

# When a Day Means More than a Year: Effects of Temporal Framing on Judgments of Health Risk

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We demonstrate the differential effects of framing health hazards as occurring every day versus every year, two reference periods that objectively refer to the present but subjectively seem different. Through three studies, we show that every day framing makes risks appear more proximal and concrete than every year framing, resulting in increased self-risk perceptions, intentions to exercise precautionary behavior, concern and anxiety about the hazard, and effectiveness of risk communication. Across different health domains, we show that, while temporal frames moderate self-positivity biases (study 1), difficulty of preventive behaviors (study 2) and outcome valence (study 3) moderate temporal framing effects.

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Four hundred and forty thousand Americans succumb each year to the deadly effects of tobacco smoke. (Brody 2001)

What will it take to get the 3,000 teenagers who each day start smoking to resist this deadly addiction? (Brody 2001)

**I**ncreasingly, we are exposed to statistics, such as those in the epigraphs, that frame risky behavior or occurrence of a disease in terms of a temporal frame (e.g., every day, every year, every minute). The questions that arise then are the following: Do consumers draw different inferences from these statistics depending on the time frame in which they are presented? For instance, if the article said that 1,206 Americans succumb each day to the deadly effects of to-

bacco smoke (vs. the numeric equivalent of 440,000 each year), would we draw different conclusions about the risks of smoking? In this article, we examine theoretical implications of the notion that risk perceptions are likely to be systematically affected by the temporal frame in which the risk communication is set.

We examine the effects of framing a health hazard statistic using two different temporal frames—every day and every year—that objectively refer to same time period (i.e., the present). We investigate individuals' subjective perceptions of these reference periods through three studies by examining (a) risk perceptions, (b) attitudes about the health hazard, (c) behavioral intention, (d) emotions, and (e) effectiveness of risk communication. We study these issues across three domains: mononucleosis, cell phone radiation, and heart disease.

Our theoretical framework is based on Construal Level Theory, which proposes that people use higher-level construals—characterized as abstract and decontextualized—to represent information about distant future events as compared to information about near future events (Trope and Liberman 2003). We contend that these effects of temporal distance translate to temporal framing such that, when a health hazard statistic is presented in a day frame, the risk is construed as more proximal and concrete than when presented in a year frame, thereby enhancing the effectiveness of a health message focused on negative consequences.

We demonstrate that temporal framing reduces the gap between risk perceptions of self and other people (study 1) and that the nature of preventive behavior specified in the health message moderates the effects of temporal framing

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on behavioral intentions (study 2). We also present evidence for the moderating effect of outcome valence such that the effects of a day (vs. year) framing are reversed when positive outcomes are used in the message (study 3), thereby providing support for the underlying process that we theorize. In these studies, we only vary the temporal frame, and we provide no information on numeric frequency (e.g., 3,000 teenagers in the aforementioned example) by saying that a significant number of people are affected by the health hazard, thereby isolating the effects of temporal framing. We now present a theoretical framework for the proposed effects of temporal framing of risk information.

## CONCEPTUAL FRAMEWORK

### Proposed Relationship between Temporal Distance and Temporal Framing

The literature on temporal distance refers to it as the actual distance between a reference point (typically today) and the point of occurrence of the event under consideration (e.g., tomorrow, next year) and has examined its effects on outcomes such as attitudes, perceptions, confidence, and choices (Ariely and Zakay 2001; Karniol and Ross 1996). In the context of risk communication, information is often presented about current, ongoing health or safety hazards (e.g., lung cancer from smoking). Such risks can, and often are, represented as rates of occurrence of hazards set in different temporal reference periods—that is, risks occurring every day or every year—which by themselves convey no objective information on the temporal distance of the events they describe. In this article, our interest focuses on whether such objectively neutral reference periods trigger disparate subjective temporal perceptions that systematically affect judgments of risk. Construal Level Theory (CLT; Liberman and Trope 1998; Trope and Liberman 2000) suggests that people have very distinct psychological associations with temporal distances. We expect the psychological effects of temporal distance to translate to temporal frames. More specifically, while objectively the risk communication may refer to the same time period (the present), the use of temporal reference frames, such as day or year, is likely to trigger subjective associations with a near or a distant future that results in temporal distance effects. Therefore, while a day frame suggests an event that is closer in time (more proximal), thereby replicating a near future event, a year frame moves the event further off in time (less proximal), replicating a distant future event. The use of temporal reference frames, in effect, serves to manipulate the perceived proximity of the event.

Further, CLT suggests that the level of abstraction is greater with distant future events such that people view the distant future in more abstract terms and the near future in a more concrete manner (Liberman and Trope 1998; Trope and Liberman 2000). Accordingly, “people use more schematic (higher level) construals to represent information about more distant-future events” (Sagristano, Trope, and Liberman 2002, p. 364). Such higher-level construals are considered to be decontextualized

representations extracted from more specific information (see also Trope and Liberman 2003). For example, Liberman and Trope (1998) manipulated temporal distance as tomorrow versus next year, and they examined the level of abstractness with which participants thought about the same behavior in the two time frames. While participants described “moving into a new apartment” as “starting a new life” (a high-level, abstract construal) in the “next year” time frame, they described it as “packing and carrying boxes” (a low-level, concrete construal) in the “tomorrow” time frame. Therefore, CLT delineates concreteness of the construal as varying as a result of the perceived proximity of the event.

In sum, we expect that, when a health risk is presented in a day (vs. a year) frame, people view the risk as being more proximal and therefore more concrete, thereby replicating the results of temporal distance. Our conceptual model is presented in figure 1, and the first two rows represent the manner in which we propose temporal distance translates to temporal framing. We now derive the hypotheses that constitute the rest of this conceptual model.

### Temporal Framing and Self-Risk Estimates (Hypothesis 1)

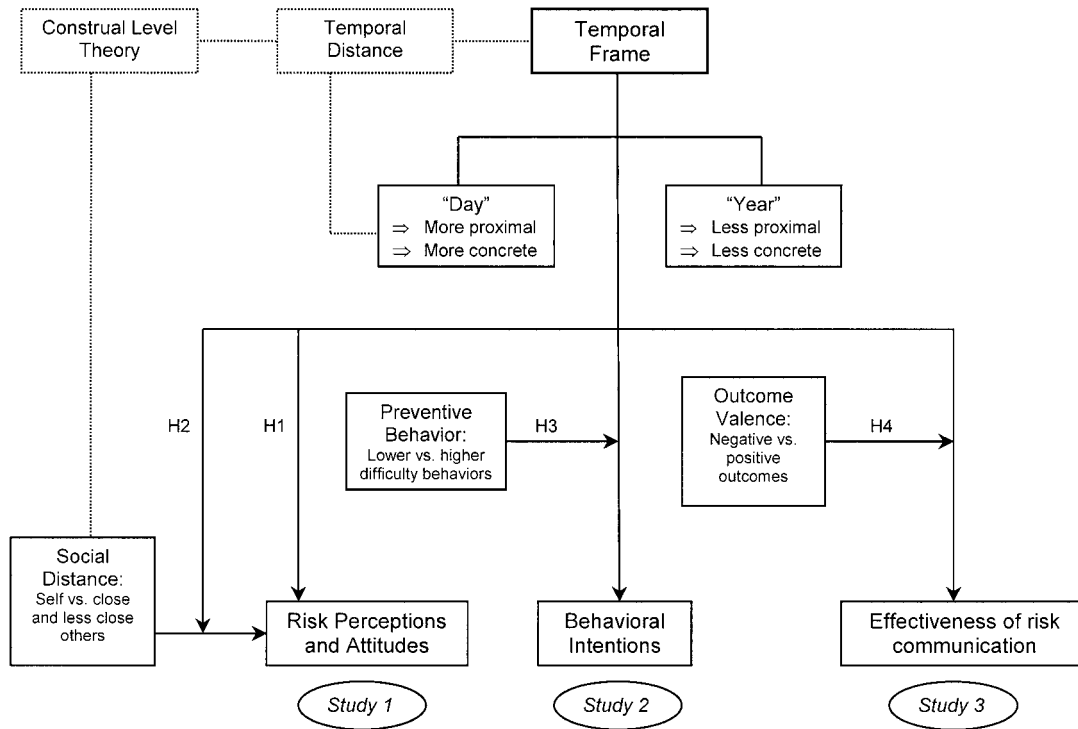
Prior studies demonstrate that the differential framing of health-related outcomes affects message persuasion (Block and Keller 1995; see Rothman and Salovey [1997] for a review), self-risk perceptions, and attitudes toward the health hazard (Menon, Block, and Ramanathan 2002; Raghuram and Menon 1998). The fundamental premise of the current research is that temporal framing of objectively neutral reference periods leads to differential subjective perceptions of psychological distance. Health risks represented in a day frame are perceived to be more proximal and concrete and hence more threatening to an individual than health risks represented in a year frame that are perceived to be more distant and abstract. This is the basic building block of our framework, and we begin by looking at how framing affects self-risk perceptions of health-related communication. Thus, our baseline hypothesis is:

