Temporal Framing and Persuasion to Adopt Preventive Health Behavior: Moderating Effects of Individual Differences in Consideration of Future Consequences on Sunscreen Use

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Objective: Previous work on temporal framing of health communications has focused upon detection behaviors that possess an inherent immediate risk of negative consequences. The present studies evaluate the role of temporal frame for a preventive behavior, using sunscreen. Design: Two experimental field studies manipulated the temporal frame in which positive and negative consequences of using sunscreen were presented. Main Outcome Measures: Cognitive responses, intention, and behavior (experiment 2). Results: Consistent with hypotheses, Experiment 1 showed that individual differences in consideration of future consequences (CFC; A. Strathman, F. Gleicher, D. S. Boninger, & C. S. Edwards, 1994) moderated (a) the processing of long- versus short-term consequences and (b) the persuasive impact of the different temporal frames on behavioral intentions. In Experiment 2, the balance of positive versus negative thoughts generated by reading the persuasive communications was shown to mediate the effects of the Temporal Frame × CFC interaction on a behavioral measure. Conclusion: Findings extend previous work by demonstrating the importance of individual differences in CFC to the processing of health communication about a preventive health behavior and to a behavioral outcome.

Keywords: consideration of future consequences, persuasion, health communication, cognitive responses, sunscreen

Different approaches to the issue of designing persuasive messages to promote preventive health behavior include personally tailoring message content (e.g., Kreuter, Bull, Clark, & Oswald, 1999) and framing in terms of losses versus gains (e.g., Meyerowitz & Chaiken, 1987; Schneider et al., 2001). Studies have also examined a range of moderators of the persuasion process, including argument quality (Smith & Petty, 1996); characteristics of the behavior under consideration, such as whether it involves detection or prevention of ill health (Rothman, Salovey, Antone, Keough, & Martin, 1993); regulatory focus (Lee & Aaker, 2004), degree of personal involvement with the health issue (e.g., Rothman & Salovey, 1997); and certainty regarding behavioral outcomes (Apanovitch, McCarthy, & Salovey, 2003). The present study addresses a further aspect of health communications, namely, the temporal frame in which the costs and benefits of a health-related behavior might occur and the relationship of individual differences in consideration of future consequences (CFC; Strathman et al., 1994) to the persuasive impact of different temporal frames.

Consideration of Future Consequences

Individual differences in the extent to which a person considers the short- or long-term outcomes of his or her current actions do not merely represent a future orientation but a cognitive mindset that will determine the extent to which an individual is influenced by potential immediate and distant outcomes in deciding how to act. When confronted with a current behavioral decision, with one set of immediate outcomes and one set of longer term outcomes, the resolution of this dilemma is proposed to be a relatively stable individual characteristic that can be assessed by the Consideration of Future Consequences Scale (CFC Scale; Strathman et al., 1994; see also Petrocelli, 2003). Individuals who are low on CFC are expected to focus more on immediate needs and concerns and to act accordingly, whereas individuals high on CFC are expected to focus more on the future implications of their behavior and use these longer term outcomes as guides to their behavioral decision making. People with higher CFC have been shown to be more likely to engage in proenvironmental political and consumer behavior (Joireman, Lasane, Bennett, Richards, & Solaimani, 2001a; Joireman et al., 2001b; Lindsay & Strathman, 1997; Strathman et al., 1994, Study 1). In other behavioral domains, CFC is inversely associated with impulsive sensation seeking (Joireman, Anderson, & Strathman, 2003) and is positively correlated with academic achievement and goal attainment in college students (Joireman, 1999).

A number of lines of research suggest that the concept of CFC might have implications for health-related behaviors. Behaviors performed to protect health typically involve delayed benefits and immediate costs. If an individual disregards future outcomes, it might be predicted that the likelihood of performing a health-related behavior will depend upon the individual’s evaluation of the inconvenience, loss of pleasure, or psychological costs that are incurred in the short term (Chapman, 2005). Strathman et al. (1994, Study 2) showed that high CFC was inversely associated with cigarette use. Rothspan and Read (1996) reported that scores
on a related construct, the future subscale of the Zimbardo Time Perspective Inventory (ZTPI; Zimbardo & Boyd, 1999; see also Zimbardo, 1990, for the Stanford Time Perspective Inventory) are related to delaying first intercourse (Rothspan & Read, 1996). Using specifically designed measures, Alberts and Dunton (2007) showed that people with osteoarthritis who had higher present temporal orientation were more likely to use reactive, rather than proactive, coping strategies to manage their condition.

Consideration of Future Consequences and Temporal Framing of Behavioral Outcomes

High CFC is not proposed simply to reflect a preference for long-term goals but also to guide the processing of information with regard to a current behavior. A conservative test of the hypothesized consequences of CFC might be afforded if individuals are confronted with information about both positive and negative outcomes of a current behavior but the temporal frame in which those outcomes are proposed to occur is manipulated. This is because, although the valence of behavioral outcomes is anticipated to drive the direction of their persuasive influence, the salience of those outcomes to people high or low in CFC will be determined by the time frame in which those outcomes are presented as occurring. Strathman et al. (1994, Study 1) obtained evidence in line with these theoretical predictions in relation to attitude toward an environmental policy. A more precise test might involve a decision regarding personal behavior with rather more direct personal consequences. Two studies (Orbell & Hagger, 2006; Orbell, Perugini, & Rakow, 2004) have examined the implications of CFC for information processing and persuasion in relation to screening behaviors. Consistent with hypotheses, low-CFC people were more persuaded (generated more positive relative to negative thoughts) by a message in which positive outcomes occurred in the short term, whereas high-CFC people were more persuaded by a message in which positive outcomes occurred in the longer term. Orbell and Hagger (2006) further demonstrated that the balance of positive and negative thoughts generated after reading a temporally framed communication about Type 2 diabetes screening partially but significantly mediated the effects of CFC and temporal frame on attitudes, perceived behavioral control, and intention to accept an invitation to screening, derived from the theory of planned behavior (Ajzen, 1985).

