Does psychic numbing apply to endangered species conservation? The case of the Peregrine Falcon in Berkeley, California

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Introduction: Many individuals exhibit compassion towards charismatic animals in distress, yet they are not as motivated to help the thousands of endangered animal species. The foundation of this paradox is psychic numbing, a psychological phenomenon that explains why people are more inclined to donate to help save human lives when presented with accounts of single identifiable victims compared to accounts of mass atrocities like genocide. The impact of psychic numbing on human tragedies has been well documented, but its impact on non-human tragedies, such as the crisis of endangered species conservation, has not been thoroughly assessed.

Methods: This study uses Peregrine Falcon (*Falco peregrinus*) conservation as a case study, examining whether identifiable lives or statistical lives elicit the greatest concern for Peregrine Falcon preservation and increased donations. Participants are randomly presented with one of three messages: (1) The story of Annie, a celebrity falcon residing in the University of California, Berkeley, (2) Statistical data on Peregrine Falcon decline and history, or (3) A combination of Annie's story and statistical data.

Results: We did not find a significant difference in donation amount for identifiable versus statistical lives. However, the three different messaging conditions did evoke significant differences in word association tasks about endangered species.

Discussion: Our results demonstrate the importance of further research into messaging conditions that will bring about the greatest level of human action for endangered species conservation.

1 Introduction

Global discussions on environmental issues revolve around the increasing number of endangered species with some becoming extinct at worrisome rates at tens to hundreds of times higher than the average rate of extinction across the past ten million years (Dirzo et al., 2014). Various conservation legislation efforts have been pushing back against this dire state of biodiversity loss, with the successes of the Endangered Species Act (ESA) paving the way (Doremus and Pagel, 2001). Since its establishment in 1974, the ESA has saved more than 99 percent of its listed species from extinction (Greenwald et al., 2019). The ESA has been particularly successful in recovering threatened or endangered bird species, and 85% of bird populations protected under the ESA in the continental United States have either increased or stabilized (Suckling et al., 2016).

However, most of these biodiversity conservation efforts are successful only if the listed endangered species has funding allocated to its conservation (Brown and Shogren, 1998; Ferraro et al., 2007). This type of financial support increasingly relies on garnering public support, with public attitudes towards endangered species significantly impacting fundraising for conservation efforts (Smith et al., 2012). Understanding the motivations behind public donations for endangered species conservation is critical for ensuring funded, and therefore successful, conservation efforts (Echeverri et al., 2017a; Manfredo, 2008).

The field of social psychology has much to offer when understanding what motivates the public to donate to social or environmental causes. Research on pro-social spending has proposed the concept of *psychic numbing*, referring to the turning off of feeling in the human brain when presented with a large enough scale of tragedy (Lifton, 1976). While psychic numbing was originally coined with a positive connotation in that it helps victims function in the aftermath of a tragedy, the disadvantageous impacts of this psychological phenomenon have since been studied through a more critical lens. Psychic numbing can lead to apathetic inaction in humans when faced with large-scale tragedies such as a genocide, in that the value of saving a life decreases as the number of lives needing saving increases (Västfjäll et al., 2014, 2015).

The foundation of psychic numbing is in the *identifiable victim effect*, in which people are more willing to help when presented with one identifiable victim than when presented with statistics that represent many unidentified victims (Jenni and Loewenstein, 1997; Kogut and Ritov, 2005; Slovic, 2007; Small and Loewenstein, 2003). This collapse of compassion, also called compassion fatigue, is rooted in the idea that for each additional victim, the attention per victim decreases (Tomm et al., 2019). The connection of psychic numbing to donation tendencies was proven in a study by Small et al. (2007) that assessed the differences in donation amounts by study participants who were presented with one of three different types of famine victims: a story of one identifiable life, statistics representing masses of lives, and the combination of identifiable and statistical lives. The average donation for the singular identifiable life was almost double the average donation for the mass number of statistical lives. There was not a significant difference in the donation amount towards statistical lives and statistical lives added to the identifiable life, showing the ability of the statistical results to drag down intended donations (Small et al., 2007). Psychic numbing has been tested in the context of human catastrophes such as genocide and famine, but it has not been fully explored in catastrophes that are not human-centric. For example, there has not been thorough research on determining whether psychic numbing can apply to intended donations for endangered species conservation.

While, to our knowledge, psychic numbing has not been expressly studied in the context of endangered species, there are multiple accounts that show the ability of an identifiable individual animal to motivate public donations. In the context of conservation biology, these identifiable victims are referred to as flagship species. Flagship species are usually charismatic large vertebrates and are used as the foundation of conservation efforts because they spark public sympathy (Simberloff, 1998). An example of the power of a flagship animal can be found in Cecil the Lion, a lion killed by poachers in 2015 while living in a national park in Zimbabwe under the surveillance of a research team (Macdonald et al., 2016). Jimmy Kimmel lamented the loss of Cecil the Lion in a monologue during The Tonight Show, helping catapult the story of Cecil's death into mainstream media and igniting an unprecedented total donation of more than $1 million from over 13,000 people towards WildCRU, a conservation organization (Macdonald et al., 2016). While there has been debate surrounding the impact of this overwhelming response, primarily from Western media, on the goals of the Zimbabwean conservationists (Chimuka, 2019), this singular story undoubtedly evoked a uniquely massive global response that the conservation movement as a whole hopes to emulate for other species.

Conservation marketing uses marketing principles to influence its audience to adopt practices and behaviors that are more oriented towards environmental conservation (Verissimo and McKinley, 2016; Wright et al., 2015). Conservation marketing is an increasingly applied field that continues to grow into an effective way to address environmental problems, showing the importance of humans at the center of biodiversity conservation struggles (Veríssimo et al., 2019). This field is drawing inspiration from the identifiable victim effect and from flagship animals such as Cecil the Lion to most effectively encourage greater donations towards species conservation. Conservation marketing studies suggest that anthropomorphizing a species increases the average donation amount because species that more closely resemble humans are seen as more charismatic and significant (Root-Bernstein et al., 2013; Veríssimo et al., 2017). Psychic numbing has been studied in the context of human suffering, and flagship species have been acknowledged as important tools in conservation marketing, but there is a research gap on the applications of these two concepts together.

