Temporal Frames of Environmental Threats

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Temporal Frames of Environmental Threats

Scientists, NGOs, and the press communicate temporal predictions about environmental threats either in terms of the calendar *date* by which a threat is expected to materialize (e.g., "Water shortage by 2040") or in terms of the amount of *time left* until the threat (e.g., "Water shortage within 20 years"). Our archival analysis of news articles on climate change shows that date frames are much more frequently used than time-left frames. Despite this common practice, across four online studies and a field experiment, we find that time-left frames make environmental threats feel closer in time than date frames and are more effective in garnering consumers' engagement and donations. These findings extend and qualify past research which showed that, in the context of intertemporal choice, time-left frames made receipt of money in the future feel farther in time than date frames. Our findings can inform communication of environmental threats to encourage environmental action.

Keywords: time perception, framing, environmental action

Track: Consumer Behavior

England at serious risk of water shortage by 2040 (Edie, 2020)
Parts of England could run out of water within 20 years (The Guardian, 2020)

Many people perceive environmental threats such as climate change as temporally distant events (Campbell et al. 2020; Jones, Hine, and Marks 2017; Spence, Poortinga, and Pidgeon 2012; Stollberg and Jonas 2021; Vlasceanu et al. 2024; Wang et al. 2019; Wilson and Orlove 2021). Consistent with this observation, a recent mega-study found that decreasing psychological distance—the subjective experience that an event is close or far away from the self, here, and now—was the most effective behavioral intervention in strengthening climate change beliefs (Vlasceanu et al. 2024; see also Chu and Yang 2020; Gifford 2011; Spence et al. 2011). Taking this behavioral challenge into account when communicating about future environmental threats is therefore imperative to garner public engagement and action. As illustrated in the epigraphs, predictions about such threats commonly use one of two distinct temporal frames referring either to a *date*—the calendar year by which the threat is expected to materialize—or the amount of *time left* until its occurrence.

In this research, we explore the effects of date and time-left frames on the perceived time until environmental threats. We find that time-left compared with date frames make the time until a threat feel shorter. We also find that framing the interval in terms of time-left (vs. date) triggers greater consumer engagement and support to avert the threat.

Our findings extend and qualify past research showing that for certain events in the future (e.g., receiving money), a time-left frame leads to longer perceptions of time than a date frame (LeBoeuf 2006; Read et al. 2005; Zauberman et al. 2009). We suggest that the difference may arise due to the valence of the situations being investigated—anticipated rewards versus dreaded threats. We show that date and time-left frames have the opposite effects of that found in past research when the future event is negative. We study the consequences of this opposite effect in the context of environmental threats—where date and time-left frames are commonly used.

Our research can inform managers and policymakers in shaping effective communication strategies. Companies, NGOs, and the press often use temporal predictions when referring to environmental threats. However, our archival analysis of online news articles on climate change over the last 24 years revealed that 93% of them used date frames. While conveying temporal information in date frames may be more convenient than using an updated time-left frame each year, our research draws attention to different psychological consequences of these two frames, and shows that, counter to common practice, time-left frames can be more effective in increasing interest in environmental news and donation efforts to avert environmental threats.

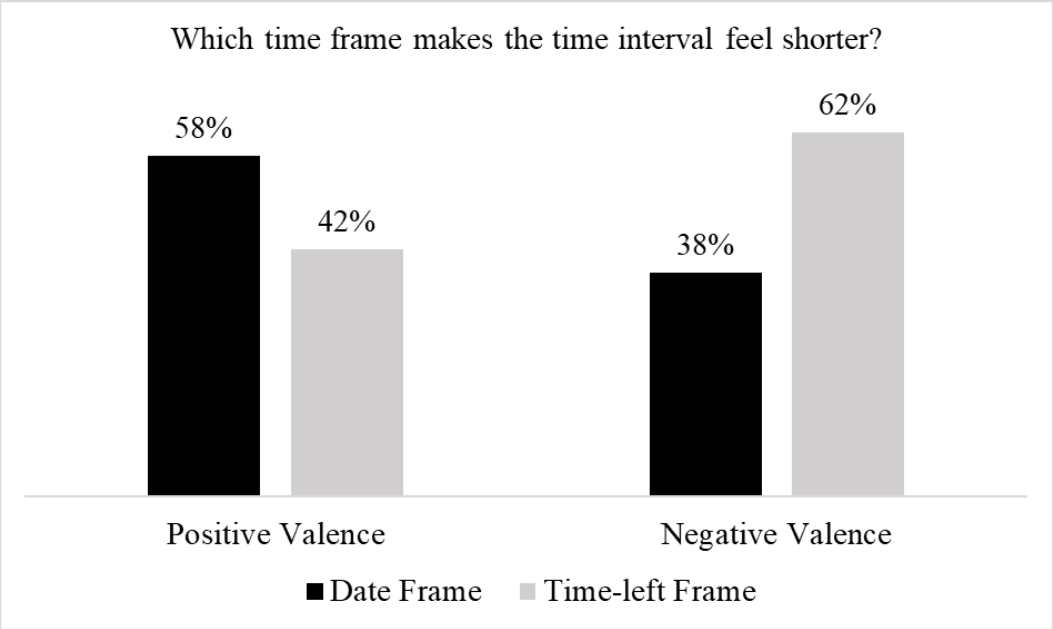
1. Study 1: Moderation of Outcome Valence