Screening behaviors may be considered to be a special class of health behavior, in that people are faced with the dilemma that the potential to prevent long-term serious disease or premature mortality is obtainable only by taking the risk of immediately discovering that one already has a disease or predisease condition. As a consequence, the balance of shorter versus longer term outcomes may be particularly salient for behavioral decisions regarding screening participation (Orbell & Hagger, 2006). Screening behaviors are classified by Rothman and Salovey (1997)’s typology as detective behaviors and contrasted with purely preventive behaviors, such as using sunscreen or taking exercise, in which the focus is solely on preventing the onset of a disease or predisease condition. Because previous investigations of temporal framing have focused on detective behaviors carrying a risk of immediate negative consequences, it seems important to evaluate the impact of temporal framing of a health communication for preventive behavior. This was the primary goal of the present experiments.

Although preventive behaviors do not have associated short-term risks of disease detection, they may nonetheless be considered to possess associated positive and negative outcomes. Indeed, the balance of costs and benefits is fundamental to theoretical accounts of health-related behavior (Orbell, 2007). The cigarette smoker deciding to quit smoking may be deterred by the potential risk of short-term weight gain, or the adult considering taking up jogging may be deterred by the anticipation of feelings of embarrassment. Thus, a range of negative physical, social, and self-evaluative outcomes may be weighted against the positive health benefits of engaging in a preventive behavior.

We examined the effect of individual differences in CFC and temporal framing in the context of sunscreen use. Great Britain saw a threefold increase in incidence of skin cancer between 1971 and 1996 (Office for National Statistics, 2004). In the United States, there are an estimated 59,940 new cases of melanoma reported for 2007, making skin cancer the sixth most commonly occurring cancer (American Cancer Society, 2007). Use of a sunscreen with a sun protection factor (SPF) of 15 or higher offers protection against the harmful effects of sun exposure (Koh & Lew, 1994). For example, Thompson, Jolley, and Marks (1993) found that individuals who used sunscreen with an SPF of 17 every day over the course of one summer showed fewer new skin lesions and more remissions in existing lesions, compared with individuals assigned to a control group. Nonuse of sunscreen is associated with persistent positive attitudes toward having a tanned skin (e.g., Castle, Skinner, & Hampson, 1999; Jones & Leary, 1994; Mermelstein & Riesenberg, 1992), suggesting that the consideration of the costs to self-image by using sunscreen may often outweigh the long-term preventive health benefits.

Overview of the Present Experiments

Although previous studies have examined the effects of CFC and temporal framing in the context of screening behaviors where short-term risky outcomes may be highly salient because there is a risk of detecting current disease, no previous study has examined the persuasive impact of temporal framing in the context of a preventive behavior where these risks are absent. Because sunscreen use has the purpose of preventing longer term risks of sun exposure, it is hypothesized that people higher in CFC are more likely than those low in CFC to endorse arguments in favor of the long-term benefits of sunscreen use and hold more positive intentions to use sunscreen.

The main study hypothesis concerned the interaction of CFC and temporal frame. In the first experiment, we sought to demonstrate that CFC and temporal frame would have consequences for information processing in the context of sunscreen use. High- and low-CFC participants were presented with a message that described both positive and negative consequences of using sunscreen but manipulated the time frame in which those outcomes were said to occur. It was hypothesized that low-CFC participants would generate more positive relative to negative thoughts when the positive consequences were framed as short term and the negative consequences were framed as long term, whereas high-CFC participants would be more favorable in their comments when positive consequences were framed as long term and negative consequences were framed as short term.

The second respect in which we extend previous research is with regard to the outcomes investigated. Previous studies of temporal framing have been restricted to effects on behavioral intentions...
(Orbell et al., 2004; Orbell & Hagger, 2006) because the studies involved behaviors that were not yet widely available to participants. In Experiment 2, we tested the hypothesized interaction of Temporal Frame × CFC in relation to a behavioral outcome. Our final study hypothesis concerns the mediation of the effects of the CFC × Temporal Frame interaction on intentions and behavior. We hypothesized that the balance of positive and negative thoughts generated would mediate effects of the interaction on attitudes and intentions (Experiment 1) in line with previous findings (Orbell & Hagger, 2006) and behavior (Experiment 2).