To address this gap, we designed an experimental study and used mixed methods to assess whether psychic numbing applies to endangered species conservation. Specifically, we investigated how different messaging approaches impact intended donations for endangered species conversation. We expected that the messaging condition portraying an identifiable animal life would elicit higher donations compared to the messaging condition presenting statistical data about animal populations or the control condition presenting identifiable lives and statistics together. Additionally, we

used Likert-scale items and a word association task to evaluate participants' attitudes towards endangered species, as well as the impact of each message on shaping public perceptions of endangered species. We expected that participants' baseline attitudes and emotions towards endangered species before exposure to the messages would be consistent across the three experimental conditions. After exposure, we predicted that the message featuring an identifiable animal life would evoke a more positive and emotional response to endangered species, whereas the message describing animal population statistics would evoke a more neutral and scientific response. In line with our predictions for donation behavior, we expected the control message to generate responses more closely aligned with those elicited by the statistical condition.

2 Methods

2.1 Case study

We used the Peregrine Falcon (*Falco peregrinus*) as the species in our case study to determine if psychic numbing applies in the context of assessing public behavioral intentions to donate for endangered species conservation. Peregrine Falcons experienced drastic population declines across North America during the 20th century, with the species disappearing from the eastern United States by the mid-1970s while declining to less than one quarter of their pre-decline population size in the western United States (Enderson et al., 1995). Similarly, population numbers fell to less than one third of their former numbers in interior Alaska and northern Canada (Munro and Van Drimmelen, 1988).

The primary cause of this decline was DDT, an insecticide that was first widely applied during World War II and rapidly grew in popularity and usage until its detrimental environmental impact was acknowledged and publicized in the mid-1960s–70s (Russell, 1999). The bioaccumulation of DDT in the Peregrine Falcon caused a build-up of the metabolite DDE, which inhibited calcium production and therefore caused Peregrine Falcon eggshells to be very brittle and break under the weight of the incubating parent (Peakall et al., 1990). The rapid decline of Peregrine Falcon populations caused the Peregrine Falcon to be listed as endangered under the Endangered Species Conservation Act of 1969, and under the Endangered Species Act in 1973.

North American Peregrine Falcon populations have successfully recovered due to the banning of DDT combined with extensive efforts towards the reintroduction of the species, beginning in 1974 with The Peregrine Fund and continuing with various national organizations across the United States and Canada (Cade and Bird, 1990). The success of these programs allowed the declassification of the Peregrine Falcon as an endangered species in 1999 (Gahbauer et al., 2015).

We focus on the Peregrine Falcon not only due to its history as an endangered species, but also because of its current celebrity status in Berkeley, California. In December of 2016, two Peregrine Falcons were observed setting up a nest in the campanile that is centered on the campus of the University of California, Berkeley.

These two falcons, later named Annie and Grinnell, marked the beginning of a succession of Peregrine Falcons being raised from the campanile. Annie has had multiple mates since Grinnell and has hatched over 24 chicks, all while being closely observed and celebrated by the Berkeley community. A live viewing stream of the nests at the campanile, the selling of shirts decorated with images of the falcons, and an Instagram account dedicated to Annie and her family having over 18.1 thousand followers are a few signs of the falcons' popularity (Cal Falcons, 2024). The case of Annie the celebrity Peregrine Falcon is an ideal case study to evaluate whether psychic numbing applies to the donations of endangered species conservation by testing the role of a celebrity animal from an endangered species.

2.2 Experimental design

The methods for the survey used in this study were approved by the University of California, Berkeley (UC Berkeley) Institutional Review Board composed of the Committee for Protection of Human Subjects and the Office for Protection of Human Subjects (protocol number 2024-02-17175). We collected data between April 4 and June 9, 2024. Qualtrics was used for survey design and data collection, with a unique subject ID corresponding to each respondent. Our survey consisted of a word association task, Likert-scale questions, and three different messaging conditions, one for each of the three experimental treatment groups, followed by a subsequent donation question. The three experimental treatment groups in our study were modeled after those used in prior research on psychic numbing: Celebrity falcon (i.e., identifiable life), Falcon statistics (i.e., statistical information representing masses of life), and Control (i.e., combines identifiable and statistical lives by including part of the celebrity falcon message and part of the falcon statistics message). The control group includes a combination of personal and statistical information to neutralize the independent effects of each category and to evaluate whether this combination generates responses distinct from those elicited by either group individually. This survey design enabled us to determine the impact of psychic numbing on intended donations for endangered species conservation, and to assess how participants' predisposed attitudes towards endangered species impacted their responses.

2.3 Study tasks and sampling

To determine the sample size, we conducted a power analysis based on a meta-analysis of persuasion research sample sizes (Wilson and Sherrell, 1993). Our power and sample size calculator was set to be the following parameters: alpha = .05, power = .95, three treatment groups, mean under H_0 = 20, standard deviation = 20, minimum detectable effect = 15, and superiority margin = 25. The minimum detectable effect of 15 was selected as it represents a moderate effect size commonly observed in behavioral studies and aligns with the practical significance thresholds for our outcomes. The superiority margin of 25 was chosen to reflect a meaningful

difference that could substantiate claims of significant improvement across treatment groups in this context (Faul et al., 2009). According to this power analysis, we needed a minimum of 364 subjects in total, and 91 subjects per group, to detect differences across conditions. We surpassed this minimum sample size to ensure sufficient statistical power, and far surpassed the sample size of similar studies with more conditions (e.g., Naito et al., 2024). We recruited survey participants by advertising the survey on the UC Berkeley campus and through the organization Cal Falcons. We had a total of 531 participants (Supplementary Tables S1, S2, S3). Each participant was randomly assigned to one of the following treatment groups: Celebrity falcon (n = 183), Falcon statistics (n = 173), and Control (n = 175). The celebrity falcon treatment group is analogous to the identifiable victim category in previous psychic numbing studies in that its message consists of a personalized story of the locally famous Peregrine Falcon named Annie and includes a picture of Annie and her chicks (Table 1). Continuing to follow the model set by previous psychic numbing studies (see Slovic, 2007), the message for the falcon statistics treatment group focuses on a statistical analysis of the fall and rise of the Peregrine Falcon populations across North America and includes a picture of a generic unnamed Peregrine Falcon. The message for the control group contains details about Annie in addition to Peregrine Falcon population statistics and includes both pictures.

The survey had the following sequence: 1) A consent form, 2) A word association task, 3) A message that corresponds with the participant's experimental group (Celebrity falcon, Falcon statistics, or Control) and a related donation question, 4) Several Likert-scale questions, 5) The same word association task from step 2, and 6) A

series of demographic questions. The survey components are explained in further detail below.