- H1:** Temporal framing will affect self-risk estimates and concern about the health hazard such that these judgments are higher in a day versus a year frame.

### Moderating Role of Temporal Framing on the Self-Positivity Bias (Hypothesis 2)

Temporal distance is only one aspect of psychological distance, and CLT suggests that other dimensions of distance should also create distinct psychological associations. Empirical tests of CLT have thus far focused largely on the temporal dimension of psychological distance. Further, CLT has not explored how different dimensions of psychological distance function interactively. In this research, we introduce

**FIGURE 1**  
CONCEPTUAL MODEL



social distance as another dimension of psychological distance, and we examine its interactive effect with perceptions of temporal distance (i.e., temporal framing). We selected this specific dimension of social distance not only because it enriches our theoretical understanding of different manifestations of psychological distance but also because it has important implications for risk communication. A robust finding that has been replicated in various contexts is that people selectively recruit information that favors the self (Menon and Johar 1997), presumably to maintain self-esteem (Taylor and Brown 1988). Thus, self-perceptions are, in general, self-enhancing, even in the face of reality. Perceived social distance (between oneself and another person) leads to positivity effects such that one perceives oneself as less prone to negative events such as becoming ill (Perloff and Fetzer 1986), having an accident (Robertson 1977), and contracting AIDS (Raghbir and Menon 1998) or hepatitis C (Menon et al. 2002) as compared to others. This social distance manifests in the self-positivity bias that occurs irrespective of age, occupational status, gender, or level of education (Weinstein 1987). In a similar vein, studies on the third-person effect in communication have not only demonstrated that individuals exposed to a negative persuasive message perceive that it has a greater effect on others than on themselves (Davison 1983; Perloff 1999) but also that this effect can be reversed when individuals are exposed to a positive message (Duck and Mullin 1995). Therefore, effective risk communication is

predicated on overcoming the self-positivity bias so that people do not self-select out of the target group. At a theoretical level, we expect that social distance (between self and other) increases psychological distance from the threat, thereby inhibiting self-risk perceptions. On the other hand, temporally framing risks in a day (vs. a year) frame works in the opposite direction to reduce psychological distance, thereby enhancing self-risk perceptions. We therefore expect temporal framing to moderate the self-positivity bias (see hypothesis 2 depicted in fig. 1).

**H2:** Temporal framing will moderate the self-positivity bias such that it is less in the day frame than in the year frame.

**Moderating Role of Level of Difficulty of Preventive Behavior (Hypothesis 3)**

Understanding how risk assessment is affected by various specifications of risk factors (e.g., Block and Williams 2002) is crucial since individuals' perceived risk has been established as a necessary precursor to behavioral change (Witte 1998). Therefore, having established how we expect psychological distance to affect the magnitude of risk assessment, we now focus on message elements that can induce adoption of preventive behaviors that help avoid risks of health hazards.

We posit that anticipated consequences of the hazard influence the weight people place on the difficulty of implementing preventive behavior and this varies as a function of temporal framing. When viewing risk communication, the anticipated consequence is the magnitude of the perceived risk of contracting the disease, while the preventive behavior relates to ways of mitigating or averting such negative consequences. If, as per hypothesis 1, the day (vs. the year) frame makes events more proximal and concrete, the negative value of the risk in terms of its magnitude should also increase relative to the year frame. Therefore, the weight attached to the difficulty of preventive behavior should be relatively lower in the day frame when the risk dominates, while it assumes greater weight in the year frame when the risk is perceived as relatively lower in magnitude. In other words, using a day frame to describe the negative consequences of a health hazard should make the threat serious enough that people are willing to undertake any preventive measure to avoid the risk, thereby promoting behavioral intentions irrespective of the difficulty of preventive behaviors specified. On the other hand, if the year frame makes the risk less proximal and concrete, exposure to lower (vs. higher) difficulty behaviors should elicit higher intentions, due to the lower difficulty of implementation. Thus:

- H3:** The difficulty of preventive behaviors specified in the message will moderate the effects of temporal framing on behavioral intentions such that
- a) in the day frame, behavioral intentions will not vary as a function of the difficulty of preventive behaviors; but
  - b) in the year frame, behavioral intentions will be higher when preventive behaviors are of lower difficulty rather than of higher difficulty.

What about effects of preventive behaviors specified on self-risk perceptions? Since the preventive behaviors have to do with actions in the future rather than risk based on past behaviors, we predict that the specification of these behaviors will not affect perceptions of self-risk. Thus, while preventive behaviors should interact with temporal framing to affect future behavioral intentions (as in hypothesis 3), they should have no effect on people's perceptions of the past upon which self-risk estimates are based.

#### Moderating Role of Outcome Valence (Hypothesis 4)

Thus far we have focused on negatively valenced risk communication where we draw attention to obtaining an undesirable outcome. From a theoretical standpoint, what would happen if we were to instead focus on positively valenced risk communication by drawing attention to the avoidance of the undesirable outcome? Several studies in the literature have framed the outcome of health-related behaviors as gains from compliance of recommended behaviors (positive frame) or losses from noncompliance with recommendations (negative

frame). They suggest that negative frames are more persuasive than positive frames when issue involvement is high (Maheswaran and Meyers-Levy 1990), for behaviors with low response efficacy (Block and Keller 1995), for risk-seeking behaviors (Meyerowitz and Chaiken 1987), and for illness-detecting rather than illness-preventing behaviors (Rothman and Salovey 1997). However, positive versus negative frames have also been shown to influence attitudes toward consumer products in general (see Shiv, Edell, and Payne [1997] for a review) and products with health consequences in particular. For example, Levin and Gaeth (1988) showed that consumers were more favorable toward beef labeled "75% lean" than that labeled "25% fat."

