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*Published in:*  
Judgment and Decision Making

*DOI:*  
[10.1017/S1930297500000188](https://doi.org/10.1017/S1930297500000188)

*Publication date:*  
2008

*Document Version*  
Publisher's PDF, also known as Version of record

[Link to publication](#)

*Citation for pulished version (APA):*  
Bohm, G., & Pfister, H.-R. (2008). Anticipated and experienced emotions in environmental risk perception. *Judgment and Decision Making*, 3(1), 73-86. <https://doi.org/10.1017/S1930297500000188>

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# Anticipated and experienced emotions in environmental risk perception

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## Abstract

Affective forecasting with respect to two environmental risks (ozone depletion, air pollution) was investigated by studying tourists who travelled to either Australia or Bangkok and were thus confronted with one of these risks. We measured anticipated outcome and anticipated emotions before the journey, actually experienced outcome and actually experienced emotions during the journey, and anticipated outcome and emotions concerning a future encounter with the same risk after the journey. Results indicate that tourists underestimate (air pollution) or correctly predict (ozone depletion) both the seriousness of the outcome and their emotional reactions. The relationship between actual outcome and actual emotions is stronger than that between anticipated outcome and anticipated emotions. Furthermore, tourists learn from their travel experience and adjust their anticipations concerning future encounters with the environmental risk. Findings suggest that the domain of environmental risks differs from personal outcomes with respect to the process of affective forecasting.

Keywords: anticipated emotions, affective forecasting, environmental risks, risk perception.

## 1 Introduction

Over the course of the past decade, affect and emotions have evolved from neglected to 'hot' topics in the literature on human judgment and decision making (Peters, Västfjäll, Gärling, & Slovic, 2006). The present paper investigates emotions in one particular domain, namely, risk perception with respect to changes in the natural environment. Even though the general importance of emotions in environmental risk perception has been acknowledged by some authors, not much research has specifically addressed this issue (Böhm, 2003; Västfjäll, Peters, & Slovic, this issue). Environmental risks differ in some important respects from personal risks or outcomes in that they are usually characterized by a more complex causal structure and low personal control (Böhm & Pfister, 2001; Pfister & Böhm, 2001). Whereas personal risks are taken by the same person who experiences the consequences, various actors and victims may be involved in

the case of environmental risks, because they are often brought about by the collective actions of many individuals and also affect numerous heterogeneous groups of people who may be distributed over wide-spread regions of the world (Vlek, 1996).

We focus upon the role of anticipated emotions in environmental risk perception and upon the relationship between anticipated and actually experienced emotions. The anticipation of future emotions is often called affective forecasting (Loewenstein & Lerner, 2003; Wilson & Gilbert, 2003). We address three questions with respect to affective forecasting in the domain of environmental risks: (a) Can people accurately predict their emotional reactions to some future environmental damage? That is, do anticipated emotions correspond to the emotions that are actually experienced when the future event takes place? (b) What is the basis for anticipated and experienced emotional reactions to environmental risks? That is, are they related to anticipated and experienced outcomes, respectively? (c) Do people adjust their anticipated emotions based on experience? That is, if people anticipate their emotional reactions to some type of environmental damage and then experience their actual reactions to it, does this affect what emotional reactions they

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anticipate for future encounters with this type of environmental damage?

We investigated these questions by studying tourists who travelled to a destination where they would be confronted with severe environmental damage. We chose two travel destinations and types of environmental damage: Australia with ozone depletion and Bangkok with air pollution. This allowed us to compare tourists' affective forecasts before the travel with their experience when they actually encountered the environmental problem during their travel.

## 2 Affective forecasting: The accuracy of anticipated emotions

Behavioral decisions generally imply that decision makers anticipate the consequences of the various behavioral options at hand, so that they can decide which consequences are desirable and which others are to be avoided. Moreover, decision makers need not only anticipate the consequences of the behavioral options, but also their affective reactions to these consequences. This is what has been referred to as *anticipated emotions*: Beliefs about one's own emotional responses to future outcomes (Loewenstein & Lerner, 2003; Loewenstein, Weber, Hsee, & Welch, 2001).

If a good decision is one whose outcomes actually make us feel good, then the quality of a decision depends upon our ability to correctly anticipate our emotional reaction to the outcomes (Kahneman & Snell, 1992). If we misjudge our reactions, we may miss positive outcomes, acquire unexpected negative outcomes, or misallocate our resources by striving for consequences that do not bring us as much pleasure as we expected. The same argument applies to risk perception, since risk perception amounts to the anticipation of future negative consequences and the judgment of how painful their experience would be (Yates & Stone, 1992). In the case of environmental risks, we must anticipate how devastating we would find a certain environmental damage in order to decide whether we want to engage in some preventive action.

### 2.1 Mechanisms and errors in affective forecasting

To what extent do we actually know what we will enjoy or dislike? Gilbert and Wilson (2007; Gilbert, 2006) recently reviewed the literature on affective forecasting and elaborated the mechanisms by which people arrive at such forecasts. They argue that people engage in a mental simulation of future events and then use their immediate affective - or hedonic, as the authors call it - reactions to the simulations as predictors of their likely reactions to

these future events. According to the authors, such pre-felt affective states are influenced by two factors, the simulation of the future event and current contextual factors.

Similarly, the actual affective reaction when the future event takes place is influenced by the perception of the actual event and by contextual factors that are present in this future situation. Thus, the pre-felt affective reaction to the simulation will predict the actual future affective experience to the extent that (a) the mental simulation of the event influences the affective state in the same way as the perception of the actual event, and (b) contextual factors at the time of the simulation influence the affective state in the same way as contextual factors that are present when the event actually takes place. Affective forecasts will be in error if these two conditions are not met.

There are two sources of errors in affective forecasting. First, the mental simulation of the event may not correspond to the actual event. People may, for example, simulate the event as more extreme than it turns out to be, or they may omit some features of the actual event in their simulation. With respect to environmental risks people may, for example, simulate the potential environmental damage as too serious or not serious enough. Second, when using their present affective reaction to the simulated future event as a predictor of their future affective reaction to the event, people may fail to consider that the contextual factors at the time of the simulation may differ from the future contextual factors that will be present when they experience the event. Tourists encountering some environmental problem at their travel destination may anticipate overly negative emotions in response to this event, failing to take into account that the general pleasantness of being on a vacation will ameliorate the reaction to this one negative aspect of their travel.

