(0.169)
	$p = 0.456$	$p = 0.409$	$p = 0.871$
ACME, interaction allowed	0.008**	0.009**	0.009**
	[0.001, 0.018]	[0.001, 0.019]	[0.001, 0.020]
ACME, no interaction	0.008	0.008	0.009
Observations	826	826	700
Panel D. Donation participation			
VR × ΔPD	−0.340*	−0.330*	−0.466**
	(0.194)	(0.193)	(0.210)
	$p = 0.079$	$p = 0.088$	$p = 0.027$
ACME, interaction allowed	0.008**	0.008*	0.005
	[0.001, 0.018]	[−0.000, 0.018]	[−0.002, 0.014]
ACME, no interaction	0.009	0.008	0.005
Observations	826	826	700

Note: The outcome models of Table A24 are re-estimated with a VR ×ΔPD interaction; mediator models are unchanged. The interaction coefficient is reported in the first row of each panel (on the probit-index scale for binary outcomes). The ACME with interaction is the average of the treated- and control-state indirect effects, with 95% confidence intervals from 5,000 quasi-Bayesian simulations; the comparison estimate without interaction is from Table A24. Model definitions, covariance estimators and samples are otherwise unchanged. These robustness checks are not adjusted for multiple testing. The interaction robustness analysis is restricted to outcomes for which the primary mediation specification provides evidence of an indirect effect; donation amount and hypothetical WTP are therefore omitted. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

E.4 Sensitivity to Sequential Ignorability

F Additional Heterogeneity Results

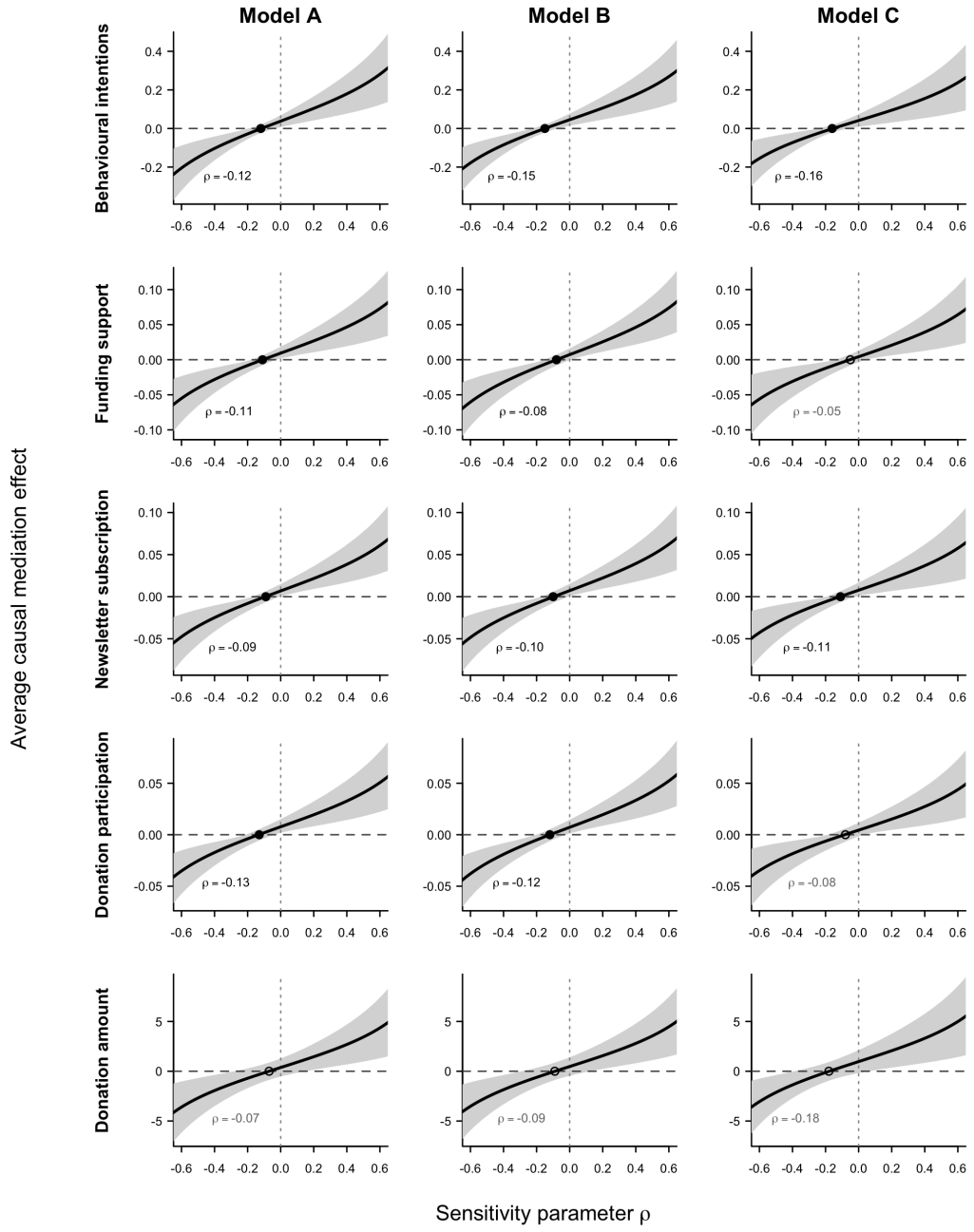


Figure A7. Sensitivity of the average causal mediation effect to unobserved mediator–outcome confounding, Models A–C

Note: Each panel plots the average causal mediation effect (ACME) of VR through the change in psychological distance against ρ, the assumed correlation between the error terms of the mediator and outcome models (Imai et al., 2010), with the 95% confidence band in grey. The dotted vertical line marks $\rho = 0$, the assumption of no unobserved confounding behind the estimates in Tables 5 and A24. The dot marks the value of ρ at which the ACME is zero, and the label gives that value. A filled dot means the ACME is statistically significant at $\rho = 0$, that is, its unadjusted 95% confidence interval in Table A24 excludes zero; an open dot means it is not, and the value is then not interpreted as a robustness threshold. Columns are Models A–C as defined in Section E.2. Rows have different vertical scales: behavioural intentions are on the 1–7 composite scale, the binary outcomes are on the probability scale, and donation amount is in A$ among positive donors. The sensitivity analysis, including the confidence bands, uses the conventional model-based covariance matrices of the mediator and outcome models in all three specifications, whereas the confidence intervals for the ACME in Tables 5 and A24 use HC1 robust covariance matrices in Models A and B. Hypothetical WTP is not shown because the sensitivity routine is not available for its interval-regression outcome.