Experiment 1

Method

Participants and Procedure

Participants were recruited in 2005 around a university campus in the east of England on (nonrainy) days during July and August. Potential participants in outdoor areas (e.g., sitting at tables outside one of the campus cafes or restaurants, sitting on a bench or the grass in an outdoor area) were asked to take part in a study concerning their views about using sunscreen. Eighty-three percent of those approached were willing to participate. As an initial screening question to ensure that the topic was of relevance, potential participants were asked if they liked to have a suntan. Fifty-nine people (32% of those willing to participate) answered “no” to this question and were not asked to participate further. Participants consented to the study by their completion of the anonymous questionnaire. No reimbursement was offered for participation. Ethical approval was obtained from the University Research Ethics Committee. The final sample of 121 comprised 68 women (56.2%) and 53 men (43.8%), whose ages ranged from 14 to 61 years \((M = 28.40, SD = 8.52)\). The majority of the sample was White northern European (74.4%) or White southern European (14.9%). The sample comprised students (73%) and academic, administrative, or support staff.

Materials

An A5-sized folded paper booklet was handed to participants to complete and collected later at an agreed-upon time. Participants were randomly allocated to experimental condition by prepackageing the booklets. A 2 (temporal frame) × 2 (CFC) design was used to test study hypotheses. Temporal frame was manipulated, with CFC as a measured variable. 

Manipulations. The first part of the booklet contained one of two short passages about skin cancer and sunscreen use. Both versions began by describing the prevalence of skin cancer. Each of the passages contained three possible positive consequences of using sunscreen and three possible negative consequences of using sunscreen derived from a pilot study. Because previous research suggests that self-image considerations are an important factor inhibiting sunscreen use, we included positive consequences related to physical appearance as well as health (e.g., Jones & Leary, 1994). Although the same consequences were presented in each passage, the temporal frame in which the consequences were presented was manipulated. In one temporal frame, the positive consequences were presented as long term and the negative consequences were presented as short term. In the second temporal frame (shown in parentheses in the following extract), the positive consequences were presented as short term and the negative consequences were presented as long term. The order in which the positive and negative consequences were presented within each temporal frame was also manipulated to control for order effects.¹

Skin cancer is one of the most common forms of cancer, affecting more than 40,000 men and women in the world every year. Protecting oneself from exposure to sunlight by using a protective sunscreen of SPF15 and above can substantially reduce your risk of getting skin cancer. Some people find that wearing sunscreen every time they are likely to be exposed to sunlight will prevent the long-term risks of sunburn and give them peace of mind about skin cancer for years into the future. They also find that using sunscreen will keep their skin from developing wrinkles in future so that they stay young and do not age prematurely. (Some people find that wearing sunscreen every time they are likely to be exposed to sunlight immediately prevents sunburn and gives them immediate peace of mind so that they do not worry about skin cancer. They also find that using sunscreen starts to protect the skin from developing wrinkles so that they look young and not older than they are.) Some people find that the decision to use sunscreen means they have to spend time and effort applying it right now. They also find it expensive to buy right away. Some people also dislike the fact that as soon as they apply sunscreen, their skin feels slightly sticky. (Some people find that the decision to use sunscreen means they have to spend time and effort applying it for years into the future. They also find that the cost adds up to a lot over the years to come. Some people also do not like having to put up with sticky skin every time they apply sunscreen, for years into the future.)

Thought listings. Immediately after reading the temporal frame manipulation, participants completed a thought listing task to assess their cognitive responses (Cacioppo, Harkins, & Petty, 1981; Das de Wit & Stroebe, 2003; Kreuter et al., 1999). A boxed outline for thought listings was provided below the instruction, “Please write down the thoughts that came to mind as you read the passage above.” Thought listings made by participants were independently coded as positive, negative, or neutral/irrelevant thoughts by two raters who were unaware of condition and CFC score. Positive thoughts were defined as any thought representing a positive evaluative orientation toward using sunscreen; negative thoughts represented a negative evaluative orientation. Interrater reliability was satisfactory \((\kappa = .85, p < .01, \text{for positive thoughts}; \quad \kappa = .77, p < .01, \text{for negative thoughts})\).

Theory of planned behavior measures. After completing the thought listings, participants responded to a series of items to assess constructs specified by the theory of planned behavior (Ajzen, 1985). Direct evaluative measures were utilized (Ajzen & Fishbein, 1980). Six-point Likert-type scales were used to assess attitude, subjective norm, perceived behavioral control, and intention. Attitude was assessed by the item, “For me to use sunscreen every time I am likely to be exposed to sunlight in the next month would be . . . .” followed by eight bipolar scales (worthwhile–worthless, necessary–unnecessary, good–bad, important–unimportant, pleasant–unpleasant, beneficial–harmful, desirable–undesirable, wise–foolish), \(a = 0.94\). Subjective norm was measured with three items: “Most people who are important to me would think I should apply sunscreen every time I am going to be exposed to sunlight over the next month (strongly agree–strongly disagree),” “Most people who are important

