Anticipation and Emotion

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Abstract This work tries to provide a systematic outline of the manifold relations between emotion and anticipatory activity. We first address the route from emotion to anticipation, which implies considering the anticipatory function of emotion in a twofold sense. On the one hand, emotions may mediate the relationship between a stimulus and a response, by triggering anticipatory behaviors which are not based on cognitive representations of future states or events (preparatory emotions). On the other hand, emotions may accomplish the function of signaling underlying mental states (premonitory emotions), that is, the fact of experiencing a certain emotion may induce some anticipatory belief. Then we address the route from anticipation to emotion, by considering those emotional states which are elicited by anticipatory representations (expectation-based emotions). Whereas in premonitory emotions, the latter induce some expectation, in expectation-based emotions, the causal relationship is reversed; the expectation of a certain event elicits an emotional response. Here we are in the domain of cognitive appraisal proper, with the sole restriction that the appraisal regards future events. Moreover, the route from anticipation to emotion also accounts for those emotions – such as disappointment and relief – which are elicited by the invalidation of expectations (invalidation-based emotions). Finally, we discuss a third kind of interaction between emotion and anticipatory activity, that is, the anticipation of future emotions. Emotions are here the object of anticipatory representations, rather a response to them. Two kinds of expected emotions are identified, "cold" expectations versus "hot" expectations of emotions (which include some anticipated feeling), and their role in decision making is discussed.

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P. Petta et al. (eds.), *Emotion-Oriented Systems*, Cognitive Technologies,
DOI 10.1007/978-3-642-15184-2_25,

1 Introduction

The relationship between emotion and anticipation is manifold and very strict. To start with, one of the functions ascribed to emotions is precisely that of anticipating events, especially when they are relevant to central concerns and the well-being of the organism. In fact, the negative bias against emotions, and more generally against "irrational" responses – traditionally viewed as contrary to utility and disruptive for both rational thinking and effective behavior[1] – has been practically reversed in the last decades. The functional value of emotions has been widely acknowledged, and their anticipatory, interpretive, and evaluative features have been especially emphasized (e.g., Frijda, 1986; Oatley and Jenkins, 1996; Parrott and Schulkin, 1993; Smith and Lazarus, 1990).

Turning to anticipatory representations of the world, it is worth emphasizing that their use is epistemic, that is, for predicting the future. Anticipatory representations can tell us not only how the world will be but also how the world should be, or better how the organism would like it to be. They can have a motivational, axiological, or deontic nature. In fact, these representations can be used as goals and drive the behavior of the organism. Whereas a merely *adaptive* organism may tend to adjust its epistemic representations (knowledge, beliefs) to the world, to make them as accurate as possible, a goal-directed system tries to adjust the external world to its endogenous representations (which also paves the way for both hallucinations and utopias) (Castelfranchi, 2005). A goal-directed system tries to change the world (through its actions) and make it as close as possible to its mental picture. Thus, any goal-directed system is necessarily anticipatory, since it is driven by the representation of the goal state and activated by the latter's mismatch with the current state of the world (e.g., Miller et al., 1960; Rosenblueth et al., 1968).

Emotions show a relationship not only with epistemic anticipatory representations but also with goals. Emotions *monitor* and *signal* goal pursuit, achievement, and failure (e.g., Frijda, 1986; Gordon, 1987). Moreover, they *generate* goals (e.g., Frijda, 1987, 1993); once an emotion has signaled the achievement or the failure of a certain goal, generally an action tendency or an actual behavioral response is elicited, which implies the activation of some goal (of either the approach or the avoidance type). For instance, the emotion of fear not only signals the presence of a possible danger but also generates the goal to avoid it. Finally emotions may *translate* into goals (Miceli and Castelfranchi, 2002a; Miceli et al., 2006), that is, agents may perform (or avoid performing) an action *in order* (not) *to feel a certain emotion*: I may give you a present to feel the joy of making you happy or do my own duty not to feel guilty. In behavioristic terms, emotions are often (positive or

[1] Just to provide some example, consider Norman's (1981) "action slips," that is, the mistakes which typically occur in task execution when intentional behavior is "disturbed" by unconscious processes, which divert one's attention from the task itself. In the same vein, consider Elster's (1985, p. 379) remark about emotions, which, when involved in action, would "tend to overwhelm or subvert rational processes."

negative) reinforcements, favoring either the reoccurrence or the extinction of certain behaviors. Hence the important role emotions play in learning: a given action can be performed (or avoided) not only on the grounds of the agent's expectations about its outcome and evaluations of its costs but also in order to feel (or not to feel) the associated expected emotions.