F.1 Prior Reef Experience

Table A26. Full Models 6–7 estimates: heterogeneity by prior reef experience

Panel A. Valuation outcomes

	Hyp. WTP		**Donation: any**		**Donation: amount**	
	(6)	**(7)**	**(6)**	**(7)**	**(6)**	**(7)**
VR	−0.783**	−0.774**	0.036	0.001	0.426	−0.083
	(0.353)	(0.355)	(0.166)	(0.172)	(3.642)	(3.409)
Reef user	−0.310	−0.282	−0.030	−0.020	−2.467	−5.087*
	(0.301)	(0.356)	(0.156)	(0.187)	(3.073)	(3.019)
VR × Reef user	0.771*	0.663	0.037	0.062	1.732	2.659
	(0.448)	(0.453)	(0.215)	(0.224)	(3.959)	(3.901)
Gender: Female	0.120	0.061	0.258**	0.225**	0.065	0.608
	(0.224)	(0.229)	(0.107)	(0.115)	(1.769)	(1.769)
Gender: Another gender	0.567	0.323	1.320***	1.280***	1.890	1.385
	(0.592)	(0.617)	(0.346)	(0.326)	(3.377)	(3.460)
Age	0.009	0.007	0.002	0.003	0.309***	0.332***
	(0.007)	(0.008)	(0.003)	(0.004)	(0.084)	(0.090)
Education	0.032	0.020	0.001	−0.011	−0.693	−0.784
	(0.054)	(0.055)	(0.025)	(0.027)	(0.744)	(0.732)
Log income	−0.011	−0.018	0.023	0.025	0.933***	0.919***
	(0.041)	(0.042)	(0.022)	(0.022)	(0.340)	(0.327)
Reef familiarity		−0.072		−0.081		0.671
		(0.109)		(0.057)		(0.759)
Marine biology background		−0.203		0.026		2.996*
		(0.263)		(0.130)		(1.759)
Environmental attitudes		0.111		0.108		−1.368
		(0.152)		(0.075)		(1.358)
National identity		0.045		0.084		1.335
		(0.114)		(0.067)		(1.247)
GBRMPA trust		−0.134		−0.019		−1.547*
		(0.089)		(0.040)		(0.826)
Reef behaviour		0.063		0.023		0.066
		(0.080)		(0.039)		(0.537)

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Table A26 *(continued)*

Green behaviour		0.108		−0.063		−1.756*
		(0.112)		(0.047)		(0.903)
Reef knowledge		0.155		0.149***		0.237
		(0.104)		(0.055)		(1.014)
Log bid	−1.042***	−1.068***				
	(0.067)	(0.069)				
Constant	1.634***	0.165	−1.433***	−2.869***	−2.678	12.148
	(0.550)	(1.095)	(0.289)	(0.529)	(3.730)	(9.919)
Observations	388	388	826	826	144	144
R^2 or pseudo-R^2	0.009	0.021	0.026	0.064	0.237	0.309

Panel B. Behavioural outcomes

	Behav. intentions		**Funding support**		**Newsletter**	
	(6)	**(7)**	**(6)**	**(7)**	**(6)**	**(7)**
VR	0.098	0.020	−0.260*	−0.315**	−0.159	−0.234
	(0.156)	(0.135)	(0.146)	(0.153)	(0.158)	(0.163)
Reef user	−0.244*	−0.239*	−0.047	−0.194	0.053	−0.071
	(0.146)	(0.135)	(0.131)	(0.153)	(0.141)	(0.166)
VR × Reef user	0.172	0.115	0.270	0.318*	0.090	0.146
	(0.202)	(0.169)	(0.185)	(0.192)	(0.200)	(0.207)
Gender: Female	0.589***	0.359***	0.076	0.007	0.336***	0.271***
	(0.100)	(0.086)	(0.091)	(0.095)	(0.099)	(0.104)
Gender: Another gender	0.365	0.184	0.269	0.092	0.660*	0.545*
	(0.248)	(0.198)	(0.320)	(0.311)	(0.356)	(0.327)
Age	−0.004	−0.009***	0.000	−0.001	0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Education	0.051**	0.024	0.048**	0.031	0.053**	0.041
	(0.023)	(0.021)	(0.022)	(0.023)	(0.024)	(0.025)
Log income	−0.016	−0.016	0.035*	0.037**	0.004	−0.000
	(0.016)	(0.014)	(0.018)	(0.018)	(0.018)	(0.019)
Reef familiarity		−0.090**		0.023		0.003
		(0.041)		(0.046)		(0.051)
Marine biology background		0.152		0.027		0.066

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Table A26 *(continued)*

		(0.096)		(0.106)		(0.113)
Environmental attitudes		0.201***		0.124**		0.138**
		(0.054)		(0.060)		(0.067)
National identity		0.068		0.061		0.037
		(0.046)		(0.055)		(0.058)
GBRMPA trust		0.056		−0.037		−0.064
		(0.040)		(0.037)		(0.039)
Reef behaviour		0.362***		−0.019		0.135***
		(0.033)		(0.034)		(0.037)
Green behaviour		0.143***		0.025		−0.001
		(0.041)		(0.044)		(0.047)
Reef knowledge		0.059		0.175***		0.042
		(0.043)		(0.046)		(0.050)
Constant	4.018***	0.534	−0.976***	−2.633***	−1.361***	−2.517***
	(0.230)	(0.399)	(0.231)	(0.466)	(0.244)	(0.519)
Observations	826	826	826	826	826	826
R^2 or pseudo-R^2	0.059	0.351	0.017	0.058	0.025	0.068

Note: Entries are coefficients with standard errors in parentheses. Model 6 includes VR, reef-user status, their interaction and the demographic controls; Model 7 adds the extended controls and is the primary specification (Table 6). The interaction is the difference in the VR effect between reef users and non-users. Hypothetical WTP uses the DBDC model among willing non-protest respondents; donation participation, funding support and newsletter subscription use probit; donation amount uses OLS among positive donors; and behavioural intentions use OLS. OLS and probit models use HC1 robust standard errors and DBDC uses its maximum-likelihood covariance matrix. Covariate definitions are in Table A8. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A27. Heterogeneity by recency of prior reef experience

Outcome	**More than 2 years**	**1–2 years**	**Within 12 months**	**Joint p**	**N**
Panel A. Behavioural outcomes					
Behavioural intentions	0.200	0.168	−0.144	0.500	818
	(0.191)	(0.311)	(0.246)		
Funding support	0.300	0.365	0.342	0.428	818
	(0.213)	(0.331)	(0.298)		

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Table A27 *(continued)*

Outcome	More than 2 years	1–2 years	Within 12 months	Joint p	N
Newsletter subscription	0.159	0.413	−0.124	0.546	818
	(0.233)	(0.345)	(0.327)		
Panel B. Valuation outcomes					
Donation participation	−0.141	0.577	0.136	0.270	818
	(0.249)	(0.368)	(0.407)		
Donation amount	3.483	5.466	−1.978	0.506	143
	(4.235)	(5.222)	(5.937)		
Hypothetical WTP	0.578	0.641	0.775	0.562	384
	(0.522)	(0.729)	(0.679)		

Note: Entries are VR interactions with categorical recency of the respondent's last reef dive, relative to non-reef users, with standard errors in parentheses. Recency replaces the binary reef-user indicator and the models otherwise use the Model 3 controls. The joint p-value is from a Wald test that the three VR × recency interactions are jointly zero; respondents with missing recency are excluded. Estimators and standard errors follow the corresponding main outcome models. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

F.2 Psychological-Distance Response

Table A28. Heterogeneity in the psychological-distance response by prior reef experience

	(6)	(7)
VR	−0.296***	−0.309***
	(0.074)	(0.073)
Reef user	−0.061	−0.055
	(0.065)	(0.076)
VR × Reef user	0.255***	0.247***
	(0.095)	(0.094)
Gender: Female	−0.074	−0.083*
	(0.049)	(0.049)
Gender: Another gender	−0.061	−0.085
	(0.114)	(0.106)

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Table A28 *(continued)*

	(6)	(7)
Age	−0.002	−0.002
	(0.002)	(0.002)
Education	−0.000	−0.004
	(0.011)	(0.011)
Log income	0.012	0.010
	(0.011)	(0.011)
Reef familiarity		−0.013
		(0.024)
Marine biology background		0.079
		(0.055)
Environmental attitudes		0.011
		(0.035)
National identity		−0.058
		(0.038)
GBRMPA trust		−0.033*
		(0.019)
Reef behaviour		0.067***
		(0.018)
Green behaviour		0.012
		(0.022)
Reef knowledge		0.015
		(0.023)
Constant	−0.182	−0.071
	(0.128)	(0.233)
Observations	826	826
R^2	0.031	0.071

