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Graham, Agnieszka; McCormack, Teresa; Lorimer, Sara; Hoerl, Christoph; Beck, Sarah; Johnston, Matthew; Feeney, Aidan

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Relief in Everyday Life

Agnieszka J. Graham<sup>1</sup>, Teresa McCormack<sup>1</sup>, Sara Lorimer<sup>1</sup>, Christoph Hoerl<sup>3</sup>, Sarah R. Beck<sup>2</sup>, Matthew Johnston<sup>1</sup>, & Aidan Feeney<sup>1</sup>

<sup>1</sup> Queen's University Belfast

<sup>2</sup> University of Birmingham

<sup>3</sup> University of Warwick

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Correspondence concerning this article should be addressed to Agnieszka J. Graham, School of Psychology, Queen's University Belfast, Belfast, UK, BT7 1NN. E-mail: [agnieszka.graham@qub.ac.uk](mailto:agnieszka.graham@qub.ac.uk)

## Abstract

Despite being implicated in a wide range of psychological and behavioral phenomena, relief remains poorly understood from the perspective of psychological science. What complicates the study of relief is that people seem to use the term to describe an emotion that occurs in two distinct situations: when an unpleasant episode is over, or upon realizing that an outcome could have been worse. This study constitutes a detailed empirical investigation of people's reports of everyday episodes of relief. A set of four studies collected a large corpus ( $N = 1835$ ) of first-person reports of real-life episodes of relief and examined people's judgments about the antecedents of relief, its relation to counterfactual thoughts, and its subsequent effects on decision making. Some participants described relief experiences that had either purely temporal or purely counterfactual precursors. Nevertheless, the findings indicated that the prototypical instance of relief appears to be one in which both these elements are present. The results also suggest that, although relief is frequently experienced in situations in which people are not responsible for the relief-inducing event, nevertheless they typically report that the experience had a positive impact on subsequent decision making.

*Keywords:* Relief; Counterfactual Emotions; Counterfactual Thinking; Temporal Cognition; Decision Making

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## Relief in Everyday Life

Relief is a common and readily identified emotional experience; indeed, some theoretical perspectives take relief to be a ‘basic’ positive emotion (e.g., Levenson, 2011). Yet, despite having featured in theorizing about phenomena as diverse as self-harming (e.g., Chapman et al., 2006; Favazza, 1998; Franklin et al., 2013), addiction (e.g., Bottorff et al., 2009; Shead & Hodgins, 2009), phobia (e.g., Lohr et al., 2007), and educational motivation (e.g., Pekrun et al., 2014), relief has been understudied empirically. What makes this relative lack of research on relief all the more surprising is that, in what there is of such research, relief is often conceived of as the antonym of regret (e.g., Coricelli et al., 2007; Guerini et al., 2020; Liu et al., 2016) — an emotion that, by contrast, has already attracted a large amount of attention in psychology, neuroscience, and behavioral economics, leading to the development of detailed theoretical frameworks (e.g., Davison & Feeney, 2008; Gilovich & Medvec, 1995; Roese & Summerville, 2005; Zeelenberg et al., 2000; Zeelenberg & Pieters, 2007).

It is primarily in the context of decision making research that relief has been conceptualized as the antonym of regret, although it has also been conceived of this way by some developmental psychologists (Weisberg & Beck, 2010, 2012). For example, Guttentag and Ferrell (2004, p. 764) describe relief as follows: “Closely related to regret is relief, an emotion that is experienced in situations in which (a) the actual outcome of a course of action is positive or neutral and (b) a possible alternative decision would have resulted in a more negative outcome.” When conceived of in this way, relief is considered to be a *counterfactual* emotion, i.e., an emotion that is grounded in a comparison between an actual outcome and how things might have turned out differently. Counterfactual thoughts can simulate a better alternative (termed *upward counterfactuals*) or a worse alternative [termed *downward counterfactuals*; Markman et al. (1993)]. On this picture, relief is considered to be the antonym of regret, because while regret is an emotional consequence of comparing the present situation to a better alternative, relief is thought to occur when one reflects on how things might have turned out worse. So, for example, one may feel relieved that one

managed to catch the last train home (actual outcome), because otherwise one would have had to pay for an expensive taxi (counterfactual outcome).

Conceived of like this, the standard experimental measures of relief have been tasks in which participants report feeling happier after considering a downward counterfactual. Commonly used tasks are ones in which people must choose between two possible gambles and subsequently find out not just what they have won/lost but what they would have won/lost if they had chosen differently (i.e., the counterfactual outcome). This approach has proved fruitful for decision making researchers and has been used frequently in neuropsychology (e.g., Burnett et al., 2010; Coricelli et al., 2007; Larquet et al., 2010; Liu et al., 2016).

However, on reflection, it is not obvious that the emotion measured in this way maps neatly onto what people consider to be relief. An important reason why such a mapping is not straightforward is because, in everyday life, people seem to use the term ‘relief’ to refer to an emotion that can occur in two quite different contexts. People do talk about being relieved when they realize that an outcome could have been worse if things had taken another turn (e.g., if they had missed the last train). But, on the face of it, people also describe their emotion as relief when a painful, stressful, or otherwise unpleasant episode has ended (e.g., relieved that a dental procedure has finished). In this case, it seems to be the *ending* of a negative experience, rather than the *avoiding* of such an experience, that is the antecedent of relief. This raises the issue of whether relief is in fact a unitary emotion. And, as we shall discuss below, distinctions between these kinds of antecedents also feature prominently in some theoretical claims about approaches to relief (Deutsch et al., 2015; Sweeny & Vohs, 2012).

The aim of this paper is to examine whether people do indeed describe their emotional experience as relief in these distinct contexts, and also whether the characteristics of the emotional experiences they describe under these two contexts are different or similar. We do this by looking in detail at examples participants provided of episodes of relief in everyday

life and their associated judgments about these episodes, including their judgments about the antecedents of their experiences. As should be clear from our methodology, our primary concern is understanding and characterizing the emotional experience that people describe as relief. Although there are a number of influential survey-type studies of everyday experiences of regret (e.g., Bonnefon & Zhang, 2008; Feeney et al., 2005; Gilovich & Medvec, 1994; Roeser & Summerville, 2005; Zeelenberg, Van Dijk, Van der Pligt, et al., 1998), there has been no equivalent study of everyday experiences of relief. However, it is clear that the studies of everyday experiences of regret have had a considerable impact on how this emotion is conceived of, both in terms of understanding when and why regret is usually experienced (Gilovich & Medvec, 1995), and in characterizing its typical function and relation to cognitive processes (e.g., Inman & Zeelenberg, 2002; Tsiros & Mittal, 2000; Zeelenberg et al., 2002). This suggests that a careful study of self-reports of everyday experiences of relief may similarly contribute to an understanding of this emotional experience.

### **Theoretical claims about relief**

As we have pointed out, people seem to use the term ‘relief’ to refer to experiences that have two different types of antecedents. Mirroring this, the idea that relief occurs in two distinct types of situations has also featured in previous researchers’ theorizing about the emotion, where this idea has typically been expressed in terms of a distinction between two different ‘types’ of relief. In this section, we outline three related ways in which such a distinction has been described.

**(i) Near miss versus task completion relief.** Sweeny and Vohs (2012) provide an analysis of relief from a social psychology perspective, distinguishing between *near-miss* relief, assumed to emerge following the narrow avoidance of an unpleasant experience (i.e., a counterfactual negative state that was avoided), and *task-completion* relief, assumed to follow the completion of an unpleasant or difficult task (i.e., an actual negative state that was experienced during a task but has now concluded). Near-miss relief is thought to be

associated more strongly with downward counterfactual thinking, i.e., counterfactuals comparing reality to a hypothetically worse outcome.

**(ii) Counterfactual versus temporal relief.** Hoerl (2015), in a philosophical analysis of the emotion of relief, distinguishes between *counterfactual* and *temporal* instances of relief, proposing that these relief types have different triggering conditions and functions. His characterization of counterfactual relief is close to the way in which relief, in decision making research (e.g., Coricelli et al., 2007; Habib et al., 2012), is viewed as the antonym of regret, with the latter occurring when an actual outcome is *worse* than a counterfactual one and the former occurring when the actual outcome is the *better* one. On this picture, there is not necessarily any unpleasant experience that precedes relief when it has a counterfactual precursor (e.g., being told at the checkout that you are buying your child the last of a much-coveted toy before Christmas may result in relief but may not have been preceded by any negative experience). Temporal relief, by contrast, is assumed to turn specifically on the fact that an unpleasant episode (e.g., a painful medical procedure) has actually taken place, but has now ended.

**(iii) Prevention versus stopping relief.** Deutsch et al.'s account (2015), which takes theories of fear and conditioned learning as its springboard, describes relief to be an emotion triggered by the “absence of expected or previously experienced” negative stimulation [p. 2; see also Leknes et al. (2011); Riebe et al. (2012)]. In this analysis, either the threat or actual experience of negative stimulation is thought to initially lead to negative affect; this then subsequently shifts to positive affect, through an opponent process mechanism, when a safety signal is detected (Solomon, 1980). Although there are commonalities in the general process giving rise to relief, according to this account, it nevertheless distinguishes between *prevention* and *stopping* relief, with prevention relief occurring when anticipated or expected negative stimulation does not occur, and stopping relief occurring after the offset of painful or unpleasant stimulation. On this picture, prevention relief always results specifically from the cessation of fear (i.e., fear that



something negative will occur, something that in fact does not come to pass), whereas stopping relief can occur following any type of negative experience (e.g., pain or shame).

Coming from quite different disciplinary perspectives, all three of these accounts make related distinctions between two separate types of circumstances in which relief occurs: Roughly speaking, all three distinguish between relief experienced in circumstances in which a worse outcome that could have occurred did not in fact occur, and relief experienced in circumstances in which something unpleasant comes to an end. Our aim in this paper is to investigate to what extent a distinction of this type is also present in people's descriptions of everyday episodes of relief, taking these theoretical accounts to provide a useful starting point in framing the relevant empirical questions.

### **Key empirical questions**

#### **(a) How should we characterize the antecedents of relief?**

At the heart of Deutsch et al.'s (2015) framework is the idea that both of what they call prevention and stopping relief are similar in that they are necessarily preceded by a period of negative affect and result via opponent processes from the removal of any threat on the detection of a safety signal. Stopping relief can be seen as an example of relief in which there is a 'purely' temporal precursor. In the case of prevention relief, the initial period of negative experience takes the form of fear or anxiety about a possible negative outcome, which then in fact does not occur. Thus, according to Deutsch et al. (2015), although the exact triggering conditions for the two types of relief are distinct, they share a fundamental similarity in terms of underpinning mechanisms. Such a claim has the advantage of helping make sense of why people use the same term to refer to both types of relief despite somewhat different triggering conditions. Note, though, that it also makes the empirical prediction that prevention relief is invariably preceded by a period of negative affect (specifically fear or anxiety).

As it stands, Hoerl's (2015) distinction between temporal and counterfactual relief does not make any assumptions about the similarity of the mechanisms underpinning these types of relief. Of note, though, is that it seems to at least leave open the possibility that what he calls counterfactual relief can occur without any initial fear or anxiety that subsequently is replaced by relief. For example, consider a situation in which someone has a ticket for a flight but changes their ticket to catch a later plane. They then discover that the earlier flight has crashed killing all on board. It seems at least possible that such a person might feel what Hoerl (2015) terms counterfactual relief, even though there is no period in which they experience fear or anxiety that dissipates on realizing that they are safe. However, existing research has not addressed whether people would indeed describe their experience under such circumstances as relief, i.e., when there is a 'purely' counterfactual precursor. We examined this question using a variety of methods for eliciting descriptions of relief experiences.

**(b) Are 'hybrid' antecedents of relief experiences prototypical? Is the experience of relief more intense or memorable under such circumstances?**

The three accounts that we have outlined all leave open the possibility there will be 'hybrid' instances of relief experiences that have both temporal and counterfactual antecedents. Indeed, it seems plausible that people may frequently feel both glad to have avoided a negative outcome (e.g., that they have passed rather than failed an exam) and also glad that an unpleasant experience is over (e.g., that a stressful period of preparing for and sitting the exam is over). Such hybrid cases may even be the prototypical (i.e., the most commonly reported) expression of relief, or it may be the case that experienced relief is particularly intense or memorable under such circumstances. Speculatively, different types of precursors might have additive effects on emotion intensity, in the sense that the experiencer has more than one 'reason' for feeling relieved. Higher intensity could then lead to increased memorability, in line with studies of autobiographical memory that have generally found that emotional memories are easier to remember than unemotional memories (e.g., Talarico et al.,

2004).

As will be described below, in the current study, we examined people's judgments about the antecedents to everyday experiences of relief, and classified them as either 'purely temporal', 'purely counterfactual', or 'hybrid' in nature in order to examine whether there are indeed any single antecedent cases and also to examine the relative frequency of these different antecedents, the salience in memory, and the level of intensity of the relief experienced in each type of case. This allowed us to consider the prototypical circumstances in which people report that relief occurs, and to explore whether hybrid antecedents are in fact most common and/or result in more intense or memorable relief.

### **(c) What is the relation between relief and counterfactual thought?**

All three of the accounts outlined above explicitly link relief with counterfactual thought, and indeed Sweeny and Vohs (2012) also provide novel empirical evidence of an association between the frequency of downward counterfactual thought and what they describe as near-miss relief. An implication is that, on any of these approaches, in trying to understand relief, it will be crucial to examine the relation between this emotion and counterfactual thought. The same can be said about the way relief has been frequently characterized in the decision-making literature as an emotion triggered by counterfactual thought. Thus, in order to replicate and extend the findings of Sweeny and Vohs (2012) to a novel paradigm, we asked people to report on whether their experiences of relief were accompanied by downward counterfactual thoughts and by upward counterfactual thoughts. We were particularly interested in whether relief that people reported experiencing on realizing that things could have been worse was more strongly associated with downward counterfactual thinking than relief people reported experiencing following the end of an unpleasant event.

**(d) Does relief primarily occur in circumstances in which one is personally responsible for an outcome? Is it more strongly associated with action rather than inaction?**

As we have pointed out, in the decision-making literature, relief is sometimes characterized as being the antonym of regret, and, within the regret literature, the role of personal responsibility has been an important focus of research. Indeed, one of the central findings of Gilovich and Medvec's (1994) landmark study of self-reported regrets is that the vast majority of the described instances of regret — over 95% — involved events that were within the person's control. It has since been documented experimentally that the experience of regret tends to accompany thoughts about how one could have, or should have, acted differently — by contrast to disappointment, which is often experienced when a negative outcome happens independently of one's own decision (Zeelenberg, Van Dijk, & Manstead, 1998). Thus, the experience of regret typically involves focusing attention on one's own role in the occurrence of a regretted outcome and is strongly associated with a feeling of personal responsibility (e.g., Wrosch & Heckhausen, 2002; Zeelenberg et al., 2000).