In this work, we will try to provide a systematic, albeit schematic, outline of the reciprocal relations between emotion and anticipation. We will first address the route from emotion to anticipation, then the reverse one, from anticipation to emotion. Finally we will consider a third class of interaction between emotion and anticipatory activity, consisting of the anticipation of future emotions.

2 From Emotion to Anticipation

From the perspective of biological evolution (e.g., Tooby and Cosmides, 1990), emotions are psychological mechanisms that evolved to solve adaptive problems – such as escaping dangers and predators, finding food, shelter and protection, finding mates, being accepted and appreciated by one's conspecifics – and thus surviving and delivering one's genes to one's offspring. Therefore, emotions *generate* goals and behaviors our ancestors had to pursue in order to answer recurrent ecological demands. Of course, the instrumental relation between such emotion-generated goals and their functions was far from being represented in our forefathers' minds.

Addressing the route from emotion to anticipation implies considering the anticipatory function of emotion. This function may be accomplished in two basic ways. On the one hand, emotions may mediate the relationship between a stimulus and a response, by triggering anticipatory behaviors which are *not* based on cognitive representations of future events. We may call this a "preparatory" function. On the other hand, emotions may accomplish the "premonitory" function of signaling underlying mental states, that is, the fact of experiencing a certain emotion (e.g., anxiety) induces some anticipatory belief (e.g., about some impending danger). Let us now better specify either the *preparatory* or the *premonitory* roles of emotions.

2.1 Preparatory Emotions

Not every anticipatory behavior is based on explicit cognitive representations of future events, that is, on predictions. Many instances may exist of "implicit" or merely *behavioral anticipation* or *preparation.* This occurs whenever some stimulus that is precursory to a forthcoming event is associated with a certain behavior, which has been selected to react to the forthcoming event (*preparatory behavior*). For example, the jumping of a grasshopper at a rustle is not only a simple reaction to the noise itself but also (functionally) "meant" to avoid possible predators (Fig. 1).

Often, the relationship between the precursory stimulus and the behavioral anticipation is mediated by emotions. A classical example is offered by fear, whose

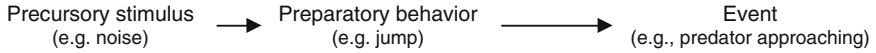

Fig. 1 Behavioral anticipation

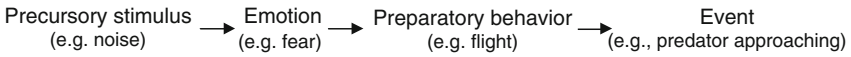

Fig. 2 Behavioral anticipation mediated by emotion

implied bodily activation is preparatory for a flight behavior. That is, the precursory stimulus elicits an internal emotional response, and the latter activates the anticipatory behavior, which is preparatory for the forthcoming event (Fig. 2).

There may be a variant of the preceding process, where no observable behavior is present. In such cases the precursory stimulus elicits an emotion which is itself preparatory for the upcoming event. For example the fear elicited by a noise may just activate a state of vigilance and alertness, without any overt behavior, and this very state is the preparatory response to the upcoming event.

The basic question about this kind of phenomena is: Why did living systems evolve from an S⇒R mechanism to the S⇒E⇒R mechanism, with an emotional (internal) mediating response? If the function of the E response is just to elicit a certain behavior, why not have the simpler direct S⇒R association? A possible answer is that the internal response E is also likely to play other roles besides that of eliciting a certain behavior. Mediating the relationships between Ss and Rs might allow that (a) various stimuli Ss elicit the same internal reaction that in turn elicits R and also, more important, (b) E may play a role in *learning*; it is a "reinforcement" since it can be pleasant or painful. Finally, E remains associated with S in memory and is automatically retrieved – in a very fast and automatic way – when S is perceived, thus representing *an implicit evaluation* of S (based on the past experience) (Miceli and Castelfranchi, 2000a).