Note: The dependent variable is the change in psychological distance from baseline to post-treatment; negative values indicate a reduction in distance. Entries are OLS coefficients with HC1 robust standard errors in parentheses. The VR coefficient is the effect among non-reef users and the interaction is the difference for reef users. Model 6 includes the demographic controls and reef-user status; Model 7 adds the extended controls. This analysis was not pre-specified. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

F.3 Combined Mediator–Moderator Specifications

Table A29. Combined mediator–moderator specifications, Models 8–10

Panel A. Hypothetical WTP and donation participation

	Hypothetical WTP			Donation participation		
	(8)	**(9)**	**(10)**	**(8)**	**(9)**	**(10)**
VR	−0.765**	−0.746**	−1.069**	0.001	−0.035	0.168
	(0.355)	(0.360)	(0.433)	(0.169)	(0.173)	(0.208)
Reef user	−0.507	−0.323	−0.890**	−0.131	−0.055	−0.004
	(0.309)	(0.361)	(0.414)	(0.162)	(0.190)	(0.217)
VR × Reef user	0.708	0.606	0.884	0.025	0.063	−0.072
	(0.451)	(0.458)	(0.542)	(0.221)	(0.228)	(0.265)
Psychological distance, baseline	−0.642***	−0.669***	−0.770***	−0.415***	−0.342***	−0.394***
	(0.153)	(0.193)	(0.229)	(0.068)	(0.093)	(0.115)
Psychological distance, change	−0.211	−0.261	−0.503**	−0.252***	−0.235**	−0.152
	(0.192)	(0.205)	(0.243)	(0.094)	(0.102)	(0.120)
Observations	388	388	337	826	826	700
R^2 or pseudo-R^2	0.030	0.035	0.096	0.075	0.086	0.152

Panel B. Donation amount and behavioural intentions

	Donation amount			Behavioural intentions		
	(8)	**(9)**	**(10)**	**(8)**	**(9)**	**(10)**
VR	0.712	−0.218	5.466	0.063	−0.021	−0.047
	(4.070)	(3.767)	(5.482)	(0.152)	(0.135)	(0.148)
Reef user	−2.960	−5.342*	−0.135	−0.366***	−0.252*	−0.186
	(3.145)	(3.118)	(3.317)	(0.136)	(0.130)	(0.137)
VR × Reef user	0.966	2.258	−5.402	0.136	0.115	0.152
	(4.280)	(4.130)	(6.037)	(0.190)	(0.166)	(0.182)
Psychological distance, baseline	−3.022***	−3.505***	−3.585**	−0.580***	−0.355***	−0.294***
	(1.116)	(1.327)	(1.663)	(0.058)	(0.066)	(0.069)
Psychological distance, change	−1.524	−1.931	−2.438	−0.255***	−0.298***	−0.308***
	(1.579)	(1.612)	(2.003)	(0.089)	(0.076)	(0.077)
Observations	144	144	126	826	826	700
R^2 or pseudo-R^2	0.264	0.337	0.540	0.174	0.380	0.452

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Table A29 *(continued)*

Panel C. Funding support and newsletter subscription

	Funding support			Newsletter subscription		
	(8)	**(9)**	**(10)**	**(8)**	**(9)**	**(10)**
VR	−0.310**	−0.321**	−0.214	−0.197	−0.270	−0.262
	(0.150)	(0.155)	(0.182)	(0.162)	(0.165)	(0.199)
Reef user	−0.148	−0.211	−0.173	−0.015	−0.085	−0.044
	(0.134)	(0.152)	(0.175)	(0.143)	(0.166)	(0.188)
VR × Reef user	0.278	0.296	0.182	0.098	0.163	0.050
	(0.190)	(0.194)	(0.226)	(0.203)	(0.208)	(0.249)
Psychological distance, baseline	−0.412***	−0.305***	−0.305***	−0.269***	−0.153*	−0.161*
	(0.059)	(0.072)	(0.085)	(0.062)	(0.079)	(0.094)
Psychological distance, change	−0.211***	−0.159**	−0.090	−0.174**	−0.189**	−0.217**
	(0.071)	(0.076)	(0.090)	(0.082)	(0.087)	(0.099)
Observations	826	826	700	826	826	700
R^2 or pseudo-R^2	0.067	0.075	0.097	0.047	0.075	0.129

Note: Entries are coefficients with standard errors in parentheses. Models 8 and 9 add baseline psychological distance and its change to Models 6 and 7, respectively; Model 10 further adds the wider demographic controls and replaces composite attitudinal, behavioural and knowledge measures with their component items. Only coefficients of interest are shown. For hypothetical WTP, Model 10 omits state of residence because it cannot be estimated in the smaller sample. Estimators, scales and standard errors are as in Table A26. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

G Persistence and Follow-Up

G.1 Participation and Selection

Table A30. Follow-up participation diagnostics

	Text-and-image	VR	*p*
Panel A. Participation rates			
Opted in to the follow-up survey, n / N (%)	201 / 408 (49.3)	195 / 428 (45.6)	0.284
Completed the survey among those who opted in, n / N (%)	61 / 201 (30.3)	45 / 195 (23.1)	0.102

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Table A30 *(continued)*

	Text-and-image	VR	*p*
Completed the survey among all participants, n / N (%)	61 / 409 (14.9)	45 / 428 (10.5)	0.056

Panel B. Effect of VR on participation, probit coefficients

	(1)	(2)	(3)
Opted in	−0.093	−0.127	−0.163*
	(0.087)	(0.089)	(0.090)
Observations	836	825	825
Completed, among opt-ins	−0.222	−0.226	−0.224
	(0.136)	(0.141)	(0.146)
Observations	396	391	391
Completed, among all participants	−0.213*	−0.235**	−0.239**
	(0.111)	(0.115)	(0.117)
Observations	837	826	826

Note: Panel A reports follow-up opt-in, completion conditional on opt-in, and overall completion by treatment condition. One participant has no recorded opt-in decision and is excluded from the first two rows; overall completion uses all randomised participants. *p*-values are from tests of equal proportions. Panel B reports the VR coefficient from probit models of the same outcomes with HC1 robust standard errors. Models 1–3 follow the covariate specifications of Table 7. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A31. Baseline characteristics of follow-up respondents and non-respondents, by treatment condition

	Text-and-image		VR		
	Resp.	Non-resp.	Resp.	Non-resp.	*p*, interaction
Age (years)	40.05	37.77	38.53	36.45	0.958
Female (%)	65.6	47.1	56.8	52.1	0.184
Education	7.74	7.36	7.76	7.31	0.879
Log income	10.84	10.10	10.19	10.00	0.303
Reef user (%)	62.3	59.5	60.0	60.8	0.723
Reef familiarity	1.15	1.17	1.02	1.07	0.938
Marine biology background (%)	27.9	31.3	37.8	27.9	0.178
Environmental attitudes	6.17	5.98	6.14	5.94	0.918

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Table A31 *(continued)*

National identity	6.15	6.02	6.39	6.07	0.326
GBRMPA trust	4.61	4.68	4.80	4.56	0.251
Reef behaviour	3.02	2.96	3.16	3.22	0.707
Green behaviour	5.58	5.42	5.40	5.57	0.147
Reef knowledge	4.79	4.93	5.52	5.01	0.014
Baseline psychological distance	2.88	3.08	2.69	3.05	0.423
Participants (N)	61	348	45	383	

Note: Entries are means, or percentages where marked, of baseline characteristics for follow-up respondents and non-respondents, separately by treatment condition. The final column reports the p-value on the VR × respondent-status interaction, testing whether the respondent–non-respondent difference in each characteristic varies across conditions. HC1 robust standard errors are used. Covariate definitions are in Table A8. The tests are descriptive and are not adjusted for multiple testing.