In order to conceptually replicate the findings of past research with positive outcomes and test the effect with negative outcomes, Study 1 (N = 201, 56% Female, Mage = 41.6) used a monetary setting and manipulated the outcome valence. Participants in the positive outcome condition imagined they would receive $3500, while those in the negative outcome condition imagined they would pay $3500. The time until payment was described both in date frame (in October 2023) and in time-left frame (in 5 months). Then, participants indicated which time frame makes the time until this payment feel shorter.

Consistent with past research, time until a positive monetary outcome was perceived as longer in time-left (vs. date) frame (58% vs. 42%). However, the same interval was perceived as shorter in time-left (vs. date) frame when the outcome was negative (62% vs. 38%; $\chi 2(1) = 7.23$, $p = .007$). Figure 1 shows this result.

FIGURE 1

MODERATING ROLE OF VALENCE



2. Study 2a: Time Perception in a Between-subjects Design

Study 2a tested the effect in the context of an environmental threat: deforestation. Participants were randomly assigned to either a date or a time-left condition. Those in the date condition learnt that if the current deforestation rates continued, the Amazon Rainforest would become a savannah by 2064. Those in the time-left frame learnt that this would happen in 41 years.

Then, all participants indicated how short the time until this environmental threat feels on a 7-point Likert scale (1 = very short, 7 = very long).

Time until the threat felt shorter in time-left frame compared to date frame (M = 2.17, SD = 1.29; M = 2.46, SD = 1.41; $F(1,398) = 4.81$, $p = .03$).

3. Study 2b: Time Perception in a Within-subjects Design

Study 2b replicated this finding with a within-subjects design using the context of drought for robustness. Participants (N = 150, 61% females, Mage = 41.1) saw two different versions (date version and time-left version) of the same news headline on drought. The date version stated that "700 million people will be displaced due to drought by 2030". In the time-left version "by 2030" was replaced by "in 7 years". Then, participants indicated which time frame made the drought seem more urgent.

53% of participants indicated that time-left frame made the expected drought feel more urgent while only 24% of them indicated the opposite. (23% of them indicated that both frames felt equally urgent ($\chi 2(1) = 27.21$, $p < .001$)).

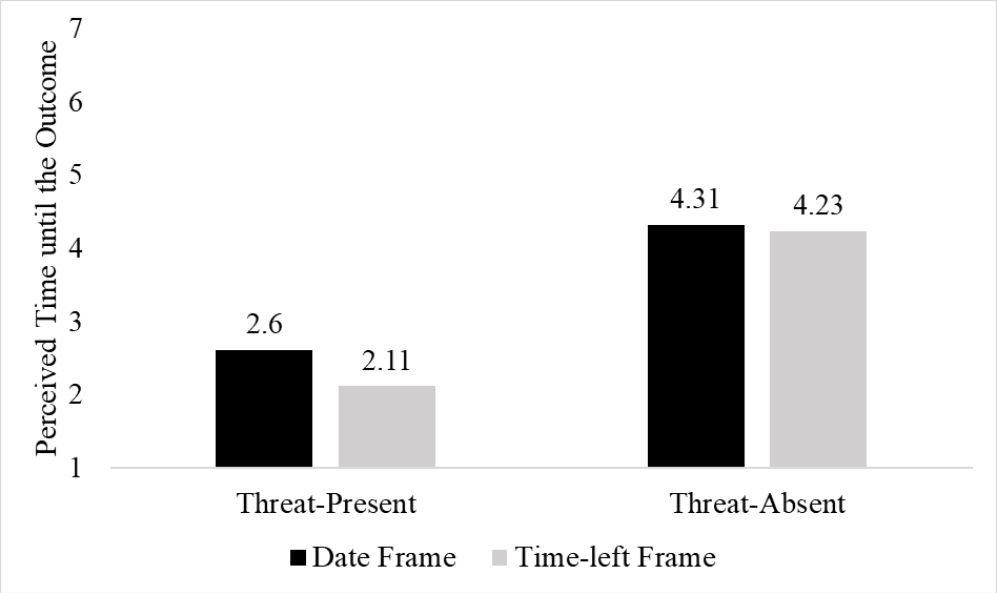
4. Study 3: Attenuation of the Effect in the Absence of a Threat

Study 3 (N = 800, 64% female, Mage = 38.8) tested whether the effect of temporal frames on time perception is attenuated in the absence of a threat. Participants viewed information about Andean bears framed as either facing extinction or maintaining a healthy population by 2063 (vs. within 40 years). Then, they rated how much time they feel was left until then on a 7-point scale (1 = very short, 7 = very long).