2.2 Premonitory Emotions

Emotions may be *signals* of underlying mental states that account for and justify them. That is, emotions accomplish an informative function by providing some insight into oneself and one's relationship with the environment (e.g., Lazarus, 1991; Schwarz, 1990). In particular, as proposed by Oatley and Johnson-Laird's (1987) communicative theory of emotions, they accomplish the function to help the cognitive system manage multiple goals in an uncertain world, by communicating that some part of a plan requires the system's attention.

Indeed we may realize and evaluate what is going on in a given situation, not before but after we experience some emotion. So, I can feel anger or fear, and then realize that something has happened that makes me angry (someone has harmed me)

or afraid (something is threatening me). To be sure, my interpretation may be incorrect, due to the ambiguity or the vagueness of the emotional arousal combined with the interpretive bias favored by a given context (e.g., Schachter, 1964). In any case, what we want to emphasize here is that one's emotions call for some interpretation and they demand some mini-theory about the reasons why one experiences them.

By now, it is widely acknowledged that so-called gut feelings may help a cognitive system to form rational beliefs and make rational decisions. A paradigmatic example is offered by the neuropsychological studies conducted by Damasio and his collaborators on the role of emotion in evaluation and decision making (e.g., Bechara et al., 1997). Elster (1996, pp. 1393–1394), though still maintaining that emotions may often interfere with rationality, points out:

> First, many pieces of information that we possess are not consciously acknowledged. Secondly, the cognitive basis of the emotions includes unconscious knowledge. If those premises are true, we can use our emotional reactions as cues to our unconscious assessment of a situation. Suppose you meet a person who makes you feel vaguely uncomfortable. Although you are unable to formulate a belief about the person that would justify that emotion, you can infer from the emotion that you must have some such belief. That belief, in turn, may serve as a premise for action . . ., e.g. for a decision not to have anything more to do with the person.

This view is akin to Schwarz and Clore's (1988) informative functions approach, according to which one's feelings are used as a source of information and a basis for judgment on a given target, by asking oneself "how one feels" about it (see also de Sousa, 1987).

Often, the very fact of experiencing a certain emotion or being in a certain mood (even independent of external stimuli) elicits some *anticipatory* belief about a future state or event. For instance, my experiencing anxiety makes me suppose some impending danger; conversely, my cheerful mood this morning can induce me to feel that today is going to be a nice day. These are cases in which emotional states induce or favor cognitive expectations about the future (Fig. 3).

In common usage, *expectation* is an ambiguous word. Sometimes it coincides with hope (or fear), sometimes with forecast, and sometimes it implies both. A simple forecast or *prediction* can be defined as a belief that a certain future event p is (more or less) probable, and it involves no necessary personal concern or goal about p. In contrast, by *expectation* here we mean an internally represented wish or goal about a future event together with the belief that the (un)desired outcome is possible or (more or less) probable. In other words, an expectation is a prediction the subject is personally concerned about.

Typically, people in a happy mood are likely to harbor positive expectations about desired outcomes, whereas people in a sad mood tend to have negative expectations (e.g., Johnson and Tversky, 1983; Nygren et al., 1996). However, the impact

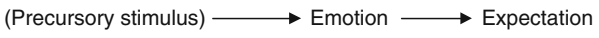

Fig. 3 From emotion to expectation

of emotions on expectations is not limited to the mere correspondence between the respective valences of emotions (or moods) and expectations. Emotions of the same valence may in fact differ in terms of their appraisals (e.g., Lazarus, 1991; Smith and Ellsworth, 1985), and the specific content of the latter impacts on the individual's expectations and consequent behavioral orientations. For instance, as shown by Lerner and Keltner (2000), two negative emotions, fear and anger, affect expectations (in the case at hand, judgments of risk) in opposite ways: fear favors pessimistic expectations, whereas anger favors optimistic expectations.