In our context, the framing of the outcome valence as positive or negative should have opposite effects. If the outcome valence is negative (succumbing to the threat), then the day frame brings the threat of the disease closer than the year frame. However, if the outcome valence is positive (averting the threat), then the day frame should bring the lack of threat closer and the year frame should make the lack of threat more distant, thereby reversing our basic temporal framing prediction. Note that a positive outcome continues to address a loss domain that deals with undesirable outcomes in the context of risk perceptions. The framing of the communication is negative in so far as the focus is on succumbing to a negative event and is positive in so far as the focus is on averting a negative event. Hence, the outcome valence is positive and negative only in relative terms. We expect the reversal of temporal framing effects, to reflect not only in risk perceptions, attitudes toward the disease, and behavioral intentions but also more generally in effectiveness of risk communication. In addition, the literature documents that people may experience increased feelings of anxiety when exposed to a health message (Helweg-Larsen and Shepperd 2001) and that anxiety is a precursor to message processing (Butler and Mathews 1987; Dewberry and Richardson 1990). Therefore, we expect that health messages should evoke anxiety in a similar manner in which they affect risk perceptions, such that temporal framing effects are moderated by outcome valence. In sum:

- H4:** The framing of outcome valence will moderate the effects of temporal framing such that
- a) When the outcome is framed negatively (i.e., succumbing to a disease), the day versus the year frame leads to
    - i) increased risk perceptions,
    - ii) more concerned attitudes,
    - iii) higher intentions to engage in precautionary behaviors,
    - iv) greater levels of anxiety, and
    - v) increased effectiveness of risk communication.
  - b) When the outcome is framed positively (i.e., averting a disease), these effects of day versus the year frame ( $i - v$ ) are reversed.

In the following sections, we present the results of three studies that programmatically test these hypotheses. Study 1 tests hypotheses 1 and 2, study 2 tests hypothesis 3, and study 3 tests hypothesis 4.

### STUDY 1: THE EFFECTS OF TEMPORAL FRAMING ON RISK PERCEPTIONS

#### Method

*Design.* We used a 2 (temporal frame: day vs. year) × 3 (target person: self vs. best friend vs. average undergraduate) mixed design, with the first factor manipulated between subjects and the second manipulated within subjects. We chose the three target persons to tease out the self-positivity effect from a true reflection of lower risk by eliciting risk estimates of people who belong to the same risk category as oneself. If such people are judged to be at greater risk than oneself, then this cannot be accounted for in terms of the alternative explanation, that is, that lower self-risk judgments reflect the truth. Since the best friend is perceived to be more similar to oneself than the average undergraduate (see Menon, Raghurir, and Schwarz 1995), the former should also be perceived to be socially closer than the latter, and this should be reflected in perceptions of risk.

*Procedure.* Forty-six undergraduates participated in this study for partial course credit. The stimulus was in the form of an article related to mononucleosis (mono) that presented a brief introduction to the Epstein-Barr virus that causes mono through kissing. In order to manipulate temporal frame, a set of risks associated with mono were listed as occurring either every day or every year (see app. A for the manipulation). Next, we collected our dependent measures and manipulation check information, which are discussed in the results section. Finally, we collected background information about gender and age; since these variables had no effect on our measures, we do not discuss them any further. Debriefing in all three studies reported in this article was done at the end of each experimental period.

#### Results

*Manipulation Check for Similarity of the Target Other Person to Self.* Participants rated how similar to themselves they perceived their best friend and the average undergraduate to be, using a seven-point semantic-differential scale. A 2 (temporal frame: day vs. year) × 2 (target person: best friend vs. average undergraduate) repeated-measures ANOVA on these ratings revealed a significant main effect of target person ( $F(1, 43) = 29.50, p < .01, \eta^2 = .41$ ), such that best friend was perceived to be more similar to oneself ( $M = 4.31$ ) than average undergraduate ( $M = 2.84$ ).

*Effects of Temporal Framing on Self-Risk Perceptions and Concern.* Participants reported self-risk estimates of contracting mono on a 101-point probability scale (0–100) for oneself and level of concern about contracting mono on

a seven-point semantic-differential scale. In order to test hypothesis 1, we ran a one-way two-level MANOVA on these two measures, with temporal frame as the independent variable. This analysis revealed a significant main effect of the temporal frame (multivariate  $F(2, 43) = 4.71, p < .05, \eta^2 = .18$ ) such that the perceptions of self-risk and concern were higher in the day frame ( $M_{\text{self-risk}} = 22.00; M_{\text{concern}} = 2.92$ ) than the year frame ( $M_{\text{self-risk}} = 4.86; M_{\text{concern}} = 1.77$ ). These results support hypothesis 1.

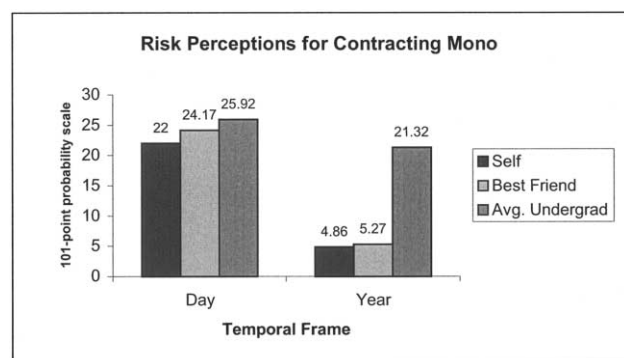
*Effects of Temporal Frames on the Self-Positivity Bias.* We also elicited perceptions of risk for one’s best friend and the average undergraduate at the school that the participant attended on the 101-point scale. We predicted a significant interaction between temporal frame and target person such that the difference in risk estimates between self and other was reduced in the day frame as compared with the year frame. A 2 (temporal frame: day vs. year) × 3 (target person: self vs. best friend vs. average undergraduate) repeated-measures ANOVA on the 101-point risk probability scale indicated a significant main effect of temporal frame ( $F(1, 44) = 6.36, p < .05, \eta^2 = .13$ ) and a significant main effect of target person ( $F(2, 88) = 5.99, p < .01, \eta^2 = .17$ ), qualified by the predicted significant interaction ( $F(2, 88) = 2.96, p < .05, \eta^2 = .07$ ). An examination of the means indicated that, while the day frame made people believe that they are as much at risk as others ( $M_{\text{self}} = 22.00, M_{\text{friend}} = 24.17, M_{\text{undergrad}} = 25.92$ ), the year frame created the perception that the self and the best friend were less at risk than the average undergraduate ( $M_{\text{self}} = 4.86, M_{\text{friend}} = 5.27, M_{\text{undergrad}} = 21.32$ ; see fig. 2), supporting hypothesis 2. The main effect of temporal frame attests to the day frame increasing the risk estimates for all three targets as compared with the year frame, and the main effect of target person tells us that the self-positivity bias exists in both temporal frames.

#### Discussion

The results of this study indicate that the effects of temporal framing extend to self-risk estimates as well as feelings

FIGURE 2

STUDY 1—TEMPORAL FRAMING MODERATES THE SELF-POSITIVITY BIAS



of concern about the health hazard. Further, we found evidence that temporal framing reduced perceived social distance, mitigating the self-positivity bias, and also affected risk perceptions of self, best friend, and the average undergraduate. It supports the notion that the day frame exerts a powerful influence on risk perceptions and attitudes toward risky behavior. Note that, in previous research, self-positivity was moderated using information pertaining to oneself (e.g., Menon et al. 2002; Raghurir and Menon 1998). In this research, we used information pertaining to the population, rather than self, as a moderator of the self-positivity bias.