According to Gilbert and Wilson (2007) there are four kinds of errors in affective forecasting: (a) Simulations are unrepresentative of the event; the simulated event is, for example, too extreme. This error is mainly due to the fact that people use their memories of previous events to construct simulations of future events and that such memories are often distorted in such a way that unusual and recent events are more easily remembered than representative ones. We will return to this aspect when we discuss whether people learn from previous experience when making affecting forecasts (research question 3). (b) Simulations are essentialized. That is, they include essential features of the event but omit inessential ones. Prospective flight passengers, for example, will include the core event of being on the plane in their simulations, but not minor parts of the activity such as showing the passport when checking in. (c) Simulations are abbreviated; they do not include every single moment of the future event, but only a few select moments, and it is the early moments of the event that tend to be selected. (d)

Simulations are decontextualized, that is, they tend to neglect contextual factors such as hunger or other bodily states.

All four types of error work in the direction that they produce simulations that are more extreme than the event is likely to be: Unusual events, essential features of the event, early moments of the event, and decontextualized events all tend to represent the intense aspects of an event that are not damped by more mundane, inessential, later, or contextual aspects. People can therefore be expected to simulate good events better and bad events worse than the events actually turn out to be. Affective forecasts based on such simulations should thus tend to overestimate future emotional reactions. This effect has indeed been found in many studies and has been labelled the impact bias (Wilson & Gilbert, 2003).

## 2.2 Affective forecasting concerning environmental risks

Affective forecasting has hardly been studied in the domain of environmental risk perception (Loewenstein & Frederick, 1997). Most studies on affective forecasting have considered personal outcomes such as life events. It is unclear whether we should expect the same effects with respect to the accuracy of affective forecasting for environmental risks as have been identified for personal outcomes. Environmental risks differ from personal outcomes in at least two respects. First, many environmental problems, such as air pollution, are brought about by the accumulated impacts of the actions of many individuals. Second, the natural environment is a collective resource, so that environmental damage affects many people and not only one person. Thus, the causation as well as the consequences of many environmental risks are collective rather than personal. As a result, people may feel little control over the causation of environmental problems and a lack of personal relevance with respect to the consequences (Böhm, 2003). This may influence the motivational basis of affective forecasting. For instance, if the prevalent error in affective forecasts for personal outcomes, the impact bias, serves to increase the motivation to strive for positive and to avoid negative outcomes, this motivation may be lower for collective outcomes, resulting in a reduced or no impact bias for environmental risks.

The fact that so few studies have investigated affective forecasting for environmental risks may be due to a methodological design difficulty in this domain which we want to tackle. Affective forecasting is usually studied in a within-subjects design. First, people are asked how they anticipate feeling if a certain event were to take place and then - when the event actually occurred - they are asked how they actually do feel. Such a within-subjects design is difficult to accomplish for environmental risks, because

it would require that participants are asked before and after some environmental damage takes place.

This is difficult to do for two reasons. First, instances of environmental pollution or destruction are usually not predictable in advance; for example oil spills or other accidents. And secondly, environmental damage is often not a single event that occurs at a definite point in time. Often, we deal with gradual processes where some pollution or damage has already taken place and more is expected in the future. Also, these processes often extend over long time periods so that there is no clear point where the event can be said to have taken place. Climate change is an example; it is impossible to define two points in time that are before and after climate change.

We aimed at investigating affective forecasting in the area of environmental risks by means of a within-subject design. While it holds that environmental risks are often gradual and unpredictable, some environmental problems are prevalent at particular places and not at others. For example, depletion of the ozone layer is more pronounced in Australia than in the Northern Hemisphere. Therefore, we decided to study tourists who travelled to a destination where they would encounter a particular instance of environmental damage. This allows us to implement a within-subjects design where we can ask participants before their travel for their affective forecasts and during their travel for their actual affective experiences. The comparison of these two evaluations addresses our first research question concerning the accuracy of affective forecasting in environmental risk perception.

## 3 The basis of emotions: Anticipated and experienced outcomes

As Gilbert and Wilson (2007) argued, people simulate a future event mentally in order to predict the event's emotional consequences. Disentangling the mental simulation of the event from the anticipated emotions is desirable yet difficult. Assume, for example, that tourists travelling to Bangkok experience more negative emotions when they encounter the air pollution at their travel destination than they had anticipated. Is that because they underestimated the degree of air pollution or because they underestimated their emotional reaction to a correctly anticipated degree of air pollution? One might even argue that if one is to study *affective* forecasting - that is, the anticipation of emotional reactions - it is necessary to separate this from the anticipation of the outcome so as to not confound the two.<sup>1</sup> Especially if the anticipated event is novel to people, such as when tourists travel to a new location, it seems likely that the event is mispredicted due to lack of knowledge.

<sup>1</sup> We thank an anonymous reviewer for pointing this out.

However, separating the event from the emotional reaction is difficult because of the close connection between these two aspects. Even the presentation of familiar or well-defined events leaves room for an incorrect simulation of the future event. Consider, for example, the events that have been used in some of the seminal studies on affective forecasting, the anticipation of how much one will like some yoghurt (Kahneman & Snell, 1992), and how happy associate professors will be after receiving tenure (Gilbert et al., 1998). It could well be argued that the yoghurt tasters did not make a mistake in anticipating their hedonic experience, but in predicting the mere taste of the yoghurt; and that the associate professors did not mispredict their affective reaction to receiving tenure but what it means to be tenured. They may, for example, not have foreseen the amount of administrative chores that come with it.

The argument applies even to such seemingly well-defined events as monetary outcomes. If we asked someone how happy she will be if she wins \$1 million, and this person later turns out to be less happy than anticipated, it might still be argued that the winner had wrong expectations about what she could do with \$1 million - and therefore misjudged the event and not her emotional reaction to it. The winner might simply not have known how much \$1 million is. Presumably, to many people this means not more than 'a large amount of money' and is not more specific than 'severe air pollution'.

Thus, from the mere difference between anticipated and experienced emotions we cannot distinguish whether this forecasting error results from wrong expectations concerning the event or concerning the emotional reaction to the event, if the anticipation of the event is not measured. Most studies did not measure the anticipated event and could therefore not separate the two parts of the process. Incorrect mental construction of the event has then by most authors been regarded as an explanation for errors in affective forecasting rather than as being confounded with it (Gilbert et al., 1998).