¹ No order effects were obtained in these or any of the subsequent analyses in either study and are not reported here.
to me would encourage/discourage me from applying sunscreen prior to sun exposure over the next month (strongly encourage–strongly discourage),” and “Most people who are important to me would approve/disapprove of my using sunscreen prior to sun exposure over the next month (strongly approve–strongly disagree),” α = 0.72. Perceived behavioral control was assessed by four items: “For me to use sunscreen prior to sun exposure over the next month would be (very easy–very difficult),” “For me to use sunscreen whenever I am likely to be exposed to sunlight over the next month would be (totally under my control–totally outside of my control),” “I am sure that I could use sunscreen every time I am likely to be exposed to sunlight over the next month if I wanted to (very sure that I could–very unsure if I could),” and “I am confident I could use sunscreen every time I am likely to be exposed to the sun over the next month if I wished to (very confident–not at all confident),” α = 0.83. Four items were used to measure intention: “I intend to use sunscreen prior to sun exposure over the next month (strongly agree–strongly disagree),” “How likely is it that you will use sunscreen before being exposed to sunlight over the next month? (very likely–very unlikely),” “I intend to use sunscreen prior to sun exposure over the next month (definitely intend–definitely do not intend),” and “I plan to use sunscreen before being exposed to sunlight over the next month (strongly agree–strongly disagree),” α = 0.96. Mean scores were computed, giving a score between 1 and 6 for each variable, with higher scores indicating more positive attitudes and intentions.

**Consideration of future consequences.** The final part of the questionnaire contained the 12-item CFC measure (Strathman et al., 1994). Respondents are required to indicate to what extent each item is characteristic of themselves on a 5-point Likert-type scale (extremely characteristic–extremely uncharacteristic). Example items are “I often consider how things might be in the future and try to influence those things with my day to day behavior,” and “I only act to satisfy immediate concerns, figuring the future will take care of itself.” A high score indicates greater consideration of future consequences. The scale has high internal reliability (α > 0.80 in four college samples) and test–retest reliability (r = .76 over 1 week and r = .72 over 5 weeks). In the present sample, CFC scores ranged from 1.75 to 4.92 (M = 3.30, SD = 0.69, Mdhn = 3.33). Participants were coded as high or low CFC by means of a median split. Alpha for the scale among the present sample was 0.89.

**Results**

**Randomization Checks**

Completed booklets were available for 60 participants in the negative short-term consequence/positive long-term (ST−, LT+) condition and 61 participants in the positive short-term/negative long-term (ST+, LT−) condition. Men and women were equally distributed across conditions, χ²(1, N = 121) = 0.99, ns, and there was no difference in the age of participants in each condition, t(119) = 0.96, ns. Northern Europeans were slightly overrepresented in the ST+, LT− condition (85.2%), compared with the ST−, LT+ condition (63.3%), χ²(1, N = 121) = 7.62, p < .01. Missing data across questionnaire items ranged from 0.7% to 6.5%, and scale means were computed using the mean of available items for each participant.

**Effects of the Manipulations on Thought Listings**

Participants generated between zero and four positive and negative thoughts (M = 0.94, SD = 0.79). If the manipulations have been successful, it was anticipated that high-CFC participants would generate more positive than negative thoughts when confronted with information in the ST−, LT+ condition, whereas low-CFC participants should generate more positive than negative thoughts in the ST+, LT− condition.

To test the experimental hypothesis, we conducted a 2 x 2 x 2 ANOVA, with type of thoughts (positive or negative) x type of thought (short-term/long-term) x condition (ST−, LT+ or ST+, LT−) as factors, on the ratings of the thought lists. Results showed a significant main effect of CFC, F(1, 117) = 4.39, p < .05, η² = .04. Participants in the ST−, LT+ condition generated more positive than negative thoughts (M = 0.55, SD = 0.65) than negative thoughts (M = 0.39, SD = 0.54), F(1, 117) = 4.11, p < .05, η² = .03, consistent with a generally positive view of sunscreen use. A significant CFC x Type of Thoughts interaction showed that high-CFC participants generated more positive thoughts (M = 0.66, SD = 0.73) than negative thoughts (M = 0.29, SD = 0.46) thoughts, F(1, 117) = 5.33, p < .05, η² = .04. Most important, the ANOVA revealed the predicted Type of Thoughts x CFC x Temporal Frame interaction, F(1, 117) = 4.64, p < .05, η² = .04. To explore this interaction, we examined the difference between the number of positive and negative thoughts across conditions (see Figure 1). High-CFC participants in the ST−, LT+ condition produced an average of 0.80 positive thoughts and 0.20 negative thoughts (a difference of 0.60). However, when confronted with negative long-term consequences in the ST+, LT− condition, these participants were apparently unable to disregard this information and generated an average of 0.48 positive thoughts and 0.40 negative thoughts (a difference of 0.08). Low-CFC participants produced, on average, 0.42 positive thoughts and 0.36 negative thoughts in the ST+, LT− condition (a difference of 0.06). However, when confronted with information about the short-term negative consequences, they were apparently unable to avoid paying attention to this information and produced an average of 0.50 positive thoughts and 0.60 negative thoughts (a difference of −0.10). In short, they produced a majority of negative thoughts about sunscreen use. These findings support the experimental hypothesis. The interaction of Temporal Frame x Type of Thoughts was nonsignificant, F(1, 117) = 1.35, ns, η² = .01.