3 From Anticipation to Emotion

Addressing the route from anticipation to emotion implies considering those emotional states which are elicited either by anticipatory representations or by their assumed invalidation. Also here we can find two classes of emotion: *expectation-based* and *invalidation-based* emotions.

3.1 Expectation-Based Emotions

The expectation of *p* (that is, the prediction of a certain event *p* coupled with the goal that *p* or not-*p*) is likely to elicit some emotion. For instance, if I expect failure at an exam, I will feel sadness and helplessness, or apprehension and anxiety; conversely, if I expect success, I will feel hope, joy, or pride. Here we are in the domain of cognitive appraisal proper (e.g., Lazarus, 1991), with the sole restriction that the appraisal regards future events.

Whereas in premonitory emotions the latter induces some expectation, here the causal relationship between expectation and emotion is reversed. It is the expectation of a certain event (positive or negative, depending on its congruency with one's own goals) that elicits an emotional response and a consequent behavior. For instance, suppose the following scenario: A child hears in the night a series of noises and recognizes them as those made by his father coming back home, usually drunk; this perceptual stimulus, or better its recognition and evaluation, elicits the negative expectation (grounded on the child's previous experience in similar circumstances) that his father will thrash him; the expectation induces the emotion of fear, which in turn activates a preparatory behavior, such as curling up in bed, awaiting the thrashing (Fig. 4).

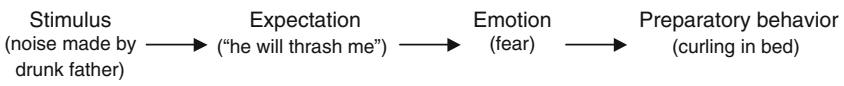

Fig. 4 From expectation to emotion

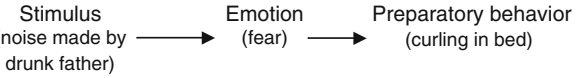

Fig. 5 From an expectation-based emotion back to a preparatory one

However, some interesting cases may occur in which an originally expectation-based emotion turns into a preparatory or even a premonitory one. Let us sketch how.

Through habituation the process above may undergo a "short circuit," where there is no longer any explicit expectation, that is, the emotion comes to be directly triggered by the stimulus (Fig. 5).

In this way, an expectation-based emotion can turn into a preparatory one. Moreover, the process may undergo some generalization. For instance, similar noises in similar contexts may directly trigger, independent of any explicit expectation, the same emotion (fear) which was originally based on an explicit expectation and now has turned into a preparatory one.

Interestingly enough, such a preparatory emotion, if consciously felt and reasoned upon ("Why am I feeling this terror? Why am I feeling this urge to hide?"), may favor in some cases the retrieval of the forgotten expectation. In other cases, it can generate a generic expectation of threat: "Since I am scared, there must be some impending danger somewhere." In this way, the preparatory emotion turns into a premonitory one, where, as already pointed out, a stimulus elicits an emotion, the emotion induces an expectation, and the latter in turn a preparatory behavior (see Fig. 3).

3.2 Invalidation-Based Emotions

Suppose that at time t_1 I have a certain (positive or negative) expectation and that at time t_2 my expectation is invalidated. The fact of having had an expectation and its being invalidated is likely to produce some emotion (Fig. 6).

If the expectation was positive – that is, my goal was congruent with my prediction – I would experience disappointment. For instance, if I both predict and want that John comes and sees me (or I both predict and want that he does not come) and I find my expectation invalidated by actual facts, I will be disappointed. Conversely, if my expectation was a negative one – that is I wanted p and predicted not-p, or vice versa – and it is invalidated, I would experience relief.

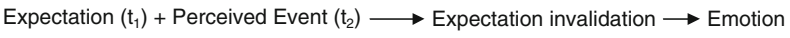

Fig. 6 Invalidation-based emotion

3.2.1 Disappointment and Relief

A number of relevant remarks are worth making in this connection. First of all, the anticipatory belief and its invalidation play a crucial role in disappointment and relief. In fact, these emotions *cannot be elicited without anticipatory beliefs*. Mere goal fulfillment or frustration, if devoid of any specific prediction (e.g., I want John to come and see me, but I do not make any particular forecast on this matter), can of course elicit some emotion (either pleasant, such as joy, or unpleasant, such as sadness). But I cannot feel (cognitive) relief unless I predicted some goal thwarting that does not come true. In the same vein, disappointment proper can arise only if my goal was accompanied by a (more or less certain) prediction about its fulfillment, and this prediction has been invalidated. As shown by Zeelenberg et al. (2000), in fact, disappointment is experienced when a chosen option turns out to be worse than expected.