We measured the anticipation of the event in terms of the anticipated impact of the environmental problem on the travellers' quality of life. Thus, rather than asking for the anticipated magnitude of the environmental problem (e.g., how serious do you think air pollution in Bangkok will be?), we focused more specifically on the anticipated personal outcome that people expect to result from the environmental problem. Additionally, we measured anticipated emotional reactions as well as actually experienced impact on life quality and actually experienced emotional reactions. This allows us to analyze whether the impact on life quality is anticipated correctly and how (anticipated) impact on life quality is related to (anticipated) emotions.

## 4 Learning from experience: The adjustment of anticipated emotions

One source of anticipated emotions is the recollection of emotional reactions to previous comparable situations. This raises the question whether people learn from past experiences when they repeatedly experience the same decision situation.

To our knowledge, the adjustment of affective forecasting has not yet been studied in the area of environmental risks. We studied tourists who travelled to their destination (either Australia or Bangkok) for the first time. Hence, they had no experience with the environmental damage that they were about to encounter, which was depending on their travel destination either ozone depletion (Australia) or severe air pollution (Bangkok). Our aim was to find out whether they learn from this novel experience to the extent that they transfer the travel experience to the situation at home and adjust their anticipations with respect to a future encounter with the environmental problem that might possibly take place at home.

To this end, we asked the tourists what impact on life quality and what emotions they anticipated if ozone depletion (for tourists travelling to Australia) or air pollution (for tourists travelling to Bangkok) were to reach the same extent at their homes as at their travel destination. We compared these responses with those of a group of participants who did not travel in order to investigate whether the travel experience had an effect on affective forecasting.

Our theoretical assumptions and the structure of our study are summarized in Figure 1. At three points in time people either anticipate or experience an outcome. The anticipated or experienced outcome triggers a corresponding emotional response. Travellers were measured at the following three points in time: before their journey, at their destination, and after their return.

## 5 Method

### 5.1 Participants

One hundred and fifty-six volunteers participated, 101 of them were tourists travelling for their first time to either Bangkok ( $N = 43$ ) or Australia ( $N = 58$ ). The remaining participants ( $N = 55$ ) served as a non-travelling comparison group. Non-travellers were matched to travellers according to age, sex, and educational level. Travellers were recruited at travel agencies, in internet travel forums, at shows and lectures presenting the travel destinations, and at the airport. Non-travellers were recruited



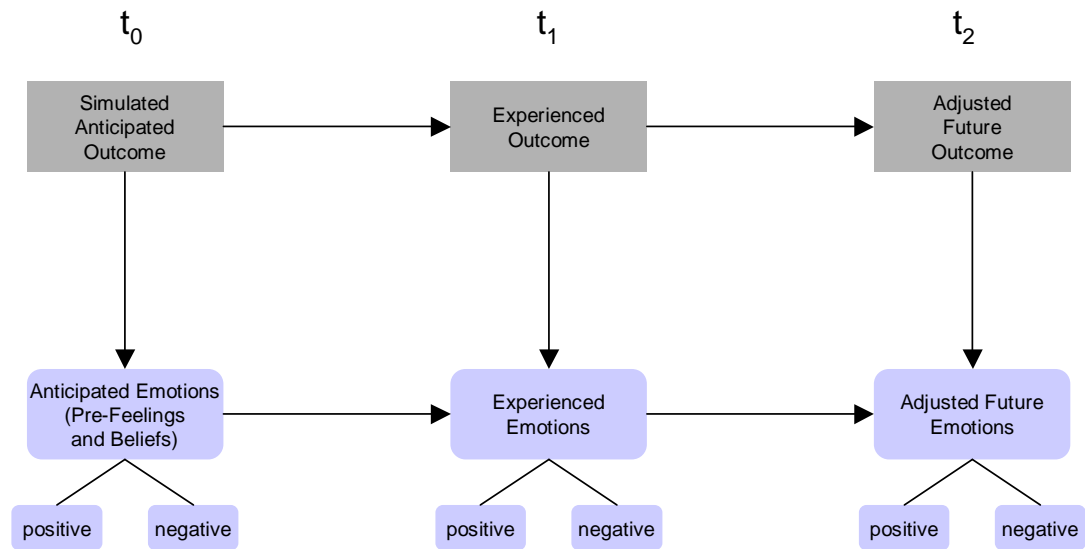


Figure 1: The process of affective forecasting across three points in time ( $t_0$ : before travelling,  $t_1$ : during travelling;  $t_2$ : after travelling).

by means of bulletin boards at grocery stores and by advertisements in newspapers. Participants were paid for their participation. Participants' age ranged from 18 to 73 years ( $M = 35.8$ ,  $SD = 12.36$ ); 49.4 % were female; 16.0 were students, 71.2 % were employed in some professional occupation, and 11.5 % did not work.

## 5.2 Design

There were two between-subjects factors: Travel (travellers vs. non-travellers) and environmental problem (air pollution in Bangkok vs. ozone hole in Australia). Two dependent variables were measured: Judged impact of the environmental problem on life quality, and judged emotional reaction to the environmental problem. There were three points of measurement for travellers: Before travel ( $t_0$ ), during travel ( $t_1$ ), and after travel ( $t_2$ ). At  $t_0$ , travellers were asked what impact on life quality and what emotional reactions they anticipated for their travel; at  $t_1$  they were asked for their actual experiences during the travel; and at  $t_2$  for their anticipations if the same state occurred at home. There were two points of measurement for non-travellers. First, they were asked for their anticipations concerning a hypothetical journey to either Australia ( $N = 29$ ) or Bangkok ( $N = 26$ ). This point corresponds to travellers'  $t_0$ . Some weeks later, they were asked for their anticipations if at home either the ozone hole were to become as serious as in Australia or air pollution were to become as serious as in Bangkok. This point corresponds to travellers'  $t_2$ .

## 5.3 Measures and materials

All variables were measured by means of a questionnaire. At the beginning of the questionnaire, participants were asked to think thoroughly about the environmental problem under consideration.

At  $t_0$ , the instructions said (all materials translated from German): You are about to travel to <Australia / Bangkok> (for non-travellers: Imagine that you are about to travel to <Australia / Bangkok>). The <ozone hole / air pollution> is more serious there than in Germany (where our participants lived). Imagine this environmental situation as precisely as possible and think about what this means to you personally. Write down in a few sentences what comes to your mind when you think about it.

At  $t_1$ , the instructions said that participants were now on-site and actually saw what it meant to them personally to experience the real <ozone hole / air pollution> at their travel destination. They were again asked to write down what came to their minds.