G.2 Full Estimates and Robustness Checks

Table A32. Full one-month follow-up estimates including covariates

Panel A. Psychological distance at follow-up

	PD: absolute drift (pre-specified)			**PD: change from baseline (not pre-specified)**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
VR	−0.061	−0.088	−0.048	−0.173	−0.190	−0.313**
	(0.096)	(0.101)	(0.107)	(0.157)	(0.155)	(0.157)
Gender: Female		0.024	0.077		0.284	0.208
		(0.117)	(0.101)		(0.182)	(0.173)
Gender: Another gender		0.337	0.375*		0.444	0.324
		(0.215)	(0.223)		(0.565)	(0.418)
Age		0.002	0.002		0.007	0.006
		(0.003)	(0.004)		(0.005)	(0.005)
Education		0.024	0.006		0.092**	0.081**
		(0.024)	(0.026)		(0.036)	(0.036)
Log income		0.001	−0.005		−0.006	0.001
		(0.011)	(0.012)		(0.023)	(0.021)
Reef user			0.093			−0.010
			(0.140)			(0.204)

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Table A32 *(continued)*

Reef familiarity			0.010			0.026
			(0.055)			(0.079)
Marine biology background			−0.056			−0.197
			(0.125)			(0.176)
Environmental attitudes			0.147**			0.179
			(0.067)			(0.112)
National identity			−0.194*			0.029
			(0.107)			(0.099)
GBRMPA trust			0.064			−0.000
			(0.047)			(0.057)
Reef behaviour			−0.011			0.062
			(0.041)			(0.059)
Green behaviour			0.033			−0.042
			(0.050)			(0.077)
Reef knowledge			0.019			0.181**
			(0.053)			(0.081)
Constant	0.686***	0.395	0.242	0.178	−0.913**	−2.890***
	(0.077)	(0.266)	(0.614)	(0.113)	(0.408)	(0.978)
Observations	106	105	105	106	105	105
R^2 or pseudo-R^2	0.003	0.027	0.169	0.011	0.110	0.289
Estimator	OLS	OLS	OLS	OLS	OLS	OLS

Panel B. Behavioural intentions and subsequent conservation actions

	Behavioural intentions at follow-up			**Unsolicited actions (count, 0–5)**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
VR	0.579*	0.582*	0.541**	0.595***	0.597***	0.708***
	(0.293)	(0.300)	(0.269)	(0.212)	(0.221)	(0.243)
Gender: Female		0.189	0.151		−0.107	−0.134
		(0.303)	(0.289)		(0.222)	(0.236)
Gender: Another gender		−0.058	−0.048		−0.334	−0.519
		(0.735)	(0.429)		(0.659)	(0.686)
Age		0.001	−0.005		−0.011*	−0.022***
		(0.007)	(0.008)		(0.006)	(0.007)

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Table A32 *(continued)*

Education		−0.192***	−0.115*		−0.081	−0.011
		(0.063)	(0.066)		(0.050)	(0.056)
Log income		0.016	0.037		0.023	0.048
		(0.057)	(0.042)		(0.049)	(0.055)
Reef user			−0.364			0.095
			(0.323)			(0.292)
Reef familiarity			−0.062			−0.115
			(0.126)			(0.111)
Marine biology background			0.378			0.251
			(0.325)			(0.280)
Environmental attitudes			0.082			−0.207
			(0.162)			(0.151)
National identity			0.094			0.273*
			(0.173)			(0.143)
GBRMPA trust			0.104			0.130
			(0.118)			(0.090)
Reef behaviour			0.395***			0.269***
			(0.092)			(0.088)
Green behaviour			0.225*			0.359***
			(0.130)			(0.120)
Reef knowledge			−0.037			−0.067
			(0.130)			(0.110)
Constant	4.128***	5.292***	1.075			
	(0.198)	(0.896)	(1.379)			
Observations	106	105	105	106	105	105
R^2 or pseudo-R^2	0.036	0.108	0.424	0.025	0.040	0.158
Estimator	OLS	OLS	OLS	Ord. probit	Ord. probit	Ord. probit

Note: Entries are coefficients with standard errors in parentheses, among respondents who completed the one-month follow-up survey. Within each outcome, columns (1)–(3) are the specifications of Table 7: Model 1 includes treatment assignment only, Model 2 adds gender, age, education and log income, and Model 3 adds reef-user status and the extended controls. Rows are shown for the covariates included in each specification, and the VR rows reproduce Table 7. The pre-specified psychological-distance outcome is the absolute difference between the post-treatment and follow-up scores; the non-pre-specified outcome is the follow-up score minus the pre-treatment baseline. Behavioural intentions are on the 1–7 composite scale. The unsolicited-action count (observed range 0–5) is estimated by ordered probit, with coefficients

reported on the latent-index scale. OLS models use HC1 heteroskedasticity-robust standard errors, while ordered probit uses maximum-likelihood-based standard errors. Sample sizes differ across specifications only where covariates are missing. Covariate definitions are in Table A8. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A33. Follow-up outcomes with inverse-probability-of-response weights

Outcome	(1)	(2)	(3)	N
Panel A. Unweighted (as in Table 7)				
PD: Absolute post-treatment drift (pre-specified)	−0.061	−0.088	−0.048	105
	(0.096)	(0.101)	(0.107)	
PD: Change from baseline (not pre-specified)	−0.173	−0.190	−0.313**	105
	(0.157)	(0.155)	(0.157)	
Behavioural intentions at follow-up	0.579*	0.582*	0.541**	105
	(0.293)	(0.300)	(0.269)	
Unsolicited conservation action count	0.595***	0.597***	0.708***	105
	(0.212)	(0.221)	(0.243)	
Panel B. Inverse-probability-of-response weights				
PD: Absolute post-treatment drift (pre-specified)	−0.065	−0.068	0.010	105
	(0.115)	(0.122)	(0.116)	
PD: Change from baseline (not pre-specified)	−0.297	−0.241	−0.369*	105
	(0.265)	(0.218)	(0.205)	
Behavioural intentions at follow-up	0.625**	0.586*	0.543*	105
	(0.317)	(0.311)	(0.287)	
Unsolicited conservation action count†	0.725***	0.676***	0.857***	105
	(0.238)	(0.234)	(0.272)	

Note: Entries are the estimated VR effects on follow-up outcomes. Models 1–3 follow Table 7; N is for Model 3. Panel A reproduces the unweighted estimates. In Panel B, respondents are weighted by the inverse of their estimated completion probability from a logit using treatment assignment, the Model 3 baseline covariates and baseline psychological distance ($N = 826$, 105 respondents). The weights have mean 7.9 (range 2.7–37.3) and an effective sample size of 80. For psychological distance and behavioural intentions, Panel B uses weighted least squares with bootstrap standard errors from 500 replications that re-estimate the response model and weights. The corresponding unweighted estimates in Panel A use HC1 robust standard errors; unweighted bootstrap standard errors are similar, so differences in precision reflect both weighting and the inference method. The unsolicited-action count is estimated by ordered probit. Panel A reports maximum-likelihood-based standard errors. In Panel B, the weighted ordered probit uses the same estimated weights, held fixed for inference, with robust linearised standard errors (†), because the bootstrap weighted ordered probit does not converge reliably with the sparse outcome categories. These standard errors do not account for uncertainty from estimating the response weights. Panel B significance uses normal approximations with the respective bootstrap or robust linearised standard errors.

Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A34. Unsolicited conservation actions with collapsed 3+ category

Panel A. Distribution of the action count, n (%)		
	Text-and-image	**VR**
0 actions	26 (42.6)	9 (20.0)
1 action	17 (27.9)	15 (33.3)
2 actions	13 (21.3)	12 (26.7)
3 actions	4 (6.6)	4 (8.9)
4 actions	1 (1.6)	3 (6.7)
5 actions	0 (0.0)	2 (4.4)
3 or more actions (collapsed category)	5 (8.2)	9 (20.0)
Respondents (N)	61	45

Panel B. Effect of VR, ordered probit coefficients			
	(1)	**(2)**	**(3)**
Uncollapsed count, 0–5 (primary)	0.595***	0.597***	0.708***
	(0.212)	(0.221)	(0.243)
Collapsed count, 0/1/2/3+	0.560***	0.582***	0.671***
	(0.214)	(0.224)	(0.247)
Observations	106	105	105

Note: Panel A reports the distribution of unsolicited conservation actions at follow-up by treatment condition. Because the upper categories are sparse, the robustness specification pools counts of three or more. Panel B reports VR coefficients from ordered probit models: the primary specification uses the observed 0–5 count and reproduces Table 7, while the robustness specification uses the collapsed 0/1/2/3+ outcome. Models 1–3 follow Table 7; model-based standard errors are in parentheses. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A35. Follow-up conservation actions and immediate behavioural intentions

	(1)	**(2)**
Panel A. Uncollapsed action count, 0–5 (primary)		
VR	0.708***	0.626**
	(0.243)	(0.248)
Immediate behavioural intentions (1–7)	—	0.419***
		(0.112)

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Table A35 *(continued)*

	(1)	(2)
Model 3 controls	Yes	Yes
Observations	105	105
Panel B. Collapsed action count, 0/1/2/3+ (robustness)		
VR	0.671***	0.586**
	(0.247)	(0.252)
Immediate behavioural intentions (1–7)	—	0.396***
		(0.112)
Model 3 controls	Yes	Yes
Observations	105	105

Note: Entries are ordered probit coefficients with model-based standard errors in parentheses. Panel A uses the uncollapsed count of unsolicited conservation actions reported at the one-month follow-up, while Panel B collapses counts of three or more actions into a single category. Column (1) replicates Model 3 of Table 7; column (2) additionally controls for the five-item behavioural-intentions index (1–7) measured immediately after treatment. Both columns use the same sample of follow-up respondents with complete Model 3 covariates and behavioural intentions. As intentions are measured post-treatment and may themselves be affected by treatment, column (2) provides a descriptive association rather than an estimate of a direct causal effect of VR. The analysis is exploratory and was not preregistered. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

H Exploratory Analyses

H.1 Emotional Engagement

Table A36. Effects of VR on individual emotion items

Emotion	Text mean	VR mean	Difference	95% CI	*t*	*p*
Emotional connection	5.08	5.52	0.44	[0.24, 0.64]	4.36	<0.001
Sad	4.81	4.91	0.10	[−0.13, 0.32]	0.86	0.392
Concerned	5.56	5.63	0.07	[−0.11, 0.25]	0.77	0.439
Sympathetic	5.47	5.62	0.15	[−0.03, 0.33]	1.66	0.098
Hopeful	4.66	4.94	0.28	[0.08, 0.47]	2.82	0.005
Hopeless	3.73	3.83	0.11	[−0.12, 0.33]	0.95	0.345
Angry	3.97	3.97	0.00	[−0.24, 0.25]	0.01	0.990

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Table A36 *(continued)*

Emotion	Text mean	VR mean	Difference	95% CI	*t*	*p*
Respondents (N)	409	428				

Note: Entries are means of each emotion item by condition, the difference in means (VR minus text-and-image) with its 95% confidence interval, and the Welch two-sample t-statistic and p-value. The items were measured after the intervention on 1–7 scales. These exploratory tests are not adjusted for multiple testing.

Table A37. Multiple-mediator analysis with emotions

Alternative mediator	r with ΔPD	ACME	95% CI	ADE	95% CI	σ
Panel A. Behavioural intentions (N = 826)						
Sad	−0.029	0.037	[0.007, 0.068]	0.056	[−0.104, 0.216]	0.195
Anger	0.031	0.043	[0.010, 0.077]	0.050	[−0.110, 0.211]	0.196
Hopeful	−0.041	0.044	[0.009, 0.078]	0.050	[−0.111, 0.210]	0.199
Hopeless	0.043	0.042	[0.008, 0.077]	0.051	[−0.110, 0.212]	0.198
Sympathetic	−0.078	0.032	[0.001, 0.063]	0.061	[−0.099, 0.222]	0.194
Concerned	−0.087	0.027	[−0.000, 0.054]	0.067	[−0.094, 0.228]	0.193
Emotional Connection	−0.094	0.030	[0.001, 0.060]	0.063	[−0.097, 0.224]	0.189
Panel B. Funding support (N = 826)						
Sad	−0.029	0.009	[−0.001, 0.018]	−0.051	[−0.117, 0.015]	0.082
Anger	0.031	0.008	[−0.001, 0.017]	−0.051	[−0.117, 0.015]	0.082
Hopeful	−0.041	0.008	[−0.001, 0.017]	−0.050	[−0.117, 0.016]	0.082
Hopeless	0.043	0.008	[−0.001, 0.017]	−0.050	[−0.117, 0.016]	0.082
Sympathetic	−0.078	0.008	[−0.001, 0.017]	−0.050	[−0.116, 0.016]	0.082
Concerned	−0.087	0.009	[−0.000, 0.019]	−0.052	[−0.118, 0.014]	0.082
Emotional Connection	−0.094	0.008	[−0.001, 0.018]	−0.051	[−0.117, 0.015]	0.082
Panel C. Newsletter subscription (N = 826)						
Sad	−0.029	0.007	[−0.001, 0.016]	−0.052	[−0.110, 0.007]	0.073
Anger	0.031	0.007	[−0.001, 0.016]	−0.052	[−0.110, 0.007]	0.073
Hopeful	−0.041	0.007	[−0.001, 0.016]	−0.051	[−0.110, 0.007]	0.073
Hopeless	0.043	0.007	[−0.001, 0.016]	−0.052	[−0.110, 0.007]	0.073
Sympathetic	−0.078	0.007	[−0.001, 0.016]	−0.051	[−0.110, 0.007]	0.073

