

Appraisals cause experienced emotions: Experimental evidence

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Recent theories claim appraisals cause emotions. But supporting evidence has been correlational or simulational, leaving doubt about direction of causality and the generalisability of these findings to actual emotional experiences. This study manipulated appraisals of motivational state (relating an event to appetitive vs. aversive motivation) and outcome probability (certain vs. uncertain), and found evidence for some (though not all) hypothesised effects on actual experiences of joy, relief, and hope: Events consistent with pleasure-maximising goals gave rise to joy; events consistent with pain-minimising goals and certain to occur produced relief; and events consistent with pleasure-maximising goals but uncertain led to hope. These findings provide experimental evidence that appraisals do cause experienced emotions.

A number of recent theories claim that cognitions or appraisals cause people to feel emotions (e.g., Frijda, 1986; Lazarus, 1991; Oatley & Johnson-Laird, 1987; Ortony, Clore, & Collins, 1988; Roseman, 2001; Scherer, 2001; Smith & Lazarus, 1990; Stein & Levine, 1987; Weiner, 1985). But evidence cited in support of these theories has come largely from correlational studies (e.g., Frijda, Kuipers, & ter Schure, 1989; Levine, 1996; Roseman, Spindel, & Jose, 1990; Scherer, 1993; Smith & Ellsworth, 1985; Weiner, Graham, & Chandler,

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1982, study 1) or simulation studies (e.g., Roseman, 1991; Smith & Lazarus, 1993; Weiner et al., 1982, study 2).

Correlational studies leave doubt about the direction of causality (Parkinson & Manstead, 1992): perhaps one's emotional response precedes and produces the associated cognitions (see, e.g., Bower, 1981; Zajonc, 1980). There are also some correlational studies that have failed to support appraisal theory predictions (e.g., Parkinson, 1999).

Simulation studies leave doubt about whether the cognitions manipulated in read or imagined scenarios would cause people who are actually in those situations to feel the specified emotions. As noted by Parkinson and Manstead (1993), in such research paradigms subjects may overemphasise the importance of cognitive processes in causing emotions because they are detached observers rather than involved participants who care about the events to which they are reacting; or they may be incorrectly inferring the emotions they would feel in response to an event, based on naive theories rather than real knowledge about the determinants of emotional response.

To address these doubts, experimental research is needed that manipulates participants' appraisals and measures the emotions they actually experience.

There have been some studies that manipulate situational or cognitive factors, in which effects upon emotions might be mediated by appraisals (e.g., Darlington & Macker, 1966; Lewis, Allessandri, & Sullivan, 1990). For example, Lewis et al. taught 2- to 8-month infants to pull a string in order to turn on an appealing stimulus. Withholding the stimulus then led to facial expressions of anger. This finding fits appraisal theory predictions that control potential contributes to anger elicitation (Roseman, 2001; cf. Scherer, 2001). However, as these manipulations were not specifically designed to operationalise appraisal constructs, and appraisals were not measured, there is doubt about whether the theory-relevant appraisals were in fact the crucial mediators.

Other studies have manipulated cognitive determinants of emotion *groups* (e.g., Breier, Albus, Pickar, & Zahn, 1987; Higgins, Shah, & Friedman, 1997; Spiesman, Lazarus, Mordkoff, & Davidson, 1964) or states *related to* emotions, such as learned helplessness (e.g., Hiroto, 1974). For example, Spiesman et al. instructed subjects to view a surgical procedure film as an occasion for joy rather than pain. This decreased viewers' negative emotions. But missing here is evidence of causal links between *appraisals and particular emotions*.

A few studies have manipulated theory-relevant attributions or appraisals (other than positive vs. negative outcome, which has often been shown to contribute to positive vs. negative emotion) and measured specific experienced emotional effects (e.g., Betancourt, 1990; Nerb & Spada, 2001; Smith & Pope, 1992; van Dijk, Zeelenberg, & van der Pligt, 1999; Weiss, Suckow, & Cropanzano, 1999). The latter three find different effects on two or more emotions of the same hedonic sign, providing evidence of appraisals affecting particular emotions, rather than emotion in general or positive versus negative

emotion groups. However, despite the fact that leading theories claim appraisals interact to generate emotions, in only one of these studies are multiple appraisals manipulated: Weiss et al. found that negative outcomes unfair to self engendered anger whereas positive outcomes unfair to others engendered guilt. This is consistent with some appraisal hypotheses (e.g., Scherer, 1988), but does not systematically test the set of determinants of any emotion in any appraisal theory.

THE PRESENT STUDY

In the experiment reported in this paper, we manipulated multiple theory-relevant appraisals (beyond positive vs. negative outcome), and tested predictions about their combined effects on several different emotions. The dependent variables were emotions that subjects were actually experiencing, related to their own well-being in the ongoing situation, rather than recalled, imagined, or inferred emotions.

Source of appraisal theory hypotheses

The predictions that we tested were taken from a theory which proposes that seven appraisals combine to differentiate 17 positive, negative, and neutral-valenced emotions (Roseman, 1984, 2001; Roseman, Antoniou, & Jose, 1996).

For this experiment, we focused on three positive emotions which we thought could be relatively easily and ethically induced (joy, relief, and hope) and the two appraisal determinants (motivational state and outcome probability) that are hypothesised to differentiate among them.

The emotions studied

According to data obtained from subjects recalling experiences of different positive emotions by Roseman, Swartz, Newman, and Nichols (1994), joy, relief, and hope can be differentiated by their phenomenology, actions or action tendencies, and “emotivational” goals (goals pursued when feeling a particular emotion). Joy was characterised by vivid perception, a sense of lightness in one’s movements, feeling like jumping up and down, smiling, celebration, and wanting to make the experience last longer; relief by feelings of tension leaving the body and being able to breathe more easily, thoughts of the worst being over and being safe for the moment, resting, and wanting to get on to something else; and hope by optimistic thoughts, feeling like planning for the future and trying something new, wanting to approach something, and wanting what one was thinking of to happen. For additional theoretical and empirical work on these

emotions, see, for example, Frijda et al. (1989), Izard (1991), Shaver, Schwartz, Kirson, and O'Connor (1987), and Scherer and Wallbott (1994) on joy; Davitz (1969), Derryberry (1988), Frijda et al. (1989), Lazarus (1991), and Mowrer (1960) on relief; and Breznitz (1986), Davitz (1969), Frijda et al. (1989), Lazarus (1991), Mowrer (1960), and Snyder (2000) on hope.