At  $t_2$ , participants were asked to imagine as precisely as possible what it would be like if the <ozone hole / air pollution> were as serious where they live as in <Australia / Bangkok> and what that would mean to them personally. Again, they were asked to write down their thoughts. These open questions served to elicit a vivid mental image of the respective environmental risk, but were not further analyzed.

The following items concerning life quality and emotional reactions asked participants to think of the environmental problem and to rate how it affected them personally. Life quality was described as the quality of aspects

of their lives that were important to them. Some examples were listed for what such aspects might include, for instance their health, their financial situation, the cleanliness and beauty of the natural environment, social relationships and acknowledgement, freedom of choice, availability of cultural activities, and availability of positive experiences. Emotional reactions were described as the emotions elicited by the environmental problem. Examples were given for what such emotions might be (e.g., anger, fear, distress for negative emotions and joy, relief, pride for positive emotions).

*Anticipated impact on life quality at t0.* Participants rated the extent to which the <ozone hole in Australia / air pollution in Bangkok> would probably affect their general life quality. The rating scale ranged from -5 (very negative impact) to +5 (very positive impact).

*Experienced impact on life quality at t1.* The actually experienced impact of the environmental problem on general life quality was measured on the same rating scale ranging from -5 (very negative impact) to +5 (very positive impact).

*Anticipated impact on life quality at t2.* Participants rated the extent to which it would probably affect their general life quality if the <ozone hole / air pollution> were as serious where they lived as in <Australia / Bangkok>, again on a rating scale that ranged from -5 (very negative impact) to +5 (very positive impact).

*Anticipated emotional reaction at t0.* Participants responded to two questions. One asked how much they would probably experience positive emotions when they encountered the <ozone hole in Australia / air pollution in Bangkok>. The second question asked for the anticipated intensity of negative emotions. Both ratings were given on a 7-point rating scale ranging from 1 (not at all) to 7 (very strongly).

*Experienced emotional reaction at t1.* The actually experienced emotional reaction was again measured for positive and negative emotions on two rating scales from 1 (not at all) to 7 (very strongly).

*Anticipated emotional reaction at t2.* Participants rated on two rating scales how much they anticipated to experience positive and negative emotions if the <ozone hole / air pollution> were as serious where they live as in <Australia / Bangkok>. Rating scales ranged again from 1 (not at all) to 7 (very strongly).

## 5.4 Procedure

Participants received and returned all questionnaires by mail. Travellers received the questionnaires for t0 and t1 in separate envelopes before their travel. They filled in and returned the questionnaire for t0 the week before their departure. They were instructed to take the envelope with the questionnaire for t1 with them and to open the enve-

lope and complete the questionnaire at the end of their stay in Australia or Bangkok, respectively. The questionnaire for t2 was sent out and completed approximately four weeks after their return. Non-travellers received and completed the questionnaire for t2 approximately eight weeks after the one for t0 to match the time period between t0 and t2 of the travellers.

## 6 Results

### 6.1 Research question 1: Accuracy of anticipated emotions

Do travellers correctly anticipate their emotional reactions to the environmental problem at their travel destination (research question 1)? In general, we found that travellers underestimated the intensity of their emotional reactions to air pollution and correctly predicted their emotional reactions to ozone depletion. This holds for the intensity of both positive and negative emotions.

Table 1 shows the means and standard deviations of the intensity of positive and negative emotions for travellers (and of impact on their life quality, which we will refer to later). The two travel destinations were analyzed separately.

Dependent-sample *t*-tests indicate that there is no difference between predicted (t0) and experienced (t1) intensity of positive emotions for tourists who travel to Australia and thus encounter the ozone hole,  $t(48) = -.74$ ,  $p = .46$  (two-tailed). Likewise, predicted and experienced intensity of negative emotions do not differ for ozone depletion,  $t(50) = 0.13$ ,  $p = .90$  (two-tailed).

For tourists encountering air pollution at Bangkok, in contrast, predicted and experienced emotional reactions differ. Air pollution reduced the intensity of positive emotions during their travel more than they had predicted,  $t(34) = 2.48$ ,  $p = .02$  (two-tailed). And they experienced more intense negative emotions during their travel than they had anticipated before their travel,  $t(37) = -2.41$ ,  $p = .02$  (two-tailed).

In sum, participants encountering ozone depletion anticipated the intensity of their emotional reactions correctly whereas participants being confronted with air pollution misjudged the intensity of their emotional reactions. The results suggest that positive emotions are overestimated, whereas negative emotions are underestimated.

### 6.2 Research question 2: The basis of emotions

*Accuracy of anticipated outcomes.* If affective forecasts are based upon a mental simulation of the future outcome

Table 1: Means (standard deviations) for travellers before and during travel.

	Point of Measurement		
	t0	t1	Difference <i>t1 – t0</i>
	Anticipation (before journey)	Actual experience (during journey)	
Ozone hole			
Intensity of positive emotions	1.55 (1.08)	1.73 (1.35)	0.18
Intensity of negative emotions	3.92 (1.94)	3.88 (1.63)	–0.04
Impact on life quality	–0.49 (1.30)	–0.74 (1.30)	–0.25
Air pollution			
Intensity of positive emotions	2.40 (1.97)	1.60 (1.06)	–0.80
Intensity of negative emotions	4.34 (1.53)	4.95 (1.52)	0.61
Impact on life quality	–1.09 (2.24)	–2.00 (1.50)	–0.91

*Note.* Judgments for impact on life quality were made on 11-point scales (-5: very negative impact, +5: very positive impact). Judgments for intensity of positive and negative emotions were made on 7-point scales (1: not at all, 7: very strongly).

then the correct anticipation of the outcome is a prerequisite for the correct prediction of the emotional response. We therefore analyzed whether travellers correctly anticipated their personal outcomes, that is, the impact they judged the environmental problem would have on their life quality.

The means and standard deviations of impact on life quality are displayed in Table 1. The results parallel those for emotional reactions. Anticipated impact on life quality does not differ from experienced impact on life quality for travellers encountering ozone depletion in Australia,  $t(52) = 1.21$ ,  $p = .23$  (two-tailed). Participants experiencing air pollution in Bangkok, in contrast, anticipated the impact on life quality to be less serious and negative than they actually experienced it during their travel,  $t(32) = 2.22$ ,  $p = .03$  (two-tailed).