Moreover, even in circumstances in which events are under one's personal control, it is possible to distinguish between experiences of regret following action versus those following inaction. In Gilovich and Medvec's (1994) study of self-reported regrets, people describe regret experiences following both action and inaction. Nevertheless, there is a temporal pattern to this dimension of regret. In the short-term, people tend to be more regretful about negative outcomes that stem from actions taken than about equally negative outcomes that result from actions foregone (Gleicher et al., 1990; Kahneman & Tversky, 1982; Landman, 1987). Interestingly, the pattern reverses for long-term regrets: When looking back, people tend to experience most regret over the things that they did not do (e.g., Beike et al., 2009; Gilovich & Medvec, 1994; Landman & Manis, 1992). Potential reasons for this are discussed by Gilovich and Medvec (1995; see also Savitsky et al., 1997).

To the best of our knowledge, by contrast, very little is known about the role of

personal responsibility or action versus inaction in the events that people report as triggering relief. Thus, when examining the nature of the events described as triggering relief in the current study, we explored the role of responsibility and activity of the experiencer in determining such events. If relief experiences do have two distinct types of antecedents, then there may be differential relations between these experiences and both agent responsibility and activity.

**(e) Do people report that relief is related to decision making?**

According to Hoerl (2015), discerning two types of relief is of practical value because the antecedents of relief likely determine its behavioral consequences. He speculates that anticipating relief following the endurance of an unwelcome experience may serve to make people more likely to engage in aversive but ultimately beneficial activities (Hoerl, 2015); Sweeny and Vohs (2012) also suggest that task-completion relief may serve to motivate people to complete unpleasant tasks. So, for example, feeling relief after completing a run in cold and wet weather might serve to motivate further runs and thus yield associated health benefits. To the best of our knowledge, empirical studies have not yet examined whether anticipating relief following the ending of an unpleasant but beneficial experience does actually increase the likelihood that one will engage in that experience, although this seems like a plausible intuition.

This also raises the issue of the function (if any) of relief experiences when there is a counterfactual precursor. Sweeny and Vohs (2012) suggest that what they term near-miss relief could prompt people to learn to avoid similar situations in the future, perhaps because it serves to highlight the riskiness of a given course of action and leads to risk-aversion (Burnett et al., 2010; Wu et al., 2017). However, we note that if relief triggered by counterfactuals is construed as the antonym of regret, this might also lead one to expect it to have the opposite functional role to that emotion, which runs counter to Sweeny and Vohs' suggestion. Regret is known to support choice switching (e.g., Brassens et al., 2012; E.

O'Connor et al., 2014), i.e., having regretted one's choice, when faced with a similar choice again, one will choose differently. Thus, if relief has the opposite effect to regret, it should serve to reinforce a past choice or behavior rather than leading to avoidance of that choice.

In our studies, we asked participants questions about the impact that episodes of relief had on subsequent decision making and examined whether this varied as a function of the nature of the antecedent of relief. Although there are obvious limitations in using self-report to study the consequences of experiencing relief, the data did allow us to make a preliminary examination of whether relief tends to have positive or negative impact on decision making. We were also able to specifically examine whether experiencing relief with a temporal antecedent was associated with participants reporting they were more likely to endure similar unpleasant experiences in the future.

### Overview of Studies

As we have discussed, there are three existing accounts that distinguish, albeit in somewhat different ways, between two 'types' of relief. These accounts all have in common the idea that there are two different triggering conditions for relief. Because we wanted to keep the framing of the current studies as broad as possible, we decided to initially adopt the distinction between temporal and counterfactual *precursors* of relief, on the assumption that this distinction maps on to the commonalities between three accounts and does not necessarily imply that there are two distinct *types* of relief (e.g., with different phenomenology or function). For the purposes of our studies, temporal precursors were understood as the coming to an end of any type of negative experience, and counterfactual precursors were understood as an unrealized negative outcome. Taken together, the studies allowed us to begin to address the set of questions about relief that we have outlined above.

In Studies 1 and 2, large groups of participants completed online questionnaires that asked them to briefly describe and reflect on a time from their past when they felt the emotion of relief. Each description was coded as having temporal or counterfactual

precursors, or as hybrid with both precursors. Participants were also asked to make judgments about the intensity of the experience and how often they had thought about the event since its occurrence. As well as examining whether there appear to be distinct cases of relief involving either temporal or counterfactual precursors, this also allowed us to examine whether hybrid cases are associated with more intense relief, or more likely to be recalled. As in the literature on regret, we also broadly categorized the life domains into which each experience fell. Motivated by the questions described above concerning the relation between relief and decision making, we additionally asked participants to (i) make judgments about the frequency of counterfactual thinking following the experience, (ii) report the extent to which they were personally responsible for the precipitating event, (iii) report whether the event was a result of action or inaction, and (iv) judge the impact of the experience on subsequent choices and decisions. Studies 3 and 4 then followed up on these findings by using more focused methodologies to examine the likelihood of ‘purely’ counterfactual precursors to relief (Study 3) and ‘purely’ temporal precursors (Study 4).

### **Study 1: Real-Life Episodes of Relief**

#### **Method**

**Participants.** A total of 513 adults aged between 18 and 60 were recruited via Prolific (<https://www.prolific.co/>), a web-based crowd-sourcing platform. To allow the researchers to interpret answers to open-ended questions, only native English speakers residing in the United Kingdom were eligible to take part. The final sample after exclusions (see supplementary materials for details) included 500 participants (59% female,  $M_{\text{age}} = 37.29$  years,  $SD_{\text{age}} = 12.22$ ), the majority of whom reported having higher education (60.40%). Characteristics of the final sample, split by level of education, are presented in the supplement. All participants received an honorarium (2 UK pounds) for completing the survey, which took approximately 12 minutes. The required sample size was estimated a priori using G\*Power 3.1 (Faul et al., 2007) to test goodness of fit with medium effect size

( $w = 0.2$ ) and alpha level of .05. Results showed a sample of 495 was needed to achieve a power of .95. The estimated sample size was also adequate for detecting small effects ( $f = 0.1$ ) in ANOVA models (assuming  $\alpha = .01$ , and power = 95%).<sup>1</sup>

**Materials and procedure.** All studies reported in this paper were approved and conducted in accordance with the guidelines of the Faculty Ethics Committee, on behalf of the university of the first author. For Studies 1-3, the data were collected using Qualtrics (Qualtrics, 2019), an online survey tool. Following standard demographic questions about age, gender, and level of education, participants were instructed to think about a time in their life when they felt the emotion of relief and to provide a detailed description of the circumstances in which they felt this emotion using an open-ended text box. A valid description had to contain a minimum of 10 characters, with no upper word limit. Subsequent questions (summarized in Table 1) concerned how long ago the incident occurred and probed thought frequency after the event. Participants also rated the intensity of the relief they experienced on a 100-point scale anchored *very weak* to the left and *very intense* to the right.

To examine the hypothesized distinction between counterfactual and temporal precursors of relief, we asked respondents to indicate whether the emotion they had described related to: an unpleasant event that had ended (categorized as a temporal precursor), a bad outcome that was avoided (categorized as a counterfactual precursor), both an unpleasant event that had ended and a bad outcome that was avoided (categorized as a hybrid precursor), or neither an unpleasant event that had ended nor a bad outcome that was avoided. These judgments were subsequently verified by a coder who read the event description provided by the participant. Next, we posed two questions to establish whether the circumstances surrounding relief-inducing episodes were under participants' control. Participants had to indicate who was mainly responsible for the circumstances in which they felt relief and whose decision led to these circumstances. Participants were then asked

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<sup>1</sup> The same calculation was used in Studies 2 and 4.



whether they attributed the events to action or inaction (where action was defined as a decision to do something and inaction as a decision not to do something); if they had previously answered that the decision had been mainly theirs, the question was worded as one about their own action/inaction, whereas if they had previously answered that the decision had been mainly someone else's, they were asked about the other's action/inaction. Whenever respondents indicated that no decision was involved in the circumstances in which they felt relief, they were instead instructed to report whether they experienced relief because something happened or because something did not happen.

Participants also completed a set of judgments concerning the degree of upward and downward counterfactual thinking following the event and the impact of this relief, if any, on subsequent choice. A sub-sample of participants who indicated that the feeling of relief they had described was related to either a bad outcome that was avoided (counterfactual precursor) or both an unpleasant event that had ended and a bad outcome that was avoided (hybrid precursor) were additionally asked to undo the event and generate counterfactual mutations by completing open-ended stems beginning with *Things would have been worse if...* Participants were instructed to provide at least one and up to four mutations. A final binary (yes/no) question probed the impact of relief. If participants responded in the affirmative, they were asked to provide additional details using an open-ended text box. The precise wording of all survey questions reported in this paper is provided in the supplementary materials.

Table 1

*A summary of survey questions used in Studies 1 and 2. Note: \* featured only in Study 2, † featured only in Study 1.*

<b>Area of interest</b>	<b>Question</b>	<b>Response format</b>
<b>Relief precursors</b>	We would like you to take a moment to think about a time in your life when you felt the emotion of relief. Please provide a detailed description of the circumstances in which you felt this emotion.	A text box in which respondents formulated their own answers
<b>Distance from the event</b>	How long ago did this event happen?	Eight response choices ranging from <i>less than a week ago</i> to <i>more than 10 years ago</i> in Study 1 and from <i>1 day ago</i> to <i>7 days ago</i> in Study 2
<b>Rumination</b>	How often have you thought about this event since it happened?	A 100-point scale ranging from <i>never</i> to <i>very frequently</i>
<b>Ease of retrieval*</b>	How easy was it to bring this event to mind?	A 100-point ranging from <i>very easy</i> to <i>very difficult</i>
<b>Intensity</b>	Bearing in mind the event that you have described: [ <i>Description provided here</i> ]. Please rate the intensity of the relief you experienced.	A 100-point scale ranging from <i>very weak</i> to <i>very intense</i>
<b>Precursor</b>	Was the feeling of relief that you have described related to:	Four response choices: i) an unpleasant event that had ended, ii) a bad outcome that was avoided, iii) both an unpleasant event that had ended and a bad outcome that was avoided and iv) neither an unpleasant event that had ended nor a bad outcome that was avoided
<b>Person responsible</b>	Who was mainly responsible for the circumstances in which you felt relief?	Three response choices: i) I was mainly responsible, ii) someone else was mainly responsible, iii) no one was responsible
<b>Decision maker</b>	Whose decision led to the circumstances in which you felt relief?	Three response choices: i) mainly my decision, ii) mainly someone else's decision, iii) nobody's decision

Area of interest	Question	Response format
<b>Action/inaction</b>	You said that it was mainly your/someone else's decision that led to the circumstances in which you felt relief. Was the decision that you made:	Two response choices: i) a decision to do something, ii) a decision not to do something
<b>Downward counterfactual thinking</b>	Following the event that you have described, were you thinking about how things could have been worse?	A 100-point scale ranging from <i>no, not at all</i> to <i>yes, a lot</i>
<b>Upward counterfactual thinking</b>	Following the event that you have described, were you thinking about how things could have been better?	A 100-point scale ranging from <i>no, not at all</i> to <i>yes, a lot</i>
<b>Counterfactual mutations</b>	What could have been different (e.g., about you, about somebody else, about your behavior, about people involved, about the situation) so that the event could have had a worse ending?	Four text boxes beginning with <i>Things would have been worse if...</i>
<b>Impact†</b>	Has the feeling of relief that you described had an impact on any choices and decisions you have made since?	Yes or no
<b>Impact†</b>	Please explain how the feeling of relief that you described had an impact on choices and decisions you have made since.	A text box in which respondents formulated their own answers

**Coding schemes.** Each description of a relief-inducing episode was judged by the participants as involving either a temporal precursor, a counterfactual precursor, hybrid, or neither. Prior to analyses, these judgments were verified by a coder who determined whether the description provided by the participant matched their response to the question probing the precursors of relief. Overall, the coder agreed with the participants 84.40% of the time (Cohen's Kappa = 0.76, 95% confidence intervals (CI) [0.71, 0.81]). Over half of the disagreements (48 of 78) were due to some participants' propensity to categorize their relief experiences as having neither temporal nor counterfactual precursors, when (as evaluated by the coder) antecedents of the relevant instance of relief could be clearly identified from the description. Out of the 48 participants unable to classify antecedents of relief, 52.08% had higher education and 47.92% did not, indicating that the inability to categorize relief precursors as either counterfactual, temporal, or both was not driven by the linguistic complexity of the question. All coding discrepancies were resolved by an independent adjudicator who was considered a third rater. In those instances, the classification agreed on by two of three raters (i.e., participant, coder, adjudicator) became the final categorization. All 78 disagreements were resolved in favor of the coder. In one instance, where all three raters disagreed, the data were removed from further analyses.

We coded each open-ended description of a relief-inducing episode by drawing on prior theoretical conceptualizations of the domains of life priorities (e.g., Oishi & Diener, 2001; Roese & Summerville, 2005) and inducing a set of categories to describe the contexts in which participants reported having experienced relief. All open-ended survey responses were loaded into NVivo qualitative data analysis software (NVivo, 2018), which was used to develop the coding scheme and code text-based data. Discrepancies between coders were negotiated until consensus was reached. All stems provided in response to the prompt (i.e., *Things would have been worse if...*) were coded as mutating an aspect of the situation that was either *under participant's control*, *under someone else's control*, or *uncontrollable*. Finally, all impact statements provided in response to the question probing the consequences

of the relief episode for subsequent decision making were coded in terms of *valence* (positive, negative, or ambiguous), *type of change* (behavioral, attitude, both behavioral and attitude, or ambiguous) and participant's *willingness to complete unpleasant tasks in future* (yes or no).