**Effects of the Manipulations on Theory of Planned Behavior Measures**

To test the main hypothesis that different temporal frame manipulations would be effective in persuading high- versus low-CFC participants to use sunscreen, we subjected attitude, subjective norm, perceived behavioral control, and intention to a 2 x 2 (temporal frame: ST+, LT− vs. ST−, LT+) x 2 (CFC: high vs. low) multivariate analysis of variance (MANOVA). Results showed a significant main effect of CFC, F(4, 114) = 2.93, p < .05, η² = .09. Univariate analysis showed that perceived behavioral control and intention contributed to this effect. High-CFC individuals
possessed more positive intentions to use sunscreen ($M = 5.03$, $SD = 1.49$) than low-CFC individuals ($M = 4.36$, $SD = 1.32$), $F(1, 117) = 7.13, p < .01, \eta^2 = .06$. Similarly, high-CFC individuals possessed more positive perceptions of behavioral control ($M = 5.30$, $SD = 1.07$) than low-CFC individuals ($M = 4.68$, $SD = 1.21$), $F(1, 117) = 8.23, p < .01, \eta^2 = .07$. The main effect of temporal frame was nonsignificant, $F(4, 114) = 0.67, ns$. More important, the predicted interaction of Temporal Frame $\times$ CFC was significant, $F(4, 114) = 2.92, p < .05, \eta^2 = .09$. Significant univariate effects were obtained for attitude, $F(1, 114) = 4.01, p < .05, \eta^2 = .03$; perceived behavioral control, $F(1, 114) = 4.28, p < .05, \eta^2 = .04$; and intention, $F(1, 114) = 7.95, p < .01, \eta^2 = .06$. Figure 2 illustrates the pattern of this interaction, which parallels that obtained for the thought listings. The ST–, LT + manipulation led to high-CFC individuals being more likely to endorse sunscreen use and low–CFC individuals being less likely to endorse sunscreen. Similarly, the ST+, LT– manipulation led to low–CFC individuals being more likely to endorse sunscreen use and high–CFC individuals less likely to endorse sunscreen use. These findings support study hypotheses.

Mediation of Intention, Attitude, Subjective Norm, and Perceived Behavioral Control by Cognitive Responses

To evaluate the hypothesis that effects of the manipulations and CFC on attitude, perceived behavioral control, and intention were mediated by thoughts generated immediately after reading the manipulations, we conducted a mediation analysis using the procedures advocated by Baron and Kenny (1986). Four criteria require satisfaction for mediation to be supported: (a) The dependent variable should be significantly associated with the independent variable (as demonstrated by the effect of the CFC $\times$ Temporal Frame interaction on attitude, perceived behavioral control, and intention); (b) the mediator should be significantly associated with the independent variable (as demonstrated by the effect of the CFC $\times$ Temporal Frame interaction on the balance of positive–negative thoughts); (c) the mediator should have a significant unique effect on the dependent variable when included alongside the independent variable in a multivariate test of these relationships; (d) the effect of the independent variable on the dependent variable should be significantly attenuated on the inclusion of the mediator as an independent predictor of the dependent variable. Correlation analyses showed that the balance of positive–negative thoughts (the mediator variable) was also significantly associated with each of the dependent measures, attitude ($r = .42, p < .01$), subjective norm ($r = .67, p < .01$), perceived behavioral control ($r = .39, p < .01$), and intention ($r = .55, p < .01$). Because no significant interaction effect was obtained on subjective norm in the ANOVA, scores on this measure were not anticipated to be mediated by thought listings.

To examine the satisfaction of Conditions 3 and 4, we conducted a series of multiple regression analyses (see Table 1). At the first step, significant betas were obtained for the effects of the CFC $\times$ Temporal Frame interaction on attitude, perceived behavioral control, and intention. The nonsignificant effect of the interaction on subjective norm is consistent with the differential effects of the manipulations obtained in the previous ANOVA. At the second step, the mediator variable, positive—negative thoughts, was entered and obtained a significant beta value in each regression model. The inclusion of the mediator variable resulted in attenuation of the beta values associated with the effect of the CFC $\times$ Temporal Frame interaction on attitude, perceived behavioral control, and intention, suggestive of partial mediation. Although the beta value of the interaction was reduced to nonsignificance in the regression of intention, the beta values of the interaction were attenuated in the regression of attitude and perceived behavioral control. Sobel tests$^3$ of the indirect effect of the interaction were also conducted (for intention, Sobel $z = 2.07, p < .05$; for attitude, Sobel $z = 1.96, p = .05$; and for perceived behavioral control, Sobel $z = 1.89, p = .058$).

$^3$ Details of Sobel test procedures were obtained from David Kenny’s website http://davidakenny.net/cm/mediate.htm
Table 1
Summary of Linear Regression of Attitude, Subjective Norm, PBC and Intention on Experimental Conditions and Thought Listings (Difference of Positive and Negative Thoughts): Experiment 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Attitude With mediator</th>
<th>Subjective norm With mediator</th>
<th>Perceived behavioral control With mediator</th>
<th>Intention With mediator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporal frame</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.10</td>
<td>0.07</td>
</tr>
<tr>
<td>CFC</td>
<td>0.52**</td>
<td>0.38***</td>
<td>0.27**</td>
<td>0.51**</td>
</tr>
<tr>
<td>Temporal Frame × CFC</td>
<td>-0.35***</td>
<td>-0.27**</td>
<td>-0.12</td>
<td>-0.07</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thought difference</td>
<td>0.35***</td>
<td></td>
<td>0.21**</td>
<td>0.29***</td>
</tr>
</tbody>
</table>

Model F
6.29*** 3.38** 7.22*** 8.00***
Model R²
0.14 0.25 0.08 0.12 0.16 0.24 0.17 0.38

F change
16.75*** 5.40** 11.89*** 38.71***
R² change
0.11 0.04 0.08 0.21

Note. For Step 1, degrees of freedom were 3 and 117. For Step 2, degrees of freedom were 4 and 116. Values in the upper half of the table are standardized betas. Values in the lower half of the table are as indicated in the left-hand column. Temporal frame was coded as 0 = negative short-term consequence/positive long-term condition (ST−, LT+) and 1 = positive short-term/negative long-term condition (ST+, LT−). CFC = consideration of future consequences.

p = .05. ** p < .05. *** p < .01.