Hence, impact on life quality was predicted correctly for ozone depletion, but underestimated for air pollution. The fact that this pattern corresponds to the one found for emotions is compatible with the assumption that anticipated emotions result from the anticipation of future outcomes.

*Relationship between outcomes and emotions.* According to Gilbert and Wilson (2007), affective forecasts are the result of the mental simulation of the future outcome and actually experienced emotional reactions are produced by the perception of the actual event. A prediction that can be derived from this assumption with respect to our data is that anticipated impact on life quality should correlate with anticipated emotional reactions and

Table 2: Pearson correlations between life quality and emotional reactions (for travellers, number of cases in parentheses.)

	Point of Measurement	
	$t0^a$	$t1^b$
Ozone hole		
Positive emotions	.11(54)	.29(52)*
Negative emotions	-.28(55)*	-.44(53) **
Air pollution		
Positive emotions	.01(38)	.25(33)
Negative emotions	.14(39)	-.65(36) **

*Note.* <sup>a</sup> Correlation between anticipated impact on life quality and anticipated intensity of emotional reaction (before journey). <sup>b</sup> Correlation between experienced impact on life quality and experienced intensity of emotional reaction (during journey).

\* $p < .05$ ; \*\* $p < .01$

actually experienced impact on life quality should correlate with actually experienced emotions.

Table 2 shows the correlations. Results indicate that experienced impact on life quality and experienced emotions at  $t1$  are more closely related than anticipated impact on life quality and anticipated emotions at  $t0$ : Experienced life quality is positively related to an increase



Table 3: Regression models predicting experienced emotions from anticipated emotions and experienced impact on life quality (travellers).

Predictor	B	SE(B)	$\beta$
Model 1: Ozone depletion; DV: experienced positive emotions (t1) ( $R^2 = .27$ )			
Intensity of anticipated positive emotions (t0)	.008	.178	.006
Experienced impact on life quality (t1)	.273	.144	.269
Model 2: Ozone depletion; DV: experienced negative emotions (t1) ( $R^2 = .50^{**}$ )			
Intensity of anticipated negative emotions (t0)	.178	.108	.211
Experienced impact on life quality (t1)	-.520	.161	-.415**
Model 3: Air pollution; DV: experienced positive emotions (t1) ( $R^2 = .43^*$ )			
Intensity of anticipated positive emotions (t0)	.189	.090	.351*
Experienced impact on life quality (t1)	.191	.111	.285
Model 4: Air pollution; DV: experienced negative emotions (t1) ( $R^2 = .68^{**}$ )			
Intensity of anticipated negative emotions (t0)	.255	.138	.230
Experienced impact on life quality (t1)	-.533	.137	-.549**

Note. \* $p < .05$ ; \*\* $p < .01$ ; DV = dependent variable.

in positive emotions for ozone depletion and negatively related with negative emotions for both ozone depletion and air pollution. Anticipated impact on life quality, in contrast, is related only to anticipated negative emotions for ozone hole; none of the other correlations involving anticipated life quality is significant.

Another way of looking at the pattern of correlations in Table 2 is to contrast positive and negative emotions: All in all, negative emotions show a stronger relationship with life quality, anticipated and experienced, than do positive emotions.

Thus, the assumption that (anticipated) emotional reactions are based on (anticipated) outcomes is more strongly supported for experienced emotions than for affective forecasts, and particularly for negative experienced emotions.

*Predicting experienced emotions.* If people anticipate their emotional reactions correctly, then anticipated emotions should predict experienced emotions. Furthermore, as both Gilbert and Wilson (2007) pointed out and our results showed, experienced emotions are affected by experienced outcomes. Combining these two aspects, we analyzed whether experienced emotions at t1 can be predicted from anticipated emotions at t0 and experienced impact on life quality at t1. Overall, it turns out that the experienced impact on life quality is a better predictor for experienced emotions than are anticipated emotions.

The regression models are depicted in Table 3. The two environmental problems as well as positive and negative

emotions were analyzed separately. The model predicting positive emotions for travellers experiencing ozone depletion was not significant. For positive emotions experienced with respect to air pollution anticipated emotions yield a significant predictor. For negative emotions experienced with respect to both ozone depletion and air pollution, experienced impact on life quality was a stronger predictor than anticipated emotions.

### 6.3 Research question 3: Learning from experience

Do travellers adjust their anticipations based on the travel experience? We asked this question concerning both the anticipation of personal outcomes (i.e., the anticipated impact on life quality) and the anticipation of emotional reactions. We addressed this question in two ways. First, we tested whether the difference from t0 to t2 is different for travellers and non-travellers; that is, whether the travel experience interacts with the time of measurement. If travellers' anticipations differ for t0 and t2 but non-travellers' anticipations do not, this difference may be due to the experiences that travellers made during their journey. Second, we conducted a mediation analysis. If travellers adjust their anticipations from t0 to t2 based on their travel experience at t1, then the relationship between anticipations made before the travel (t0) and anticipations made after the travel (t2) should be mediated by the actual experience during the travel (t1).