Within the boxes of Figure 1 are shown proposed distinctive aspects of phenomenology, expression, behaviour, goals, and coping strategies for joy, relief, and hope, as well as for the contrasting negative emotions of sadness, distress, and fear (see Roseman, Wiest, & Swartz, 1994, for data relevant to the negative emotions, and Roseman, 1994, for discussion of responses and coping strategies in the complete set of emotions in the model).

Hypothesised appraisal determinants

The appraisal of *motivational state* is a perception of whether what's at stake in a situation is getting less of something painful ("aversive" motivation), or getting more of something pleasurable ("appetitive" motivation). The *probability* appraisal is a perception of whether the occurrence of motive-relevant aspects of a situation is merely possible ("uncertain") or is definite ("certain").

In Figure 1, the appraisal values hypothesised to distinguish each emotion are found by looking at the borders of the chart (here, above and to the left of each emotion box). Thus, as shown in Figure 1, appraising an event as consistent with an appetitive (pleasure-maximising) motive and as certain to occur should result in joy; appraising an event as consistent with an aversive (pain-minimising) motive and as certain to occur should produce relief; and appraising an event as consistent with either an appetitive motive *or* an aversive motive, but uncertain, should result in hope.

It should be pointed out that the type of motive to which an event is related (motivational state: appetitive vs. aversive) is conceptually independent of whether the event is seen as motive-consistent versus motive-inconsistent (the "*situational state*" dimension). As shown in Figure 1, joy, relief, and hope are *all* predicted to result from events appraised as (actually or potentially) motive-consistent. In contrast, appraising an event as (actually or potentially) motive-inconsistent would produce a negative emotion, with the particular negative emotion depending on how the event was appraised on the dimensions of motivational state and probability (and other dimensions, such as control potential, described in Roseman, 2001).¹

To test these predictions, we manipulated appraisals of motivational state (whether subjects would see themselves as wanting to obtain a pleasant outcome

¹ Note that because motivational state and probability combine with situational state to generate emotions, they manipulate what Lazarus and Smith (1988) regard as true appraisal of a situation (perceptions of personal significance), rather than mere knowledge.

	<u>Positive Emotions</u>		<u>Negative Emotions</u>	
	Motive-Consistent	Aversive Motive	Appetitive Motive	Motive-Inconsistent
Uncertain	<p>Hope</p> <p>PHE: potential; eager EXP: brows raised, eyes widened, focused BEH: anticipate, approach EMV: get closer, make happen <prepare to move toward or to stop moving away from it></p>	<p>Relief</p> <p>PHE: amelioration; calming EXP: exhalation, sigh BEH: rest, relax EMV: return to normal <stop moving away from it></p>	<p>Fear</p> <p>PHE: danger; cold, heart pounding EXP: brows raised, straight; eyes wide, lips drawn back BEH: vigilance, inhibition or flight (run) EMV: get to safety, prevent <prepare to move away from or to stop moving toward it></p>	
Certain	<p>Joy</p> <p>PHE: attainment; vivid, light EXP: smile BEH: jump (move), act (do) EMV: sustain <move toward it></p>		<p>Sadness</p> <p>PHE: missing; lethargy, throat lump EXP: weep BEH: inaction EMV: recover <stop moving toward it></p>	<p>Distress</p> <p>PHE: harm; agitated EXP: cry out BEH: move around, leave EMV: terminate, get out <move away from it></p>

Figure 1. Key appraisals and resulting emotional responses proposed to differentiate joy, relief, hope, and contrasting negative emotions (taken from chart of 17 emotions in Roseman, 2001). *Note:* Emotion response components: PHE = phenomenological; EXP = expressive; BEH = behavioural; EMV = emotivational goal. Strategies integrating the response components for each emotion are given in angle brackets. Appraisal combinations eliciting each emotion are shown around the borders of the figure.

vs. avoid an unpleasant outcome) and outcome probability (whether the outcome would be seen as certain vs. uncertain); and measured the extent to which subjects experienced joy, relief, and hope.

METHOD

Overview

Subjects were randomly assigned to one of four experimental conditions or a control condition. Subjects in all experimental conditions were told there would be two groups in the study, which would experience different outcomes; they then rated their preference for being in one of these groups; and then were given information indicating they were going to be assigned to the relatively desirable of their two groups. Within this framework, subjects' motivational state and outcome probability appraisals of the basic situation were manipulated to test hypothesised appraisal-emotion linkages.

Appraisal of the situation in terms of an appetitive (pleasure-maximising) motivational state was produced by telling some subjects that of the two groups in the study, *one group would get a pleasant taste and the other group would get no taste*. Half of these subjects subsequently discovered that they would *definitely be in the pleasant taste group* (Obtain Pleasant Certain condition); the other half learned that they would *probably be in the pleasant taste group* (Obtain Pleasant Uncertain condition).

Appraisal in terms of an aversive (pain-minimising) motivational state was produced by telling other subjects *they would be in either a no taste group or an unpleasant taste group*. Half of these subjects subsequently discovered they would *definitely be in the no taste group* (Avoid Unpleasant Certain condition); the other half learned that they would *probably be in the no taste group* (Avoid Unpleasant Uncertain condition). Control condition subjects were told they had been randomly assigned to a control group rather than a "hypothesis group" and would not be tasting anything. All subjects rated their emotions both before and after the manipulations.

Subjects

A total of 54 female undergraduates from colleges in New York City were recruited for a study of "reactions to possible sensory experiences" via signs, newspaper ads, in-class announcements, and solicitations at semester registration. Because we were studying the effects of appraisals on emotions, employing verbal English-language measures, and videotaping facial expressions,² we

²The facial expression data addresses issues that go beyond the scope of the present paper, and will not be considered further.

accepted only individuals who were not taking any mood-altering drugs, were native English-speakers, and did not need to wear eyeglasses when reading. Subjects were paid \$5 for one hour's participation.

Procedure

When subjects arrived to participate in the experiment, it was framed as a study of reactions to different taste experiences. Subjects were run individually in a room marked "Taste Laboratory". Each subject was greeted by a male experimenter in a white laboratory coat, and seated at a table on which were paper plates, napkins, plastic spoons, cups, and a container labelled "distilled water". Behind the table was a one-way mirror almost completely covered by a silver slide projection screen. When seated upright at the table, the subject could be seen through a 14-cm high uncovered area below the screen, but could not see her own reflection or what was behind the glass.

Each subject was told that she would be assigned at random to one of the groups in a study dealing with the effects of taste on pupil size. She then gave ratings of some current feelings and desires, which, it was explained, also influence pupillary response (this included our pre-test measure of emotion, presented as "practice" for a later measurement), and filled out a questionnaire on taste preferences. The questionnaire began the manipulation of appraisals, and was followed by the post-test measures of emotions and a suspicion assessment, as will now be described.