After agreeing to the necessary consent forms, the participants were presented with a word association task in which they were instructed to list three words they associate with the phrase "Endangered Species". Word associations are credited for revealing images and associations, negative and positive affect, without the full burden of discursive language (Slovic et al., 2007; Echeverri et al., 2017b). This word association task was repeated near the end of the survey to determine if the messages elicited different types of responses for words they associate with "Endangered Species". We analyzed the words with two types of qualitative codes. First, we coded the words as positive, negative, or neutral to evaluate participant's sentiment and affect towards endangered species *sensu* Echeverri et al. (2017b). To do this, we analyzed the relative frequencies of words per category and compared the frequencies before and after the exposure to the different experimental conditions. Second, we categorized the words according to six non-hierarchical axial codes (i.e., animal, emotion, human, policy, population size, and science) and used this same method of analysis as an additional assessment of the qualitative impact of the three experimental conditions.

Participants were randomly and evenly assigned to each experimental condition and viewed one of the messages depending on which condition they were assigned to (Celebrity falcon, Falcon statistics, or Control). After viewing the message, participants were presented with a sliding scale of $0 to $100 and were asked how much they would be willing to donate to conserve "Annie and her family" (Celebrity falcon), "Peregrine Falcons"

TABLE 1 Three messaging conditions presented in the experimental study.

	Celebrity falcon	Falcon statistics	Control
Image			
Message	Annie is a Peregrine Falcon who has lived in UC Berkeley's campanile since December 2016. She has raised 18 chicks at Berkeley. Annie's 2023 chicks were Rosa, Luna, and Zephyr. We're excited to get to know her 2024 chicks! She has had multiple mates, including Grinnell, Lou, Alden, and her current mate Archie. Annie and her family's day to day activities are frequently filmed and shared via livestream. Annie and her family are examples of the remarkable comeback of an endangered species in the United States.	In the 1970s, the Peregrine Falcon was listed as endangered under the Endangered Species Act. Thousands of Peregrine Falcons used to live across the United States, but widespread use of the chemical pesticide DDT nearly drove the species to extinction. By the 1960s, only 8% of nesting pairs had survived. A variety of successful recovery programs have released more than 6,000 Peregrine Falcons into North America since 1974, allowing the declassification of the Peregrine Falcon as a federally endangered species in 1999.	In the 1970s, the Peregrine Falcon was listed as endangered under the Endangered Species Act. Thousands of Peregrine Falcons used to live across the United States, but widespread use of the chemical pesticide DDT caused the species to decline. By the 1960s, only 8% of nesting pairs had survived. A variety of successful recovery programs have released more than 6,000 Peregrine Falcons into North America since 1974. Annie is a Peregrine Falcon who has lived in UC Berkeley's campanile since December 2016. Annie's 2023 chicks were Rosa, Luna, and Zephyr. We're excited to get to know her 2024 chicks!
Donation Question	How much would you be willing to donate to conserve Annie and her family?	How much would you be willing to donate to conserve Peregrine Falcons?	How much would you be willing to donate to conserve Peregrine Falcons, like Annie and her family?
Image Source	*Image courtesy of Cal Falcons*	*Image courtesy of Tom Sanders*	*Image courtesy of Tom Sanders (left) and Cal Falcons (right)*

(Falcon statistics), or "Peregrine Falcons, like Annie and her family" (Control).

Participants were asked to rate their agreement to 13 Likert-scale items, on a 5-point scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5). The questions were adapted from Kellert's attitudes towards nature (Kellert, 1985) (See Supplementary Table S4). The Likert-scale items were designed to assess participants' interest in nature and endangered species in addition to assessing their level of agreement to different attitudes towards wildlife. The questions also aimed to assess participants' positions along the spectrum of wildlife value orientations, ranging from mutualism (i.e., viewing wildlife as integral to our community with rights akin to those of humans) to domination (i.e., regarding wildlife primarily as a resource for human benefit) (Manfredo et al., 2021b).

At the end of the survey, we collected data on participants' age, gender, and education to take into account the impact of demographic characteristics on participants' attitudes towards endangered species and their willingness to donate to endangered species conservation.

Participation was voluntary, but to incentivize participation, participants had a chance to enter their email to win a $25 gift card. A total of 10 cards were given in August 2024 after data collection was completed. While we acknowledge the potential impact of a monetary incentive on donation studies (Hertwig and Ortmann, 2001), we do not think this applies to our study, because only 0.018% (n=10 of 531) of the participants received the incentive, and they only received it after the data collection period was closed. Additionally, the sample size of survey participants exceeding the minimum sample size increases the statistical power of the analysis and therefore minimizes the impact of any skew that may have occurred due to this incentive.

2.4 Quantitative data analysis

Statistical analysis of all survey responses was conducted in R (version 2023.12.1 + 402). We tested our psychic numbing hypothesis on the donation response variable (H_0 = There are no statistical differences between experimental conditions). After inspecting the donation data per experimental condition visually through violin plots and determining the data is not normally distributed, we used Kruskal-Wallis tests (alpha = 0.05) to determine if there is a significant difference in intended donation amount amongst conditions. We additionally used an ANOVA test (alpha = 0.05) to further confirm our results. We also assessed the impact of demographic variables (age, gender, education) on the intended donation amount. After plotting the donation amount within each demographic category and determining the data is not normally distributed, we used Kruskal-Wallis tests to determine if there is a significant difference in donation amounts across ages, genders, and education levels, respectively.

Visual inspection of Q-Q plots for the residuals of each Likert-scale item indicated that the data does not follow a normal distribution. We therefore used Kruskal-Wallis tests (alpha = 0.05) to determine the impact of experimental condition on the Likert-item responses. We also assessed the impact of demographic

variables (age, gender, education) on the Likert-scale responses with Kruskal-Wallis tests. We then used a composite PERMANOVA test to determine if there are significant multivariate differences amongst the categories for each of the respective predictor variables (experimental conditions, age, gender, and education levels) when considering all Likert-scale questions simultaneously. We used the scale "Strongly Disagree" = 1, "Somewhat disagree" = 2, "Neither agree nor disagree" = 3, "Somewhat agree" = 4, and "Strongly agree" = 5 in the analysis of the Likert-scale questions.