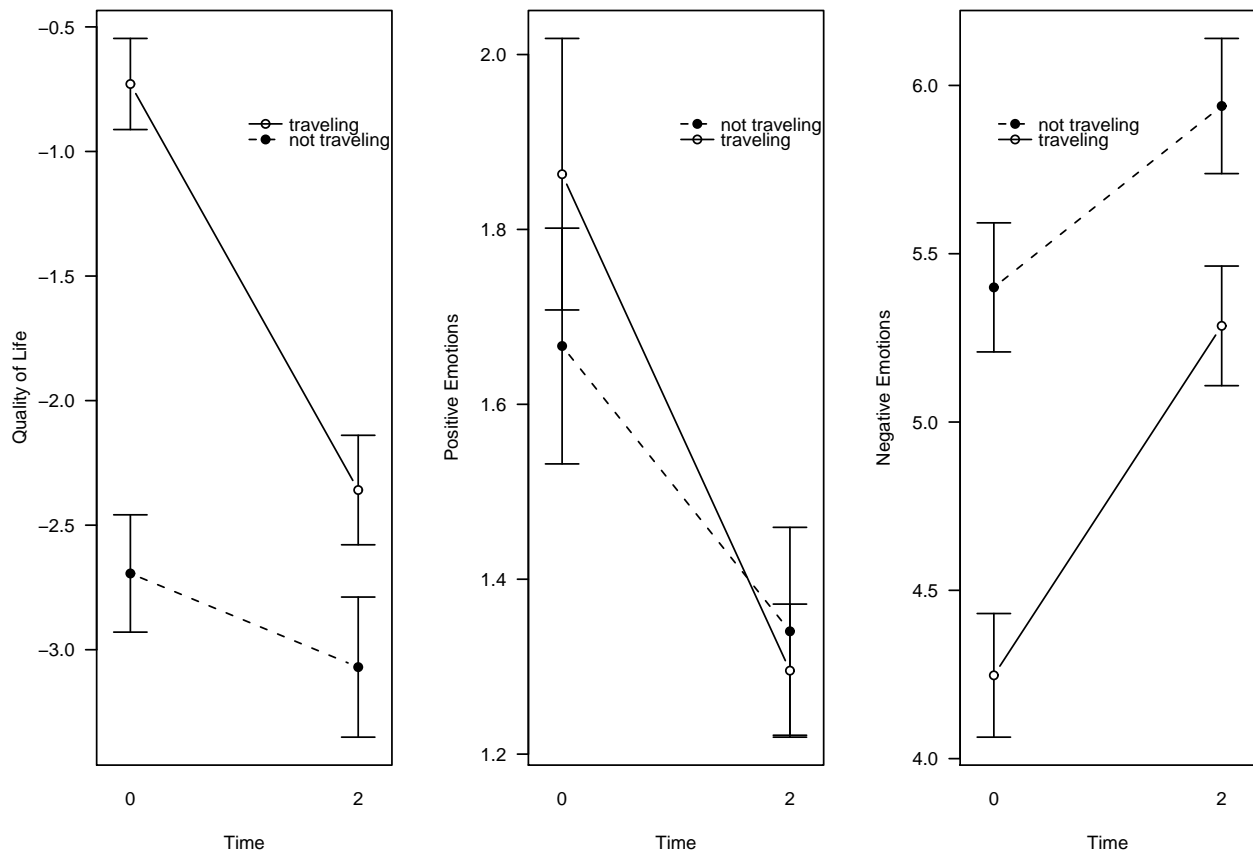


Figure 2: Interaction between travel (travellers vs. non-travellers) and point of measurement (before travel and after travel) with respect to anticipated impact on life quality (left panel), anticipated intensity of positive emotions (middle panel), and anticipated intensity of negative emotions (right panel). t0: Anticipation made before travel for a future encounter with the environmental problem at travel destination. t2: Anticipation made after travel for a future encounter with the environmental problem at home. Judgments for anticipated life quality were made on 11-point scales (-5 = very negative impact, +5 = very positive impact). Judgments for anticipated intensity of positive and negative emotions were made on 7-point scales (1 = not at all, 7 = very strongly).

*Interaction between travel and time of measurement.* With respect to the interaction between travel and time of measurement, results showed that in general travellers' anticipations differ for t0 and t2 in contrast to non-travellers' anticipations. More specifically, when comparing the anticipations for travel at t0 with those for home at t2, these two anticipations did not differ for non-travellers with respect to impact on life quality and intensity of positive emotions. Travellers, in contrast, anticipated more serious impact on life quality, less intense positive emotions, and more intense negative emotions for home than for travel.

The dependent variables impact on life quality, intensity of positive emotions, and intensity of negative emotions were each analyzed by a  $2 \times 2$  (Travel: travellers vs. non-travellers  $\times$  Time: t0 vs. t2) multifactorial analysis of variance with repeated measures on time. Figure 2

displays the cell means of these three analyses.

*Impact on life quality* yielded significant main effects for travel,  $F(1, 112) = 27.82, p = .001$ , and time,  $F(1, 112) = 25.06, p = .001$ , as well as a significant Travel  $\times$  Time interaction,  $F(1, 112) = 12.96, p = .001$ . The interaction effect qualifies both main effects (see Figure 2): Travellers at t0 anticipated less impact on life quality than all other groups. Most importantly, travellers anticipated less serious impact on life quality at t0 than at t2,  $t(73) = 7.26, p = .001$ , whereas this difference was not significant for non-travellers,  $t(39) = 0.873, p = .388$ .

*Intensity of positive emotions* yielded only a significant main effect for time,  $F(1, 127) = 17.78, p = .001$ . There was no significant main effect for travel,  $F(1, 127) = 0.20, p = .655$ , and no significant interaction effect,  $F(1, 127) = 0.79, p = .377$ . Even though the interaction effect was not significant, the means showed the expected pattern

Table 4: Mediation analyses: Do travellers adjust their anticipation from before (t0) to after (t2) their travel based on their travel experience (t1)?

	Regression (a): $IV \rightarrow MV$		Regression (b): $IV \rightarrow DV$		Regression (c): $IV + MV \rightarrow DV$		
	$\beta(IV)$	$R^2$	$\beta(IV)$	$R^2$	$\beta(IV)$	$\beta(MV)$	$R^2$
(1) Anticipated impact on life quality (t0) $\rightarrow$ experienced impact on life quality (t1) $\rightarrow$ anticipated impact on life quality (t2)	.335**	.112**	.214 <sup>a</sup>	.046 <sup>a</sup>	.085ns	.344**	.146**
(1) Anticipated intensity of positive emotions (t0) $\rightarrow$ experienced intensity of positive emotions (t1) $\rightarrow$ anticipated intensity of positive emotions (t2)	.127ns	.016ns	.477**	.228**	.461**	.169 <sup>b</sup>	.252**
(1) Anticipated intensity of negative emotions (t0) $\rightarrow$ experienced intensity of negative emotions (t1) $\rightarrow$ anticipated intensity of negative emotions (t2)	.368**	.136**	.621**	.386**	.474**	.398**	.523**

Note. IV: independent variable; DV: dependent variable; MV: mediator variable;  $\beta$ : standardized regression coefficient.

\* $p < .05$ ; \*\* $p < .01$ . <sup>a</sup> $p = .067$ ; <sup>b</sup> $p = .091$

(see Figure 2): The difference between t0 and t2 is more pronounced for travellers than for non-travellers.

With respect to the *intensity of negative emotions*, the analysis of variance yielded significant main effects for travel,  $F(1, 134) = 13.36, p = .001$ , and for time,  $F(1, 134) = 46.89, p < .001$ . The Travel  $\times$  Time interaction effect just missed the significance level of .05,  $F(1, 134) = 3.84, p = .052$ . Inspection of the means (Figure 2) indicates that both travellers and non-travellers anticipated more intense negative emotions at t2 than at t0, but that the difference is larger for travellers than for non-travellers.