Manipulation of motivational state appraisal

Appraisal in terms of appetitive motivation. In the taste preference questionnaire, subjects in the two Obtain Pleasant conditions were given a list of 10 foods and drinks often regarded as pleasant, such as premium grade ice cream, chocolate, Roquefort cheese, champagne,³ and freshly squeezed juice. From this list they picked the food or drink they liked the most, and rated how much they liked or disliked tasting it on a 21-point scale ranging from *dislike extremely* (−10) to *like extremely* (+10).

Obtain Pleasant subjects were then told: "This study asks whether people who are tasting pleasant food have a larger pupil size than people who are not tasting anything. Therefore, in this study, you will be assigned to participate in one of two groups. If you are in the Pleasant Taste group, you will taste food that is extremely pleasant and delicious to you. If you are in the No Taste group, you will not be tasting anything."

³ Our description of the champagne mistakenly said it was "1978 Chateau Lafite-Rothschild, Grand Cru Classe (from the Bordeaux-Medoc region)". As has been pointed out to us, this is not a champagne but rather a red wine. None of our college student subjects remarked on this error.

It was explained that in order to achieve sufficient pleasantness to influence pupil size, it was necessary to use foods that would be pleasant to participants and to serve them in a pleasant environment. Therefore, if the subject was assigned to the pleasant taste group, the researchers would pay up to \$25 for her to taste her favourite food in the pleasant atmosphere of the New York City restaurant of her choice. A noninvasive measurement of pupil size would be subsequently taken. Subjects then indicated how much they wanted to be in the pleasant taste group on a 21-point scale ranging from *very much do not want to be in the Pleasant Taste group* (−10) to *very much want to be in the Pleasant Taste group* (+10).

Thus, Obtain Pleasant subjects were led to appraise the situation in terms of appetitive motivation by presenting them with the alternatives of a no taste group versus a pleasant taste group, with the latter involving tasting the listed food they liked most, in a pleasant environment.

Appraisal in terms of aversive motivation. Subjects in the Avoid Unpleasant conditions were given a taste preference questionnaire that listed 10 foods and drinks often regarded as unpleasant, such as sour milk, castor oil, livers, raw eggs, and veal brains. From this list, they picked the food or drink they disliked most, and indicated how much they liked or disliked tasting it (using the same scale as Obtain Pleasant condition subjects).

Avoid Unpleasant subjects were then told: “This study asks whether people who are tasting unpleasant food have a larger pupil size than people who are not tasting anything . . . If you are in the Unpleasant Taste group, you will taste food that is extremely unpleasant and disgusting to you. If you are in the No Taste group, you will not be tasting anything.”

It was explained that so as to achieve sufficient unpleasantness to affect pupillary response, *if* a subject was assigned to the unpleasant taste group, she would taste her most disliked food or drink in the unpleasant environment of the Taste Laboratory of the Eating Disorders Research Center. The disliked food would be “combined with powerful flavour intensifiers . . . developed by scientists who were trying to make ordinary food repulsive in order to treat people with overeating problems. They make bad food taste even more unpleasant and make the taste last longer.” Subjects then indicated how much they wanted to be in the unpleasant taste group on a 21-point scale ranging from *very much do not want to be in the Unpleasant Taste group* (−10) to *very much want to be in the Unpleasant Taste group* (+10).

Thus, Avoid Unpleasant subjects were led to appraise the situation in terms of aversive motivation by presenting them with the alternatives of a no taste group versus an unpleasant taste group, with the latter involving tasting the listed food they disliked most, combined with flavour intensifiers that would make it taste even more unpleasant.

Control condition. Control condition subjects were asked to list three foods or drinks that were neutral to them (not particularly liked or disliked). They then rated how often they ate or drank each one.

Manipulation of outcome probability appraisal

Subjects in the four experimental conditions were then told that during the experimental session they would get two random numbers from 1 to 9. “If the two numbers add up to 7 or more”, the subject would be put into (what had been confirmed in pilot testing to be) the relatively desirable of her two possible groups (the “Pleasant Taste” group for Obtain Pleasant subjects; the “No Taste” group for Avoid Unpleasant subjects). “If the two numbers add up to less than 7”, then she would be in the relatively undesirable of her two groups (the “No Taste” group for Obtain Pleasant subjects; the “Unpleasant Taste” group for Avoid Unpleasant subjects). The words “desirable” and “undesirable” were not used in communications to subjects—only the quoted group names were used.

The subjects then immediately found their first number by looking at and circling a specified cell of a random number table. Subjects in the two Certain outcome conditions found an 8, which meant that they would definitely be in the relatively desirable of their two groups. Subjects in the Uncertain outcome conditions found a 5, which meant that they would probably be in the relatively desirable of their two groups.⁴

As a manipulation check, subjects were presented with the following paragraph: “To make sure you have understood the instructions above, look at the number you have just circled. Then indicate (with a ✓) the group you will be in.” For Obtain Pleasant Certain and Obtain Pleasant Uncertain subjects, the four choices were: “Definitely in the Pleasant Taste group/Definitely in the No Taste group/Probably in the Pleasant Taste group/Probably in the No Taste group.” For subjects in the two Avoid Unpleasant conditions, the word “Unpleasant” replaced “Pleasant” in these choices. Manipulation check data are presented in the results section, below.

⁴The “random process” we used (getting two numbers from 1 to 9 that sum to 7 or more) creates an objective probability of .81 for obtaining a positive outcome. We used this (rather than .5) to make it more likely that both Obtain Pleasant and Avoid Unpleasant subjects would appraise the potential outcome as motive-consistent, in accord with Figure 1’s prediction that joy, relief, and hope all result from envisioned motive-consistent outcomes. For subjects in the two Certain conditions, getting an 8 as their first number raised the objective probability of a motive-consistent outcome to 1.00. For subjects in the two Uncertain conditions, getting a 5 as their first number raised this probability to .89 (more probable, but still uncertain). Percentage probability information was not explicitly provided to subjects, but their understanding of the theory-relevant appraisal implications was checked, as described below.

Subjects in the four experimental conditions were then reminded that they would receive their “second number (from 1 to 9) later in the session today”, and no subjects questioned this process.

Subjects in the Control condition read that “Most psychology studies involve two groups of participants” ... “a ‘hypothesis’ group”, and a “control group” which “tells us how people would normally behave if they were not participating in the study”. Instead of receiving a random number and answering the manipulation check question, they were told: “You have randomly been selected to participate in the ‘No Taste’ control group.”

Distinguishing aspects of all manipulations were given in writing, so that the experimenter was blind to a subject’s condition until the debriefing.