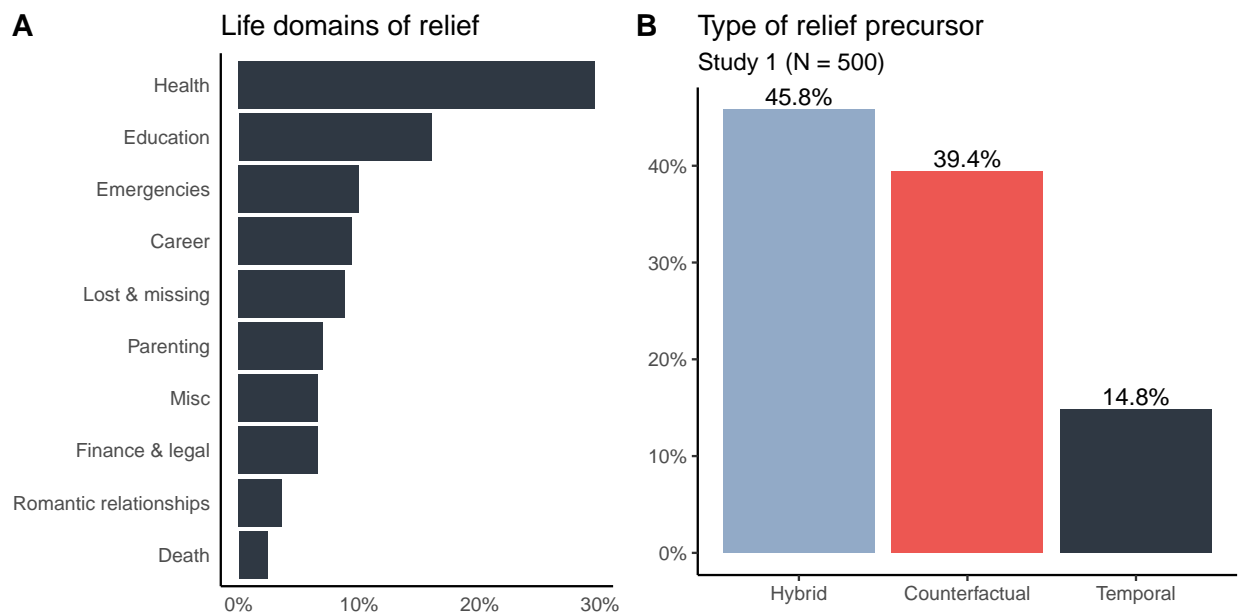
**Transparency and openness.** For all four studies, we report how we determined our sample size, all data exclusions, and all measures collected in the study. All data, analysis code, and research materials are available on the Open Science Framework [<https://osf.io/dz6f4/>; Graham et al. (2022)]. Experimental designs and data analysis plans were not pre-registered.

Data were analyzed using R, version 4.0.0 (R Core Team, 2018), and written using the package *papaja* (Aust & Barth, 2018). To analyze the data, a model comparison approach based on Bayes factors, implemented with the *BayesFactor* package in R (Morey & Rouder, 2018) was used. Bayesian statistics provide a better foundation for probabilistic inference than null hypothesis significance testing (e.g., Wagenmakers, 2007). In our implementation, Bayes factors (BF) reflect the weight of evidence in favor of omitting a particular component from a model containing all relevant available variables. Bayes factors in favor of a particular main effect (over the null model) or interaction (over main effects only) are reported as  $BF_{10}$ , whereas Bayes factors in favor of the null are reported as  $BF_{01}$  ( $BF_{10} = 1/BF_{01}$ ). A large  $BF_{10}$  value indicates strong evidence for including the parameter; i.e., that it was important in predicting the data. Conversely, a large  $BF_{01}$  value indicates strong evidence that the parameter was not important.

## Results

As illustrated in Figure 1 (Panel A), the corpus of reports elicited in Study 1 pertained to many facets of life, with the five most commonly reported relief-inducing episodes falling into the following life domains (in descending order of frequency): health (e.g., “Discovering I did not have cancer”), education (e.g., “When I got my Uni results and realized I had done

better than expected”), emergencies and accidents (e.g., “When I turned the corner whilst learning to drive and lost control but managed to weave through the 3 cars that I almost hit”), career and employment (e.g., “I felt relief when I found out I had got my current job as I was very unhappy in my previous employment”), and lost (possessions) or missing (pets/people; e.g., “When my cat went missing and I found her stuck in a shed a couple of days later”). Across all domains, many descriptions referred to a state of mental uncertainty associated with awaiting an outcome or decision (e.g., medical test results, exam grades, job interview invitations; see supplementary materials for additional details). Domains of relief split by type of precursor are reported in the supplement.

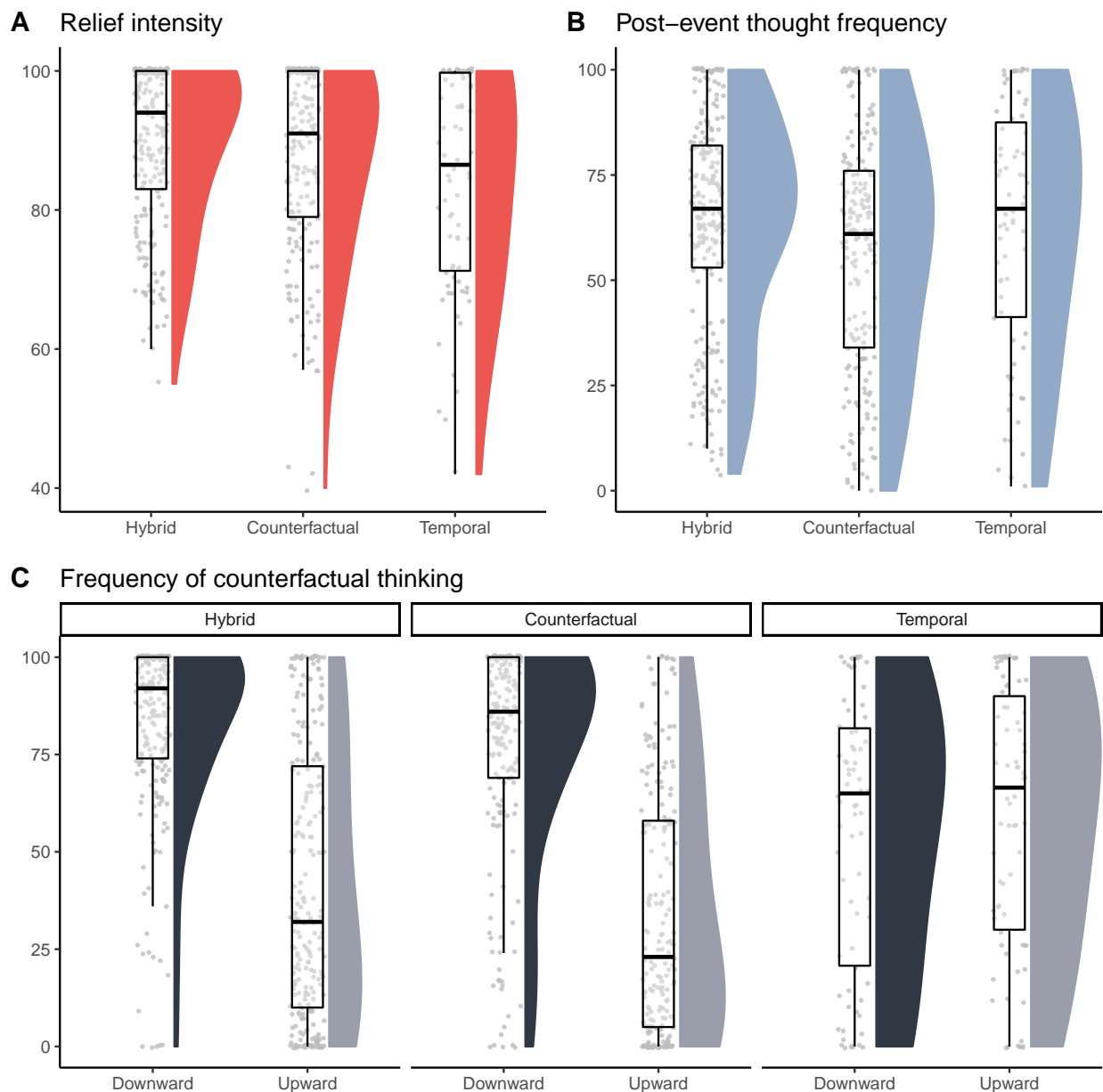


*Figure 1.* The percentage of relief-inducing episodes reported in Study 1 split by life domain (A) and type of relief precursor (B).

**What are the precursors of relief, and are there hybrid precursors?** The final dataset of 500 relief-inducing episodes split by type of relief precursor is depicted in Figure 1, panel B. Descriptions varied considerably in terms of temporal distance from the event and included very recent experiences on one end of the spectrum and recollections of events that occurred many years in the past on the other end. Overall, the majority of

participants (61.00%) reported situations that occurred more than 1 year ago (see Figure S1 in the supplement). Most pertinently for the current paper, feelings of relief triggered (solely or in part) by the avoidance of a negative outcome were reported more frequently than feelings experienced solely because an unpleasant event came to an end. Specifically, 39.40% of descriptions were coded as involving counterfactual precursors (e.g., “I had to rehome my pet lizard (a specialist species) and I was relieved that I managed to find a fantastic new home for him”; “When I thought I had made a mistake in my tax return and found that I had not”) and 45.80% as involving hybrid precursors (e.g., “When my partner accepted me back after a period of separation, due to inappropriate behavior on my part”). Purely temporal precursors, on the contrary, were reported only 14.80% of the time (e.g., “I had a job interview I spent a long time preparing for and, although I didn’t get the job, I was relieved when the whole thing was over”). A Chi-square test of goodness of fit indicated that the frequency of reports varied significantly by type of precursor,  $\chi^2(2, n = 500) = 80.36, p < .001$ .

**Is intensity and salience in memory stronger in cases with hybrid precursors?** Participants’ ratings of relief intensity and post-event thought frequency are presented in Figure 2 (panels A and B). A one-way ANOVA performed on the intensity data revealed a main effect of precursor type ( $F(2, 497) = 6.39, MSE = 167.59, p = .002, \hat{\eta}_G^2 = .025, BF_{10} = 9.44$ ), with relief following hybrid precursors being most intense overall. Post-hoc comparisons ( $t$ -tests) indicated that events considered to have both counterfactual and temporal precursors were judged as significantly more intense than those considered only temporal in nature ( $\Delta M = 5.83, 95\% \text{ CI } [1.97, 9.69], t(99.83) = 3.00, p = .003, BF_{10} = 42.52$ ). The other differences were not significant (both  $p > .017$ , Bonferroni-corrected). Analogous analysis of the frequency of post-event thought yielded an inconclusive Bayes factor ( $BF_{10} = 0.71$ ) in favor of the null ( $F(2, 497) = 3.49, MSE = 739.74, p = .031$ ), indicating that type of precursor had no discernible effect on the amount of time spent mentally re-visiting the event.



*Figure 2.* Self-reported ratings of relief intensity (panel A), the frequency of post-event thought (panel B), and the frequency of upward and downward counterfactual thinking (panel C), depicted by type of precursor. Points are individual scores (jittered within groups to reduce overlap) with split-half violin illustrating distribution; black lines indicate median; the lower and upper hinges correspond to the first and third quartiles; whiskers depict maximum and minimum values within 1.5 times the interquartile range.



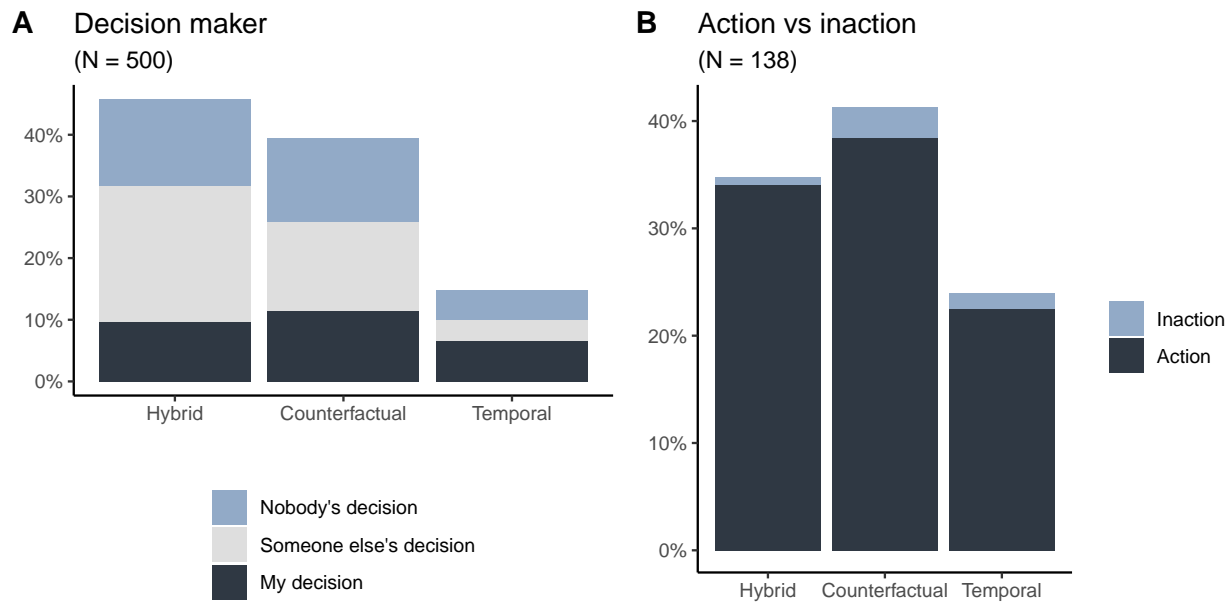
**Do relief precursors differ in terms of their link with counterfactual thought?** Presented in Figure 2 (panel C) is the average self-reported frequency of counterfactual thinking following the event. A mixed 2 x 3 ANOVA with a within-subjects factor of direction (upward and downward counterfactual thinking) and a between-subjects factor of type of precursor (temporal, counterfactual, hybrid) revealed a main effect of direction ( $F(1, 497) = 330.08$ ,  $MSE = 970.81$ ,  $p < .001$ ,  $\hat{\eta}_G^2 = .260$ ), with thoughts about how things might have been *worse* being, overall, more recurrent than thoughts about how things might have been *better* ( $M = 76.68$  [ $SD = 28.16$ ] and  $M = 40.87$  [ $SD = 34.42$ ], respectively). The main effect of relief precursor ( $F(2, 497) = 4.97$ ,  $MSE = 861.91$ ,  $p = .007$ ,  $\hat{\eta}_G^2 = .009$ ) was also significant, with a difference in the overall frequency of counterfactual thinking (irrespective of direction) between relief with a hybrid precursor and a counterfactual precursor ( $M_D = 6.21$ , 95% CI [1.35, 11.1],  $t(997) = 2.51$ , Bonferroni-adjusted  $p = .037$ ). The other two pairwise comparisons (i.e., hybrid vs temporal, counterfactual vs temporal) were non-significant. Finally, the interaction term between direction and relief precursors ( $F(2, 497) = 34.70$ ,  $MSE = 970.81$ ,  $p < .001$ ,  $\hat{\eta}_G^2 = .069$ ) was also significant. Accordingly, Bayesian ANOVA revealed strong support for a full model containing both main effects and the two-way interaction, relative to the next strongest model containing only the main effect of direction ( $BF_{10} > 100$ ).