Finally, temporal framing results in one form of psychological distance—temporal distance. In study 1, we show that perceived social distance could hinder risk communication efforts to raise risk perceptions. Temporal framing, which evokes differential perceptions of temporal distance, can help reduce this hindrance. While in this study we test the interaction of two dimensions of psychological distance (temporal and social), other dimensions like geographical and spatial distance may also operate similarly, and we discuss this further in the general discussion.

## STUDY 2: THE MODERATION EFFECT OF DIFFICULTY OF PREVENTIVE BEHAVIORS

### Method

**Design.** We used a 2 (temporal frame: day vs. year)  $\times$  2 (difficulty of preventive behaviors specified: higher vs. lower) between-subjects design.

**Procedure.** Sixty-four undergraduates participated in this study for partial course credit. Participants were randomly assigned to one of the four experimental conditions. We used cell phone radiation as our domain. Participants began by reading an article about cell phone radiation (see app. A for our manipulation). In order to manipulate preventive behaviors, we used either four lower-difficulty (easier-to-implement) or four higher-difficulty (difficult-to-implement) behaviors in the persuasive message. The lower-difficulty behaviors included using a hands-free device, not carrying the phone on the belt, directing the antenna away from the head, and using a radiation protection case. Higher-difficulty behaviors included not using the cell phone in areas where the signal was weak, keeping conversations short, using phones as little as possible in a car, and comparing specific absorption rates when looking to upgrade or buy a new cell phone. We then collected dependent measures, manipulation checks, and background information about cell phone ownership, usage, familiarity, gender, and age. The background variables did not affect our measures and are therefore not discussed any further.

### Results

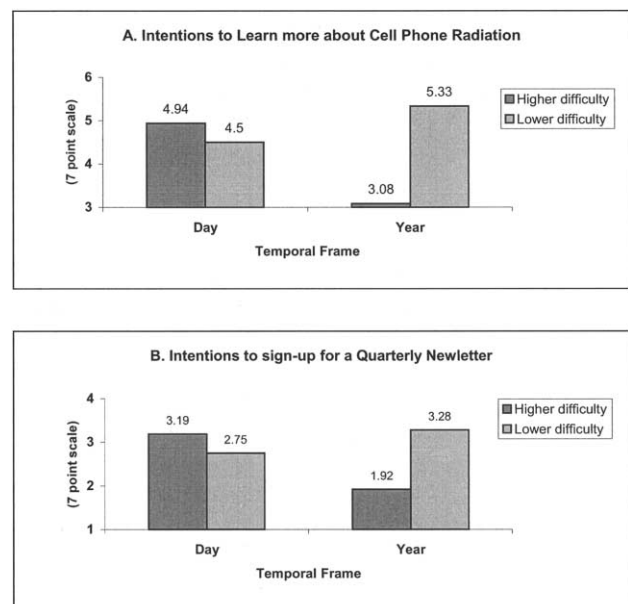
**Manipulation Check for Type of Preventive Behaviors.** Participants rated each of the eight behaviors

(four lower-difficulty and four higher-difficulty) on ease-of-implementation on seven-point semantic differential scales anchored at very easy and very difficult. We computed a Difficulty Index for each set of lower- and higher-difficulty behaviors (Cronbach's  $\alpha_{\text{lower}} = .77$ ,  $\alpha_{\text{higher}} = .74$ ). We conducted a 2 (temporal frame, between-subjects)  $\times$  2 (type of behavior specified, between-subjects)  $\times$  2 (lower- and higher-difficulty indices, within-subjects) repeated-measures ANOVA. The main effect of the within-subjects factor was significant ( $F(1, 59) = 20.18$ ,  $p < .01$ ,  $\eta^2 = .25$ ), with the lower-difficulty index ( $M = 2.70$ ) being rated easier than the higher-difficulty index ( $M = 3.29$ ). No other effect was significant. Our manipulation of the difficulty of behavior was, therefore, successful.

**Intentions to Behave in a Precautionary Manner in the Future.** We asked participants about their intentions to learn more about the problem and to sign up for a quarterly newsletter about it on seven-point semantic-differential scales, with a higher number reflecting higher intentions. We conducted a 2  $\times$  2 MANOVA on these measures, which indicated the predicted significant interaction (multivariate  $F(2, 59) = 5.23$ ,  $p < .01$ ,  $\eta^2 = .15$ ), such that, in the year frame, lower-difficulty behaviors generated higher intentions than higher-difficulty behaviors (multivariate contrast  $F(2, 59) = 7.11$ ,  $p < .01$ ), but in the day frame the nature of behaviors specified made no difference (multivariate contrast  $F < 1$ ; see fig. 3 for cell means for each individual intention measure). These data support hypothesis 3.

FIGURE 3

STUDY 2—NATURE OF PREVENTIVE BEHAVIOR MODERATES THE EFFECTS OF TEMPORAL FRAMES ON BEHAVIORAL INTENTIONS



*Self-Risk Perceptions.* Participants reported risk estimates of radiation on a 101-point probability scale for self, best friend, and average undergraduate, as in study 1. A 2 (temporal frame)  $\times$  2 (behavior) ANOVA on the self-risk measure revealed a significant main effect of the temporal frame ( $F(1, 60) = 43.44, p < .01, \eta^2 = .42$ ); no other effect was significant. As expected, perceptions of self-risk were higher when a day frame was used ( $M = 67.88$ ) than when a year frame was used ( $M = 25.56$ ). Thus, while the temporal frame has an effect on self-risk perceptions (providing further support for hypothesis 1), the framing of futuristic preventive behaviors had no effect on these perceptions.

Further, a 2 (temporal frame)  $\times$  2 (behavior)  $\times$  3 (target person) repeated-measures MANOVA on risk judgments indicated only a main effect of temporal frame ( $F(1, 60) = 37.32, p < .01, \eta^2 = .09$ ), qualified by a significant interaction between target person and temporal frame ( $F(1, 60) = 5.61, p < .05, \eta^2 = .39$ ), replicating the moderation of the self-positivity bias (hypothesis 2) demonstrated in study 1. Thus, in the day frame, there were no differences in the risk estimates across the target persons ( $M_{\text{self}} = 67.88, M_{\text{friend}} = 70.47, M_{\text{undergrad}} = 71.91$ ), while the self-positivity bias manifested in the year frame ( $M_{\text{self}} = 25.56, M_{\text{friend}} = 38.25, M_{\text{undergrad}} = 45.22$ ).

## Discussion

In this study, we expanded our testing of the basic premise to include the effects of the specification of two sets of preventive behaviors that differed on level of perceived difficulty in compliance on behavioral intention. Our results indicate that the day frame makes the risk seem so proximal and concrete that it overrides resistance associated with implementing higher difficulty behaviors. From the perspective of effective communication, these findings imply that if a day frame is used, the type of preventive behaviors specified does not matter. On the other hand, if a year frame is used, it is important to specify behaviors that are easy to implement.

## STUDY 3: THE MODERATING EFFECT OF OUTCOME VALENCE

In studies 1 and 2, we used negatively valenced communication that draws attention to succumbing to undesirable outcomes. We now test hypothesis 4, in which we examine the effects of positively valenced communication, at the same time extending our battery of dependent measures to include effectiveness of the risk communication and anxiety evoked by the message.