2.5 Qualitative data analysis

The qualitative data consists of the word association responses to the phrase "Endangered Species", which were recorded both at the beginning of the survey and after the experimental condition message and donation question. All responses were spell checked and edited where necessary. First, we conducted a sentiment analysis by assigning each word to one of the following three categories: positive association, negative association, or neutral association. Words were categorized into each of these three categories based on the generally accepted connotation of the word. First, the most strongly positive and strongly negative words were categorized, and then the remaining words were looked over again and assigned to the positive, negative, or neutral categories. The categorizations of all words were then checked twice more and discussed amongst collaborators. We determined the frequency of positive, negative, and neutral words before and after each experimental condition message. We calculated a sentiment score for the words (the absolute value of the proportion of negative words subtracted from the proportion of positive words) before and after the message for each experimental condition. The closer the sentiment score is to zero, the greater the proportion of negative words.

We then created six non-hierarchical axial codes based on the words described by the participants (Table 2). We assigned each word to one of these labels, apart from a few words ("death", "life", "threatened", "sickness") that were assigned to both the science label and the emotion label due to an inability to separate them into singular categories without making false deductions. These four words were assigned to multiple labels after a discussion amongst collaborators about categorizing borderline words, from which we concluded that these words could originate from a scientific perspective (i.e., "threatened" as in threatened species) or from an emotional perspective (i.e., "threatened" as in vulnerable or afraid). To avoid falsely assuming the intentions of the survey participant, we assigned these words to both categories. When categorizing the words as positive, negative, or neutral, we would assign words to the neutral category if their association could be construed as positive or negative depending on the participant's unknown intent. However, there is no analogous neutral category within the six non-hierarchical axial codes, which is why we instead assigned these words to two categories. When determining the frequency of words per label before and after each respective experimental condition message, the words assigned to two categories were counted as 0.5 per category, to ensure each word had an equal impact in the following quantitative analysis.

TABLE 2   Non-hierarchical axial codes used in the qualitative analysis of the word association task.

Label	Meaning	Examples
Animal	Animal species or types of animals	Pandas, Mammals, Animals, Rhinos
Emotion	Words associated with emotions or opinions	Beautiful, Tragic, Important, Grief
Human	Words that refer to humans and how their actions help or harm endangered species	Conservation, Deforestation, Protect, Humans
Population Size	Words associated with an amount or number	Rare, Few, Many, Limited
Policy	Words that refer to legislative action or are associated with politics	ESA, Treaties, Nixon, Laws
Science	Words associated with the ecology and biology of animals and the environment	Nature, Biodiversity, Climate Change, Keystone
Science + Emotion	Words with an overlap of scientific and emotional association that are unable to be placed in a singular category due to their unknown connotation	Death, Life, Threatened, Sickness

Chi-squared tests (alpha = 0.05) were used to assess the association between each experimental condition and the frequency of word associations (positive, negative, neutral) both before and after the experimental condition message. Additionally, chi-squared tests were used to evaluate whether the experimental condition messages influenced the frequency of words coded into the six non-hierarchical categories (animal, human, science, emotion, policy, and number). We visually inspected Q-Q plots of the word association data, sentiment score data, and the non-hierarchical axial code data to assess normality. The data appeared to follow a normal distribution, justifying the use of one-sample t-tests (alpha = 0.05) to determine whether there was a significant difference in the word associations, sentiment scores, and non-hierarchical codes of the words before and after the experimental condition messages.

Word clouds were created for before and after each experimental condition to visually display the words with the highest frequency. The more commonly a word was used, the larger the size of the word in the word cloud. Separate word clouds were created for the sentiment analysis, in which the positive, negative, and neutral words were each coded a different color, and for the six non-hierarchical axial codes analysis, in which the words belonging to each label were coded a different color.

3 Results

3.1 Donations to conserve Peregrine Falcons as an endangered species

We find that psychic numbing does not apply in the context of Peregrine Falcon conservation, as participants are willing to donate a median value of $20 (Mean = $30.73, Standard deviation = $30.93) to conserve Peregrine Falcons (Figure 1). There is no statistically significant difference in the amount of money participants are willing to donate based on the experimental condition (p = 0.788; see Supplementary Table S8). The additional ANOVA test on the impact of experimental condition on donation amount also returned a non-significant result. The distribution of donations appears similar across the experimental conditions, as illustrated by the violin plots (Figure 1). This indicates that participants are not more likely to donate a larger amount after reading the message about an identifiable victim (i.e., the celebrity falcon Annie) compared to reading the message about statistical victims (i.e., statistics representing falcon population declines) or the message that includes details about both identifiable and statistical victims.

The donation amount varies significantly across the categories within each demographic variable (age, gender, education) (Supplementary Figure S6). Notably, female participants donated more than male participants, donation amount increased with age, and participants with an education level reported as Master's degree level or higher donated more than all other education categories. Age as an independent variable is a highly significant predictor of donation amount (p < 2e-16) as is education (p = 6.975e-5), and gender is a moderately significant predictor (p = 0.00421; see Supplementary Table S8).

3.2 Effects of the experimental condition on attitudinal Likert-scale items

Participants overall strongly agree with Likert-scale items measuring public attitudes towards endangered species (Supplementary Table S4). This pattern holds for items assessing willingness to learn about and appreciate endangered species, as well as those addressing a moral responsibility to protect species. There is almost no variation in the distribution of agreement and disagreement with these items across experimental conditions (Supplementary Table S4, Supplementary Figures S1–S3). Participants also strongly disagree with negativistic and dominionistic attitudes towards endangered species, such as those suggesting that management plans should enable active human use of the species, or that, given current economic problems, it makes little sense to spend money on endangered species conservation (Supplementary Table S4, Figure 2).