Measuring of emotional response

Dependent measures. Before and after the manipulations, subjects were asked “To what extent do each of the following describe what you are feeling *right now at this moment?*” They rated the extent to which they felt joy, hope, relief, anger, fear, and sadness, on 11-point scales ranging from *not at all* (0) to *extremely* (10). All subjects rated the six emotions in the order just listed (randomly determined, except that positive emotions, of focal interest in this study, were presented first) at pre-test and post-test.⁵

Supplementary questions. After the post-test rating, subjects were asked which one of the six emotions they felt most in response to the study; whether they felt some other emotion that had not been listed; and why they felt the way they did. Unlike the emotion-rating data, answers to these questions yielded information on only one emotion (out of six) per subject, and gave no information on the degree to which any of the emotions were felt. The questions were also more remote in time from the appraisal manipulations and focused subjects on their responses to the study as a whole, rather than the appraisal manipulations in particular. As they were less complete, less sensitive, and less precise, these responses were used only to supplement the emotion-rating data, and will not be reported in detail.

⁵Ratings of sadness, fear, and anger were included to assess common negative emotional reactions that subjects might unexpectedly have to the study, as well as to reduce demand characteristics and make the focus of measurement less obvious. As we were not intending to create conditions in which negative emotions would be felt, no predictions were made for these emotions, and analysis of these data was minimal. However, we will report mean sadness, fear, and anger ratings for each condition, and use them to assist in the interpretation of our main results where appropriate.

Assessment of suspicion

Finally, the subject was asked two questions to allow the experimenter to assess if she suspected the experiment was in fact a study of emotions,⁶ and was then given a thorough debriefing. The two subjects who were given scores of 4 or higher on a 7-point suspicion scale were dropped from the study, as were two other subjects who did not receive the proper outcome probability manipulations due to procedural errors.

RESULTS

Taste and group preference and appraisal manipulation check data

Taste preference. For each appraisal manipulation condition, the first numeric column in Table 1 shows subjects' ratings of how much they would like tasting the food or drink they had selected as their most liked (or, in the Avoid

TABLE 1
Taste preference, group preference, and perceived group, for each appraisal manipulation condition

Appraisal manipulation condition	Mean liking of food or drink	Mean preference for food tasting group ^a	N saying they would be in each group on manipulation check					
			DP	PP	DN	PN	DU	PU
Obtain Pleasant Certain	9.10	7.40	10	0	0	0	–	–
Obtain Pleasant Uncertain	9.00	7.90	0	10	0	0	–	–
Avoid Unpleasant Certain	–9.60	–7.80	–	–	9	1	0	0
Avoid Unpleasant Uncertain	–9.00	–5.60	–	–	0	6	1	3
Control	–	–	–	–	–	–	–	–

Note: DP = definitely in the Pleasant Taste group; PP = probably in the Pleasant Taste group; DN = definitely in the No Taste group; PN = probably in the No Taste group; DU = definitely in the Unpleasant Taste group; PU = probably in the Unpleasant Taste group. Dashes indicate that a particular alternative was not presented in a particular condition.

^aThe “Pleasant Taste group” for the two Obtain Pleasant conditions; the “Unpleasant Taste group” for the two Avoid Unpleasant conditions.

⁶First, at the end of the booklet containing the dependent measures was a page with the following instruction: “In the space below please write *at least one sentence* describing your reactions to this experiment so far”. Then, before explaining the study to the subject, the experimenter asked: “There is more to this study than what has been revealed so far and I am curious if you have any idea what it might be?”

Unpleasant conditions, their most disliked). An a priori contrast test comparing the two Obtain Pleasant conditions (contrast weights = +1) to the two Avoid Unpleasant conditions (contrast weights = -1; see Rosenthal & Rosnow, 1985) confirmed that Obtain Pleasant subjects anticipated greater liking for their selected food, $t(16.5) = 31.10$, $p < .001$ (separate variance estimate). Newman-Keuls multiple comparison tests on the absolute values of these scores (equating liking and disliking to compare the *strength* of taste preference among the four experimental conditions) showed no significant differences. Thus, as intended, the envisioned pleasant tastes were much preferred over the unpleasant tastes, and there were no differences in strength of taste preference among conditions.

Group preference. For each appraisal manipulation condition, the second numeric column in Table 1 shows subjects' ratings of how much they wanted to be in the group in which they would be tasting food. Consistent with their taste preferences, an a priori contrast test comparing the two Obtain Pleasant conditions (contrast weights = +1) to the two Avoid Unpleasant conditions (contrast weights = -1) confirmed that Obtain Pleasant subjects showed a greater preference for being in their food-tasting group, $t(28.4) = 11.18$, $p < .001$ (separate variance estimate). Newman-Keuls multiple comparison tests on the absolute values of these scores (equating preference for being in the pleasant taste group and preference for *not* being in the unpleasant taste group, to compare strength of group preference) showed no significant differences among the four experimental conditions. Thus, although the strength of group preferences may have been less than the strength of taste preferences (compare numeric columns 1 and 2 in Table 1), Obtain Pleasant subjects showed equally strong group preferences as Avoid Unpleasant subjects, and preferences were in the intended direction. The correlation between subjects' taste preference and group preference ratings was .86 ($p < .001$).

Perceived group. The remaining columns of Table 1 show subjects' perceptions of their group assignment at the conclusion of the manipulations, just before emotion measurement. As may be seen in the first three rows, the 10 subjects in the Obtain Pleasant Certain condition and the 10 in the Obtain Pleasant Uncertain condition all perceived their situations as intended by the appraisal manipulations, as did 9 of 10 in the Avoid Unpleasant Certain condition. However, as shown in the fourth row, only 6 of 10 in the Avoid Unpleasant Uncertain condition perceived their situation as intended (a significantly lower proportion than in either Obtain Pleasant condition, $z = 1.68$, $p < .05$). One Avoid Unpleasant Uncertain subject said that she would definitely be in the unpleasant taste group, and three said they would probably be in the unpleasant taste group. Implications of these unintended appraisals for subjects' emotions will be discussed below.

Calculation of adjusted standardised emotion means

The dependent measures used in the main analyses presented here are subjects' adjusted standardised ratings of their emotions upon completion of the appraisal manipulations (just after the subject received the information indicating that she would definitely or probably be assigned to a particular group). That is, subjects' postmanipulation ratings for each emotion were transformed to standard score form (to facilitate comparisons across emotions) and then adjusted by covarying out their standardised premanipulation ratings for the same emotion.