## Method

*Design.* Conceptually, temporal distance refers to two different time periods (e.g., tomorrow vs. a year from now). One of our objectives in the current study is to demonstrate that, even though “temporal frames” objectively refers to the same time period (i.e., to the present), such frames evoke

psychological distance and have similar implications for our battery of dependent measures as does temporal distance. Therefore, in this study, we manipulated temporal framing, as in the previous studies (i.e., every day vs. every year), as well as temporal distance (tomorrow vs. a year from now; see app. B for the manipulation). Thus, we used a 2 (reference period: day vs. year)  $\times$  2 (temporal dimension: frame vs. distance)  $\times$  2 (outcome valence: negative vs. positive) between-subjects design.

*Procedure.* One hundred and fifty-three undergraduates participated in this study for partial course credit. Participants were randomly assigned to one of the eight experimental conditions. We used heart disease as our domain. Participants began by reading the article about heart disease in the United States, followed by the manipulations of the three independent variables (see app. B). Next, dependent measures and manipulation checks were elicited. Finally, background information about heart disease among close family members, gender, and age was collected; these variables did not affect our results and are not discussed any further.

## Results

*Manipulation Checks.* We had two sets of checks to assess the efficacy of the reference period (day vs. year) and the outcome valence (positive vs. negative outcomes) manipulations.

i) *Reference Period.* Construal Level Theory posits that proximal time frames (e.g., tomorrow vs. a year from now) evoke more concrete construals. Therefore, we elicited ratings on proximity and concreteness to demonstrate that temporal framing (every day vs. every year) mimics temporal distance (tomorrow vs. a year from now). For efficacy of our manipulations, a 2 (reference period)  $\times$  2 (temporal dimension)  $\times$  2 (outcome valence) ANOVA on these measures should yield a main effect of reference period (i.e., day is perceived as nearer in time and more concrete than year).

a) *Perceptions of Proximity.* Using seven-point semantic-differential scales, we measured perceptions of occurrence of the hazard in the persuasive message as: (1) now versus later, (2) today versus sometime over the year, and (3) the near future versus the distant future. Since the three items were highly correlated (Cronbach's  $\alpha = .89$ ), we computed a Proximity Index and subjected it to a 2  $\times$  2  $\times$  2 ANOVA. The main effect of reference period was significant as predicted ( $F(1, 141) = 7.83, p < .01, \eta^2 = .05$ ), with the day frame evoking a greater degree of proximity ( $M = 4.22$ ) than the year frame ( $M = 5.03$ ). No other effect was significant.

b) *Concreteness.* Research on the effects of concreteness on memory suggests that visualizing and vividness are associated with easier and more fluent processing of concrete (vs. abstract) features of stimuli (Amrhein, McDaniel, and

Waddil 2002; Paivio, Walsh, and Bons 1994). Therefore, we operationalized concreteness as vividness with which the content of the health message could be visualized. Accordingly, we created a Concreteness Index combining responses to two seven-point semantic-differential scales anchored at strongly disagree and strongly agree ( $r = .64$ ): (1) ability to generate a mental picture of the information contained in the persuasive message and (2) thoughts on the article were hazy and indistinct (reverse coded); higher numbers indicate higher concreteness scores. A  $2 \times 2 \times 2$  ANOVA on this index indicated the hypothesized main effect of reference period ( $F(1, 145) = 42.96, p < .05, \eta^2 = .23$ ), with the score for concreteness being higher in the day frame ( $M = 4.52$ ) than in the year frame ( $M = 3.18$ ). In addition, we obtained a reference period  $\times$  temporal dimension interaction ( $F(1, 145) = 5.15, p < .05, \eta^2 = .03$ ) such that the difference in concreteness between day and year was higher when we manipulated temporal frame ( $M = 4.72$  vs.  $M = 2.92$ ; contrast  $F(1, 149) = 40.00, p < .01$ ) versus temporal distance ( $M = 4.32$  vs.  $M = 3.44$ ; contrast  $F(1, 149) = 9.24, p < .01$ ), though it was significant in each case. No other effect was significant.

ii) *Outcome Valence*. We assessed the efficacy of our outcome valence manipulation by eliciting whether the information in the message was negative or positive, scary or not, and whether the situation portrayed was hopeful or hopeless, combined to form an Outcome Valence Index (Cronbach's  $\alpha = .68$ ), with a higher number indicating more positive information. A  $2 \times 2 \times 2$  ANOVA on this index revealed the desired main effect of outcome valence ( $F(1, 139) = 17.87, p < .01, \eta^2 = .11$ ), with the information being perceived more negative in the negative outcome valence condition ( $M = 3.54$ ) than in the positive outcome valence condition ( $M = 4.40$ ). In addition, the main effect of temporal dimension was significant ( $F(1, 139) = 5.02, p < .05, \eta^2 = .04$ ), with the ratings more negative in the temporal frame ( $M = 3.72$ ) than the temporal distance condition ( $M = 4.21$ ). We speculate that this may be because temporal frame manipulations refer objectively to the present, while the temporal distance manipulations refer to the future; the former may make the situation more immediate than the latter. No other effect was significant.

*Dependent Measures to Test Hypothesis 4*. We had five sets of dependent measures pertaining to perceived self-risk, attitudes toward the disease, behavioral intentions, anxiety evoked, and effectiveness of risk communication. In a  $2 \times 2 \times 2$  (M)ANOVA on each of these measures, hypothesis 4 would be supported if we obtained a significant reference period  $\times$  outcome valence interaction such that the threat of the disease is greater for day versus year in the negative outcome valence condition and for year versus day in the positive outcome valence condition. Planned contrasts are reported as one-tailed tests. Cell means are presented in the table.

i) *Self-Risk Perceptions*. Participants reported their

perceptions of self-risk for heart disease during their lifetime on two scales: a seven-point likelihood scale anchored at not at all likely and very likely and the 101-point probability scale (as in studies 1 and 2). We conducted a  $2 \times 2 \times 2$  MANOVA on the two measures that revealed the predicted significant interaction of reference period and outcome valence (multivariate  $F(2, 143) = 11.68, p < .01, \eta^2 = .14$ ). An examination of simple effects reveals that, in the negative outcome valence condition, the risk perceptions are higher in the day frame versus the year frame (multivariate contrast  $F(2, 147) = 6.47, p < .01$ ), while in the positive outcome valence condition, the risk perceptions were higher in the year frame than the day frame (multivariate contrast  $F(2, 147) = 5.58, p < .01$ ), supporting hypothesis 4i. The main effect of outcome valence was also significant (multivariate  $F(2, 143) = 4.81, p < .01, \eta^2 = .06$ ), suggesting that risk perceptions, in general, were higher in the negative versus the positive valence condition (see table 1 for means). No other effect was significant.

ii) *Attitudes toward the Health Hazard*. We measured attitudes toward the health hazard in two ways: (a) as it pertained to participants personally, by measuring how concerned and worried they were they would contract heart disease, using seven-point semantic differential scales, which we combined to form Attitude Index I (Cronbach's  $\alpha = .88$ ); (b) as it pertained to society, by eliciting ratings on three seven-point agree-disagree scales about whether there was a risk of heart disease in the short run, whether it was a longer-term problem, and whether the harmful effects of heart disease would take their time to catch up with an individual, which we combined to form Attitude Index II (Cronbach's  $\alpha = .74$ ). A higher mean indicates a more serious problem.