There is no effect of experimental condition on any of the Likert-scale items, as indicated by individual Kruskal-Wallis tests (p
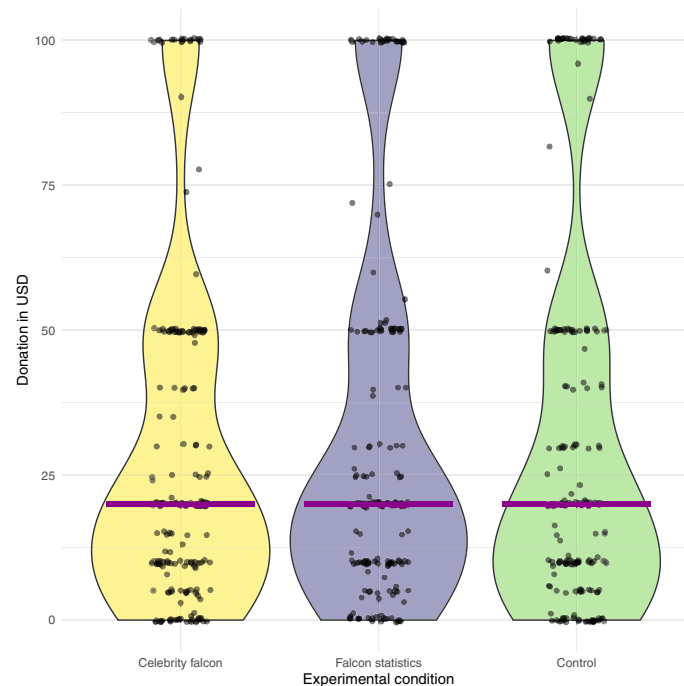
FIGURE 1
Psychic numbing does not apply in the context of Peregrine Falcon conservation. People subject to all three messages are willing to donate a median value of $20 to conserve Peregrine Falcons, and the distributions look very similar to each other in all three conditions.

> 0.05 for each Likert-scale item) and a PERMANOVA test (p = 0.364), suggesting that we cannot reject the null hypothesis (Supplementary Table S5). This means that reading different types of messages (i.e., about an identifiable victim, statistical victims, or both) does not change the average level of agreement to general statements about wildlife and endangered species.

3.3 Effects of demographic variables on attitudinal Likert-scale items

As shown by the individual Kruskal-Wallis tests, age significantly impacted the responses for ten of the Likert-scale items, gender has a significant impact on eight of the Likert-scale items, and education has a significant impact on six of the Likert-scale items (Supplementary Table S5). All three demographic variables have a significant impact on the Likert-scale item responses when considering all Likert-scale items compositely, as shown by a PERMANOVA test for age (p = 0.001), gender (p = 0.004), and education (p = 0.021; see Supplementary Table S5).
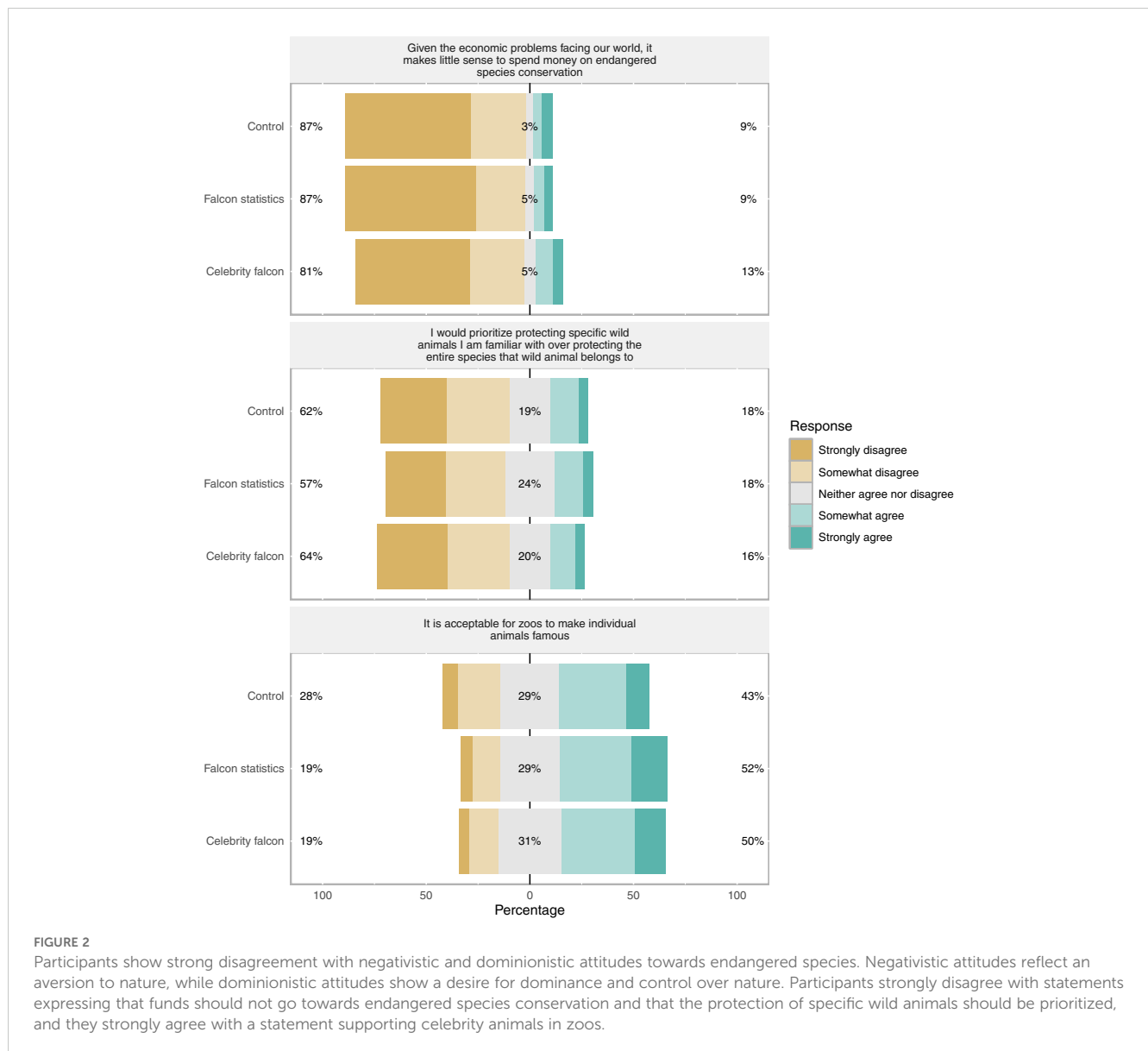
3.4 Effect of experimental condition on qualitative word associations

Participants completed the word association task twice: once before and once after exposure to the messages. As predicted, the chi-squared results show that there is no association between words coded as positive, negative, or neutral in the sentiment analysis and

the experimental condition before exposure to the messages (Table 3). However, after the messages, a chi-squared test reveals that we can reject the null hypothesis, indicating that participants' sentiment scores changed based on the experimental condition. Bar plots show a higher proportion of positive words for participants who saw the celebrity falcon story about Annie (Figure 3). Word clouds reveal that words such as "Protect," "Save," and "Conservation" become more frequent after reading Annie's story (Supplementary Figure S4). In contrast, participants who read the statistics about Peregrine Falcons are more likely to report neutral words: "Rare," "Human," and "Climate" become more common (Figure 3).