To follow up on the direction by precursor interaction, paired  $t$ -tests revealed that participants who described an instance of relief with a counterfactual precursor, or an episode that involved both counterfactual and temporal precursors, reported significantly higher rates of downward counterfactual thinking than upward counterfactual thinking (for hybrid precursors:  $M_D = 42.00$ , 95% CI [36.44, 47.56],  $t(228) = 14.87$ ,  $p < .001$ ,  $BF_{10} = 1.33 \times 10^{32}$ ; for counterfactual precursors:  $M_D = 43.38$ , 95% CI [37.44, 49.32],  $t(196) = 14.40$ ,  $p < .001$ ,  $BF_{10} = 1.95 \times 10^{29}$ ). By contrast, the frequency of counterfactual thought did not differ as a function of direction for those respondents who described purely temporal precursors of relief ( $t(73) = -0.59$ ,  $p = .559$ ,  $BF_{10} = 0.15$ ). Thus, in summary, hybrid precursors and

counterfactual precursors were specifically characterized by significantly more downward than upward counterfactual thinking as compared with relief triggered by temporal precursors.

**Does relief primarily occur in circumstances in which one is personally responsible for an outcome?** We found a significant association between responses to two questions probing personal agency ( $\chi^2(4, n = 500) = 190.43, p < .001$ ), indicating that the reported decision maker was also typically the person perceived to bear responsibility for the circumstances leading up to relief experiences. Therefore, in the interest of brevity, data relating to the main decision maker are reported in the main manuscript (Figure 3, panel A) and responses to the question probing responsibility (for Study 1 and Study 2) are included in the supplement. A Chi-square test revealed that the reported decision maker (i.e., the participant, someone else, no one) varied significantly by type of precursor ( $\chi^2(4, n = 500) = 21.62, p < .001$ ). With respect to temporal relief precursors, the participant was the most frequently reported decision maker. By contrast, purely counterfactual and hybrid precursors of relief were most often linked to a decision made by someone other than the respondent.

A second way in which we looked at the role of agency was by asking participants to generate counterfactual mutations and then examining the extent to which participants focused on their own actions. To do this, counterfactual mutations were initially extracted for those instances of relief categorized as having either counterfactual or hybrid precursors by the participant and by the independent rater/adjudicator. A total of 896 *if* stems were then subsequently coded as mutating an aspect of the situation that was either under participant's control, under someone else's control, or uncontrollable. Twenty-two responses that could not be coded using this scheme were labelled as ambiguous. Overall, 60.04% stems were coded as uncontrollable, 25.33% as under the participant's control, and 12.17% as under someone else's control. Thus, consistent with the data reported in Figure 3 (Panel A), the participants themselves did not typically focus on their own actions when considering ways in which the relief-inducing event could have been worse.



*Figure 3.* The percentage of descriptions of real-life experiences of relief collected in Study 1, split by type of relief precursor, the reported decision maker (i.e., participant, someone else, no one; panel A) and the action/inaction dichotomy in a subset of the data containing 138 participants who reported that they were the decision maker (panel B).

**Is relief more likely following action rather than inaction?** To establish whether relief is more likely following action or inaction we analyzed a subset of the data for which the participant was the reported decision maker. Overall, 131 out of 138 (94.93%) participants/decision makers attributed the relief-inducing events to an action rather than inaction (see Figure 3, panel B) and the likelihood of the event being due to an action or an inaction did not differ significantly as a function of type of precursor ( $\chi^2(2, n = 138) = 1.41, p = .495$ ). Across the board, over 90% (92.98%–97.92%) of relief episodes were reported to be associated with an action. Furthermore, although the action effect was most pronounced for experiences where the participant was the decision maker (94.93% due to action,  $n = 138$ ), action was also predominant when someone else had made the decision (80.40% due to action,  $n = 199$ ). On the other hand, when no one was responsible for the decision, the outcome was attributed to inaction slightly more often than to action (45.40% due to action,  $n = 163$ ). Finally, the overall ratio of events linked to actions and inactions remained stable across the data set and did not vary by temporal distance in the past which was measured

with eight response choices ranging from *less than a week ago* to *more than 10 years ago*,  $\chi^2(7, n = 138) = 4.10, p = .768$ .

**Do experiences of relief have an impact on decision making, and does this vary as a function of precursor?** Finally, 60.40% of all respondents indicated that the feeling of relief they had described had an impact on choices and decisions they made since. The likelihood of the relief-inducing event being judged as having an impact on participants' subsequent choices and decisions differed significantly as a function of type of relief precursor ( $\chi^2(2, n = 500) = 8.81, p = .012$ ), suggesting that some relief experiences are more likely to lead to such changes. More specifically, relief episodes linked to hybrid precursors were reported as having an impact on future decision making more frequently (67.25% of the time) than feelings of relief that had either purely counterfactual or purely temporal antecedents (53.30% and 58.11%, respectively). Furthermore, and perhaps unsurprisingly, there was an association between judging oneself to be the main decision maker responsible for the relief-inducing event and judging that the episode had an impact on choices or decisions,  $\chi^2(2, n = 500) = 12.22, p = .002$ .

All impact statements ( $n = 302$ ) were coded in terms of valence (positive, negative, or ambiguous), type of change (behavioral, attitude, both behavioral and attitude, or ambiguous) and participant's willingness to complete unpleasant tasks in the future. We were interested in the latter category because of the suggestion that relief with temporal precursors increases the likelihood that one will endure unpleasant but beneficial experiences in the future (Hoerl, 2015; Sweeny & Vohs, 2012). In terms of valence, the vast majority of participants (81.46%) reported that relief experiences had a positive impact on their subsequent choices and decisions. The remaining impact statements were mainly ambiguous (17.88%; i.e., neither positive nor negative) with only two participants reporting to have been negatively impacted by relief experiences (0.66%). Furthermore, almost half (45.70%) of participants disclosed having made behavioral changes in the aftermath of relief experiences (e.g., to spend less, to be more pro-active), whilst another 31.46% of statements revealed

changes in terms of outlook and attitude (e.g., becoming more appreciative, becoming more careful). A smaller proportion of participants (15.89%) described consequences that encompassed changes in both behavior and attitude (e.g., checking for cancer symptoms more regularly as well as becoming more aware of signs and symptoms of cancer). Twenty-one of 302 descriptions (6.95%) could not be categorized as belonging to either one of the aforementioned categories. Overall, only 11.92% of statements were categorized as indicating that participants will be more likely to complete aversive tasks in the future and the frequency of reports did not differ by type of precursor  $\chi^2(2, n = 302) = 0.30, p = .859$ . Thus, as they stand, these analyses suggest that experiences of relief are at least conceived of by the experiencer as having a positive effect on subsequent decision making. However, there is very little evidence that relief following a temporal precursor typically increases the likelihood of enduring an unpleasant but beneficial experience.

## Discussion

In Study 1 we collected a corpus of first-person reports of real-life episodes of relief and distilled their features; we also probed aspects of people's reports of the relief-inducing context and relief's behavioral consequences. Participants were largely able to categorize the precursors that triggered the episode of relief as counterfactual, temporal, or a hybrid of both. Notably, the vast majority (85.20%) of the instances of relief reported were described as having some type of counterfactual precursor, either on its own or as part of a hybrid, and episodes with hybrid precursors were the single most reported type of instance. Experiences of relief that had hybrid precursors, in addition to being recalled most frequently, were rated as more intense than those with only counterfactual or temporal antecedents. This apparent association between emotion intensity and memory recall is in line with the extant literature showing that emotional memories are generally easier to remember and more resilient to forgetting than unemotional memories (Hall et al., 2021; e.g., Talarico et al., 2004) and that, particularly when memory is tested after longer retention intervals, emotionally arousing

events are better recollected than more neutral events (Wirkner et al., 2018).

The data also revealed that relief experiences preceded by either counterfactual or temporal precursors have different associations with counterfactual thinking. Specifically, relief experienced following counterfactual precursors was found to be characterized by significantly more downward than upward counterfactual thinking as compared with relief triggered by purely temporal precursors, which is what would be predicted if relief in the former type of circumstance is a counterfactual emotion underpinned by downward counterfactual thoughts. By contrast, instances of relief experiences with purely temporal precursors appear to elicit equivalent amounts of upward and downward counterfactual thoughts. Thus, it is not the propensity to think counterfactually but rather the direction of the comparison that seems to distinguish between relief experiences with different types of precursors.

A somewhat surprising aspect of the results is the frequency of upward counterfactual thoughts related to relief. Although such thoughts were particularly common in the case of experiences of relief judged to have temporal precursors, even in the case of experiences of relief with counterfactual or hybrid precursors, a substantial minority of participants reported upward counterfactuals. The presence of concurrent downward and upward counterfactual thoughts in the latter case is consistent with the possibility that, in some instances, regret and relief can be experienced simultaneously. Speculatively, this might be driven by the multiplicity of potential counterfactual outcomes. Take for example a poker player with a chance to win \$100, win nothing, or lose \$100. In this scenario, breaking even may spur both upward and downward counterfactual comparisons and thus a mixture of regret and relief. Alternatively, in the case of relief experiences with purely temporal precursors, although people may have been relieved that an unpleasant experience is over they may, at the same time, entertain thoughts that things would have been better if the experience had not been undergone in the first place, potentially yielding regret. This possibility is consistent with findings described by Lorimer et al. (2022) who observed that

after Joe Biden was inaugurated as President in 2021, Republican voters felt relieved that the process was over whilst regretting the outcome.

One of the aims of our study was to examine relations between descriptions of everyday episodes of relief and attributions of personal responsibility, the action/inaction distinction, and decision making. Strikingly, when there was a counterfactual component to the relief precursor (either on its own or as part of a hybrid), the participants typically judged themselves as not personally responsible, a finding which contrasts sharply with the pattern observed for everyday episodes of regret (e.g., Gilovich & Medvec, 1994). Consistent with this, when then asked to generate mutations that would have instead yielded the poor outcome that was avoided, participants rarely focused on things within their own control. Thus, the findings suggest that although relief experiences do seem to be frequently triggered by counterfactual comparisons, even in these circumstances relief does not seem to straightforwardly be the positively valenced counterpart of regret — people most typically felt relieved about avoiding poor outcomes in scenarios in which they were not in control of the relevant decisions, whereas regret is strongly associated with personal responsibility.

The link between regret and personal responsibility has often been assumed to be an important reason why regret affects decision making: If people feel regret about choices they have made, this may result in making different choices when faced with a similar situation again (McCormack et al., 2020; Zeelenberg & Pieters, 2007). Although relief episodes with counterfactual precursors did not typically result from participants' own choices, nevertheless around 60% of respondents believed that the episode led to constructive changes in behavior and outlook. Although this type of self-report measure can only provide preliminary evidence for a functional role of relief, exceptionally few participants reported a negative impact on behavior or outlook. Analysis of the types of changes reported by participants suggested that the episodes were perceived as having a positive effect on their subsequent behavior or on their attitudes, and in some instances both. It is interesting that participants believed that the episode had an impact on their subsequent choices or decisions despite the fact they did

not typically attribute the original relief-inducing event to their own choices. If this finding generalizes, then it has implications for how the function of relief might be characterized, because it suggests it does not straightforwardly contribute to either reinforcing or devaluing choices made by the participants that yielded the relief-inducing episode.

Unlike relief experiences with counterfactual precursors, participants typically linked relief experiences with purely temporal precursors to decisions for which they themselves had direct responsibility. Moreover, relief experiences with this type of precursor were particularly likely to involve an action rather than an inaction (i.e., in most cases, the relevant event involved the participant themselves carrying out an action). We were interested in the function of relief under these circumstances, given suggestions that it specifically serves to motivate people to complete unpleasant but beneficial tasks (Hoerl, 2015; Sweeny & Vohs, 2012). The reported characteristics of the triggering events — i.e., as ones that typically involved an action on the part of the participant themselves — are consistent with this suggestion, because they imply that participants experienced relief at the cessation of an unpleasant experience that they had proactively chosen to undergo in the first instance. However, an analysis of participants' descriptions of the subsequent impact of the relief-inducing episode did not provide good evidence in support of this idea, with only around 10% of descriptions categorized as motivating people to undergo an unpleasant but beneficial experience in the future. In summary, although, for all types of precursors, the majority of participants believed that experiencing an episode involving relief did have a positive impact on their choices or decisions, considerably more research is required to establish why this is the case.

### **Study 2: Recent Experiences of Relief**

Study 2 had two main purposes. First, it served as an attempt to replicate some of the key findings of Study 1, given the exploratory nature of this research. Second, it aimed to address an aspect of Study 1's findings that we found surprising. Specifically, we were



surprised by the findings which suggested that experiences of relief with ‘purely’ temporal precursors are much rarer in everyday life than experiences involving counterfactual precursors (either purely counterfactual or hybrid; see Figure 1). An alternative explanation of this finding is that, in studies using retrospective methods, instances of relief spurred by counterfactual comparisons are retrieved more easily (and thus more frequently) than episodes involving purely temporal precursors. Notably, the majority of participants in Study 1 recollected events that took place more than 1 year ago. Perhaps people experience many instances of relief with temporal precursors in everyday life but typically do not remember them over the longer term. We sought to answer this question by asking participants to reflect on a more readily retrievable experience — a time *in the last week*, when they felt the emotion of relief. Our goal was to establish whether relief experiences preceded by counterfactual precursors are genuinely more commonplace or instead simply more memorable than relief experiences triggered by purely temporal precursors. Speculatively, recollections of situations in which an unpleasant experience came to an end (i.e., purely temporal instances of relief) may be subject to more rapid decay over time, consistent with a well-established fading affect bias showing that affect associated with unpleasant events fades faster than the affect associated with pleasant events (e.g., Walker et al., 2003).

## Method

**Participants.** Only native English speakers residing in the United Kingdom and aged between 18 and 60 were eligible to participate. A total of 536 adults were recruited via Prolific. Data from 33 volunteers were excluded from analysis (see supplementary materials for reasons for exclusion), resulting in a final sample of 503 respondents (65.21% female,  $M_{\text{age}} = 37.67$  years,  $SD_{\text{age}} = 12.33$ ). Participants’ characteristics split by level of education are included in the supplement. Over half of participants (56.26%) had higher education. All respondents received 1.50 UK pounds for completing the survey, which took approximately 10 minutes.