We have ignored the distinction between the two travel destinations in our discussion of the interaction between travel and time of measurement. When the environmental problem is included as a variable in the analyses of variance, air pollution generally elicits stronger anticipated reactions than the ozone hole. However, the general pattern that travellers in contrast to non-travellers tend to differ between t0 and t2 holds for both environmental problems.

*Difference between travellers and non-travellers.* As can be seen from Figure 2, travellers and non-travellers generally differ in that non-travellers anticipated more negative reactions for an encounter with the environmental problem. This general difference between travellers and non-travellers was not expected. Most importantly, travellers and non-travellers differ already at t0. Non-travellers anticipate more serious decline in life quality,  $t(143) = -6.41, p < .001$  (two-tailed), and more intense negative emotions,  $t(150) = 4.07, p < .001$  (two-tailed), for a confrontation with the environmental problem dur-

ing a hypothetical travel than actual travellers for a real journey. Travellers and non-travellers do not differ with respect to positive emotions at t0,  $t(147) = -.86, p = .39$  (two-tailed).

Thus, travellers and non-travellers may not be equivalent groups with respect to their anticipations of personal reactions to future encounters with environmental problems. This finding is unexpected. Maybe it is the fact that they anticipate more negative experiences that keeps the non-travellers from travelling. However, non-travellers were selected only on the basis that they had not been to the target destination before; they could be frequent travellers to other destinations, they may even have planned to go there in the near future. We did not specifically select people who did not travel in general. Hence, it remains puzzling what the difference between travellers and non-travellers means.

*Mediation analyses t0  $\rightarrow$  t1  $\rightarrow$  t2.* We conducted mediation analyses according to Baron and Kenny (1986) in order to find out whether the relationship between anticipations at t0 (the independent variable) and anticipations at t2 (the dependent variable) are mediated by the experience at t1 (the mediator). In general, we find support for a mediated relationship for life quality and negative emotions, but not for positive emotions. Results are shown in Table 4.

For *impact on life quality*, the independent variable significantly predicts the mediator; the regression of the dependent variable on the independent variable just misses the significance level of .05. The multiple regression of the dependent variable on both the independent variable

and the mediator is significant and the regression weight of the independent variable is smaller than in the previous regression model. Thus, the analysis generally supports the assumption of mediation, except that the second regression model falls short of the conventional significance level.

For *intensity of positive emotions*, the first regression of the mediator on the independent variable does not reach significance so that the conditions for mediation are not met.

*Intensity of negative emotions* shows a pattern of mediation. All three regression models are significant and the regression weight of the independent variable is reduced in the third compared to the second model.

In sum, there is a general pattern that travellers, in contrast to non-travellers, differ in their judgments at t0 and t2. This pattern is very clear for the anticipated impact on life quality. It is less pronounced for the anticipated intensity of positive and negative emotions, but can be discerned for these two variables as well. Travellers differ markedly from non-travellers at t0 in that non-travellers generally anticipate stronger reactions than travellers. At t2, travellers assimilate to non-travellers in their anticipations. This may be due to a learning process; the travel experience may have made the travellers more wary concerning the environmental problem that they encountered during their journey than they had been before their travel. However, we cannot rule out that travellers would have been more concerned about the environmental problem at home than at a travel destination without any travel experience, and that travellers simply distinguish between these two targets, whereas non-travellers do not.

The mediation analyses yielded further evidence for the assumption that travellers adjust their anticipations based on their experiences at the travel destination. For impact on life quality and negative emotions, the relationship between travellers' anticipation at t0 and that at t2 seems to be mediated by the experience during travel at t1.

## 7 Discussion

We investigated emotional reactions that people anticipate and experience with respect to an encounter with an environmental problem such as ozone depletion or severe air pollution. The anticipation of emotional responses to future events and outcomes is often referred to as affective forecasting (Wilson & Gilbert, 2003) and seen as an important determinant of decisions (Loewenstein & Lerner, 2003). A particular feature of our design is that there was no decision involved for our participants, since their decision to travel (or not to travel) had already been

made. We do not know if the environmental problem at their destination had been a concern when they booked their travel. Some decisions during their travel, such as using sun screen, may have been guided by their emotions concerning the consequences of the environmental problem. However, we did not measure such decisions. In this study, we focus on the process of affective forecasting and do not address the relationship between affective forecasting and decision making.

Following Gilbert and Wilson (2007) we maintain that predictions of emotional responses are based on a mental simulation of the future event and that actually experienced emotions are triggered by the perception of the actual event. We addressed three research questions: the accuracy of affective forecasting, the basis of anticipated and experienced emotions, and the adjustment of affective forecasting based on experience.

### 7.1 Accuracy of affective forecasts

With respect to environmental risks, people need to anticipate how serious they will find some environmental damage in order to decide whether they want to prevent it. Our results show that tourists correctly predicted the intensity of positive and negative emotions due to an encounter with ozone depletion in Australia. Regarding a confrontation with severe air pollution in Bangkok, travellers underestimated their reactions to this environmental problem: The experience with the environmental damage reduced positive and increased negative emotions more than they had anticipated before their journey. Such an underestimation of the reaction to environmental damage is likely to produce regret. If people do not expect the environmental problem to affect them seriously, they will probably not be inclined to take preventive actions, so that when the event turns out to be more devastating than expected, they will presumably regret not having done anything about it.

The fact that tourists anticipated their emotional reactions correctly (for ozone depletion) or underestimated their emotional responses (for air pollution) contradicts the pattern that has usually been found in the literature on affective forecasting. The prevalent result is the so-called impact bias (Wilson & Gilbert, 2003). That is, people usually overestimate their emotional reactions and predict to be happier after positive and unhappier after negative events than they actually are when these events take place. The impact bias has typically been found in studies that investigated reactions to personal events such as achievement outcomes or life events. Maybe the affective forecasting for personal events differs from affective forecasting for environmental risks. We assume that it is the causal structure of environmental risks that distinguishes them from personal outcomes. Even though peo-

ple generally show concern over environmental issues, they often feel neither personally responsible nor personally affected by environmental risks (Böhm, 2003; Böhm & Pfister, 2001; Pfister & Böhm, 2001). If the functional basis of the impact bias is to motivate people to strive for positive and to avoid negative outcomes (Gilbert et al., 1998), this motivation should be reduced if the outcomes are judged as uncontrollable and not personally relevant.