After coding the words into six non-hierarchical axial codes (Table 2), we find no association between word categories and experimental condition before the participants see the messages (Table 3). However, after exposure to the messages, chi-squared tests reveal a statistically significant association between word categories and experimental condition (Table 3). This indicates that the different messaging conditions impact the types of words that participants associate with "endangered species". Specifically, words reflecting emotions are more likely for participants who read the celebrity falcon story, while words associated with humans or policy are more frequent for participants in the control condition (Figure 4, Supplementary Figure S5).

The one sample t-tests reveal no difference in the frequency of neutral words before and after the message, but there is a significant difference in the frequency of positive words and the frequency of negative words before and after the message (Supplementary Table S6). There is also a significant difference in the sentiment scores

FIGURE 2
Participants show strong disagreement with negativistic and dominionistic attitudes towards endangered species. Negativistic attitudes reflect an aversion to nature, while dominionistic attitudes show a desire for dominance and control over nature. Participants strongly disagree with statements expressing that funds should not go towards endangered species conservation and that the protection of specific wild animals should be prioritized, and they strongly agree with a statement supporting celebrity animals in zoos.

before and after the message (Supplementary Table S6). After coding the words into six non-hierarchical axial codes (Table 2) and calculating another round of one sample t-tests, we find no difference in the frequency of words coded as animal, emotion, human, number, policy, or science before and after the message across all experimental conditions (Supplementary Table S7).

4 Discussion

Our study investigates the effects of messaging and framing on donations and attitudes towards Peregrine Falcon conservation. We found that the experimental messaging condition did not have a significant impact on the intended donation amount. Similarly, there was a consistent level of agreement to the Likert-scale items about endangered species and conservation across all messaging conditions. However, the messaging conditions did impact the types of words participants associated with endangered species. The

identifiable life message about Annie elicited more positive and emotional words, the statistical lives message about Peregrine Falcon population declines elicited more neutral words, and the control message that combined identifiable and statistical lives elicited words more aligned with humans and policy.

Contrary to Paul Slovic's concept of psychic numbing, which posits that individuals become desensitized to large-scale human or environmental suffering (Slovic, 2007), our results indicate that such numbing does not apply in the context of Peregrine Falcon conservation. Participants across all conditions displayed a similar willingness to donate, with a median value of $20, and no significant difference in donation amounts based on experimental conditions.

Slovic's research suggests that people's ability to empathize and respond to crises diminishes as the scale of the issue increases (Slovic et al., 2017). However, our findings suggest that the narrative of a single, identifiable animal, Annie the Peregrine Falcon, did not significantly impact donation amounts compared to statistical information alone or a combination of both. The concept of the

TABLE 3 Chi-squared results, for both sentiment analysis and word association categories, show no association between experimental condition and word choice before the message, and a significant association between experimental condition and word choice after the message.

Time	Experimental condition	Sentiment analysis			X^2	df	p-value
		Positive	Negative	Neutral			
Pre-message (Before)	Celebrity falcon	99	223	221	8.651	4	0.0704
	Falcon statistics	114	179	226			
	Control	124	197	201			
Post-message (After)	Celebrity falcon	140	194	208			
	Falcon statistics	141	151	224			
	Control	165	171	189	10.416	4	0.0340

Time	Experimental condition	Word Association Categories						X^2	df	p-value
		Animal	Emotion	Human	Number	Policy	Science			
Pre-message (Before)	Celebrity falcon	88	167	85	36	8	126	14.219	10	0.1632
	Falcon statistics	90	180.5	112	22	5	132.5			
	Control	73	173	114	35	11	114			
Post-message (After)	Celebrity falcon	70	177	108	27	17	124			
	Falcon statistics	81	167	123	17	15	123			
	Control	53	164.5	160	26	8	112.5	23.988	10	0.0076