The columns in Table 2 show the means for the various emotions, for all appraisal manipulation conditions. Each cell in Table 2 presents, for a given appraisal manipulation condition and emotion, the raw premanipulation mean, the raw postmanipulation mean, the adjusted postmanipulation mean, and the adjusted standardised postmanipulation mean, with the latter value shown in italics.

The use of adjusted scores allowed us to take account of chronic individual differences among subjects in emotional predispositions (emotion traits; see, e.g., Kagan, 1992; Rothbart, 1994) as well as shorter-term variations in emotions (daily or more transient emotion states; see, e.g., Clark, Watson, & Leeka, 1989; Zelenski & Larsen, 2000).⁷

Tests of appraisal manipulation predictions for particular emotions

Theoretical predictions were tested by separate analyses of covariance for joy, relief, and hope. In all these analyses, the independent variable was Appraisal Manipulation Condition (Obtain Pleasant Certain/Obtain Pleasant Uncertain/Avoid Unpleasant Certain/Avoid Unpleasant Uncertain/Control). For each analysis, the dependent variable was the standardised postmanipulation intensity rating for a particular emotion, and the covariate was the standardised premanipulation rating on that same emotion.

In each ANCOVA, a vector of contrast weights specified the predicted relative intensities of the means for a given emotion in the various appraisal manipulation conditions. These theory-testing contrast weights are shown in the

⁷Newman-Keuls multiple comparison tests showed only one significant difference between groups in premanipulation emotions: Obtain Pleasant Certain subjects had lower premanipulation fear than Control group subjects. This was irrelevant to tests of hypotheses concerning joy, relief, or hope; and results of the contrast test on between-group differences in fear, reported below, are the same whether adjusted (by premanipulation scores) or unadjusted fear scores are used as the dependent variable.

TABLE 2
Mean emotion scores in each appraisal manipulation condition

Appraisal manipulation condition	Measure	Emotion rated					
		Joy	Relief	Hope	Sadness	Anger	Fear
Obtain Pleasant Certain	pre	3.60	3.40	4.80	2.00	0.90	0.90
	post	4.60	4.10	5.30	1.80	1.10	1.20
	adj	5.12	4.24	5.44	1.83	1.39	2.40
	adjz	0.30	-0.13	0.03	-0.03	0.04	-0.13
Obtain Pleasant Uncertain	pre	5.30	5.40	4.90	2.10	1.70	3.10
	post	6.10	5.50	6.60	1.40	1.60	2.40
	adj	5.23	4.77	6.67	1.35	1.31	2.23
	adjz	0.34	0.09	0.54	-0.26	-0.01	-0.20
Avoid Unpleasant Certain	pre	4.50	3.10	5.40	1.90	1.00	2.90
	post	4.30	5.90	5.50	1.30	1.00	2.10
	adj	4.09	6.17	5.27	1.41	1.22	2.05
	adjz	-0.15	0.67	-0.04	-0.23	-0.06	-0.27
Avoid Unpleasant Uncertain all subjects ($n = 10$)	pre	4.20	3.20	5.30	2.40	1.70	3.40
	post	3.40	3.30	4.50	3.20	1.60	4.60
	adj	3.43	3.53	4.33	2.93	1.31	4.24
	adjz	-0.44	-0.43	-0.42	0.49	-0.01	0.59
subjects reporting they would probably be in the no taste group, as intended ($n = 6$)	pre	4.67	3.33	6.17	2.17	2.00	3.50
	post	4.00	3.17	5.83	3.00	1.83	4.50
	adj	3.65	3.34	5.18	2.90	1.33	4.07
	adjz	-0.34	-0.51	-0.07	0.48	0.00	0.52
subjects reporting they would probably be in the unpleasant taste group ($n = 3$)	pre	3.33	3.00	3.67	3.67	1.67	2.67
	post	2.33	2.00	2.67	4.33	1.67	5.33
	adj	3.07	2.31	3.47	3.11	1.40	5.43
	adjz	-0.59	-0.94	-0.78	0.57	0.05	1.05
Control	pre	3.60	3.50	4.70	1.80	2.00	3.80
	post	3.80	4.00	4.90	1.80	1.30	3.40
	adj	4.32	4.10	5.10	1.98	1.37	2.79
	adjz	-0.05	-0.19	-0.11	0.04	0.03	0.02

Note: Pre = unadjusted raw premanipulation emotion scores; Post = unadjusted raw postmanipulation emotion scores; Adj = adjusted raw postmanipulation emotion scores. Adjz = adjusted standardised postmanipulation emotion scores. $N = 10$ in each condition.

columns of Table 3. For example, as shown in the first column of the table, joy was predicted to be higher in the Obtain Pleasant Certain condition (contrast weight = +4) than in the other four conditions (contrast weights = -1). Each analysis employed its weights to calculate a directional (one-tailed) t -statistic indicating whether the observed means conformed significantly to the predicted pattern (Rosenthal & Rosnow, 1985).

TABLE 3
 Contrast weights for tests of predicted relationships between appraisals and emotions

<i>Appraisal manipulation condition</i>	<i>Emotion rated</i>		
	<i>Joy</i>	<i>Relief</i>	<i>Hope</i>
Obtain Pleasant Certain	+4	-1	-2
Obtain Pleasant Uncertain	-1	-1	+3
Avoid Unpleasant Certain	-1	+4	-2
Avoid Unpleasant Uncertain	-1	-1	+3
Control	-1	-1	-2

Joy. Results of the theory-testing contrast test for joy were of marginal significance, $t(44) = 1.51, p < .10$. Residual variation in joy scores beyond the contrast was also marginal significant, $F(3, 44) = 2.24, p < .10$. This appears to reflect the fact that joy was elevated not only in the Obtain Pleasant Certain condition, as had been predicted, but also in the Obtain Pleasant Uncertain condition (see Table 2). Additional contrast tests indicated that joy was indeed significantly higher in Obtain Pleasant than in Avoid Unpleasant conditions, $t(44) = 2.85, p < .01$, but there were no significant differences in joy between the Obtain Pleasant Certain and Obtain Pleasant Uncertain conditions, $t(44) = -0.14, n.s.$

Relief. For relief, the theory-testing contrast test was significant, $t(44) = 2.73, p < .01$. That is, relief was significantly greater in the Avoid Unpleasant Certain condition than in the other four conditions, as predicted. Residual variation here was not significant, $F(3, 44) = 0.66, n.s.$

Hope. According to the model shown in Figure 1, hope should be elevated in both the Obtain Pleasant Uncertain and the Avoid Unpleasant Uncertain conditions. But the contrast testing these two conditions against the other three failed to find significant support for this prediction, $t(44) = 0.41, n.s.$ Residual variation was marginally significant, with $F(3, 44) = 2.43, p < .10$.