Discussion

Consistent with previous studies (Orbell et al., 2004; Orbell & Hagger, 2006), high-CFC participants, who weighed long-term outcomes more heavily, produced more positive, relative to negative, thoughts and were more persuaded when positive outcomes of using sunscreen were presented as lasting years into the future and negative outcomes were presented as immediate. In contrast, low-CFC participants produced more positive, relative to negative, thoughts and were more persuaded when positive outcomes were presented as immediate and negative outcomes were presented as occurring years into the future. These findings support the generalizability of previous research to preventive behavior. A second experiment was therefore conducted to provide a test of the implications of temporal frame and CFC for a behavioral outcome.

Experiment 2

Method

Participants and Procedure

Staff, students, and visitors were recruited around a university campus in the east of England on (nonrainy) days during May, June, and July of 2006, the year following Experiment 1. Potential participants were approached if they were in an outdoor area and asked to take part in a study concerning their views about using sunscreen. Eighty-eight percent of those approached were willing to participate. In Experiment 2, we did not screen for eligibility. A total of 569 questionnaires were completed. Data from 219 participants were subsequently excluded because they reported their ethnicity as non-European (e.g., Indian, Pakistani, African), and 71 were excluded because they had responded “no” to the questionnaire item “Do you like to have a suntan?”^4^ Participants consented to the study by their completion of the anonymous questionnaire and received a sunscreen voucher on completion of the questionnaire. Ethical approval was obtained from the University Research Ethics Committee. The final sample of 279 ranged in age from 17 to 69 years (M = 24.90, SD = 9.44). Forty-two percent of the sample were men and 58% were women; 87.5% were northern European and 12.5% were southern European.

Materials

Materials for the study comprised an A5-sized booklet that was handed to participants to complete and collected later at an agreed-upon time. Participants were randomly allocated to experimental condition by prepackaging the booklets. A 2 (temporal frame) × 2 (CFC) design was used to test study hypotheses. Temporal frame was manipulated, with CFC was a measured variable.

Manipulations. The first part of the booklet contained one of two short passages about skin cancer and sunscreen use. In one
condition, participants read the ST+ , LT− manipulation; in the other, participants read the ST− , LT+ manipulation. The order in which the consequences were presented within each temporal frame was also counterbalanced. The wording of each of the passages was exactly as described in Study 1.

Thought listings. Immediately after reading the temporal frame manipulation, participants’ cognitive responses were assessed by asking, “Please write down the thoughts that came to mind as you read the passage above.” A boxed outline was provided below this instruction for thought listings. Thoughts were independently coded as positive, negative, or neutral by two raters who were unaware of condition and CFC score. Interrater reliability was satisfactory (κs = .79 for positive thoughts and .78 for negative thoughts, both ps < .01).

Consideration of future consequences. The final part of the questionnaire contained the 12-item CFC measure (Strathman et al., 1994). Alpha for the scale among the present sample was .80. Mean scores were computed, with higher scores indicating higher consideration of future consequences. The CFC Scale had a mean of 3.31 (SD = .54) and a median of 3.25. Participants were classified as high or low CFC using a median split.

Behavioral measure. After completing the questionnaire, participants were invited to detach a code-numbered cardboard voucher as a token of thanks for their participation in the study. The voucher was printed with the words; “This voucher may be exchanged for one bottle of sunscreen lotion at either the Student Union shop or the Campus shop.” The two stores, each situated centrally on the university campus, were supplied with 500-ml bottles of sunscreen SPF15 by the experimenter. The store assistants retained redeemed vouchers. Redeemed vouchers thus served as the dependent measure in the study. Although this measure is an indirect assessment of actual sunscreen use, it has been previously adopted in a number of studies of this kind (Detweiler, Bedell, Salovey, Pronin & Rothman, 1999; Rothman et al., 1993) and represents a proximal behavioral indicator of motivation to use sunscreen.

Results

Randomization Checks

There were 129 participants in the ST− , LT− condition and 150 in the ST+ , LT+ condition. Participants in the two conditions did not differ in terms of age, t(277) = 0.30, ns; gender, χ²(1, N = 279) = 1.56, ns; or ethnicity, χ²(1, N = 279) = 3.53, ns. Missing data across questionnaire items ranged from 1.1% to 6.8%, and scale means were computed using the mean of available items for each participant.

Effects of the Manipulations on Thought Listings

Participants generated between zero and seven positive and negative thoughts (M = 1.63, SD = 1.24). If the manipulations have been successful, it is anticipated that high-CFC participants would generate more positive than negative thoughts when confronted with information in the ST− , LT+ condition, whereas low-CFC participants should generate more positive than negative thoughts when confronted with information in the ST+ , LT− condition.