A  $2 \times 2 \times 2$  MANOVA across these two indices indicated that the interaction between reference period and outcome valence was significant (multivariate  $F(2, 144) = 7.69, p < .01, \eta^2 = .10$ ) with the people perceiving the problem as more serious in the day frame than the year frame (multivariate contrast  $F(2, 148) = 5.98, p < .01$ ) in the negative outcome valence condition. In the positive valence condition, this result directionally reversed and approached significance (multivariate contrast  $F(2, 148) = 2.22, p = .06$ ; see table 1 for cell means). In addition, the main effect of valence was significant (multivariate  $F(2, 144) = 8.96, p < .01, \eta^2 = .11$ ), such that people were more concerned or saw the issue as more dire in the negative outcome valence frame than the positive, thus supporting hypothesis 4ii. No other effect was significant.

iii) *Attitudes toward the Health Hazard*. We collected measures of participants' intentions to see a doctor, to learn more about heart disease, to be careful of what they eat, to plan food ahead of time, to work out, to lead a more active lifestyle, to participate in a public event about heart disease, to sign up for a quarterly newsletter, and to join an online group about the threats of heart disease, all on seven-point semantic-differential scales. We combined these nine measures to form an Intention Index (Cronbach's  $\alpha = .81$ ), and



**TABLE 1**  
STUDY 3 RESULTS

Dependent measures		Negative outcome (succumbing to disease)		Positive outcome (averting disease)		Interaction between day/year and outcome valence ( $F(1, 145), p < .01$ )
		Day	Year	Day	Year	
Perceptions of self-risk (hypothesis 4i):						
Self-Risk Likelihood (7-point scale)	Frame	4.84	3.75*	3.11	4.47*	23.28
	Distance	5.16	4.11*	3.15	4.22*	
Self-Risk Probability (101-point scale)	Frame	55.53	41.58*	33.63	41.58	9.82
	Distance	47.95	36.74*	37.00	45.00	
Attitudes (hypothesis 4ii):						
Attitude Index I (two 7-point scales; $\alpha = .88$ )	Frame	5.16	4.05*	3.56	4.05	7.45
	Distance	5.18	4.45*	3.17	3.72	
Attitude Index II (three 7-point scales; $\alpha = .74$ )	Frame	5.28	4.33*	4.44	5.19*	8.05
	Distance	5.19	4.56*	5.23	5.50	
Behavioral intentions (hypothesis 4iii):						
Intention Index (nine 7-point scales; $\alpha = .81$ )	Frame	4.48	3.69*	3.37	3.84*	10.00
	Distance	4.19	3.74*	3.34	3.79*	
Emotions (hypothesis 4iv):						
Anxiety Index (five 7-point scales; $\alpha = .91$ )	Frame	4.18	3.57*	3.07	3.85*	9.90
	Distance	3.75	2.83*	3.23	3.63*	
Effectiveness of risk communication (hypothesis 4v):						
Attitude toward the Message (five 7-point scales; $a = .75$ )	Frame	4.86	4.06*	3.88	4.55*	17.12
	Distance	4.68	4.00*	3.96	4.52*	
Persuasion Index (five 7-point scales; $a = .80$ )	Frame	4.08	3.37*	3.29	3.78*	15.24
	Distance	4.29	3.10*	3.12	3.53	
Hazard Index (five 7-point scales; $a = .94$ )	Frame	6.21	4.59*	5.62	5.97	14.96
	Distance	5.72	5.02*	5.13	5.52	

NOTE.—Contrast between day and year within outcome valence is significant at the indicated  $p$ -value.

\* $p < .10$ .

\*\* $p < .05$ .

we conducted a  $2 \times 2 \times 2$  ANOVA on this index. We obtained the predicted significant interaction of reference period and outcome valence ( $F(1, 145) = 10.00, p < .01, \eta^2 = .06$ ), with behavioral intentions higher in the day frame ( $M = 4.33$ ) versus the year frame ( $M = 3.72$ ; contrast  $F(1, 149) = 6.37, p < .01$ ) in the negative outcome valence condition, and lower in the day frame ( $M = 3.35$ ) than the year frame ( $M = 3.81$ ; contrast  $F(1, 149) = 3.73, p < .05$ ) in the positive outcome valence condition, supporting hypothesis 4iii. As with risk perceptions, the main effect of outcome valence was significant ( $F(1, 145) = 6.70, p < .01, \eta^2 = .04$ ), indicating that behavioral intentions, in general, were higher in the negative ( $M = 4.02$ ) versus the positive outcome valence condition ( $M = 3.58$ ). No other effect was significant.

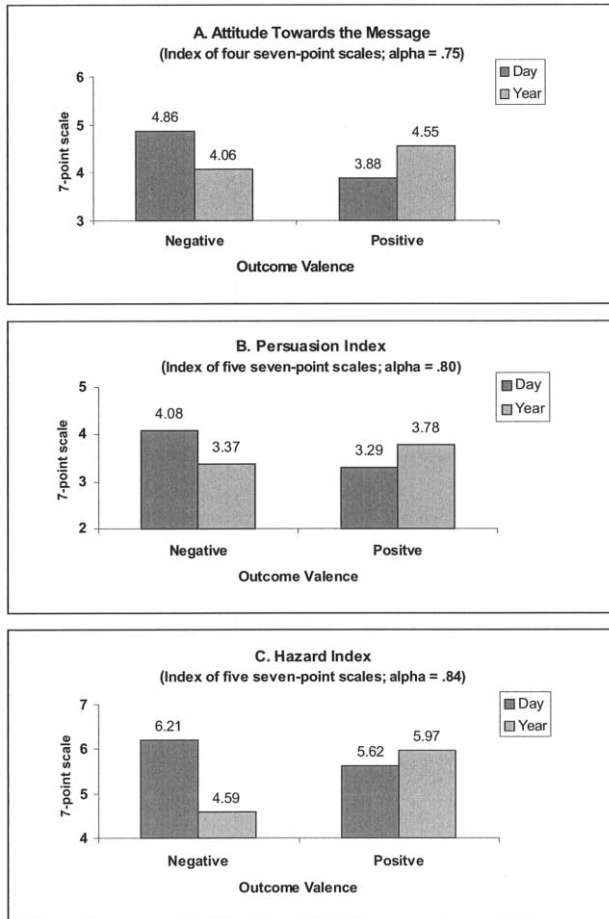
iv) *Emotions*. We also collected measures of whether participants felt anxious, worried, tense, fearful, and uptight on seven-point semantic differential scales, anchored at not at all and very strongly, which we combined to form an Anxiety Index (Cronbach's  $\alpha = .87$ ). A  $2 \times 2 \times 2$  ANOVA on this index revealed the predicted significant interaction between temporal frame and outcome valence ( $F(1, 145) = 9.90, p < .01, \eta^2 = .07$ ), with the index higher in the day frame ( $M = 3.96$ ) versus the year frame ( $M = 3.21$ ; contrast  $F(1, 149) = 6.27, p < .01$ ) in the negative

outcome valence condition and lower in the day frame ( $M = 3.15$ ) than the year frame ( $M = 3.74$ ; contrast  $F(1, 149) = 3.73, p < .05$ ) in the positive outcome valence condition. These results support hypothesis 4iv.

v) *Effectiveness of Risk Communication*. We used three separate sets of measures to evaluate message effectiveness: (a) Attitudes toward the message: we elicited ratings on seven seven-point semantic-differential scales regarding whether participants found the article informative, credible, interesting, useful, exciting, scary, and well written. We combined these to form a measure of Attitudes toward the Message (Cronbach's  $\alpha = .75$ ). (b) Persuasiveness of the message: we elicited five seven-point semantic-differential scales on how much they had learned from the message, how much the message would affect their future behavior, how persuasive it was, how relevant it was, and how applicable it was to them. We combined these variables into a Persuasion Index (Cronbach's  $\alpha = .80$ ). (c) Effectiveness of the message in communicating the magnitude of the hazard: we elicited ratings on five seven-point scales regarding whether heart disease was frightening, severe, dangerous, serious, and a major problem. We combined these to form a Hazard Index (Cronbach's  $\alpha = .94$ ). For all three indices a higher number indicates greater effectiveness of the risk communication effort. Figure 4 presents

FIGURE 4

STUDY 3—OUTCOME VALENCE MODERATES THE EFFECTS OF TEMPORAL FRAMING ON EFFECTIVENESS OF RISK COMMUNICATION



the means in the temporal framing condition graphically, while table 1 presents the cell means for the entire experimental design.