As shown in the italicised rows, means in the third column of Table 2, hope was relatively high ($M = 0.54, SD = 0.26$) in the Obtain Pleasant Uncertain condition, as predicted, but low ($M = -0.42, SD = 0.26$) in the Avoid Unpleasant Uncertain condition, contrary to predictions. A contrast test confirmed that hope was significantly higher in the Obtain Pleasant Uncertain

condition than in the Obtain Pleasant Certain, Avoid Unpleasant Certain, and Control conditions, $t(44) = 1.97, p < .05$, as predicted. Residual variation after this contrast was not significant, $F(3, 44) = 1.20, n.s.$ ⁸

Rather than showing high hope, the means in Table 2 suggest that Avoid Unpleasant Uncertain subjects felt sadness ($M = 0.49, SD = 0.17$) and fear ($M = 0.59, SD = 0.24$). Could this be due to the subjects who failed to perceive the manipulations as intended (as noted in the results for "Perceived Group", above)? Below the means for all 10 subjects in the Avoid Unpleasant Uncertain condition, Table 2 gives means for the subset of six subjects who reported they would probably be in the no taste group (the appraisal pattern we intended to create) and the subset of three subjects who reported they would probably be in the unpleasant taste group (an unintended appraisal pattern).

As can be seen in the table, even those subjects who, as intended, thought they would probably be in the no taste group (rather than the unpleasant taste group) did not feel hope ($M = -0.07, SD = 0.33$), but rather some degree of sadness ($M = 0.48, SD = 0.23$) and fear ($M = 0.52, SD = 0.31$). *T*-tests using the Tukey-Kramer adjustment for multiple comparisons showed only the sadness mean to be significantly different from zero ($p < .05$).

In contrast, those subjects who thought that they would probably be in the unpleasant taste group also felt these two negative emotions, but with somewhat greater fear ($M = 1.05, SD = 0.43$) than sadness ($M = 0.57, SD = 0.33$). Indeed, for these subjects, only the fear mean was significantly elevated ($p < .05$). This is consistent with the model shown in Figure 1, which claims that fear is produced by uncertainty about a motive-inconsistent outcome. A directional contrast test provided significant support for the hypothesis that fear would be greater for these subjects (contrast weight = +5) than for other Avoid Unpleasant Uncertain subjects and subjects in the Obtain Pleasant Certain, Obtain Pleasant Uncertain, Avoid Unpleasant Certain, and Control conditions (contrast weights = -1), $t(43) = 2.45, p < .01$.

⁸ Similar conclusions emerge if motivational state and probability are entered as separate factors in a 2×2 analysis of covariance. The ANCOVA shows: (a) no significant Motivational State \times Probability interaction, but a significant motivational state main effect on joy, $F(1, 35) = 7.04, p < .05$, reflecting the greater joy reported by subjects in the Obtain Pleasant conditions; (b) a significant Motivational State \times Probability interaction effect on relief, $F(1, 35) = 5.55, p < .05$, reflecting the greater relief reported by subjects in the Avoid Unpleasant Certain condition; and (c) a not quite marginally significant Motivational State \times Probability interaction effect on hope, $F(1, 35) = 2.78, p = .10$, reflecting somewhat greater hope felt by Obtain Pleasant Uncertain subjects.

DISCUSSION

Experimental evidence that appraisals cause emotions

Consistent with the particular appraisal model that we tested:

1. Leading subjects to perceive a situation as affecting an appetitive motivational state (the desire to obtain a pleasant taste) rather than an aversive motivational state (the desire to avoid an unpleasant taste) resulted in relatively high joy ratings.
2. Leading subjects to perceive that an aversive motivational state had definitely been avoided resulted in relatively high ratings of relief.
3. Leading subjects to perceive that an appetitive motivational state would probably be attained resulted in relatively high hope ratings.

Thus, results from the present study provide some evidence that appraisals cause experienced emotions, as appraisal theorists have contended. Moreover, these findings support specific predictions about the determinants of particular emotions made by a particular appraisal theory (Roseman, 1984, 2001; Roseman et al., 1996).

The evidence obtained from this experimental paradigm helps fill a gap in the testing of appraisal theories. Whereas many prior studies have assessed supposed causal relationships by measuring both appraisals and emotions (e.g., asking subjects to rate the thoughts and feelings that they had during a recalled event), in this study multiple appraisals were manipulated and the effects upon several different emotions were measured. These findings argue against the possibility that appraisal-emotion relationships arise simply because emotions cause appraisals, or result from some third factor (e.g., physiological processes) producing both appraisals and emotions. Of course, our findings do not contradict the claim that emotions also influence appraisals. Indeed, there is reason to believe that both causal processes take place (for evidence that emotions influence appraisals see, e.g., Gallagher & Clore, 1985; Keltner, Ellsworth, & Edwards, 1993).

Moreover, in the present study, the appraisal manipulations affected subjects' own ongoing emotions, in contrast to simulation studies that test appraisal-emotion relationships by asking subjects to infer the emotions of characters in a story (e.g., Roseman, 1991; Weiner et al., 1982, study 2); and in this study, subjects' emotions occurred in response to a situation with which they were actually confronted, rather than one that they were imagining (Smith & Lazarus, 1993). Our findings thus address a variety of criticisms directed against such simulation studies.

For example, Parkinson and Manstead (1993) suggested that appraisals might have less causal influence on emotions if subjects were involved participants in a situation rather than detached observers. In the present study, however, subjects who were told they might be tasting something were indeed involved participants, expressing fairly strong preferences for getting no taste rather than an unpleasant taste, and a pleasant taste rather than no taste, giving mean ratings of -7.8 , -5.6 , $+7.4$, and $+7.9$ on -10 to $+10$ group preference scales (as shown in Table 1), and making such comments as: “If I have to eat veal brains, I think I will die.”

Predictions not supported

Not all of the predictions from our appraisal model were supported by the data we collected. Contrary to hypotheses:

1. Subjects led to perceive that attaining an appetitive state was probable felt as much joy as subjects led to perceive that this was certain.
2. Subjects led to perceive that avoiding an aversive state was probable did not feel hope.

With regard to the first of these findings, why didn't subjects who believed that they would definitely be in a pleasant taste group experience more joy than subjects who thought that this outcome was merely probable?

One possibility is that the two groups of subjects had relatively similar experiences, in that both received two pieces of good news over the course of the experiment:⁹ (1) that they had a chance to get a pleasant taste, as explained in the motivational state manipulation; and (2) that their chances increased when they received their first random number. Each such piece of news may be thought of as a motive-consistent outcome, and hence result in joy.