Given the cognitive ingredients we postulate in these "invalidation-based" emotions, we assume that the intensity of the emotion is a function of its components. In particular:

- *the more (subjectively) certain the prediction, the more intense the disappointment or the relief* and
- *the more (subjectively) important (valuable) the goal, the more intense the disappointment or the relief.*

However, the impact of expectation invalidation on the emotional system is not limited to such feelings as disappointment and relief. On the negative side, at least a couple of other feelings are worth mentioning: discouragement and sense of injustice.

3.2.2 Discouragement

We view discouragement as a special kind of disappointment. As already pointed out, the latter implies a process of transition or transformation of a positive expectation into a negative one. A disappointed expectation is in fact a positive expectation (with varying degrees of certainty) that *becomes* negative (with varying degrees of certainty). Also in discouragement there is a transformation of a positive expectation into a negative one. In particular, discouragement implies a transition from a situation where one has the "courage," that is, one feels to manage it, to a situation where one loses heart and feels not to manage it, that is, one comes to despair of achieving some goal after having expected a positive outcome.

However, a discouragement is something more specific than a simple disappointment. Discouragement implies disappointment, whereas there may be disappointment without discouragement. Suppose yesterday I expected to have a sunny weather today; if today my expectation is invalidated, I get disappointed, but not discouraged. In this case, there is nothing to be discouraged about. In fact, one may be

disappointed about mere goals, whereas, for being discouraged, there should necessarily be some intention (that is, some goal *chosen for pursuit*) implied (Miceli and Castelfranchi, 2000b). One is discouraged from pursuing some intention (because one's positive expectations have been disappointed). Going back to the previous example, discouragement might come into play if the expected sunny weather was considered an enabling condition for pursuing the intention of, say, taking a trip. In such a case, I would be discouraged with regard to that intention, while I am just disappointed relatively to the goal of having a sunny weather.

Moreover, discouragement shows another important difference from mere disappointment. In discouragement the focus of attention is on one's *lack of* (either internal or external) *power* to achieve a certain intention *p*, whereas disappointment is, so to say, *unmarked with regard to power* (Miceli and Castelfranchi, 2000b). Though both imply a transition from a positive expectation to a negative one, in the case of discouragement the positive expectation consisted of a belief of the type "I can manage it," while in the case of mere disappointment, it could just be "*p* will happen." This is quite in line with Weiner et al.'s (1979, p. 1216) view of disappointment as "independent of attributions but dependent on outcomes" (see also Zeelenberg et al., 2000).

3.2.3 Sense of Injustice

Sense of injustice is also a likely response to invalidated positive expectations. The stronger the positive expectation (that is, the more certain its implied prediction and the more important its implied goal), the more its invalidation subjectively looks like an ill-treatment, as if one were suffering something *unfair*. In fact, anger is a common reaction to a violated positive expectation (Averill, 1982; Burgoon, 1993; Levitt, 1991; Shaver et al., 1987), as well as to perceived unfairness (Fehr and Baldwin, 1996; Fitness and Fletcher, 1993; Shaver et al., 1987). The assumed violation is accompanied by a sense of rebellion and refusal of facts (actually, they "shouldn't have gone" as they did). What I expected resembles what I was entitled to obtain. I feel I did not *deserve* what has happened (Miceli and Castelfranchi, 2002b). This feeling of injustice is somewhat metaphorical in that no explicit subjective equation of "expected" with "deserved" is necessarily implied. There is just a sort of implicit and analogical overlap of the two concepts. The reason for this implicit overlap lies in a special normative component typical of positive expectations which is absent from the other kinds of anticipatory representations of the future. Positive expectations in fact do not simply consist in "predictions plus goals"; they also imply a normative component, which results from the translation of the epistemic normativity typical of predictions into a deontic normativity: What, in probabilistic terms, "should" happen, and I want to happen, turns into what I feel entitled to obtain.