"identifiable victim effect," which posits that individuals tend to offer greater help to specific, identifiable victims than to anonymous, statistical victims (Jenni and Loewenstein, 1997), appears not to translate to endangered species in this context. A meta-analysis showed that the identifiable victim effect is common when a photograph of a suffering child is shown (Lee and Feeley, 2016). It is possible that such empathy is not evoked by Peregrine Falcons in Annie's story, especially since our message did not depict the falcons suffering but thriving. Prior research suggests that negative messages are more persuasive for endangered species conservation (Echeverri et al., 2017a). The pictures of Peregrine Falcons included in our messages depicted the falcons as healthy and content, so portraying an image of a suffering animal for the identifiable victim message may also lead to more varied donation amounts. Thus, the positively framed celebrity falcon story may not have been as persuasive in changing intentions to donate.
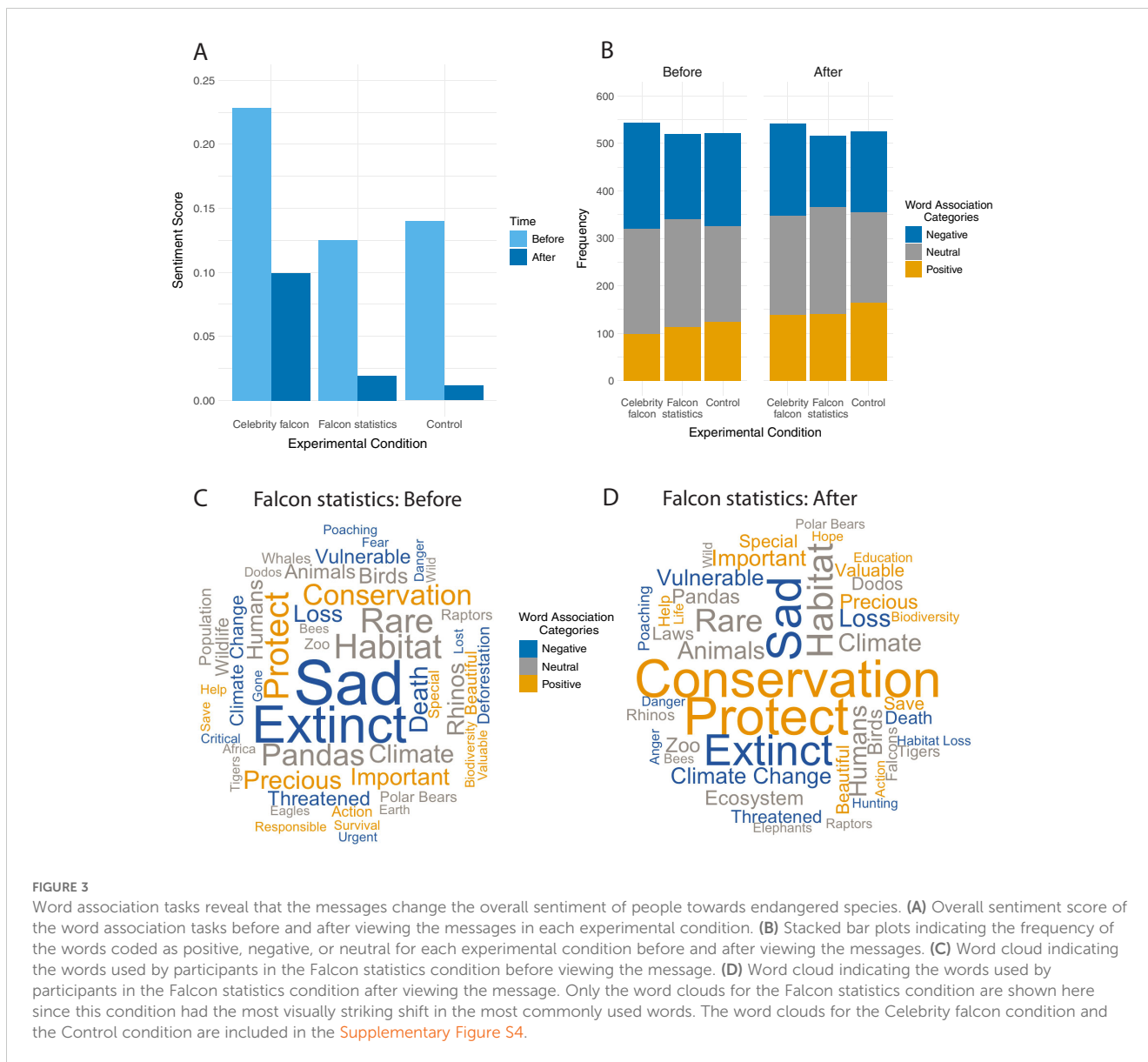
Future studies could explore using a wider range of species to determine whether the presence of psychic numbing and the effectiveness of different messaging frameworks vary by species. For example, humans have shown a greater willingness to donate towards mammal flagship species compared to bird flagship species (Lundberg et al., 2019). Conducting this study with mammals instead of birds may have prompted more significant differences in donation amount across experimental conditions. Notably, our results may have been influenced by participants' prior awareness of Annie's status as a celebrity falcon. Using an identifiable animal that is either universally recognized or unfamiliar to most participants could help produce more robust and generalizable data. Additionally, expanding this research through international collaborations by conducting similar surveys in different countries or regions, using culturally relevant species in each location, could

offer valuable insight to how cultural context may influence the presence of psychic numbing in endangered species conservation. Humans have shown greater willingness to donate towards the conservation of native species compared to non-native species (Lundberg et al., 2019), so the native status of a species may also impact the presence of psychic numbing.

Our sample exhibited ceiling effects, with many respondents scoring high on attitudes toward conservation, limiting potential increases. This aligns with research indicating that public values towards wildlife in the United States have shifted towards more mutualistic perspectives, emphasizing caring and stewardship over domination (Manfredo et al., 2021b). As modern lifestyles distance people from direct contact with wildlife, animals are increasingly viewed as human-like and deserving of respect (Manfredo et al., 2021a). This gives rise to mutualism values, wherein wildlife is seen as companions in a social community and deserving of many of the same rights as humans.

California, in particular, shows a high prevalence of mutualistic values and a decrease in traditional domination values towards wildlife (Manfredo et al., 2021b). In the San Francisco Bay Area, including Alameda County where Berkeley is located, mutualistic views of nature are particularly strong. Our results reflect this cultural context, with participants exhibiting high mutualistic and low dominionistic attitudes towards endangered species, influencing the lack of significant differences in donation intentions and the consistency of Likert-scale responses across experimental conditions.

Despite the lack of impact of experimental conditions on the Likert-scale responses, the significant impact of age, gender, and education on the Likert-scale responses highlights demographic trends across the different Likert-scale items. Notably, age was a

FIGURE 3
Word association tasks reveal that the messages change the overall sentiment of people towards endangered species. **(A)** Overall sentiment score of the word association tasks before and after viewing the messages in each experimental condition. **(B)** Stacked bar plots indicating the frequency of the words coded as positive, negative, or neutral for each experimental condition before and after viewing the messages. **(C)** Word cloud indicating the words used by participants in the Falcon statistics condition before viewing the message. **(D)** Word cloud indicating the words used by participants in the Falcon statistics condition after viewing the message. Only the word clouds for the Falcon statistics condition are shown here since this condition had the most visually striking shift in the most commonly used words. The word clouds for the Celebrity falcon condition and the Control condition are included in the Supplementary Figure S4.

highly significant predictor for questions assessing individuality, including prioritizing protection of wild animals they are familiar with over protecting the entire species the animal belongs to, and enjoying movies that tell stories of individual animals. For both questions, participants aged 18–25 agreed more strongly with the statements than participants aged 61+, indicating a stronger support of individual animals in younger age groups. This suggests that considering the average age of the target audience could enhance the effectiveness of conservation messaging, as younger audiences may respond more positively to messages featuring individual animals.

Birdwatching plays a significant role in fostering conservation attitudes in the United States, with birdwatchers often supporting conservation financially, participating in educational outreach, and advocating for habitat protection (Cooper et al., 2015). Birdwatchers are 2–3 times more likely to donate to conservation efforts than individuals who do not recreationally engage with the environment (Cooper et al., 2015). Supporting birdwatching can

therefore promote greater investment in conservation efforts. An example of the power of birdwatching communities can be seen with Cal Falcons, an organization at UC Berkeley that was borne from the strong support and affection shown by the campus community for the Peregrine Falcons residing on the UC Berkeley campanile. The public engages with the falcons through social media, live nest cameras, and community events, reinforcing the species' iconic status and emotional connections within the community (Kell, 2024). Additionally, Cal Falcons has successfully garnered financial support from their committed birdwatching communities with several successful fundraising campaigns, selling falcon memorabilia and accepting donations to support education, outreach, and research for the UC Berkeley falcons (Cal Falcons, 2024).