To test the experimental hypothesis (see Footnote 4), we conducted a 2 (temporal frame: LT+ or ST+) × 2 (CFC: high or low) × 2 (type of thoughts: positive or negative) mixed ANOVA, in which type of thoughts was treated as a within-participants measure. The ANOVA revealed that participants generated more positive thoughts (M = 1.23, SD = 1.02) than negative thoughts (M = 0.41, SD = 0.71), consistent with a generally positive view of sunscreen use, F(1, 275) = 123.84, p < .01, η² = .31. A significant CFC × Type of Thoughts interaction showed that high-CFC participants generated more positive (M = 1.33, SD = 1.18) relative to negative (M = 0.35, SD = 0.70) thoughts (mean difference = .98) than did low-CFC participants (mean difference = .66), F(1, 275) = 4.50, p < .05, η² = .02. Most important, the ANOVA revealed the predicted Type of Thoughts × CFC × Temporal Frame interaction, F(1, 275) = 4.41, p < .05, η² = .02. To explore this interaction, we examined the difference between the number of positive thoughts and the number of negative thoughts produced by participants in each condition; these are displayed in Figure 3. Low-CFC participants produced, on average, 1.29 positive thoughts and 0.33 negative thoughts in the ST+, LT− condition (mean difference = .96). However, when confronted with information about the short-term negative consequences, they were apparently unable to avoid paying attention to this information and produced an average of 0.60 negative thoughts. They also generated fewer positive thoughts (.97) when positive outcomes were presented as occurring in the long term (mean difference = .37). For high-CFC participants, who tended to produce more positive thoughts overall than low-CFC participants, the effect of temporal frame was marginal. High-CFC participants in the ST− , LT+ condition produced an average of 1.42 positive thoughts and .42 negative thoughts (mean difference = 1.0), and in the ST+, LT− condition, these participants generated an average of 1.26 positive thoughts and 0.29 negative thoughts (mean difference = .97). The significant three-way interaction was therefore due to the tendency of low-CFC participants to generate more positive, relative to negative, thoughts when confronted with short-term positive consequences. These findings support the experimental hypothesis. There was no

Figure 3. Effects of temporal frame and consideration of future consequences (CFC) on thought listings in Experiment 2.
significant interaction of Temporal Frame × Type of Thoughts, $F(1, 275) = 3.39$, $n_s, \eta^2 = .01$.

**Effects of the Manipulations on Behavior**

A total of 99 vouchers were redeemed during the study (36% of participants). Figure 4 illustrates the percentages of participants in each experimental condition who redeemed their voucher. Low-CFC participants in the ST+, LT− condition were marginally, but not significantly, more likely (41.7%) to redeem their vouchers than those in the LT+, ST− condition (23.6%), $\chi^2(1, N = 144) = 5.34, p < .05$. High-CFC participants were marginally, but not significantly, more likely to redeem their vouchers in the LT+, ST− condition (40.4%) than in the ST+, LT− condition (37.2%), $\chi^2(1, N = 135) = 0.14, ns$. These findings confirm the significant CFC × Temporal Frame interaction on behavior.

**Mediation of Effects of Temporal Frame and CFC on Behavior by Cognitive Responses**

Our final aim concerns the mediation of the effects of the CFC × Temporal Frame interaction on behavior. Thus far, we have demonstrated that the CFC × Temporal Frame interaction predicts the mediator variable (positive thoughts–negative thoughts) on the one hand and behavior on the other hand. To examine the satisfaction of conditions for mediation, we conducted multiple regression analyses in which behavior was regressed at the first step on the independent variables, CFC, temporal frame, and their interaction. At the second step, the mediator variable, balance of positive and negative thoughts was entered. Behavior was a dichotomous variable (redeemed a sunscreen voucher = 1, did not redeem a voucher = 0). Binomial logistic regression was utilized to conduct the mediation analysis because this is the most appropriate test when the dependent measure is dichotomous (Tabachnik & Fidell, 2001). The effect of including predictor variables in a logistic regression model is assessed by the reduction in the value of $-2$ log-likelihood because this reduction represents the amount of variability that remains after the relevant predictors have been taken into account and can be evaluated by the reduction in chi-square that can be attributed to adding the predictor(s).

**Summary of Logistic Regression of Behavior (Redeemed Sunscreen Vouchers) on Experimental Conditions and Thought Listings (Difference of Positive and Negative Thoughts): Experiment 2**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model without mediator</th>
<th>Model with mediator</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR 95% CI</td>
<td>OR 95% CI</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporal frame</td>
<td>2.20***</td>
<td>1.68</td>
</tr>
<tr>
<td>CFC</td>
<td>2.20***</td>
<td>1.58</td>
</tr>
<tr>
<td>Temporal Frame × CFC</td>
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<td>0.54</td>
</tr>
<tr>
<td>Step 2</td>
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<td></td>
</tr>
<tr>
<td>Thought difference</td>
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<td>1.50–2.49</td>
</tr>
<tr>
<td>$-2$ log-likelihood</td>
<td>353.76</td>
<td>321.92</td>
</tr>
<tr>
<td>$df$</td>
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<td>4</td>
</tr>
<tr>
<td>Step 2 $\chi^2$</td>
<td>31.84**</td>
<td></td>
</tr>
</tbody>
</table>

Note. $N = 279$. Temporal frame was coded as 0 = negative short-term consequence/positive long-term condition (ST−, LT+) and 1 = positive short-term/negative long-term condition (ST+, LT−). Behavior was coded as 1 = redeemed voucher and 0 = did not redeem voucher. CFC = consideration of future consequences; OR = odds ratio; CI = confidence interval; ***$p < .05$.