Continued on next page

Table A37 *(continued)*

Alternative mediator	r with ΔPD	ACME	95% CI	ADE	95% CI	σ
Concerned	−0.087	0.006	[−0.002, 0.015]	−0.051	[−0.109, 0.008]	0.073
Emotional Connection	−0.094	0.007	[−0.002, 0.015]	−0.051	[−0.109, 0.008]	0.073
Panel D. Donation participation (N = 826)						
Sad	−0.029	0.006	[−0.001, 0.014]	0.002	[−0.050, 0.054]	0.064
Anger	0.031	0.007	[−0.000, 0.014]	0.002	[−0.050, 0.054]	0.064
Hopeful	−0.041	0.006	[−0.001, 0.014]	0.002	[−0.050, 0.054]	0.064
Hopeless	0.043	0.007	[−0.001, 0.014]	0.002	[−0.050, 0.054]	0.064
Sympathetic	−0.078	0.006	[−0.001, 0.013]	0.003	[−0.049, 0.055]	0.064
Concerned	−0.087	0.006	[−0.001, 0.013]	0.002	[−0.050, 0.054]	0.064
Emotional Connection	−0.094	0.006	[−0.001, 0.013]	0.003	[−0.050, 0.055]	0.064
Panel E. Donation amount among donors (N = 144)						
Hopeful	−0.003	0.429	[−0.610, 1.469]	1.179	[−2.497, 4.855]	1.904
Sad	−0.008	0.443	[−0.604, 1.490]	1.171	[−2.550, 4.892]	1.900
Anger	0.038	0.484	[−0.575, 1.542]	1.122	[−2.609, 4.853]	1.902
Sympathetic	−0.059	0.640	[−0.437, 1.716]	0.972	[−2.720, 4.664]	1.855
Concerned	−0.080	0.549	[−0.525, 1.623]	1.067	[−2.628, 4.763]	1.890
Hopeless	−0.151	0.575	[−0.465, 1.616]	1.042	[−2.629, 4.713]	1.888
Emotional Connection	−0.192	0.576	[−0.559, 1.712]	1.050	[−2.605, 4.705]	1.854
Panel F. Hypothetical WTP (N = 388)						
Concerned	−0.015	−0.468	[−2.002, 1.066]	−0.474	[−6.279, 5.330]	4.677
Sad	0.044	−0.533	[−2.076, 1.010]	−0.409	[−6.232, 5.415]	4.672
Sympathetic	−0.045	−0.505	[−2.103, 1.092]	−0.437	[−6.277, 5.403]	4.673
Hopeful	−0.075	−0.531	[−2.110, 1.049]	−0.412	[−6.237, 5.413]	4.677
Emotional Connection	−0.103	−0.514	[−2.086, 1.058]	−0.429	[−6.245, 5.388]	4.685
Hopeless	0.117	−0.533	[−2.073, 1.008]	−0.410	[−6.209, 5.389]	4.682
Anger	0.132	−0.471	[−1.996, 1.055]	−0.472	[−6.263, 5.320]	4.680

Note: Each row reports a separate two-mediator model with change in psychological distance (ΔPD) as the focal mediator and the listed emotion as the alternative mediator, estimated with `multimed` (Imai and Yamamoto, 2013) using Model B covariates and 5,000 simulations. ACME is the indirect effect through ΔPD and ADE the average direct effect, each evaluated at $\sigma = 0$. The final column reports the smallest evaluated σ at which the ACME bounds include zero; because sensitivity is evaluated on the routine's default R^2 grid (step 0.01), this is an upper bound on the exact crossing point. r is the correlation between

the emotion and ΔPD, with rows ordered by $|r|$. Binary outcomes are coded 0/1; donation amount is in A$ among positive donors; hypothetical WTP uses elicited-interval midpoints because `multimed` does not support interval-censored outcomes. Values shown as −0.000 lie just below zero and therefore indicate intervals containing zero.

H.2 Gaze Engagement and Prior VR Experience

Table A38. Gaze engagement and outcomes within the VR condition

Outcome	(1)	(2)	(3)	N
Hypothetical WTP	−0.001	−0.007	−0.008	188
	(0.014)	(0.015)	(0.016)	
Donation participation	−0.002	0.002	0.003	401
	(0.005)	(0.005)	(0.006)	
Donation amount	−0.100	−0.023	−0.046	76
	(0.149)	(0.109)	(0.111)	
Behavioural intentions	−0.004	0.000	0.006	401
	(0.006)	(0.006)	(0.005)	
Funding support	0.004	0.007	0.008	401
	(0.005)	(0.005)	(0.006)	
Newsletter subscription	−0.003	−0.002	−0.000	401
	(0.005)	(0.005)	(0.005)	

Note: Entries are coefficients on gaze engagement, the average share (in percent) of head-gaze observations within areas of interest across the VR scenes (mean 62.3, SD 12.6), with standard errors in parentheses. The sample is the 409 VR participants with gaze data. Because gaze is not experimentally assigned, these are within-VR associations and should not be interpreted causally. Models 1–3 follow Table 4; N is for Model 3. Estimators and standard errors are as in Table A15. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A39. Prior VR experience within the VR condition

Outcome	(1)	(2)	(3)	N
Change in psychological distance	0.206***	0.206***	0.134*	420
	(0.076)	(0.074)	(0.075)	
Hypothetical WTP	0.048	0.139	−0.155	192
	(0.348)	(0.386)	(0.407)	
Donation participation	0.080	0.250	0.256*	420

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Table A39 *(continued)*

Outcome	(1)	(2)	(3)	N
	(0.149)	(0.152)	(0.153)	
Donation amount	−3.889	4.650	5.373	78
	(4.241)	(3.263)	(3.992)	
Behavioural intentions	0.207	0.258*	0.074	420
	(0.140)	(0.154)	(0.139)	
Funding support	0.130	0.225	0.190	420
	(0.130)	(0.141)	(0.145)	
Newsletter subscription	0.212	0.276*	0.212	420
	(0.143)	(0.161)	(0.166)	

Note: Entries are coefficients on an indicator for prior VR experience (276 of 428 VR participants), with standard errors in parentheses. Prior VR experience was measured only in the VR condition, so these are within-VR associations and should not be interpreted causally. Models 1–3 follow Table 4; N is for Model 3. Outcome estimators and standard errors are as in Table A15; change in psychological distance is estimated by OLS with HC1 robust standard errors. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

I Robustness and Sensitivity Analyses

I.1 Hypothetical WTP Specifications

Table A40. Hypothetical WTP: alternative distributions, spike specification, and covariance estimators

Panel A. VR coefficient by distributional assumption

Distribution	(1)	(2)	(3)	Log-lik., (3)
Log-logistic (primary)	−0.293	−0.307	−0.371*	−438.5
	(0.212)	(0.218)	(0.221)	
Log-normal	−0.149	−0.160	−0.209*	−435.5
	(0.122)	(0.125)	(0.127)	
Weibull	−0.074	−0.090	−0.156	−432.7
	(0.111)	(0.113)	(0.120)	
Logistic, linear in bid	−0.168	−0.207	−0.257	−481.7
	(0.202)	(0.208)	(0.212)	
Normal, linear in bid	−0.079	−0.101	−0.139	−502.1

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Table A40 *(continued)*

	(0.121)	(0.124)	(0.126)	

Panel B. Conditional median WTP, Model 3 (A$ per month)

Distribution	Text-and-image	VR	Difference	95% CI
Log-logistic (primary)	6.66	4.70	−1.97	[−4.34, 0.38]
Log-normal	6.46	4.61	−1.85	[−4.17, 0.31]
Weibull	6.83	5.29	−1.54	[−3.92, 0.77]
Logistic, linear in bid	8.91	4.83	−4.08	[−10.64, 2.41]
Normal, linear in bid	8.49	3.78	−4.71	[−12.96, 3.52]

Panel C. Conditional truncated mean WTP, Model 3 (A$ per month)

Distribution	Text-and-image	VR	Difference	95% CI
Log-logistic (primary)	19.64	15.14	−4.50	[−9.76, 0.89]
Log-normal	18.80	14.26	−4.54	[−10.09, 0.75]
Weibull	17.64	13.90	−3.74	[−9.41, 1.89]
Logistic, linear in bid	16.05	13.58	−2.47	[−6.36, 1.46]
Normal, linear in bid	18.12	15.42	−2.69	[−7.34, 2.00]

Panel D. Spike specification, including genuine zero WTP

	(1)	(2)	(3)	N, (3)
Spike model (logistic)	−0.131	−0.222	−0.264*	787
	(0.132)	(0.136)	(0.139)	