We subjected these three indices to a  $2 \times 2 \times 2$  MANOVA and obtained the predicted significant interaction between reference period and outcome valence (multivariate  $F(3, 143) = 8.80, p < .01, \eta^2 = .16$ ), with the indices higher in the day frame versus the year frame (multivariate contrast  $F(3, 147) = 8.50, p < .01$ ) in the negative outcome valence condition. In the positive outcome valence this effect was reversed (multivariate contrast  $F(3, 147) = 1.77, p < .05$ ; see table 1 for cell means). No other effect was significant. These results support hypothesis 4v.

## Discussion

The results of this study confirm that objectively neutral reference periods of day and year evoke different perceptions of proximity and concreteness and that temporal fram-

ing (every day vs. every year) and temporal distance (tomorrow vs. next year) manipulations act in a similar manner. We examined this effect in the context of individuals' risk perceptions, attitudes, intentions, emotions, and message effectiveness. A couple of results merit discussion.

First, of particular interest is the manner in which the effect of temporal framing is moderated by outcome valence. Taken together, the full battery of our results provides support for the notion that, in the negative outcome valence condition, the day frame (vs. the year frame) makes the health hazard seem more proximal and concrete and thereby more dire; however, in the positive outcome valence condition, the results reverse. Further, this pattern of results is also supported by research on the impact of temporal distances on preference and choice across domains like behavioral decision making (Read, Loewenstein, and Kalyanaraman 1999), delay of gratification (Mischel 1974), and self-control (Wertenbroch 1998) that suggests that individuals have a positive time preference, with immediate outcomes being valued more than discounted value of distal goals (Loewenstein 1988). The results of study 3 support our basic effect that events perceived as proximal (whether positive or negative in valence) evoke a greater sense of immediacy in risk judgments and behavioral intentions.

Second, while we obtained significant interactions between reference period and outcome valence consistently across all measures, as predicted by hypothesis 4, these interactions were driven within each temporal dimension more by the negative rather than the positive outcome valence condition (see contrasts in table 1). In addition, the evidence for greater persuasiveness of the negative outcome frame is borne out by the main effect of outcome valence on most dependent measures. Our results are consistent with literature on temporal distance that suggests that individuals tend to regard the distant future in a more positive light than the near future and that negative aspects of outcomes are discounted more steeply than positive aspects (Lewin 1951; Mitchell et al. 1997). More generally, the negativity effect, or the greater weighing of negative compared to equally extreme positive information in the formation of overall evaluations, is a robust and widely researched phenomenon in consumer psychology and marketing (e.g., Ahluwalia 2002; Maheswaran and Meyers-Levy 1990). These streams of research support our results that temporal framing effects are stronger when outcome valence is negative rather than positive.

## GENERAL DISCUSSION

The results of the three studies reported in this article attest to the robustness of temporal framing effects. In study 1, we demonstrated that temporal framing is another tool by which the adverse effects of the self-positivity bias can be combated. In study 2, we extended this investigation to demonstrate that the nature of preventive behavior presented interacts with the temporal frame to affect intentions to behave in a precautionary manner in the future. We showed that the day frame can override resistance to comply with

more difficult preventive behaviors by making the health hazard seem more threatening. In study 3, we demonstrated that the effects of temporal framing mimic those of temporal distance such that participants perceived a risk presented in a day (vs. a year) frame as closer in time and more concrete. Thus, objectively holding the time frame constant (i.e., the present), the temporal frame of every day evokes a different psychological process from that of every year. Further, we manipulated outcome valence to show a reversal in the effects observed in studies 1 and 2 when a positive outcome is used. Thus, when the outcome is framed negatively (i.e., succumbing to heart disease), the day frame is more persuasive than the year frame. However, when the outcome is framed positively (i.e., averting heart disease), the day frame makes the health hazard less of a threat than the year frame.

This research represents a starting point in developing a framework for understanding information processing implications for persuasive communication where psychological distance is a primary driver. In developing and testing this framework, several questions arise that seek further investigation: What is the nature of the relationship between the various moderating influences examined here? What is their relative strength in moderating temporal framing? Are there other potential moderators? These issues need to be addressed to further this exploration.

From a theoretical standpoint, our research demonstrates that temporal framing of events set in the present mimic processes by which temporal distance effects manifest (as per CLT; Liberman and Trope 1998; Trope and Liberman 2000). When people see health-related information in a day (vs. a year) format, their construals evoke concreteness and proximity, resulting in larger risk estimations for themselves and for others. The results reported here demonstrate these effects robustly across various domains and measures. From a practical standpoint, the results have implications for effective risk communication. They provide evidence in support of temporal frames that heighten the proximity of the health hazard (e.g., day frame), and they caution against temporal frames that make the health hazard seem more distant (e.g., year frame), thereby rendering the message less effective. If temporal frames such as a year are to be used, it is recommended that they be used in conjunction with preventive behaviors that are easy to engage in. However, this temporal framing effect is bounded by outcome valence, and caution needs to be exercised if positive outcomes are used.

Temporal framing is relatively underresearched in marketing and psychology. We have investigated this phenomenon in the context of health risk judgments and message persuasion, but it is by no means limited to the health communication domain. We can apply this framework more generally to understand how temporal framing can be used as a tool to enhance marketing communication that attempts to influence type, magnitude, and valence of time-dependent outcomes in consumers' acquisition of information, purchase, or consumption of products. For instance, when peo-

ple acquire information on a holiday cruise or consider subscribing to a stock offering, would counting down days to the event evoke proximity and concreteness to a greater extent than representing the event in weeks or months? If an individual were looking to buy a house, would representing that purchase as occurring "in a few minutes" be different from representing the purchase as occurring more generically as "now"? From a theoretical standpoint, would the nature of construal have different information processing implications as a result of this? Our research suggests that this may indeed be the case, and this is an interesting avenue for future research.

In study 3, we focused on positively and negatively valenced outcomes within an overall loss domain, that is, health-related events that represent loss of life/health or safety. An interesting question that arises is whether these results would vary if we examined temporal framing in a gain domain. For example, consider people winning (vs. missing winning) prizes in the New York State Lotto every day (vs. year). Our framework would predict that the process that evokes differing construals based on psychological distance (day being more proximal and concrete and year being more distant and abstract) will be unchanged. Further, we would predict that the mechanism will be weaker in the negative frame (nongain of missing the lottery prize) than the positive frame (gain of winning the lottery prize), analogous to the results in this article in a loss domain. This is another area for future research to enrich the scope of this framework.