Environmental risks differ on important dimensions, for example, the extent to which they can be perceived and experienced directly. Serious air pollution is perceptible and results in immediate impairments of well-being and health-related problems. Ozone depletion, on the other hand, is not perceptible. The information, for example about current UV radiation, is transmitted by the media and the impairment is more indirect in terms of restrictions of freedom; for instance by not being able to spend much time outside, or having to use sun blocker, etc. The more immediate and more readily perceptible impact of air pollution compared to ozone depletion may explain why tourists underestimated their reactions to the former but not to the latter.

## 7.2 The basis of emotional responses

Affective forecasts are assumed to result from a mental simulation of the future event and experienced emotions are assumed to be based on the perception of the event once it has taken place (Gilbert & Wilson, 2007). One prediction that follows is that the correct simulation of the future event is a prerequisite for the accurate anticipation of the emotional response to this event. We measured anticipated and experienced impact of the environmental problem on life quality as indicators of the simulated and experienced event, respectively. We found that the experienced impact on life quality is correctly predicted for ozone depletion and underestimated for air pollution. Hence, the pattern for life quality closely parallels that for emotions, which is compatible with the idea that affective forecasts are generated by mentally simulating the future outcome.

Another prediction that follows is that we should find a close relation between anticipated outcomes and anticipated emotions on the one hand and experienced outcomes and experienced emotions on the other hand. Our results showed a relationship between experienced outcomes and experienced emotions, but less so between anticipated outcomes and anticipated emotions. Regression analyses in which we predicted experienced emotions from anticipated emotions and experienced outcomes similarly showed that experienced outcomes are generally a stronger predictor for experienced emotions than anticipated emotions. One possible explanation is that our outcome measure, the impact on personal qual-

ity of life, captured tourists' experienced outcome at their travel destination in a more comprehensive manner than their mental simulation of the outcome before their travel. Prior to their travel, tourists may have simulated their travel experience as a complex outcome, consisting of diverse aspects such as positive experiences with nature, social encounters, relaxed vacation atmosphere, and many others. The environmental problem that they would encounter was only one of these aspects. Even though we instructed them to focus their anticipations on the environmental problem, the other aspects may still have been part of their mental simulation. The anticipated impact on life quality would then have covered only part of their mental simulation of the event, so that it was only weakly related to the anticipated emotions, which were based on the mental simulation of the complete event. During the journey the experienced impact of the environmental problem on life quality may then have become the dominant aspect of the situation so that it was more closely related to experienced emotions. The fact that tourists generally underestimated the impact of the environmental problem and their emotional reaction to it, at least for air pollution, is compatible with this explanation.

## 7.3 Adjustment of affective forecasting

Our results suggest that travellers adjust their anticipations based on their travel experience. Before their journey, travellers seem to be less concerned about the environmental problem at their destination than non-travellers. Travellers anticipate a less serious decline in life quality and less intense negative emotions at their destination than non-travellers anticipate concerning a hypothetical trip to the same destination. After their journey, travellers' anticipations of how they would react if the same environmental problem were to take place at home approach the level of non-travellers' anticipations. This increase in anticipated impact and negative affect may reflect an adjustment that is made based on the travel experience. This finding is further supported by mediation analyses that showed that the relationship between anticipations made before the travel and anticipations made after the travel was mediated by the actual experience during the travel. Related effects are reported by Västfjäll, Peters, and Slovic (this issue).

Such an adjustment in affective forecasting would be in contrast to existing findings. Wilson et al. (2003a) showed that the impact bias also occurs in retrospect. That is, people overestimate how happy or unhappy they had been after a past event. If people do not recollect their emotional experiences accurately, they have no basis of learning from the experience and cannot be expected to adjust their affective predictions about their reactions to future events. Indeed, Wilson and colleagues (Wilson



et al., 2003a, 2003b) found that experience does not improve the accuracy of affective forecasts, at least not for positive events such as a positive feedback on a test. People who received negative feedback on the test adjusted their predictions concerning future negative events. However, this may not have been due to learning. Rather, participants depreciated the test as a means to cope with their bad result, and then, based on this inference, predicted that another bad result on this test would not make them very unhappy (Wilson et al., 2003b). Hence, the ability to learn from past errors in affective forecasting was limited in these studies.

Not many studies have addressed the question of whether people adjust their affective forecasting when they repeatedly experience the same event. The studies that exist investigated personal outcomes such as test results and usually refer to the impact bias. Adjustment and improved accuracy of affective forecasting, then, means that people moderate their predictions about their reactions to future events. In the present study, however, we did not find an impact bias. People underestimate rather than overestimate their reactions to environmental risks, so that improved accuracy refers to an enhancement rather than to an attenuation of predictions about the reactions to future events. Apparently, environmental risks differ in some fundamental ways from personal events that affect the generation of affective predictions. We have already discussed why the motivational basis for the impact bias may be missing for environmental risks. Another aspect is that the specific environmental problems that our participants encountered on their journey were novel to them. If affective forecasts are generated via some mental simulation of the future event, then the mental simulation is likely to deviate from the actual event in such an unknown situation. The actual experience with the environmental damage then provides new information that may improve the mental simulation and thus the accuracy of predictions about future emotional reactions. Hence, the novelty of the situation and the amount of knowledge that people possess about the future event may well influence the process and the outcome of affective forecasting.

#### 7.4 Anticipated emotions in environmental risk perception

Even though affect and emotions have become a popular topic in the literature on judgment and decision making, they have not much been researched in the area of environmental risks (Böhm, 2003), and even less attention has been paid to anticipated emotions in particular in this domain (Loewenstein & Frederick, 1997). One reason may be that environmental degradation is usually a gradual and delayed process that precludes a comparison of the

anticipated emotions before the event with the actual experience after the environmental change has taken place. By studying tourists, we have found a way to investigate the divergence between anticipated and experienced emotions in a within-subjects design. The drawback of this approach is that tourists are a self-selected group so that the comparison between travellers and non-travellers is a quasi-experimental comparison between groups that may not be equivalent. We cannot think of a remedy for this drawback, unless we receive a grant that allows us to send randomly selected participants to places such as Australia. Even with this drawback, this study rendered valuable results in that we were able to show that affective forecasting may differ in the environmental domain from personal events and to point out some of the dynamics in affective forecasting and in the adjustment of affective forecasts.

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