But why should the epistemic "norm" be made equal to the deontic one? Because *a positive expectation favors an "as if" state of mind, according to which the desired state is viewed as (almost) realized*, and the individual feels already allowed to enjoy its satisfaction. Therefore the realization of the goal is represented as something

to be *maintained* rather than acquired. Because a maintenance goal (as opposed to an acquisition one) is likely to be viewed as grounded on some supposed right (a sort of usucaption), people feel entitled to obtain what they expect (Miceli and Castelfranchi, 2002b). In other words, the relationship between maintenance goals and positive expectations can account for the ease of translation of the epistemic norm into the deontic one.

Another, more general, reason for such a translation lies in the common tendency to turn mere implications into equivalences. Because perceived rights create positive expectations, we are also likely to surreptitiously assume that positive expectations create some right! As often happens in everyday reasoning, conditionals "invite" the biconditional interpretation (e.g., Geiss and Zwicky, 1971; Oaksford and Stenning, 1992; Wason and Johnson-Laird, 1972), and simple implications ("if *p* then *q,*" that is, "if there is a right, there is a positive expectation") are turned into reciprocal ones ("if *p* then *q*" *and* "if *q* then *p*"), i.e., equivalences. As a consequence, "if there is a positive expectation, there is a right."

3.2.4 Invalidated Negative Expectations: Surprise and Relief

The sense of injustice that is typical of disconfirmed positive expectations does not seem to be experienced when *negative* expectations are disconfirmed. The reason for this difference lies in our view in the absence of a normative component in negative expectations. Actually, when I want *p* but I predict not-*p* (or vice versa), I do not set any deontic norm that *p* or not-*p* ought to happen. I just believe, on the grounds of my experience or previous knowledge, that not-*p* is likely to happen, whereas I would prefer the opposite. When my negative expectation is disappointed, of course I will be *surprised*. But my surprise will take on a positive color, because my goal *p* has been fulfilled. I will neither protest nor look for somebody's responsibility, nor feel I have been treated unfairly. Rather, I will feel *relieved*, because, contrary to my prediction, my desire is fulfilled. Actually, an unexpected happy ending typically elicits such feelings as surprise and relief. The latter will be all the greater the more important is the goal fulfilled, and the more unexpected its fulfillment. Relief in fact implies a more or less explicit comparison between the anticipated distress and the actual positive situation.

Thus, a *normative component is implied only in positive expectations*. This amounts to saying that the normative component results from the *joint* force of predictions and goals. If predictions and goals are congruent with each other, then *p* "ought" to occur. If they do not converge (I predict not-*p* and I want *p*, or vice versa), no normative component will be implied. A negative expectation, when invalidated, is just disappointed, whereas a positive expectation, when invalidated, is "violated."

3.2.5 Expectation Validation and Emotions

We have pointed to the relationship between expectation invalidation and emotion. But, what about expectation *validation*? Does any specific emotion depend on the validation of one's own expectations? We do not suppose any remarkable *qualitative*

difference in emotion elicitation between a case in which a mere goal (without prediction) is fulfilled or thwarted, and a case in which an expectation (either positive or negative) is validated. To be more precise, we assume that the possible difference lies in the *intensity* of the emotions experienced rather than in their *quality*. As a general rule, we suggest that, if compared with the emotions elicited by mere goal (without prediction) fulfillment or thwarting, *those emotions which are elicited by validated* (either positive or negative) *expectations should be lower in intensity*. That is, the pre-existing prediction plays the role of "watering down" the (positive or negative) emotion associated with the destiny of the goal. In fact, expected outcomes have lower emotional impact compared to unexpected ones. As expected, negative outcomes are less painful than unexpected ones, so expected positive outcomes are less elating than surprising ones (e.g., Mellers et al., 1997; Miceli and Castelfranchi, 2002b).

3.2.6 Prediction Invalidation and Emotions

So far, we have considered the emotional responses associated with the invalidation of *expectations* proper, that is, predictions *plus* goals. However, not only expectation proper but also mere *prediction* invalidation (that is a disconfirmed forecast that *p* devoid of any goal that *p* or not-*p*) may elicit some emotion. This is, again, the case of *surprise*.