Our study's qualitative word association task provided additional insights. Before exposure to the experimental conditions, there were no significant differences in sentiment or word categories, indicating an unbiased sample. However, after
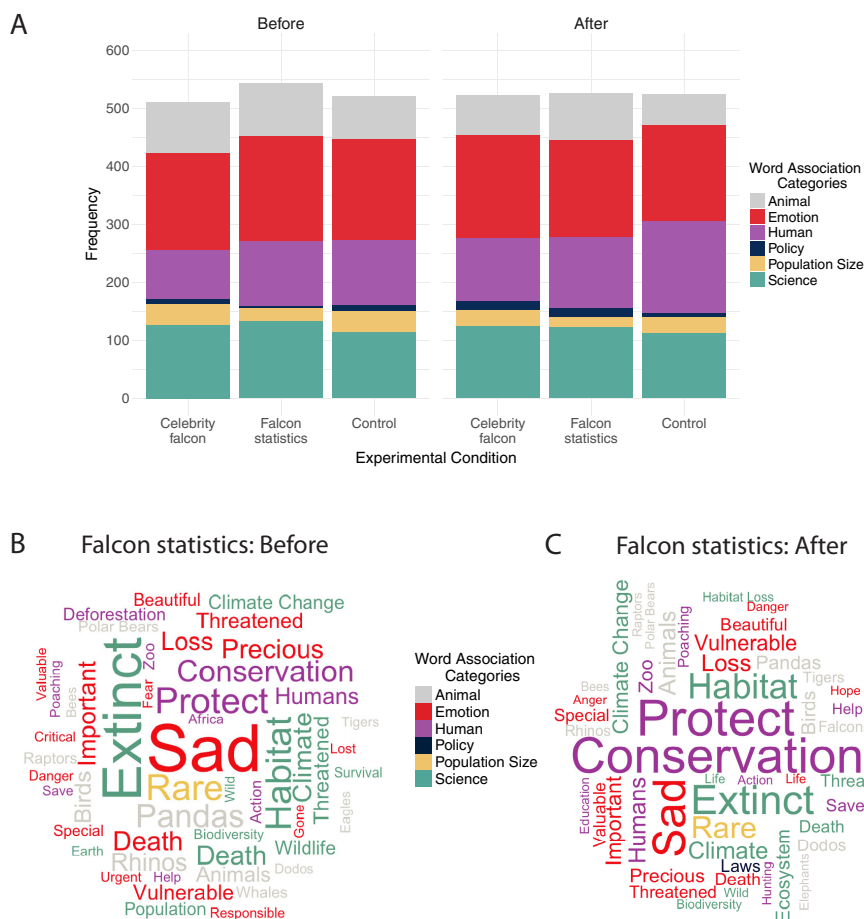
FIGURE 4
The story of the celebrity falcon Annie has a significant impact on increasing participants' words coded as emotions. **(A)** Stacked bar plots indicating the frequency of the words coded as animal, emotion, human, policy, population size, or science. **(B)** Word cloud indicating the words used by participants in the Falcon statistics condition before viewing the message. **(C)** Word cloud indicating the words used by participants in the Falcon statistics condition after viewing the message.

exposure, participants who read Annie's story were more likely to use positive and emotionally charged words such as "Protect," "Save," and "Conservation," suggesting that celebrity stories can enhance emotional engagement. This finding aligns with studies suggesting that celebrity species can attract public attention and foster emotional connections, enhancing conservation efforts (Jarić et al., 2024; Root-Bernstein et al., 2013). Conversely, participants exposed to statistical information were more likely to use neutral terms such as "Rare," "Human," and "Climate," suggesting that while statistics may inform and educate, they might not evoke the same level of emotional response as narrative stories. These findings support the literature indicating that statistics, while conveying the severity of a situation, often lack the emotional appeal necessary to spur individual action (Slovic, 2007).

Our results highlight the attitude-intention-behavior gap, where positive attitudes towards endangered species conservation do not necessarily translate into behavioral intentions or donation behavior. This gap is well-documented for environmental behaviors such as recycling (ElHaffar et al., 2020). While positive messages about celebrity animals can increase positive emotions towards endangered species, this does not yet translate into higher

donations. The relatively low median donation amount of $20 is likely influenced by the student demographic with limited financial resources. This is exemplified by the average donation amount increasing with age, as shown by participants aged under 18 and 18–25 donating significantly less than the older age categories. Likewise, undergraduate students donated significantly less than participants with a higher level of education. Future research should explore strategies to bridge this gap and promote donations to endangered species conservation, particularly in populations that already value wildlife.

Overall, our results contribute to the growing body of literature on conservation psychology and the role of messaging in shaping public attitudes and behaviors. While narrative stories about individual animals like Annie the Peregrine Falcon can enhance emotional engagement and positive sentiment, they do not necessarily translate into higher donation amounts compared to statistical information. Future research should explore the long-term effects of different types of conservation messaging and the potential for integrating narrative and statistical approaches to maximize both emotional engagement and informed decision-making in conservation efforts.

5 Conclusions

Our study indicates that psychic numbing does not apply in the context of endangered species conservation. Our findings suggests that people may feel a moral obligation to support endangered species, irrespective of how the information is presented, indicating a unique aspect of conservation psychology that differentiates it from other areas where psychic numbing is typically observed.

The field of conservation psychology is still nascent, and our findings highlight the need for further research to better understand the psychological mechanisms underlying conservation behaviors. Recruiting a more demographically diverse pool of survey participants – with balanced representation across age, education level, and gender – could help reduce the effect of any confounding variables and increase the robustness of the findings. There are several directions of future research that may stem from this study, such as assessing if there is a varying presence of psychic numbing across different species and if negatively framed messages about individual animals are more effective at increasing donation amount for the conservation of that species. The application of psychological methods and concepts to conservation is relatively rare, and more studies are required to explore how different types of messaging and framing affect public attitudes and behaviors towards conservation.

This study contributes to the emerging field of conservation psychology by providing empirical evidence on the impact of narrative and statistical information on conservation-related decisions (Callahan et al., 2019; Clayton and Brook, 2005).

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material. Further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by the University of California, Berkeley (UC Berkeley) Institutional Review Board composed of the Committee for Protection of Human Subjects and the Office for Protection of Human Subjects (protocol number 2024-02-17175). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AB: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. AE: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcosc.2025.1490272/full#supplementary-material

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