Panel E. Sensitivity to covariance estimator, log-logistic DBDC

Covariance estimator	(1)	(2)	(3)	N, (3)
Maximum-likelihood	−0.293	−0.307	−0.371*	388
	(0.212)	(0.218)	(0.221)	
Sandwich (HC1)	−0.293	−0.307	−0.371	388
	(0.220)	(0.230)	(0.233)	

Note: Panel A reports VR coefficients from alternative DBDC models of hypothetical WTP among respondents willing to contribute in principle, excluding protest responses. The primary log-logistic specification, log-normal and Weibull use log bid; logistic and normal alternatives enter bid linearly (in A$10 units) and allow negative WTP. Coefficients are on distribution-specific scales and should not be compared in magnitude across rows. Models 1–3 follow Table 4; the final column reports the Model 3 log-likelihood. Panels B and C report Model 3 conditional median and mean WTP truncated at A$150,

respectively, evaluated at sample-mean covariates. Differences are VR minus text-and-image, with 95% intervals from 5,000 paired Krinsky–Robb draws. Truncation is used because the untruncated log-logistic mean is sensitive to its heavy upper tail. Panel D reports the logistic spike specification, which assigns zero WTP to respondents unwilling to contribute in principle and excludes protest responses; the corresponding population-level mean is in Table A19. Results retaining protest responses are in Table A16. Standard errors in Panels A–D use the maximum-likelihood covariance matrix. Panel E compares inference for the primary log-logistic DBDC specification using the maximum-likelihood covariance matrix and a heteroskedasticity-robust sandwich covariance estimator with an HC1 small-sample adjustment, based on respondent-level contributions to the joint DBDC likelihood. Coefficient estimates are unchanged across covariance estimators, while standard errors and associated significance levels differ. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

I.1.1 Missing Income

Table A41. Missing income: imputation versus listwise deletion

Outcome	**Primary: imputed income**			**Listwise deletion**		
	Estimate	SE	N	Estimate	SE	N
Hypothetical WTP	−0.371*	0.221	388	−0.258	0.235	345
Donation participation	0.038	0.110	826	0.051	0.119	704
Donation amount | donating	1.523	1.736	144	1.573	1.972	125
Behavioural intentions	0.089	0.083	826	0.048	0.091	704
Funding support	−0.122	0.093	826	−0.143	0.100	704
Newsletter subscription	−0.144	0.100	826	−0.152	0.107	704

Note: Entries compare the fully adjusted Model 3 specification under two treatments of missing income. Column group (1) uses the primary income measure, combining observed income with income imputed by OLS from age, gender, education and Australian residency and then expressed in logs. Column group (2) uses the logarithm of observed income only, so respondents without reported income are excluded by listwise deletion. Hypothetical WTP is estimated using the log-logistic double-bounded dichotomous-choice model; donation participation, funding support and newsletter subscription are probit models, with coefficients on the probit-index scale that differ from the average marginal effects of Tables 4, A42 and A44; donation amount conditional on donating and behavioural intentions are estimated by OLS. Standard errors are HC1 heteroskedasticity-robust for OLS and probit models; the DBDC model uses its maximum-likelihood covariance matrix. Using the preregistered 1–9 income-bracket code with listwise deletion instead of log income gives estimates within 0.3 standard errors of the listwise-deletion estimates shown here. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

I.1.2 Experimenter Identity

As participants were recruited and assisted by multiple researchers during field implementation, we additionally re-estimated the fully adjusted Model 3 specifications controlling for experimenter identity. The treatment-effect estimates are virtually unchanged (Table A42),

indicating that the main results are not sensitive to which researcher administered the experiment.

Table A42. Robustness to Controlling for Experimenter Identity

Outcome	Primary Model 3			Model 3 + experimenter		
	Estimate	SE	N	Estimate	SE	N
Donation participation	0.009	0.026	826	0.011	0.027	826
Donation amount | donating	1.523	1.736	144	1.323	1.718	144
Behavioural intentions	0.089	0.083	826	0.090	0.083	826
Funding support	−0.044	0.034	826	−0.045	0.034	826
Newsletter subscription	−0.042	0.029	826	−0.043	0.029	826
Psychological-distance change	−0.161***	0.047	826	−0.164***	0.047	826
Hypothetical WTP	−0.371*	0.221	388	−0.408*	0.223	388

Note: Entries compare the fully adjusted Model 3 estimates with specifications additionally controlling for experimenter identity. Donation participation, funding support and newsletter subscription are reported as average marginal effects from probit models, which are on the probability scale and differ from the probit-index coefficients of Tables A15, A41 and A43. Behavioural intentions, donation amount conditional on donating and psychological-distance change are estimated by OLS. Hypothetical WTP is the coefficient from the log-logistic double-bounded dichotomous-choice model. OLS and probit specifications use HC1 heteroskedasticity-robust standard errors, with delta-method standard errors for the probit average marginal effects; the DBDC model uses its maximum-likelihood covariance matrix. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

I.1.3 Treatment Received

Table A43. As-treated estimates

Outcome	**ITT (random assignment)**	**As treated**	**N**
Hypothetical WTP	−0.371*	−0.453**	388
	(0.221)	(0.222)	
Donation participation	0.038	0.057	826
	(0.110)	(0.110)	
Donation amount	1.523	−0.380	144
	(1.736)	(1.904)	
Behavioural intentions	0.089	0.076	826
	(0.083)	(0.083)	

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Table A43 *(continued)*

Outcome	ITT (random assignment)	As treated	N
Funding support	−0.122	−0.080	826
	(0.093)	(0.093)	
Newsletter subscription	−0.144	−0.119	826
	(0.100)	(0.100)	

Note: Entries are Model 3 VR coefficients with standard errors in parentheses. The ITT column uses random assignment (Table 4); the as-treated column reclassifies the 11 participants assigned to VR who completed the text-and-image materials instead because of vertigo, discomfort or similar reasons. Estimators and standard errors are as in Table A15; coefficients for the probit outcomes (donation participation, funding support, newsletter subscription) are on the probit-index scale and differ from the average marginal effects of Tables 4, A42 and A44. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

I.1.4 Speeder Exclusion

Given that the exclusion of respondents completing the survey in less than half the condition-specific median completion time was not preregistered, we re-estimated the fully adjusted treatment-effect specifications retaining all 22 respondents classified as speeders. The resulting estimates are very similar to the primary results (Table A44), with no changes in the substantive conclusions.

Table A44. Robustness to Retaining Respondents Classified as Speeders

Outcome	Speeders excluded			Speeders retained		
	Estimate	SE	N	Estimate	SE	N
Donation participation	0.009	0.026	826	0.014	0.026	847
Donation amount | donating	1.523	1.736	144	1.523	1.736	144
Behavioural intentions	0.089	0.083	826	0.057	0.082	847
Funding support	−0.044	0.034	826	−0.047	0.033	847
Newsletter subscription	−0.042	0.029	826	−0.039	0.029	847
Psychological-distance change	−0.161***	0.047	826	−0.162***	0.047	847
Hypothetical WTP	−0.371*	0.221	388	−0.413*	0.219	398

Note: Entries compare the fully adjusted Model 3 estimates from the primary analytic sample with estimates obtained when the 22 respondents classified as speeders are retained. Donation participation, funding support and newsletter subscription are reported as average marginal effects from probit models, which are on the probability scale and differ from the probit-index coefficients of Tables A15, A41 and A43. Behavioural intentions, donation amount conditional on donating and psychological-distance change are estimated by OLS. Hypothetical WTP is the coefficient from the log-logistic double-bounded dichotomous-choice model. OLS and probit specifications use HC1 heteroskedasticity-robust standard

errors, with delta-method standard errors for the probit average marginal effects; the DBDC model uses its maximum-likelihood covariance matrix. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

I.1.5 Order of the Valuation Tasks

The order of the hypothetical valuation and actual donation tasks was randomised independently of presentation mode. We assess whether elicitation order affects the valuation results by controlling for order and allowing the effect of VR to vary across orders. Hypothetical WTP is lower when elicited second, following the actual donation task, but controlling for order leaves the estimated VR effect essentially unchanged, and there is no evidence that the effect of VR on either hypothetical WTP or actual donation outcomes varies by order. We additionally find no evidence that actual donations are associated with the randomly assigned hypothetical bid levels (Table A45).