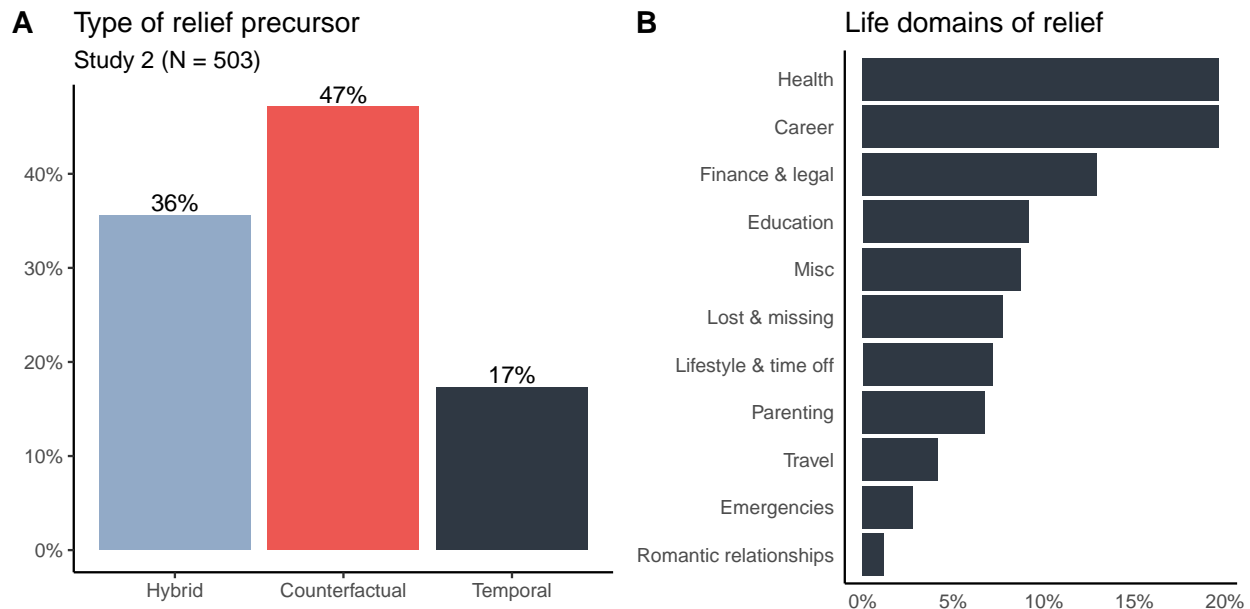
**Materials and procedure.** The survey questions and experimental procedures were identical to those used in Study 1, with three exceptions. First, participants were asked to describe a time *in the last week* (rather than a time *in their life*) when they felt the emotion of relief and to answer questions about the recollected events. Second, participants additionally estimated how easy it was to bring the reported event to mind using a 100-point scale anchored *very easy* to the left and *very difficult* to the right; this was to address whether ease of memory retrieval varied as a function of type of precursor. Third, given the questionnaire's focus on experiences that had occurred very recently, the questions probing the impact of the relief on future choices and decisions were excluded from the survey.

**Coding schemes.** Coding procedures were identical to those used in Study 1. The coder agreed with the participants 75.35% of the time (Cohen's Kappa = 0.64, 95% CI [0.59, 0.70]). The majority of the disagreements (89 of 124) were driven by the participants' propensity to categorize relief as having neither temporal nor counterfactual precursors. On a further 33 occasions, the participant classified their experience of relief as having purely temporal precursors but the coder indicated that the description of the event also contained specific references to unrealized counterfactual outcomes. All disagreements were resolved in favor of the coder. Out of 89 individuals who categorized the precursors of relief as neither temporal nor counterfactual, 60.67% had higher education and 39.33% did not, which is in line with broader sample characteristics (i.e., 56.26% of all participants included in Study 2 reported having higher education). This suggests that the inability to accurately pinpoint the antecedents of relief was not driven by the phrasing of the question which may have been less comprehensible to those with less education.

## Results

Figure 4 depicts the final dataset of 503 descriptions of relief, split by type of precursor and life domain into which the emotions fell. The most common instances of relief people reported having experienced in the previous week pertained to the following life domains:

health (e.g., recovering from an illness), career and employment (e.g., meeting an important deadline), financial and legal matters (e.g., being able to secure sufficient funds to cover expenses), and education (e.g., completing coursework).



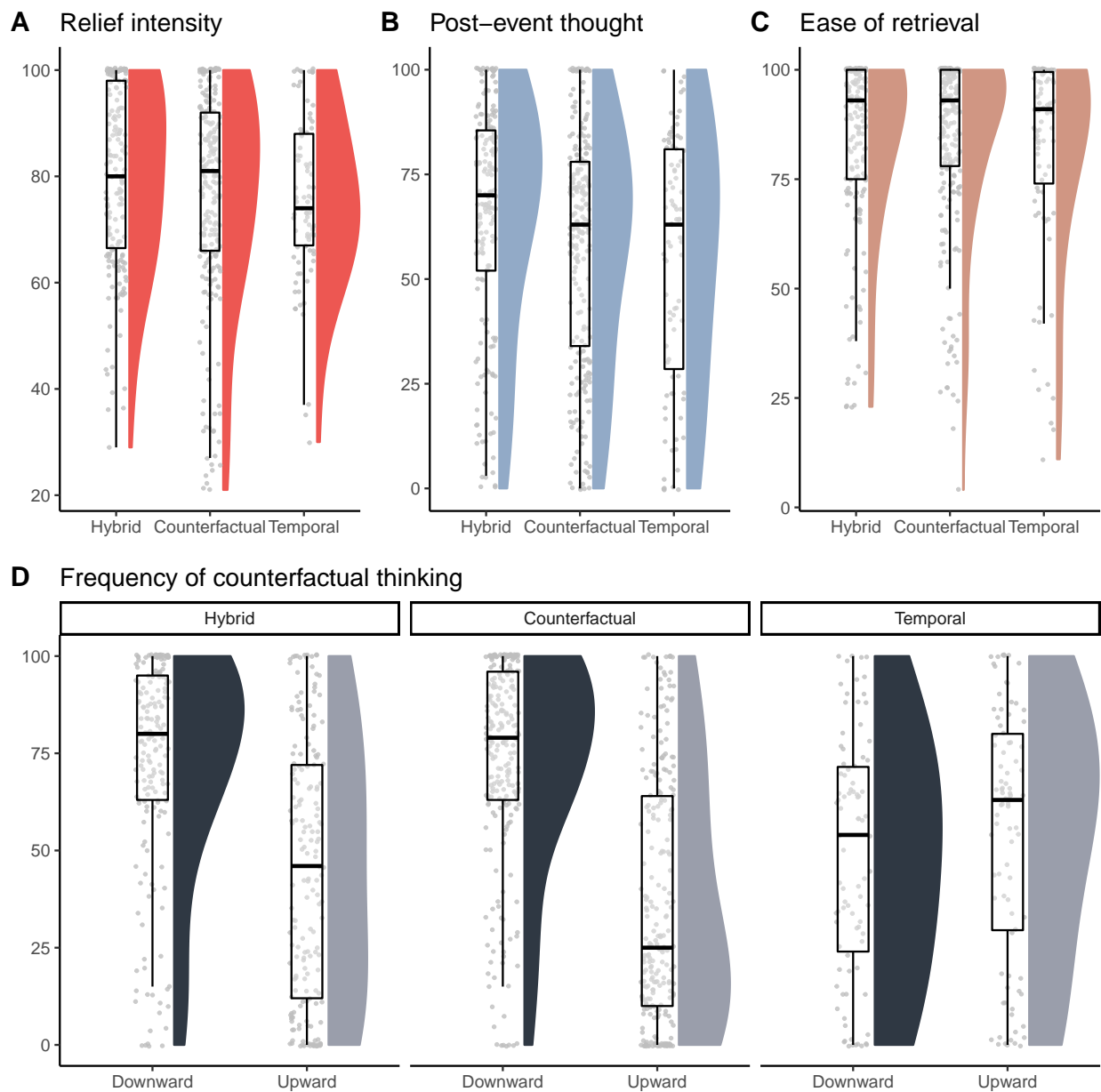
*Figure 4.* The percentage of descriptions of real-life instances of relief reported in Study 2, split by the type of relief precursor (panel A) and life domain (panel B).

**What are the precursors of relief, and are there hybrid precursors?** Purely temporal precursors of relief were reported by 17.30% of participants, which is similar to the rate observed in Study 1 of 14.80%. Instances of relief triggered by counterfactual precursors or hybrid precursors were described more frequently (47.10% and 35.60% of the time, respectively); this resembled the pattern of findings obtained in Study 1, although in that study hybrid precursors were somewhat more common than purely counterfactual precursors. Accordingly, a Chi-square test of goodness of fit indicated that the frequency of reports varied significantly by type of precursor,  $\chi^2(2, n = 503) = 68.25, p < .001$ .

**Is intensity and salience in memory stronger in cases with hybrid precursors?** Also presented in Figure 5 are the average ratings of relief intensity (panel A) and thought frequency following the event (panel B). Although the data follow the same

trend, contrary to the equivalent analysis in Study 1, a one-way ANOVA performed on intensity ratings revealed support for the null model ( $F(2, 500) = 2.40$ ,  $MSE = 334.77$ ,  $p = .092$ ,  $\hat{\eta}_G^2 = .010$ ,  $BF_{10} = 0.24$ ), indicating that recent experiences did not vary significantly in terms of intensity as a function of their precursors. Also at odds with the results from Study 1, a one-way ANOVA performed on the reports of frequency of post-event thought yielded a modest Bayes factor of 3.06 in favor of a condition effect ( $F(2, 500) = 5.17$ ,  $MSE = 792.92$ ,  $p = .006$ ,  $\hat{\eta}_G^2 = .020$ ), with thoughts about events with hybrid precursors being most recurrent. Post-hoc comparisons indicated that events considered to have both counterfactual and temporal precursors resulted in elevated rates of mental re-visiting when compared with episodes considered to have only counterfactual ( $\Delta M = 7.37$ , 95% CI [1.96, 12.77],  $t(385.13) = 2.68$ ,  $p = .008$ ,  $BF_{10} = 3.41$ ) or only temporal precursors ( $\Delta M = 10.28$ , 95% CI [2.75, 17.81],  $t(159.24) = 2.70$ ,  $p = .008$ ,  $BF_{10} = 5.17$ ). The difference in the amount of event-related thinking following emotions triggered by purely counterfactual and purely temporal precursors was non-significant ( $\Delta M = 2.91$ , 95% CI [-4.36, 10.19],  $t(144.49) = 0.79$ ,  $p = .430$ ,  $BF_{10} = 0.19$ ). Average ratings of the ease with which information corresponding to the relief experiences was brought to mind are presented in Figure 5, panel C. A one-way ANOVA assessing ease of retrieval yielded strong evidence against a condition effect ( $F(2, 500) = 0.67$ ,  $MSE = 422.69$ ,  $p = .515$ ,  $\hat{\eta}_G^2 = .003$ ,  $BF_{10} = 4.59 \times 10^{-2}$ ), indicating that, notwithstanding their antecedents, participants found all instances of relief equally easy to retrieve.

**Do relief precursors differ in terms of their link with counterfactual thought?** The average self-reported rates of counterfactual thinking are presented in Figure 5 (panel D). A 2 x 3 ANOVA with a within-subjects factor of direction and a between-subjects factor of type of precursor revealed a main effect of direction,  $F(1, 500) = 198.29$ ,  $MSE = 846.42$ ,  $p < .001$ ,  $\hat{\eta}_G^2 = .155$ , with downward counterfactuals being more recurrent than upward counterfactuals. When aggregated across both directions (i.e., upward and downward), there were no differences in the overall frequency of

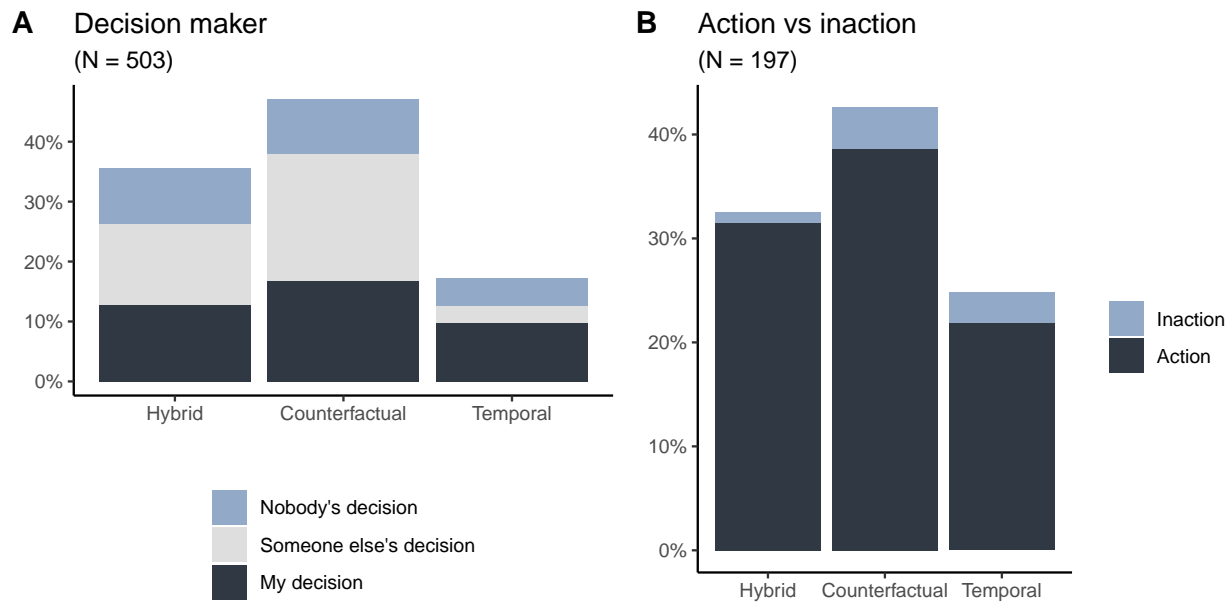


*Figure 5.* Average self-reported ratings of relief intensity (panel A), the frequency of post-event thought (panel B), the ease of retrieval (panel C), and the frequency of counterfactual thinking (panel D), depicted by type of relief precursor. Points are individual scores with split-half violin illustrating distribution; black lines indicate median; the lower and upper hinges correspond to the first and third quartiles; whiskers depict maximum and minimum values within 1.5 times the interquartile range.

counterfactual thought between the three types of precursors (all corrected  $p$  values  $> .017$ ). The main main effect of relief precursor ( $F(2, 500) = 3.32$ ,  $MSE = 981.20$ ,  $p = .037$ ,  $\hat{\eta}_G^2 = .007$ ) and a two-way interaction ( $F(2, 500) = 34.38$ ,  $MSE = 846.42$ ,  $p < .001$ ,  $\hat{\eta}_G^2 = .060$ ) were also significant, thus replicating the pattern of results obtained in Study 1. Bayesian analysis confirmed that the best-fitting model contained both main effects and an interaction ( $BF_{10} > 100$ , relative to the next best model). Post-hoc pairwise comparisons revealed that participants who described an instance of relief triggered by a counterfactual precursor, or an episode that involved both counterfactual and temporal precursors, reported significantly higher rates of downward counterfactual thinking than upward counterfactual thinking (for hybrid precursors:  $M_D = 27.44$ , 95% CI [21.21, 33.67],  $t(178) = 8.69$ ,  $p < .001$ ,  $BF_{10} = 2.55 \times 10^{12}$ ; for counterfactual precursors:  $M_D = 36.40$ , 95% CI [31.23, 41.57],  $t(236) = 13.87$ ,  $p < .001$ ,  $BF_{10} = 1.31 \times 10^{29}$ ). The frequency of counterfactual thought did not differ as a function of direction for those respondents who described purely temporal precursors of relief ( $t(86) = -1.43$ ,  $p = .158$ ,  $BF_{10} = 0.31$ ).