Research on temporal distance suggests that people have distinct psychological associations for the near and distant future, which potentially drives their judgments and actions in different directions. While it appears likely that people are able to make quick and effortless categorizations of reference time periods as long or short and near or distant, what remains unclear is how these temporal boundaries are constructed. For instance, what constitutes near future—a second, a minute, a day, a week? And what constitutes distant future—6 mo., a year, a decade? Trope and Liberman (forthcoming) suggest that such temporal boundaries may evolve as a result of repeated association between temporal distance and people's knowledge of future events. This seems to suggest an iterative learning process whereby association between the reference period and actions in the future gets linked and results in different kinds of construal. Further, it not clear how people make comparisons between events represented in different reference periods, given that the reference unit of a day is relatively narrow and that of a year is relatively broad. For instance, is 365 days from now represented in day units computed differently from a year from now that is computed in year units? The mental calculus for equalizing these different units is far from obvious. All of these issues on the evolution of temporal construction are underresearched and are exciting topics for future investigation. Another important issue in this regard is how people deal with discrete versus continuous measures of time. Our temporal framing manipulation relied on a

continuous measure (every day or every year), and in study 3 our temporal distance manipulation (tomorrow or next year) was a discrete measure. While we found similar results for both, the temporal framing manipulation was the stronger one. It would be interesting to explore under what conditions each of these kinds of measures is effective.

Typically, persuasive messages cite statistics in the form of rates, which have both a numeric component and a temporal component (\$1 per day or \$365 per year; Gourville 1998). In our studies, we focus on how people form self-risk estimates based only on information conveyed by the temporal frame. We presented participants with information about a significant number of people succumbing to the health hazard. In querying participants about what "significant number" meant to them, we found that they inferred that a higher proportion of people is at risk in the day frame as compared to the year frame (we do not report these results due to space constraints). This supports our basic temporal framing hypothesis that the day frame is more powerful than the year frame, given that across conditions no input to the risk inferencing process differs other than the temporal frame. It also provides evidence that the temporal frame is used to make sense of the ambiguous information conveyed by a significant number. In two other studies not reported here, we explicitly manipulate numeric information (holding it outcome equivalent across day and year frames, as in the *New York Times* excerpts of our epigraph), and we replicate our basic temporal framing effect. Given that people often have access to two sources of information (numerator with numeric frequency information and denominator with temporal frame information), the question is, which one is more diagnostic? Theoretically, we expect that, when there is no information about the number or when in fact the numbers provided are ambiguous in nature, participants use the temporal frame to impute the number (as in our studies) and vice versa. The factors that moderate the diagnosticity of numeric information versus the temporal frame for various judgment tasks are potentially rich and interesting areas for future research.

Research documents that cultural and religious beliefs

about time are likely to influence temporal effects on individuals. For example, Western cultures have been shown to place greater weight on punctuality and time scheduling and, in general, are more oriented to the short term (Brislin and Kim 2003). To the extent that temporal framing influences goal selection, cultures that differ in their orientation toward time may also differ in behavior (Carstensen, Isaacowitz, and Charles 1999). For instance, cultures that encourage a temporal focus on the present may place relatively more value on pleasantness and enjoyment of life than cultures dominated by a future orientation. Given that our research was conducted entirely in the United States, a question that arises is, how will such cross-cultural differences in time perception moderate our results? How would individuals' culturally determined subjective values of time interact with the message-induced psychological distance to affect risk perceptions? This is an interesting avenue for future research.

Finally, is temporal construal a more general phenomenon that can be represented by an overarching theory of how psychological distances arise? Trope and Liberman (1993) suggest that the general principles that apply to temporal distance should be applicable for other kinds of distance—social distance (e.g., self and other, in-group and out-group), geographical and spatial distance, certain and uncertain events, and active and inactive selves. Social perception research has shown that people often represent other's behavior in dispositional, abstract terms and one's own behavior in situational, concrete terms (for a review, see Robins, Spranca, and Mendelsohn [1996]). In study 1, we found that temporal framing moderated perceived social distance (self, best friend, and average undergraduate). The question is whether other forms of distance, such as geographical distance, can produce similar results. For instance, if we use a local area reference group, such as one from Nassau County instead of American smokers that die of lung cancer, will similar effects manifest? Developing such an integrative theory of psychological distance would be yet another important area for future research.

**APPENDIX A**

**MANIPULATIONS FOR STUDIES 1 AND 2**

**Study 1: Risk of Mononucleosis**

When does it strike, who does it affect, and how does it act?

- Every <day/year>, a significant number of people of people fall prey to Mono.
- Every <day/year>, a significant number of these happen to be high school and college students.
- Every <day/year>, a significant number of these happen to contract the virus by person-to-person contact, via saliva (on hands or toys, or by kissing) or by blood transfusion (in very rare cases).
- Every <day/year>, a significant number happen to suffer symptoms like fever, sore throat, swollen glands, and fatigue. Sometimes, the liver and spleen are affected. This could last from one to several weeks, and the disease is very rarely fatal.

**Study 2: Risk of Cell Phone Radiation**

So what are the suspected dangers?

- Every <day/year>, a significant number of people, increasingly teenagers and those in their twenties, use cell phones.
- Every <day/year>, a significant number of those routinely place radio frequency (RF) transmitters for long periods of time against their heads and absorb harmful radiation.
- Every <day/year>, a significant number of cell phone users allow radios wave emissions to heat up tissues in the head.
- Every <day/year>, a significant number of cell phone users are creating “hot spots” in the skull and transferring energy to the head via inductance.
- Every <day/year>, users of mobile phones who expose their heads to such ‘heating’ risk contraction of brain cancer.

**APPENDIX B**

**STUDY 3: RISK OF HEART DISEASE**

**FIGURE B1**

CONSTRUCT OPERATIONALIZATIONS

Reference Period	Temporal Dimension Construct Operationalization		Outcome Valence Construct Operationalization	
	Day	Frame	“every day”	Negative
Positive				“avert”
Distance		“tomorrow”	Negative	“succumb to”
			Positive	“avert”
Year	Frame	“every year”	Negative	“succumb to”
			Positive	“avert”
	Distance	“a year from now”	Negative	“succumb to”
			Positive	“avert”

**Study 3: Study Manipulations**

- <Every day (tomorrow)/every year (a year from now)>, a significant number of people <succumb to/avert> heart disease.
- <Every day (tomorrow)/every year (a year from now)>, a significant number of people <suffer the consequences of eating unhealthy foods/enjoy the consequences of

eating healthy foods>.

- <Every day (tomorrow)/every year (a year from now)>, a significant number of people <suffer the consequences of eating food on the run and spending no time or care preparing their own food/enjoy the consequences of planning what they eat and spending time or care preparing their own food>.
- <Every day (tomorrow)/every year (a year from now)>,

a significant number of people <suffer the consequences of choosing not to exercise and stay fit/enjoy the consequences of choosing to exercise and stay fit>.

- <Every day (tomorrow)/every year (a year from now)>, a significant number of people <suffer the consequences of choosing to spend more time watching TV and at the computer, leading to an inactive lifestyle/enjoy the consequences of choosing to spend less time watching TV and at the computer, leading to a more active lifestyle>.

All these are factors <increase/reduce> the threat of heart disease.

[Dawn Iacobucci served as editor and Barbara Kahn served as associate editor for this article.]

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