The findings of the logistic regression analyses are summarized in Table 2. At the first step, the independent variables temporal frame, CFC, and their interaction were entered. These variables were mean centered (Aiken & West, 1991) before computing the interaction term to guard against potential multicollinearity in estimating the regression coefficients. The initial $-2$ log-likelihood was 353.76 and the model was significant, $\chi^2(3, N = 279) = 9.16, p < .05$. Significant odds ratios were obtained for each of the variables temporal frame, CFC, and the interaction term. At the second step, the mediator variable, balance of positive—negative thoughts was entered. The $-2$ log-likelihood was reduced from 353.76 to 321.92, a significant increment in prediction, $\chi^2(1, N = 279) = 31.84, p < .01$. The model was highly significant, $\chi^2(4, N = 279) = 41.0, p < .01$. Important for our present purposes, the introduction of the mediator variable reduced the odds ratios of the interaction terms to nonsignificance, whereas a highly significant odds ratio was obtained for the mediator variable, balance of thoughts. These findings suggest that the effect of the Temporal Frame × CFC interaction on behavior was mediated by the balance of positive versus negative thoughts generated by participants when they read the framed messages. Mediation was also assessed by means of a Sobel test (see Footnote 3), which confirmed the indirect effect of CFC × Temporal Frame on behavior through thought listings ($z = 2.10, p < .05$). Inspection of the odds ratios shows that each unit increase in the balance of positive thoughts–negative thoughts about sunscreen is associated with a twofold increase in the likelihood of redeeming a sunscreen voucher.

**General Discussion**

The goal of the present experimental studies was to demonstrate that individual differences in the extent to which people consider
the long- and short-term outcomes of their present behaviors, as assessed by CFC, have important consequences for the persuasiveness of health communications about a preventive behavior. Low-CFC participants, who weigh short-term outcomes more heavily, were more persuaded when positive outcomes of using sunscreen were presented as occurring immediately. In contrast, high-CFC participants were more persuaded when the positive outcomes of using sunscreen were presented as occurring in the long term, although this effect was more marked in Experiment 1 than Experiment 2. Evidence from thought listings showed that the CFC × Temporal Frame interaction had an impact on the salience of information contained in the messages. It is important to note that, when the use of sunscreen was framed as having short-term positive consequences, low-CFC individuals produced fewer negative relative to positive thoughts and were more likely to redeem their sunscreen voucher. This is an important finding because low-CFC individuals are less likely to be motivated to engage in a range of health-related behaviors. The present findings suggest that careful emphasis of the positive short-term consequences in a health communication might increase motivation among low-CFC individuals.

Experiment 2 provides the first test of the effects of the CFC × Temporal Frame interaction on a behavioral outcome. Although it should be acknowledged that redeeming a voucher is at best, a proximal behavioral indicator, it is nonetheless an objective measure of an important behavioral self-regulatory strategy that must be accomplished to achieve the goal of using sunscreen. Behaviors requiring resources involve several behavioral subgoals to be achieved. For example, in a meta-analytic study of condom use, Sheeran, Abraham, and Orbell (1999) showed that enactment stage variables such as carrying a condom and condom availability had moderate-to-strong weighted average correlations with condom use. Proximal or preparatory behaviors have been used as outcomes in studies of other types of framing (e.g., Detweiler et al., 1999; Rothman et al., 1993). Nonetheless, it remains for future research to observe the effects of CFC and temporal framing on goal achievement.

Several studies of the effects of different types of message framing have been unable to demonstrate mediational processes (e.g., Rothman & Salovey, 1997; Wilson et al., 1988). Orbell and Hagger (2006) showed that participant cognitive responses (Cacioppo, Harkins, & Petty, 1981; Das de Wit & Stroebe, 2003; Kreuter et al., 1999) to a health communication were important mediators of the formation of positive intentions to undergo screening for Type 2 diabetes. The present experiment provides further evidence for this mediation hypothesis. Experiment 2 showed that, when low-CFC people were presented with a message that emphasized the immediate benefits of avoiding sunburn, wrinkles, and premature aging, they generated more positive relative to negative thoughts, and these cognitive responses mediated their decision to redeem their sunscreen voucher. It is important to note that this effect was obtained among people for whom self-image considerations might be expected to inhibit their wish to use sunscreen, as all participants in the present experiments reported that they “liked to have a suntan.”

It should be acknowledged that the present experiments utilized convenience samples of mostly younger people recruited around a university campus and may not be representative of all those who “like to have a suntan.” It is possible, for example, that the sample may have underrepresented the range of CFC that might be observed in a random sample of the general population (Orbell et al., 2004) and the consequent median value of CFC observed. However, regression analysis confirmed the interaction of CFC × Temporal Frame using a continuous measure of CFC.

In summary, individual differences in an individual’s tendency to consider the immediate or longer term consequences of his or her own current behaviors have been demonstrated to have important psychological consequences for decision making regarding a preventive health behavior.

References