**Does relief primarily occur in circumstances in which one is personally responsible for an outcome?** With regards to the issue of personal agency, Figure 6 (panel A) illustrates that relief with a purely temporal precursor was most frequently attributed to the decision made by the participant. By contrast, instances of relief coded as having purely counterfactual or hybrid precursors were most often attributed to another's decision. A Chi-square test revealed that the decision maker varied significantly by type of precursor ( $\chi^2(4, n = 503) = 25.12$ ,  $p < .001$ ), which mirrors the pattern of findings obtained in Study 1.

**Is relief more likely following action rather than inaction?** As shown in Figure 6 (panel B), 91.88% of participants who attributed their relief experience to a decision that they had made ( $n = 197$ ) reported that the event they had described was due to an action rather than inaction. Overall, 96.88% of events coded as having hybrid precursors, 90.48% of events coded as having purely counterfactual precursors, and 87.76% of



*Figure 6.* The source of attribution (i.e., reported decision maker) and action-inaction dichotomy (Study 2), plotted by relief precursor. Action/inaction dichotomy depicted with the data containing only participants who reported that they were the decision maker.

events coded as having purely temporal precursors were considered to occur in consequence of an action. Accordingly, a Chi-square test revealed that the likelihood of the event being due to an action or inaction did not vary as a function of type of relief precursor ( $\chi^2(2, n = 197) = 3.48, p = .176$ ), again replicating the effect obtained in the first study. Although the action effect was most pronounced for experiences where the participant was the decision maker (91.88% due to action,  $n = 197$ ), when someone else had made the decision, 78.84% ( $n = 189$ ) of relief episodes were still attributed to action rather than inaction. Contrastingly, when no one was responsible for the decision, the outcome was attributed to inaction more often than to action (42.74% due to action,  $n = 163$ ).

As in Study 1, participants who categorized precursors of their relief as either counterfactual or hybrid were asked to generate counterfactual mutations. A total of 740 *if* stems were subsequently coded as mutating an aspect of the situation that was either *under participant's control*, *under someone else's control*, or *uncontrollable*. Again, in line with the findings of Study 1, the largest proportion of stems (47.97%) were coded as outside of

anyone's control. The remaining 28.51% and 23.11% were classified as within the control of the participants or other persons involved, respectively. Only three stems (0.41%) could not be grouped as belonging to one of the three aforementioned categories.

## Discussion

The current results are largely consistent with the findings from Study 1. Importantly, relief with a purely temporal precursor was again the least frequent type of episode reported, even when participants reported episodes from the very recent past. On the face of it, this suggests that in everyday life, relief is more frequently experienced after counterfactual precursors than purely temporal precursors. Above, we speculated that recollections of situations in which an unpleasant experience came to an end may be subject to more rapid decay over time, consistent with the fading affect bias showing that memory for unpleasant events tends to grow substantially less negative (i.e., closer to neutral) with the passage of time. Contrary to this speculation, when participants were explicitly asked about ease of retrieval, results from Study 2 indicate that participants found all recent instances of relief, irrespective of their antecedents, equally easy to retrieve.

The only two inconsistencies observed in the results from Studies 1 and 2 related to the ratings of relief intensity and the frequency of post-event thought. Although in Study 1 relief experiences preceded by both temporal and counterfactual antecedents were judged to be significantly more intense than relief experiences occasioned only by one or the other precursor, this effect was not significant in Study 2. The pattern reversed in the context of post-event mental revisiting — with significant differences emerging only in the second study. These discrepancies could be potentially attributed to the change in the timescale of the question. When aggregated across all three categories of precursors, ratings of relief intensity were higher for events that occurred in the more distant (Study 1,  $M = 87.86$ ,  $SD = 13.08$ ) rather than more immediate past (Study 2,  $M = 77.65$ ,  $SD = 18.35$ ). This most likely reflects the fact that participants were considerably less likely to have experienced a



relief-inducing event of high personal significance over the previous week compared to over their whole lifespans. Participants also seemed to draw on somewhat different life domains, depending on the time frame of the question. In Study 1 in which participants could draw from the whole lifespan, episodes were mostly concerned with matters related to health, education, and parenting. Although health-related instances were also frequently reported in Study 2, the highest proportion of descriptions pertained to work-related events (e.g., completing difficult tasks, meeting tight deadlines, or being able to leave work earlier than expected), which is perhaps not unexpected given that relatively few people will experience significant health events over the past week whereas many will be dealing with work-related issues.

### **Study 3: Experiences of Counterfactual Relief**

The results of Studies 1 and 2 suggest that instances of ‘purely’ temporal relief are spontaneously recalled relatively rarely. The results additionally suggest that relief experiences are twice as likely to be associated with ‘purely’ counterfactual precursors as with ‘purely’ temporal precursors. This is a striking finding given that one account of relief (Deutsch et al., 2015) holds that all instances of relief with counterfactual precursors will also have a temporal precursor in the form of the cessation of an ongoing fear or anxiety about an outcome. If people’s experiences align with Deutsch et al.’s (2015) characterization of relief, we ought not to have found any instances of relief with ‘purely’ counterfactual precursors. On the face of it, though, the results of Studies 1 and 2 suggest that instances of experienced relief with purely counterfactual precursors do occur. However, it is important to note that the experience description task we used in Studies 1 and 2 did not directly ask about the experience of anxiety or worry prior to outcomes being known. Instead, participants were asked about an unpleasant event that had ended. Although this question allows us to test hypotheses about relief experiences arising from task completion or the end of unpleasant episodes, it may not permit direct testing of hypotheses about the role of

anxiety. In particular, participants may experience such anxiety but may be unclear as to its role in their relief experiences or simply fail to spontaneously mention it. This might lead to descriptions and categorizations of relief experiences that omit anxiety and its cessation as a precursor and focus instead on the counterfactual outcome that was avoided.

In Study 3, we used a more focused questionnaire method which required participants to generate descriptions of everyday episodes of relief, but solely focused on episodes of relief that had a counterfactual precursor. Participants were first asked to describe a time in their life when they felt the emotion of relief upon realizing that an outcome could have been worse (i.e., relief that had a counterfactual precursor), and then to report whether or not that experience of relief was preceded by anxiety about a potential negative outcome. By asking participants explicitly to report on whether they had experienced a period of anxiety before their experience of relief, we sought to establish how frequently participants spontaneously recall instances of relief with ‘purely’ (i.e., only) counterfactual precursors that did not include such a period. Participants also made judgments both about the aversiveness of the potentially negative outcomes and the strength of their associated emotions. If an initial period of anxiety does typically play a causal role in episodes of relief, levels of relief might be expected to be predicted by the level of the initial anxiety (potentially over and above the aversiveness of the negative outcome that was avoided if we assume that anxiety is related to both the aversiveness and the perceived likelihood of the undesired event). Establishing this would be indicative of such a causal role, even if participants do not reliably focus on the cessation of anxiety when making judgments about the precursors of their relief experiences.

## Method

**Participants.** Native English-speaking adults residing in the United Kingdom were recruited via Prolific (<https://www.prolific.co/>). A total of 247 participants (72.87% female,  $M_{\text{age}} = 32.99$  years,  $SD_{\text{age}} = 10.32$ , 55.47% reported having higher education) were given a general description of counterfactual relief and then asked to generate an example of such

relief. For additional demographic information see supplementary materials. The required sample size of 212 to achieve 95% power in regression models was estimated using G\*Power 3.1 (Faul et al., 2007) assuming a small effect size ( $f^2 = .1$ ) and  $\alpha$  level of .01.

**Materials and Procedure.** Data were collected using Qualtrics (Qualtrics, 2019). The survey began with standard demographic questions about age, gender, and qualifications. Participants were then asked to describe a time in their life when they felt the emotion of relief because something bad that could have happened did not happen and to rate the intensity of that emotion on a scale ranging from *a little* to *a lot* (all scaled responses ranged from 0 to 100). Next, after having explained the nature of the undesired counterfactual outcome (i.e., the bad thing that could have happened), participants rated its aversiveness (i.e., 0 = *not bad at all*, 100 = *very bad*) and stated whether or not they were thinking about this undesirable outcome *prior to* experiencing relief. Those participants who confirmed that they were thinking about the unwelcome counterfactual outcome before they felt relief were additionally asked to say whether they also felt anxious, worried, or scared at the anticipation of the bad thing possibly happening and, if so, to judge how strongly they felt that way on a scale anchored *a little* to the left and *a lot* to the right. Lastly, participants were instructed to say whether the feeling of anxiety, stress, or worry stopped completely after they learned that the undesired counterfactual outcome was avoided. Those participants who indicated that the feeling of anxiety persisted even after they learned that the undesired outcome did not materialize were also asked to rate the intensity of those feelings (scale ranging from *a little* to *a lot*).

## Results

No participant was unable to report an example of an episode of relief that had a counterfactual precursor. However, the vast majority of participants (94.74%,  $n = 234$ ) answered in the affirmative when explicitly asked if they had anticipated the undesired but avoided counterfactual outcome. Of that set of participants, 98.29% ( $n = 230$ ) said that they

felt worried, anxious, or fearful about the negative counterfactual outcome prior to experiencing relief. The average rating of worry intensity prior to learning the outcome was 88.05 (max = 100;  $SD = 14.97$ ), i.e., relatively high. A further 66.96% ( $n = 154$ ) of these participants indicated that the worry stopped completely once they learned the actual outcome. Those who stated that they continued to experience feelings of anxiety even after they learned that the negative outcome had been avoided, gave an average post-outcome worry rating of 50.82 ( $SD = 26.85$ ). The levels of anxiety experienced before and after the outcome was known differed significantly ( $M_D = 39.29$ , 95% CI [33.11, 45.47],  $t(75) = 12.67$ ,  $p < .001$ ,  $BF_{10} = 1.92 \times 10^{17}$ ). Thus, most instances of relief reported by people to have had a counterfactual precursor did indeed involve an initial period of relatively high anxiety, with this anxiety either dissipating entirely or reducing substantially after learning the outcome had been avoided, consistent with Deutsch et al.'s (2015) suggestion that cessation of fear is the trigger for relief under these circumstances. Nevertheless, around 5% of instances of relief that were described in this study appeared to have purely counterfactual precursors (i.e., the respondents had not anticipated the counterfactual outcome ahead of time).

Table 2

*Correlations between relief intensity, outcome aversiveness, and the levels of anxiety experienced before and after the outcome was known.*

	1	2	3	$M$	$SD$
1. Relief intensity	-			89.92	12.92
2. Outcome aversiveness	.50***	-		87.60	17.99
3. Pre-outcome worry	.67***	.64***	-	88.05	14.97
4. Post-outcome worry	.26*	.27*	.24*	50.82	26.85

*Note.* \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

Correlation coefficients indicated that relief intensity ( $M = 89.92$ ,  $SD = 12.92$ ) was associated with outcome aversiveness ( $M = 87.60$ ,  $SD = 17.99$ ) and levels of both pre- and post-outcome anxiety (Table 2). A regression analysis ( $n = 230$ ) further established that

outcome aversiveness was a significant predictor of the level of anxiety experienced before the outcome was known ( $b = 0.53$ , 95% CI [0.45, 0.62],  $t(228) = 12.45$ ,  $p < .001$ ,  $BF_{01} = 6.74 \times 10^{-25}$ ; model fit:  $R^2 = .40$ , 90% CI [0.32, 0.48],  $F(1, 228) = 155.04$ ,  $p < .001$ ).

Next, a regression analysis was conducted to determine the unique impact of outcome aversiveness and pre-outcome anxiety on reported relief intensity (Table 3), with outcome aversiveness entered into the model in the first step and pre-outcome worry added in the second step. In Step 1, outcome aversiveness accounted for 24% of the variance in relief intensity ( $p < .001$ ) and was a significant positive predictor of the reported strength of the emotion. Step 2 accounted for 45% of the variance and, importantly, significantly increased the predictive power of the model ( $\Delta R^2 = .213$ , 95% CI [.09, .35]). At Step 2, outcome aversiveness was no longer a significant predictor of relief intensity.

Table 3  
*Dependent variable: relief intensity ratings*

Predictor	$b$	$b$ 95% CI	$\beta$	$\beta$ 95% CI	Fit
(Intercept)	59.81**	[47.57, 70.85]			
Outcome aversiveness	0.35**	[0.23, 0.48]	0.49	[0.36, 0.61]	
					R2 = .237** 95% CI [.13, .37]
(Intercept)	38.96**	[25.35, 51.69]			
Outcome aversiveness	0.08	[-0.06, 0.21]	0.11	[-0.08, 0.30]	
Worry	0.51**	[0.32, 0.69]	0.60	[0.39, 0.77]	
					R2 = .449** 95% CI [.31, .61]

*Note.* A significant  $b$ -weight indicates the beta-weight is also significant.  $b$  represents unstandardized regression weights.  $\beta$  indicates the standardized regression weights. \* indicates  $p < .05$ . \*\* indicates  $p < .01$ .

## Discussion

Two key findings emerged from Study 3. The first is that, when asked to provide an example of an episode of relief that had a counterfactual precursor, the vast majority of participants called to mind a situation in which the emotion of relief followed an initial unpleasant experience that was caused by the anticipation of a negative event that subsequently did not transpire. Under these task instructions, only a small number of participants (around 5%) described an episode of relief with what could be confidently termed a ‘purely’ counterfactual precursor. Instead, when explicitly prompted, the vast majority of participants reported an initial period of anxiety or worry that then dissipated or substantially reduced on learning that their fears had not been realized.