Appraising the receipt of the first random number in terms of *subjective goals* unforseen by the researchers may provide an explanation for the second unpredicted finding. That is, subjects who were told that they would get an unpleasant taste unless their two random numbers summed at least to 7 may have set their sights on getting a 7, 8, or 9 as their first number so as to get into the no taste group. If so, Avoid Unpleasant Uncertain subjects, whose first number was a 5, might perceive this not as a potentially positive outcome which gave them an increased chance of avoiding the unpleasant taste, but rather as a definite failure to receive a number that they wanted. According to Figure 1, appraising the situation as one in which a desired event certainly did not occur would lead to feeling sadness—the emotion that received significantly elevated

⁹ We are grateful to Brian Parkinson for suggesting this possibility.

ratings from Avoid Unpleasant Uncertain subjects who indicated they would probably (though not definitely) be in the no taste group.¹⁰

With or without such subjective goal-setting, the emotions reported by these subjects may reflect a focus on the event of getting their first random number, rather than the probable consequence of that event at some time in the future. This may have happened because we measured subjects' emotions just after they received their random number, when this event was fresh and salient. Had we measured emotions a little later, subjects may have shifted their appraisal focus to the imminent taste experience.

If so, cognitive focus could provide a parsimonious explanation for the two theory-discrepant findings. Obtain Pleasant Uncertain subjects felt more joy than was predicted insofar as they focused on the very recent event of getting a good first random number. Avoid Unpleasant Uncertain subjects did not feel hope insofar as they focused on the very recent event of getting a first random number that failed to neutralise the threat, rather than the more remote and positive future implications of that event. Of course, this explanation is post hoc, and would need to be evaluated by further research manipulating cognitive focus and measuring emotional response.

And what of those subjects who believed, despite the information given, that they were likely to get an unpleasant taste? According to the appraisal theory tested in this study (see Figure 1), either hope or fear can be experienced in response to uncertainty about an aversive event. Which emotion is experienced is determined by an appraisal of motive-consistency versus -inconsistency. Manipulation check data from the present study fit this formulation. As was described in the results section, those subjects from the Avoid Unpleasant Uncertain condition who indicated they would probably be in the unpleasant taste group felt fear instead of hope, and higher fear than all other subjects in the study—as our appraisal model would predict.¹¹

Note that in everyday experiences, people sometimes *do* appear to feel hope that aversive events will not occur. For example, in a study by Roseman et al. (1990), although 62% of subjects recalling hope experiences felt this emotion in response to events that they related to appetitive motives, another 24% of

¹⁰ As was shown in Table 2, these subjects may also have felt some fear, perhaps because the first number they received did not get them out of danger. However, as was noted in results above, the elevation in their fear scores did not reach significance. We are grateful to Brian Parkinson for pointing out that appraisals may have been affected both by the most recent information subjects received (e.g., getting their first random number in the outcome probability manipulation) and by their perception of the overall situation (e.g., whether they were still in danger).

¹¹ As was shown in Table 2, some sadness may also have been felt by Avoid Unpleasant Uncertain subjects who thought they would probably be in the unpleasant taste group, perhaps because they failed to get a first number that would get them into the group they wanted. However, as noted in results above, this elevation in sadness scores did not reach significance.

subjects said they felt hope about minimising aversive events (e.g., that the military draft would be avoided, or that a loved one would not die from cancer).¹² Similarly, in the present study, one subject in the Avoid Unpleasant Uncertain condition reported feeling hope after getting her first random number because: “I don’t want to taste intensified liver”, and another subject, explaining her emotional response to the study, said: “I very adamantly hope that I am not chosen to be a number of the Unpleasant Taste Group, because I hate the texture of raw eggs, and the taste of raw eggs.”

Limitations of the evidence in support of appraisal theory

Although several theoretical predictions were supported by our data, the effect sizes observed were low. The values of η^2 associated with the theory-testing contrasts were, for joy .05, for relief .14, and for hope .00 (.08 for the Obtain Unpleasant Uncertain condition alone). This may indicate that the emotions of participants were affected by a variety of factors in addition to the manipulations, such as features of the experimental situation, associations or memories triggered by the situation, or thoughts about events outside the context of the experiment. For example, in explaining their emotional responses to the study, individual participants mentioned such things as joy about participating in a psychology study for the first time, relief that the study did not involve electric shocks, hope to find out more about the study, fear of the unknown, fatigue, and anger about “my life”.

It is also possible that subjects’ emotion ratings were influenced by factors other than their true emotions. For example, subjects might have only limited awareness of their true feelings, or might have reported feeling the emotions they believed we wanted them to feel, or reported an emotion that they did not feel in order to achieve an interaction goal (e.g., reporting fear to provide a rationale for withdrawal from the study). These possibilities are difficult to evaluate with self-report data, and point to the desirability of supplementing self-reports with other sources of information about emotional states, such as facial expression and physiological measures.

¹² The percentages cited were calculated from subjects’ own ratings of questions measuring the aversive/appetitive motivational state appraisal in the Roseman et al. (1990) study. That is, we disaggregated the data from the group of subjects recalling hope experiences, categorising subjects whose ratings were above the scale midpoint as relating the event to pleasure-maximising motives, and subjects whose ratings were below the scale midpoint as relating the event to pain-minimising motives. The remaining 14% of subjects felt hope in response to events that they rated as midway between appetitive and aversive motives (see Roseman et al., 1990, for details of scale construction).

Of course, these alternative measures also have their limitations. For example, researchers have reported difficulty identifying physiological variables that distinguish one emotion from another across situations and individuals (see, e.g., Cacioppo, Klein, Berntson, & Hatfield, 1993). With facial expression, even though distinctive patterns have been established for some basic emotions, as with Ekman and Friesen's (1978) Facial Action Coding Scheme (FACS), and expression may often correspond to emotion state (see, e.g., Ekman, 1993; Laird & Bresler, 1992), some studies suggest that emotion may also be experienced without visible expression, and expressive movements simulated without emotional experience (see, e.g., Duclos & Laird, 2001; Reisenzein, 2000; Tourangeau & Ellsworth, 1979). These problems are compounded when emotions other than those most frequently studied (e.g., other than the seven FACS-coded affects) are the focus of investigation, as is the case in this research.