A two-way ANOVA revealed a significant interaction between temporal frame and threat ($F(1,796) = 4.99$, $p = .026$). When the threat was present, time felt shorter in the time-left frame (M = 2.11) compared to the date frame (M = 2.60; $F(1,408) = 16.98$, $p < .001$). In the absence of a threat, this difference was attenuated (Mtime-left = 4.23 vs. Mdate = 4.31; $F(1,408) = .37$, $p = .543$). Time felt significantly shorter overall when the threat was present (M = 2.36) compared to absent (M = 4.27; $F(1,796) = 443.07$, $p < .001$). Figure 2 summarizes these results.

FIGURE 2

ATTENUATION OF THE EFFECT IN THE ABSENCE OF A THREAT



5. Study 4: Consequences on Engagement with Environmental News Articles

Study 4 (N = 23,035, 60% female, Age Range = 20-45) tested the consequence of this effect using a field experiment. We collaborated with a news aggregator platform and sent out push notifications to users either in date frame or in time-left frame. The notification text stated that "700 million people will be displaced due to drought by 2030 (vs. in 7 years)". We predicted that because drought was perceived as more urgent in time-left frame compared to date frame, more people would click on the notification to read the full article, indicating a greater engagement with the environmental issue.

As predicted, a greater proportion of users clicked on the push notification to read the news article in time-left frame compared to date frame (2.5% vs. 1.9%; $\chi 2(1) = 7.56$, $p = .006$).

6. Study 5: Consequences on Donation Choice

Study 5 tested the effect of temporal frames on donation behavior using an incentive-compatible design. Participants (N = 295, 51.5% females, Mage = 37.9) learnt about two endangered species: Andean Bears which are expected to go extinct by 2062 and Leatherback Sea Turtles which are expected to go extinct by 2060. We manipulated whether we presented the extinction time of Andean Bears in date frame or in time-left frame. All participants then indicated the perceived time until each species would become extinct on 7-point Likert scales (1=very short, 7=very long). Then, participants chose between two charities: Rainforest Concern to save Andean Bears and The Leatherback Trust to save Sea Turtles. We told participants that we would randomly select one participant and donate $100 to the charity they chose.

Results showed that time until Andean Bears would become extinct felt shorter in time-left frame ($M = 2.70$, $SD = 1.55$) compared to date frame ($M = 3.25$, $SD = 1.66$; $F(1,299) = 8.87$, $p = .003$). Consequently, a greater proportion of participants chose to donate to Rainforest Concern to save the Andean Bears in time-left frame (54%) compared to date frame (41%; $\chi2(1) = 5.19$, $p = .023$).

7. General Discussion

Across five online experiments, and a field experiment in collaboration with a news platform, we showed that despite the more common use of date frames in the communication of environmental threats, time-left frames as opposed to date frames made environmental threats seem temporally closer (studies 2a–2b). The effect was robust to using different environmental threats such as deforestation, drought, and animal extinction and different time horizons ranging from 7 years to 41 years. Extending past research on time-left and date frames, we showed that context moderated the effect of these frames on time perception. The effect found in reverse for negative events (study 1) and was attenuated when the threat was removed from the context (study 3). Time-left (vs. date) frames were more effective in increasing the interest in environmental news articles (study 4) and raising donations to environmental NGOs (study 5).

Our work contributes to the literature on temporal framing by studying the effect of date and time-left frames in an environmental context. Past research examined those frames mostly in positive contexts like the receipt of money (Read et al. 2005; LeBoeuf 2006; Klapproth 2012; Zauberman et al. 2009). We showed that the effects of date and time-left frames on time perception were reversed for a negatively (vs. positively) valenced outcome – an environmental threat.

Our research offers insights for marketers and policy makers for the effective communication and marketing strategies. Companies and NGOs typically communicate environmental threats with date frames. Our findings suggest using time-left frames instead to emphasize the pressing nature of environmental issues. By doing that, managers and policy makers can be more successful in encouraging environmental behaviour.

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