Table A45. Robustness to the order of the valuation tasks

Panel A. Controlling for elicitation order

	Primary Model 3		**Model 3 + elicitation order**				**N**
	VR		**VR**		**Donation first**		
	Est.	SE	Est.	SE	Est.	SE	
Hypothetical WTP	−0.371*	0.221	−0.392*	0.223	−0.584**	0.229	388
Donation participation	0.038	0.110	0.038	0.110	−0.008	0.108	826
Donation amount | donating	1.523	1.736	1.515	1.740	0.350	1.978	144

Panel B. VR effect by order

	Hypothetical first		**Donation first**		**Difference**		**N**
	VR effect		*VR effect*		*VR × order*		
	Est.	SE	Est.	SE	Est.	SE	
Hypothetical WTP	−0.347	0.284	−0.464	0.363	−0.118	0.463	388
Donation participation	−0.057	0.157	0.127	0.151	0.183	0.215	826
Donation amount | donating	−1.655	2.579	4.393	3.085	6.048	4.549	144

Panel C. Bid anchoring of actual donations

	Hypothetical first	**Donation first**	**N**

Continued on next page

Table A45 *(continued)*

	Bid slope		*Bid slope (placebo)*		
	Est.	SE	Est.	SE	
Donation participation	0.022	0.074	0.048	0.068	826
Donation amount | donating	1.048	1.130	−0.612	1.231	144

Note: Order 1 presents the hypothetical valuation first and order 2 the actual donation first. Order was balanced across presentation mode (chi-squared $p = 0.339$) and reef-user strata ($p = 0.708$). All specifications use the fully adjusted Model 3 controls. Panel A compares the primary VR coefficient with the corresponding estimate after adding an indicator for donation first and reports the coefficient on that indicator. Panel B allows the VR effect to vary by order; the reported difference is the VR × order interaction. Panel C tests whether actual donations are associated with the logarithm of the randomly assigned initial hypothetical bid; anchoring of the actual donation on the hypothetical bid is possible only when the hypothetical valuation comes first, while the donation-first order provides a placebo comparison. Hypothetical WTP is estimated using the log-logistic DBDC model, donation participation by probit, and conditional donation amount by OLS among positive donors. OLS and probit models use HC1 robust standard errors and the DBDC model its maximum-likelihood covariance matrix. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

I.2 Alternative Measures and Exposure Time

Table A46. Alternative constructions of behavioural intentions

Outcome	**(1)**	**(2)**	**(3)**	**N**
Panel A. Behavioural intentions at baseline survey				
Average of five items (primary, OLS)	0.236**	0.199**	0.089	826
	(0.100)	(0.099)	(0.083)	
Educate others (ordered probit)	0.100	0.067	−0.005	826
	(0.072)	(0.073)	(0.074)	
Support funding (ordered probit)	0.133*	0.112	0.049	826
	(0.072)	(0.072)	(0.074)	
Newsletter (ordered probit)	0.085	0.081	0.013	826
	(0.072)	(0.073)	(0.074)	
Donate (ordered probit)	0.118*	0.095	0.032	826
	(0.072)	(0.072)	(0.074)	
Discuss (ordered probit)	0.198***	0.188***	0.139*	826

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Table A46 *(continued)*

Outcome	(1)	(2)	(3)	N
	(0.072)	(0.073)	(0.074)	
First principal component (OLS; 66% of variance)	0.301**	0.253**	0.115	826
	(0.126)	(0.124)	(0.104)	
Panel B. Behavioural intentions at one-month follow-up				
Average of five items (primary, OLS)	0.579*	0.582*	0.541**	105
	(0.293)	(0.300)	(0.269)	
Educate others (ordered probit)	0.299	0.326	0.382*	105
	(0.205)	(0.214)	(0.229)	
Support funding (ordered probit)	0.330	0.339	0.329	105
	(0.205)	(0.213)	(0.229)	
Newsletter (ordered probit)	0.281	0.371*	0.434*	105
	(0.208)	(0.217)	(0.232)	
Donate (ordered probit)	0.490**	0.452**	0.489**	105
	(0.207)	(0.214)	(0.230)	
Discuss (ordered probit)	0.185	0.185	0.157	105
	(0.204)	(0.213)	(0.228)	
First principal component (OLS; 71% of variance)	0.709*	0.710*	0.658*	105
	(0.361)	(0.369)	(0.332)	

Note: Entries are VR coefficients with standard errors in parentheses. The primary behavioural-intentions outcome is the average of five 1–7 items (educate others, support funding, newsletter, donate, discuss). As preregistered, the items are also analysed separately by ordered probit (latent-scale coefficients, model-based standard errors), and their first principal component by OLS with HC1 robust standard errors, signed so higher values indicate stronger intentions. Models 1–3 follow Table 4; N is for Model 3. Panel B repeats these measures among one-month follow-up respondents (Table 7). These robustness checks are not adjusted for multiple testing. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A47. Exposure time in the text-and-image condition and its association with outcomes

Panel A. Exposure time in seconds

	N	Mean	SD	Median	P25	P75	P5	P95
Total exposure	403	68.4	53.0	56.6	30.8	92.7	12.0	158.6
Page 1	403	17.7	20.9	13.4	6.1	23.1	1.9	43.2
Page 2	403	14.8	11.9	12.4	6.2	19.8	2.4	36.3
Page 3	403	16.8	13.4	14.3	8.0	21.9	2.6	40.7

Continued on next page

Table A47 *(continued)*

Page 4	403	19.2	18.1	15.1	6.2	27.3	2.6	48.3

Panel B. Log exposure time and outcomes

	(1)	(2)	(3)	N
Change in psychological distance	−0.055	−0.037	−0.030	400
	(0.040)	(0.041)	(0.044)	
Hypothetical WTP	0.293*	0.298	0.327	192
	(0.177)	(0.193)	(0.216)	
Donation participation	0.455***	0.537***	0.561***	400
	(0.109)	(0.116)	(0.134)	
Donation amount	3.089*	0.912	0.868	66
	(1.599)	(1.741)	(2.159)	
Behavioural intentions	−0.003	−0.022	0.050	400
	(0.095)	(0.096)	(0.086)	
Funding support	0.323***	0.348***	0.288***	400
	(0.083)	(0.089)	(0.099)	
Newsletter subscription	0.212**	0.181*	0.214*	400
	(0.093)	(0.102)	(0.116)	

Note: Panel A summarises page-submit exposure times for the 403 text-and-image participants with timing data; VR exposure was fixed at 300 seconds, so the conditions are not duration-matched. Panel B reports associations between log exposure time and outcomes within the text-and-image condition only. Because exposure time was self-selected, these coefficients should not be interpreted as causal effects of duration or as estimates of its contribution to the VR–text treatment contrast. Models 1–3 follow Table 4; N is for Model 3. Estimators and standard errors are as in Table A15; change in psychological distance is estimated by OLS with HC1 robust standard errors. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.