Finally, it is unclear how much we can generalise from this particular situation to the universe of instances in which emotions are experienced. Appraisals may be less important determinants of emotional response in some situations than they were in this experiment. For example, physiological processes may sometimes affect emotions independently of appraisal, as when depression is produced endogenously by neurotransmitter dysfunction or alleviated by psychoactive drugs (see Izard, 1993, for a discussion of several nonappraisal mechanisms which might generate emotions). In the course of social interaction, emotional expressions or other cues from interaction partners might affect emotions directly (see Hatfield, Cacioppo, & Rapson, 1994), or indirectly, for example by influencing the motivation to experience particular emotions (see Parkinson, 1997, for discussion of the view that the appraisal-emotion connection might not be as tight as some appraisal theorists have contended).

In other situations, appraisal may have a greater impact on emotions than it did here. If a person appraised some ongoing event as affecting an important interpersonal relationship, or as indicating a significant change in material well-being, or as bearing upon survival itself—that is, if appraisal yielded implications for any concern that is more important than the pleasant or unpleasant taste experience at stake in the present study—a much greater impact on emotions might be seen. Consider, for example, the effect upon emotions if a random number one received was appraised as indicating that a million dollar lottery had been won, or that conscription into military service had been avoided).

Overall—although effect sizes were small, not all predictions were supported, and it is possible that emotion ratings were affected by factors other than subjects' true emotions—the data indicate that our appraisal manipulations were fairly successful and show significant support for a number of predictions about appraisal determinants of joy, relief, and hope. In terms of face validity, most subjects' emotions were plausibly related to their appraisals of the experimental situation (e.g., thinking one would probably be in a no taste group rather than an

unpleasant taste group, and feeling relief), and most free response explanations of emotional reactions were consistent with the appraisal-emotion relationships revealed by data analyses (e.g., feeling relief because “I do not have to taste an unpleasant food or drink”). Moreover, the fear felt by subjects who thought (despite the information given) that they would probably get an unpleasant taste is consistent with the contention of appraisal theorists that it is the *interpretation* of events, rather than events *per se*, that determines emotional response (see Roseman & Smith, 2001).

Issues of validity and generalisability can be further addressed by additional research, and we now turn to a consideration of possible research directions.

Future research

Results of our study suggest at least three areas in which further research would be valuable.

Factors that influence appraisal. As suggested in the discussion of our results for joy and hope, research is needed on the determinants of cognitive focus and resulting appraisals. To date, appraisal theories have primarily concentrated on specifying which patterns of appraisal lead to which emotions, and they have achieved significant success in this endeavour. But however valuable is that achievement, it tells only half the story of the causation of emotions. To fully account for and predict emotional responses, we must also understand why a given individual in a given situation makes particular appraisals (see, e.g., Roseman, 2001; Smith & Kirby, 2001).

Based on participants' responses to our experimental situation, we suggested that subjective goal framing and outcome recency can influence which outcomes people focus on and whether an uncertain situation will be appraised as motive-consistent or as motive-inconsistent. Research is needed to test whether such factors do indeed affect appraisal and consequent emotional response.

Other potential influences on appraisal also merit investigation. For example, as was briefly mentioned in discussing the determinants of hope versus fear, a situational variable of special relevance to motive-consistency appraisals under conditions of uncertainty may be the imminence (nearness in future time) of an event. In a survey study, Averill, Catlin, and Chon (1990, p. 20) found that hope increased as the imminence of events increased. However, these authors did not also study fear reactions to the same events, or the relative predominance of hope versus fear. Extrapolating from Brown's (1948) classic finding that avoidance tendency increases faster than approach tendency as an approach/avoidance goal situation is neared, it may be predicted that increasing imminence will cause people to focus increasingly on the possible motive-inconsistent occurrence of an aversive outcome rather than its motive-consistent nonoccurrence. For example, as the time of receiving the results of a biopsy

approached, people might increasingly focus on the possibility that the tissue would turn out to be malignant, and thus feel fear more often or more intensely than hope. As discussed in Paterson and Neufeld (1987), data gathered by Breznitz (1967) and Monat (1976) support the thesis that increasing imminence of an aversive event increases fear (see also Fanselow & Lester, 1988, who propose that the increasing imminence of a predator increases the intensity of fear, e.g., in rats; and Craske, 1999, who proposes that increasing threat imminence underlies a progression from more preferred modes of behaviour to fear and panic among people).

There are additional factors that are worthy of further study insofar as they may affect the emotion-generating appraisals discussed in this paper. These include dispositional optimism versus pessimism (e.g., Scheier & Carver, 1985; Scheier, Weintraub, & Carver, 1986), positive versus negative mood (e.g., Bower & Forgas, 2000; Mayer, Gaschke, Braverman, & Evans, 1992), goal commitments (Smith & Pope, 1992), culture- and experience-based appraisal schemas and emotion-elicitation scripts (see, e.g., Beck, 1983; Buchanan & Seligman, 1995; Fletcher & Fitness, 1996; Mesquita & Frijda, 1992; Rodriguez Mosquera, Manstead, & Fischer, 2000; Roseman, Dhawan, Rettek, Naidu, & Thapa, 1995; Tomkins, 1991), and strategies for emotion regulation (see, e.g., Dunkel-Schetter, Feinstein, Taylor, & Falke, 1992; Folkman & Lazarus, 1985; Norem & Cantor, 1986; Pyszczynski, 1982; Scheier & Carver, 1993; Winter & Kuiper, 1997).

Further experimental tests on the determinants of joy and hope. Although we have offered explanations for why our Obtain Pleasant Uncertain subjects felt unexpectedly high joy and Avoid Unpleasant Uncertain subjects felt unexpectedly low hope, additional experimental tests are needed to conclusively determine whether certainty (as opposed to uncertainty) about obtaining appetitive stimuli produces joy, and uncertainty about avoiding aversive stimuli (as well as uncertainty about obtaining appetitive stimuli) produces hope. If there is merit to claims about the importance of hope for successful coping (e.g., Breznitz, 1986; Snyder, Cheavens, & Michael, 1999), it is of special importance to firmly empirically establish the determinants of this insufficiently studied emotion.

Experimental tests of the determinants of other emotions. Finally, although the present study provides some evidence that appraisals cause emotions, additional experimental tests are needed of the hypothesised appraisal determinants of emotions not examined here (e.g., those specified by Frijda, 1986; Oatley & Johnson-Laird, 1987; Ortony et al., 1988; Reisenzein & Hofmann, 1990; Roseman, 2001; Scherer, 2001; Smith & Lazarus, 1990; and other researchers). For example, more experimental evidence is needed concerning the hypothesised differential determinants of emotions such as

sadness, anger, and guilt, as specified in the various theories. As noted earlier, correlational and simulational evidence exists, but causal data showing that appraisals have predicted effects on actual experiences of these emotions, like that reported here for joy, relief, and hope, has been relatively scarce.

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