This result is important in interpreting the findings of Studies 1 and 2. In those studies, participants were not explicitly asked whether their experience of relief was associated with the reduction of anxiety; rather, they were asked about whether their experience was related to the ending of an unpleasant event, the avoidance of a bad outcome, or both. Although ‘both’ responses were common, at least 40% of the time people judged their experience as solely related to the avoidance of a bad outcome. However, the findings of Study 3 strongly suggest that many of these cases of ‘pure’ counterfactual relief will have been preceded by a period of anxiety or worry. This means that in most instances in Studies 1 and 2 in which people attributed their relief solely to avoiding a bad outcome, they either did not consider the reduction of anxiety to fit the description of ‘the ending of an unpleasant event’, or they did not view it to be related to their experience of relief. Regardless of whichever of these interpretations is correct, the findings of Study 3 indicate that, if we allow the cessation of anxiety to be considered as the ending of an unpleasant event, the vast majority of relief experiences with counterfactual precursors described in Studies 1 and 2 were hybrid.

The second finding of note from Study 3 was that negative affect experienced prior to the outcome being known was predictive of reported relief intensity over and above the level of aversiveness of the undesired outcome. This result suggests that the cessation or reduction

of anxiety does indeed play a causal role in relief experiences, even if participants do not always focus on this role (as the results of Studies 1 and 2 suggest). Moreover, it is consistent with the idea put forward by Ortony et al. (1990) that there are three variables that affect relief intensity: (i) the intensity of the attendant fear emotion, (ii) the effort expended in trying to prevent the negative event, (iii) and the degree to which the negative event is realized. The findings of Study 3 provide clear evidence for the first of the variables identified by Ortony et al. (1990). That outcome aversiveness only had an indirect effect on intensity of relief is also in line with a growing body of research showing that awaiting uncertain news can be more distressing than actually receiving the bad news one fears (e.g., Bolvin & Lancaster, 2010; Poole, 1997; Sweeny & Falkenstein, 2015).

#### **Study 4: Experiences of Post-Exam Relief**

Previously, we speculated that people's memory for unpleasant events tends to grow substantially less negative (i.e., closer to neutral) with the passage of time, and this might explain why experiences of relief with purely temporal precursors may be reported relatively infrequently. However, results from Study 2 indicated that even when participants were specifically asked to report episodes of relief from the previous week, descriptions of relief episodes with purely temporal precursors remained relatively rare compared to those that had a counterfactual precursor (< 20% of the total). Moreover, participants reported finding all recent instances of relief, irrespective of their antecedents, equally easy to retrieve from memory.

In Study 4, we adopted a different approach to examining experiences of relief with a purely temporal precursor. Our first aim was to assess people's attribution of relief to temporal and/or counterfactual precursors in a real-life situation in which, a priori, relief would be expected to have a strong temporal precursor, i.e., where there is a clear delineated cessation of an experience that most people would find unpleasant. If people again relatively rarely report episodes of relief with a purely temporal precursor, this might indicate either

that our self-report measure of relief precursor attribution is not sensitive, or that people rarely attribute relief episodes to purely temporal precursors. We note that our findings so far already indicate that some degree of caution must be applied to self-report attributions: In Studies 1 and 2 participants frequently stated that their experience of relief had a purely counterfactual precursor, whereas, using a more focused approach in Study 3, we found evidence suggesting that relief with purely counterfactual precursors does occur but is spontaneously remembered relatively rarely.

The second aim of Study 4 was to examine whether people's attribution of relief to either temporal or counterfactual precursors (or both) varies as a function of temporal distance from the relief-inducing event. One possible explanation for the finding that < 20% of episodes of relief in Studies 1 and 2 were reported as having purely temporal precursors is that, although people might be likely to attribute relief purely to the cessation of an unpleasant experience immediately after the experience ends, after relatively short time scales they tend to switch their attribution of the original relief experience towards a counterfactual. For example, it could be that immediately after an exam, people may feel relief which they might express along the lines of 'Thank goodness that's over' whereas after time has elapsed and they have reflected on how the exam went, they may also have thoughts along the lines of 'That could have gone worse.' If asked about the precursor of their original relief experience, they may then (retrospectively) at least partially attribute it to a counterfactual precursor.

In Study 4, we approached first- and second-year university undergraduates at the end of the exam period and asked them how they felt as they left the exam hall after having taken their final exam of that year's exam period. Our choice of event was motivated by previous research findings demonstrating that relief was the emotion most frequently reported after taking an exam (Pekrun et al., 2004; e.g., Pekrun et al., 2011; Reeve et al., 2014) which is generally considered to be a source of stress and anxiety for most students. Students were asked to report on their emotions, and explain any relief they felt in terms of



either temporal or counterfactual precursors. Crucially, they either answered these questions in person immediately after they left the exam hall (No-delay condition), or online after a variable delay (Delay condition).

## Method

**Participants.** First- and second-year undergraduates who completed their end-of-year exams between May and July 2019 were invited to take part. One group of participants (consisting only of students taking exams at the university of the first author) – participants in the No-delay condition – was approached in person. A second group of participants — participants in the Delay condition — (consisting of students studying at three different universities to which authors are affiliated) was contacted via email. Of 585 students who participated in the study, 236 (53.81% female;  $M_{\text{age}} = 20.46$  years,  $SD_{\text{age}} = 3.13$ ) were approached outside of exam halls and completed the pen-and-paper version of the survey (No-delay condition); the remaining 349 (52.44% female;  $M_{\text{age}} = 19.99$  years,  $SD_{\text{age}} = 2.62$ ) were contacted via email and filled in an online version of the survey using Qualtrics (Delay condition). Over 90% of participants reported English as their first language. Additional demographic information can be found in the supplement. As a token of appreciation, participants exiting exam halls were offered snacks. Students who completed the online survey had an opportunity to enter a prize draw for a voucher worth 100 UK pounds.

**Materials and procedure.** In the first instance, all participants answered questions about age, gender, and native language, and confirmed the date of their final exam. Next, all students were instructed to think about their final exam and rate the extent to which each of the following emotion words — relieved, regretful, confident, nervous — described how they felt as they left the exam hall. Additional words (i.e., regretful, confident, nervous) were included to ensure that participants did not simply indicate that they felt relief by default. Ratings were given on four separate 100-point scales (one scale per emotion

word) anchored *not at all* to the left and *extremely* to the right. The words were presented in a counterbalanced order in the pen-and-paper survey and in a fully randomized order in the web-based survey. If participants reported that they were feeling relieved as they left the exam hall, they were additionally asked to indicate whether they felt relieved because: their exam was over (categorized as temporal precursor), their exam could have gone worse (categorized as counterfactual precursor), their exam was over and it could have gone worse (categorized as hybrid precursor), or because of something else (categorized as an event unrelated to the final exam and excluded from analysis). Printed surveys were handed out and collected by the experimenters outside of exam halls at the university of the first author. Links to online surveys were distributed via email in the afternoon on the day of the final exam or either 7 or 14 days later.<sup>2</sup> The online survey that was distributed at least 7 days after the exam contained additional questions concerning the frequency of post-exam thought and both upward and downward counterfactual thinking rated using 100-point scales; these data are reported only in the supplement for reasons of space. Both versions of the survey took around 5 minutes to complete. No students who completed the online version of the task had received their exam results in advance of completing the questionnaire and no students were included in both the No-delay and the Delay conditions.

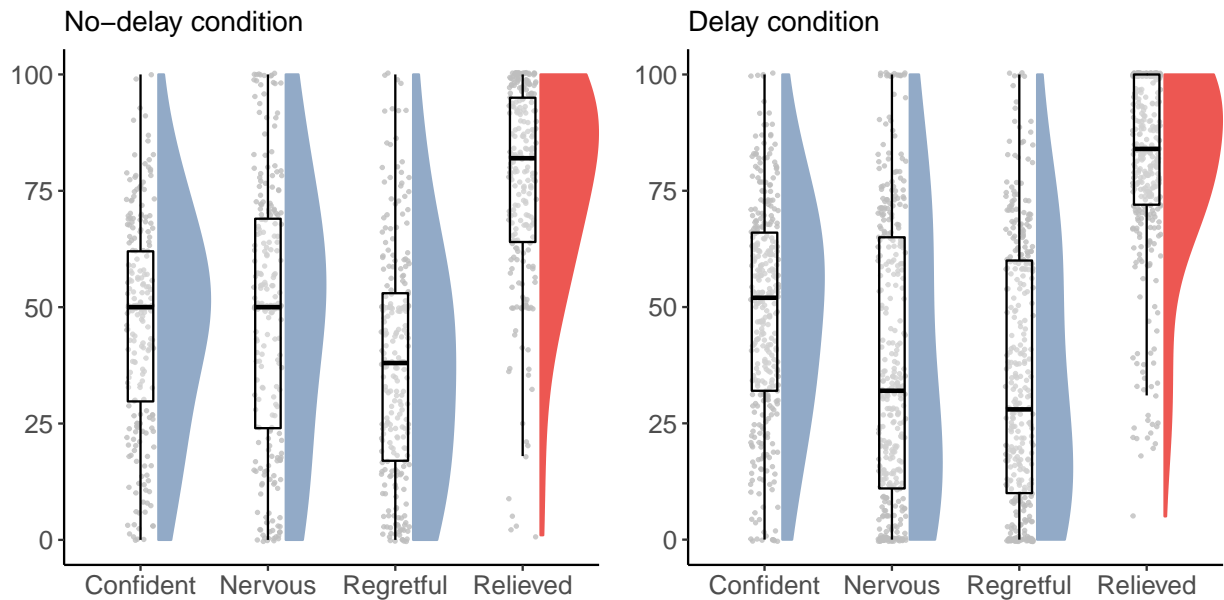
## Results and Discussion

We expected the students who completed the online version of the task (i.e., Delay condition) to complete the survey within 48 hours from receiving the email invitation to take part in the study. However, in practice, the participants completed the survey at varying intervals from receiving the email (see Figure S7 in the supplement) and thus at varying intervals from completing the final exam itself. We originally sought to establish whether the frequency with which students reported experiencing relief preceded by purely temporal precursors varied as a function of time (0-1 days after the event vs 1-2 weeks after the event),

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<sup>2</sup> In practice, the online survey was completed between 0 and 36 days after the exam (see Figure S5 in the supplement for a full distribution).

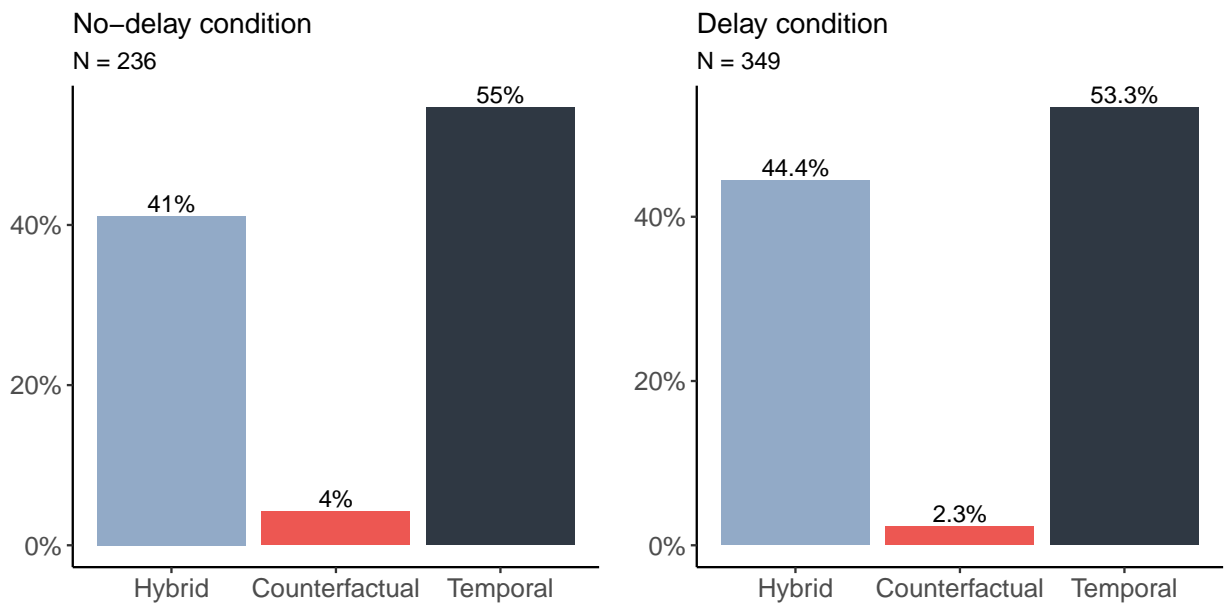
but this proved not to be possible given the variable intervals of participant completion of the online survey. Instead, we focus only on comparing the No-delay and Delay versions of the survey (i.e., probing relief minutes after the event versus after a delay lasting hours and days). This approach is justified because the pattern of findings is identical irrespective of the analysis employed. See the supplementary materials for additional details.



*Figure 7.* Average intensity of confidence, nervousness, regret, and relief experienced following the final exam. Points are individual scores with split-half violin illustrating distribution; black lines indicate median; the lower and upper hinges correspond to the first and third quartiles; whiskers depict maximum and minimum values within 1.5 times the interquartile range.

Figure 7 depicts the intensity ratings for the four named emotions split by condition (No-delay vs Delay). It can be seen from the figure that the emotion with the rating of highest intensity was relief, in both versions of the survey, confirming the intuition that the ending of a final exam is a good scenario in which to measure relief. Figure 8 shows participants' judgments of the antecedents of relief (hybrid, counterfactual, and temporal) split by condition. Comparing the antecedents of relief in the No-delay and Delay conditions, a Chi-square test of goodness of fit indicated that the frequency of reports did not vary

significantly as a function of time,  $p = .343$ . The vast majority of participants reported feeling relieved either because the exam was over (purely temporal precursor), or because the exam was over and it could have been worse (hybrid precursor) and the relative proportions of these responses did not change significantly over time.



*Figure 8.* The percentage of instances of relief reported in Study 4, split by the type of relief precursor.

The findings of this study establish two things. First, people do indeed report relief as having a purely temporal precursor in the sort of scenario in which this might reasonably be expected to occur (e.g., Pekrun et al., 2004, 2011; Reeve et al., 2014), suggesting that in the right circumstances, in our self-report measure, people can and will frequently causally attribute their relief in this way. Second, the pattern of findings was the same regardless of whether or not there was a delay between leaving the exam hall and completing the survey, suggesting that the attributions about the cause of relief remain stable over time, at least over the period of time studied. This result suggests that the low rates of relief experiences reported to have purely temporal precursors observed in Study 2 are not due to people making different retrospective attributions about the source of their relief as time passes (i.e.,

switching from attribution to a purely temporal precursor to a precursor that has a counterfactual component).

### General Discussion

The four large studies reported provide a detailed empirical investigation of everyday episodes of relief. These studies yielded a number of novel findings, which, taken together, provide an important basis for considering the characteristics of experiences of relief. First, there are grounds for distinguishing between temporal and counterfactual precursors to relief. Studies 1 and 2 provided evidence that people are prepared to distinguish between purely counterfactual and purely temporal antecedents to experiences of relief. Although people attributed relief to purely temporal antecedents relatively rarely in those studies, Study 4 provided good evidence that people are willing to use the term relief to describe experiences that have ‘purely’ temporal precursors. However, and importantly, viewed together, the findings of Studies 1-3 suggest that the prototypical relief episode is associated with *both* these precursors, i.e., a combination of the ending of an unpleasant experience, which often involves the cessation of fear or anxiety, plus a counterfactual comparison with a potentially negative outcome that did not in fact happen.

Second, our results reveal distinctive relations between relief and decision making which suggest that relief should not be regarded as simply the positively valenced counterpart of regret. It is true that, as shown in Studies 1 and 2, people report that relief that has a counterfactual precursor is strongly associated with downward counterfactual thought; in this sense relief appropriately contrasts with regret, which has a well-established link with upward counterfactual thought (e.g., Mandel, 2003; Zeelenberg, Van Dijk, Van der Pligt, et al., 1998). However, unlike regret, people do not report that the relief experienced in these circumstances is typically a result of their own decisions. In line with this, when asked to generate counterfactuals about how the situation might have turned out worse (Studies 1 and 2), people typically did not focus on their own actions, whereas in similar

tasks studying regret people will frequently focus on what they could have done differently (e.g., Gilovich & Medvec, 1995; Kahneman, 2014; Landman et al., 1995). Finally, Studies 1 and 2 provided preliminary evidence that experiencing relief has a beneficial effect on people's choices and decisions, although we note that the means by which this occurs are not clear given that relief does not seem to straightforwardly serve to either reinforce or devalue one's own previous choices.

### **To what extent do theoretical accounts of relief map on to the characteristics of everyday episodes of relief?**

In the introduction to this paper, we outlined three accounts of relief, each of which made a related but different distinction between 'types' of relief. Although we did not aim to adjudicate between these accounts, the empirical questions that structured our studies were informed by these accounts, particularly in terms of considering precursors of everyday relief experiences. Given this, we now consider the extent to which these accounts appear to map on to the characteristics of relief episodes described by participants.

In discussing relief that has a temporal precursor, Sweeny and Vohs (2012) focused on what they term 'task completion' relief. Our findings suggest people use the term 'relief' to refer to instances of emotion following the ending of variety of types of unpleasant events, rather than solely the completion of an unpleasant task. It is true that in Studies 1 and 2, relief reported to have a purely temporal precursor was relatively more likely to be attributed to a decision that the experiencer themselves had made than relief that had a counterfactual antecedent. Nevertheless, there were episodes that were attributed either to another person's decision, or no decision maker at all; in these instances episodes did not typically involve the participant completing a task (e.g., relief experienced following recovery from an illness). Moreover, the results of Study 3 suggest that the 'temporal' component of precursors in hybrid cases is not one of task completion, but of cessation of anxiety or fear.

In this latter respect, the features of people's self-reported episodes of relief seem to

map more closely to Deutsch et al.'s (2015) characterization of two types of relief. These authors distinguished between stopping and prevention relief, with prevention relief necessarily having a particular type of temporal component, specifically the cessation of anxiety. Thus, what Deutsch et al. (2015) refer to as prevention relief could potentially be mapped onto the instances of relief in our studies with hybrid precursors, and stopping relief onto those with purely temporal precursors. These authors also leave open the possibility that relief can occur either because of the experiencer's actions or because of circumstances outside of the experiencer's control. That is, they distinguish between *active* and *passive* relief, with active relief resulting from the experiencer acting in such a way to avoid or cease a negative experience and passive relief being independent of the experiencer's actions; note that they view this distinction to be orthogonal to the stopping/prevention distinction. That relief can occur in either active or passive circumstances is at least compatible with the findings of Studies 1 and 2, which indicate that relief can be triggered following the experiencer's own actions, but also frequently occurs for other reasons. As we have pointed out, this is an important sense in which everyday episodes of relief differ from regret, which psychologists have closely associated with personal responsibility (e.g., Habib et al., 2012, 2015; Mellers et al., 1999; Weisberg & Beck, 2012).

Put together, the findings of Studies 1-3 suggest that Deutsch et al.'s (2015) description of prevention relief aligns with what appears to be, based on people's descriptions of everyday relief episodes, the prototypical precursor of relief: a hybrid precursor that involves a period of unpleasant anxiety that ceases or at least diminishes on learning that a feared outcome has been avoided. However, at the center of Deutsch et al.'s (2015) characterization of relief is the idea that it is a positive emotion underpinned by opponent processes that are triggered either because of the cessation of fear or by the cessation of a negative experience. Thus, their account does not predict that there will be instances of relief with purely counterfactual precursors. While our findings suggest that such cases are spontaneously reported very rarely, nevertheless a small proportion of participants in Study 3 were able to

describe such instances. Such instances are deserving of additional study as they have the potential to help discriminate between Deutsch et al.'s (2015) and Hoerl's (2015) accounts. In particular, Hoerl's account, which proposes that temporal and counterfactual relief can be wholly distinct, appears to predict instances of relief with purely counterfactual precursors.

Our findings indicate that the distinction between 'purely' temporal, 'purely' counterfactual, or hybrid precursors of relief is a useful one. Our methodology was not, though, designed to address questions about whether relief should be thought of as a single 'basic' emotion, as having a specific neural signature or specific perceptual features, or whether it is more meaningful to talk about two 'types' of relief. As one of the most central debates in the history of emotion research is over how, or whether, to distinguish between discrete emotions (Ekman, 1992; Izard, 1991; Lazarus, 1991; Roseman et al., 1994; Tangney et al., 1996; see Feldman Barrett & Westlin, 2021, for a recent discussion), we would be very cautious in arguing that there are two distinct types of emotion in play when people report feeling relief in response to different types of antecedents. We note that, in the regret literature, empirical attempts to distinguish between discrete emotions (e.g., regret and guilt) typically involve examining a wide variety of dimensions including associated thoughts, attributions, action tendencies, motivational characteristics, and affective components (e.g., Buchanan et al., 2016; Zeelenberg et al., 2008; Zeelenberg & Breugelmans, 2008). It was beyond the scope of our study to measure all of these dimensions, given that its aim was not to establish whether relief is a discrete emotion. However, we did measure some of these variables for other purposes — namely, to examine whether experiences of relief have features suggesting this emotion is best conceived of as the antonym of regret — most notably the relation with counterfactual thought and whether people report that the experience had an impact on subsequent choices or decisions. We now turn to considering these aspects of the data.



### **Relief, counterfactual thought, and decision making**

Counterfactual thoughts are known to be especially likely to arise following a so-called near miss — i.e., when an alternative outcome has been narrowly avoided (e.g., Markman & Tetlock, 2000; Roesse, 1997; Teigen, 1995). By contrast, Sweeny and Vohs (2012) suggest that counterfactual thoughts tend *not* to be elicited when a negative state is endured rather than avoided, as in the case of relief with a purely temporal precursor. Thus, our intuition before carrying out our studies was that levels of self-reported thought about what might have been would be more strongly associated with relief described as having a counterfactual rather than a purely temporal precursor. This was not what we found: rather, what differed as a function of precursor was whether downward counterfactual thought was more frequent than upward counterfactual thought. More specifically, people reported that episodes of relief involving a counterfactual component were associated with higher proportions of downward comparisons (i.e., contemplating how things might have turned out worse than they did), whilst episodes involving only temporal precursors were associated with comparable rates of downward and upward counterfactual thoughts.

One potential interpretation of this finding is that counterfactual thoughts play different roles with regard to the cognitive underpinnings of relief. Downward counterfactual thoughts may typically play a causal role in cases of relief with counterfactual precursors, i.e., entertaining the counterfactual outcome and evaluatively comparing it with the actual outcome may be a crucial part of the process that yields the emotion itself. Indeed, in the absence of any initial period of fear or anxiety, as is the case with relief with purely counterfactual precursors, it is difficult to see what other process could underpin the experience. In this specific respect, relief with counterfactual precursors may resemble regret, for which entertaining counterfactuals (in the case of regret, upwards counterfactuals) and comparing them to actual outcomes is assumed to underpin the emotion itself (e.g., Beck et al., 2011, 2014; Miller & Taylor, 2014). However, it is possible that counterfactual thoughts associated with cases of relief with purely temporal precursors may not play a causal role in

the processes underpinning the emotion itself, and instead may occur simply as a consequence of experiencing a life event with emotional significance, with both upward and downward counterfactual thoughts occurring equally often. Although it is well established that counterfactual thought might be particularly likely to be triggered in certain scenarios (McEleney & Byrne, 2006; Roese, 1997; Roese & Olson, 1995), it also appears to be ubiquitous in everyday life (Byrne, 2007; Markman et al., 1993; Petrocelli et al., 2011), which may in itself be sufficient to explain the counterfactual thinking reported in the cases in which relief had purely temporal precursors. As mentioned in the Discussion of Study 1, it could also be the case that in the case of relief with purely temporal precursors, participants felt relief that an unpleasant experience was over, but, in addition, a degree of regret that they had made decisions that resulted in the unpleasant experience in the first instance, based on upwards counterfactuals (e.g., ‘I was relieved to have finished root canal surgery, but if only I had looked after my teeth better in the first place I could have avoided it.’).

When thinking about what our results reveal with respect to the relationship between relief and decision making, it is helpful to consider conclusions which have been drawn about relations between regret and decision making. It has been argued that regret plays a distinctive role in decision making because of two key properties: (i) its association with upward counterfactual thought and (ii) the fact that it typically occurs in scenarios in which the person experiencing regret was responsible for the decision that subsequently led to regret (Connolly & Zeelenberg, 2002; Tsiras & Mittal, 2000; Zeelenberg, Van Dijk, Van der Pligt, et al., 1998). Thus, in the context of regret, counterfactual thoughts are assumed to play a role in instructing future behavior and improving performance (e.g., Epstude & Roese, 2008; Miller & Taylor, 2014; Roese, 1997; Zeelenberg & Pieters, 2007) such that the experience of regret helps ensure that one’s own costly mistakes are not repeated. If relief were simply the positively valenced counterpart of regret in terms of its relation with counterfactual thought and decision making, it would be expected to have a similar profile — to be associated with downward counterfactual thought, to typically occur in scenarios in which the person

experiencing relief was responsible for a decision, and to reinforce that previous decision because it yielded a good outcome. However, the descriptions and judgments that people made about their everyday episodes of relief do not map on to such a picture of relief. First, as we have already discussed, instances of relief with purely temporal precursors do not seem to be specifically associated with downward counterfactual thought. Second, and more importantly, even though people's judgments suggest that there are clear associations between relief and downward counterfactual thought in some instances (i.e., in the case of relief with purely counterfactual or hybrid precursors), data from Studies 1 and 2 strongly indicate that relief in such circumstances is typically not associated with events or decisions the person experiencing relief felt responsible for. Consistent with this, in both those studies, when asked to generate statements about how things might have been worse, participants did not typically focus on their own actions. All of these findings suggest that if relief has a link with decision making, such a link cannot be characterized in analogous ways to the link with decision making in the case of regret. Nevertheless, participants did typically report that the episode of relief had an impact on their subsequent choices, and the overwhelming majority of impact statements were positive and indicated that participants believed that they had made constructive behavioral changes as a result of experiencing relief.

An important reason for examining the relation between relief and decision making are suggestions regarding a special functional role of relief with a purely temporal precursor: that anticipating such relief may serve to motivate people to undergo aversive but beneficial experiences (Hoerl, 2015; Sweeny & Vohs, 2012). There was little in our findings to support this suggestion: coding of participants' descriptions of the effects of relief on choice indicated that participants relatively rarely (~10% of the time) reported that experiencing relief made it more likely that they would undergo further unpleasant but beneficial tasks in the future, and when such reports did occur they were not specifically associated with relief with purely temporal precursors. However, we acknowledge that more fully characterizing any functional role for relief with regard to decision making will require studying this emotion more closely

in decision-making contexts whilst considering other emotions that may coincide with the experience of relief. For example, completing a difficult task may, in addition to relief, elicit a feeling of pride, given that the latter emotion has been associated with motivation to persevere with effortful and unpleasant tasks (e.g., Williams & DeSteno, 2008). We also note that although it has been suggested that anticipating relief has a functional (i.e., adaptive) role, it has also been characterized as playing a role in motivating behaviors generally viewed to be negative ones, such as addictive, phobic, and self-destructive behaviors (e.g., Franklin et al., 2010; Lohr et al., 2007; R. C. O'Connor et al., 2009; Shead & Hodgins, 2009). Taken together with the findings of the current study, such considerations suggest that, in contrast with the case of regret where there is an existing coherent characterization of the functional role of regret based on what is known about its typical features, it may not be straightforward to characterize any general functional role of the set of experiences that people refer to as relief experiences.

### **Future research directions**

Our findings raise further questions about the nature of relief that will require careful experimentation to address. Future research should endeavor to examine whether relief with a hybrid precursor tends to be less or more intense than relief with a purely temporal precursor, matching for the negative experience either avoided or stopped. More research also needs to be undertaken before the association between relief and decision making is more clearly understood. In the first instance, studies should establish whether counterfactual relief reinforces a choice or leads to risk aversion, and test Hoerl's (2015) hypothesis that the anticipation of temporal relief functions to increase people's willingness to undergo aversive but ultimately beneficial experiences in the future. Studies might also examine purely counterfactual relief in more detail to establish whether it is commonly experienced, even if not spontaneously recalled by participants in our studies. Finally, our results raise interesting questions about the role played by uncertainty in the experience of relief and future work

might seek to determine, for example, whether and when the resolution of uncertainty, independent of outcome desirability, is sufficient to occasion the experience of temporal relief.

## **Conclusion**

The findings of the large studies reported here provide an initial step towards a better understanding of everyday instances of relief, and as such begin to fill a striking gap in our psychological knowledge about this commonly-experienced emotion. The results indicate that it is useful to maintain a distinction between two types of precursors to relief: counterfactual and temporal. Nevertheless, prototypical instances of relief seem to involve a combination of both precursors where the temporal element involves the ending of (or reduction in) fear or anxiety. Our findings also strongly indicate that relief, even when it has purely counterfactual precursors, is not best conceptualized as the antonym of regret. Despite the differences we have highlighted between features of regret and relief, we hope that the current studies will provide a springboard for more extensive study of relief in a manner similar to that provided by influential studies of everyday regret (Gilovich & Medvec, 1994, 1995).

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