As just remarked, mere predictions do not imply any personal concern about *p*, in the sense that *p*'s occurrence does not affect any of the person's goals. For instance, my prediction that next Wednesday John will visit Mary (because this happens each Wednesday) may have nothing to do with my goals: I have no interest in the fact by itself. In this sense, a prediction is a "cold," or better neutral, belief that "probable *p*." However, if this neutral *p* does not occur, we are likely to experience a surprise which contains a certain degree of distress as if we *wanted p* to become true. The more certain the prediction, that is, the more *p*'s assumed probability is close to 100%, the more the surprise turns into a bewilderment that is tinged with a negative connotation. But, if we do not have the goal that *p* by itself, what is the "goal" implied in a prediction?

People have a need for prediction, that is, they need to know what causes will come into play to produce what effects (whether beneficial or harmful). The need for prediction implies both a need to anticipate future events and the consequent need to find such anticipations validated by facts. This is Bandura's (1982) *predictability*, i.e., the cognitive component of *self-efficacy* (as distinct from the other component, *controllability*, i.e., the need to exert power over events). However, we assume that the need for prediction is *not* a goal proper, that is, it is *not* a regulatory state represented (consciously or unconsciously) in the person's mind, but a *meta-goal*, that is, a *regulatory principle* concerning one's mental functioning (Miceli and Castelfranchi, 1997). Consider belief consistency. In a sense, we "want" to maintain consistent beliefs. In fact, if a contradiction is detected, we try to eliminate it. However, the mind has this "goal" as a function. It is not necessary to express these finalistic effects as represented goals on the basis of which the

mind reasons and plans. It is sufficient to conceive these principles as *procedures*, which are implemented when a contradiction is detected. If they are unsuccessful, a form of cognitive distress is likely to be experienced.[2] In the same vein, the mind's architecture includes the meta-goal to make predictions and to find those predictions validated by the evidence.[3] Finally, the meta-goal to find one's predictions validated implies the further meta-goal that *p* happens (since according to one's beliefs, it should happen). This can account for the surprise experienced and its likely negative connotation, which is stronger the more certain the prediction, and comes close to a sense of bewilderment, because the world is less predictable than expected. This view can also account for the tendency to behave in accordance with one's predictions in those cases when one's behavior can affect the likelihood of the predicted event (see Sherman, 1980).

4 Expected Emotions

A third general case of interaction between expectations and emotions is offered by explicit representations of *future states which coincide with emotions*. In other words, emotions are here the *object* of anticipatory representations, rather a reaction to them: "If I do *a*, I will feel guilty" (or happy, ashamed, relieved, and so on). Two kinds of expected emotions can be identified: "cold" expectations and "hot" expectations of emotions or, better, *expected and non-pre-felt emotions* versus *expected and pre-felt emotions*. The latter include some anticipated feeling. In both cases, expected emotions may play a remarkable role in the decision-making process: Expecting possible emotions as a consequence of one's candidate decisions affect the latter, changing one's preferences about the given options.

Although this aspect has been already acknowledged by some authors (e.g., Frijda, 1986), contemporary research has mainly focused on the motivational, decisional, and behavioral effects of past or current emotional experiences (e.g., Frijda, 1986; Lazarus, 1991; Schwarz and Bohner, 1996). Only more recently, the role played by the anticipation of future emotions in decision making and behavior has started to be systematically addressed. In particular, decision theorists have started to modify the traditional expected-utility theory so as to account for the role played in decision by anticipated emotions such as anticipated pleasure or pain, disappointment or regret (e.g., Bell, 1985; Loomes, 1987; Mellers and McGraw, 2001). However, as already remarked by some authors (e.g., March, 1978; Schwarz, 2000),

[2]Quite in line with the basic assumptions of dissonance theory (e.g., Festinger, 1957), inconsistency in fact produces an unpleasant psychological state (Carlsmith and Aronson, 1963; Cooper and Fazio, 1984; Fazio and Cooper, 1983), and the consequent attempt to eliminate it by restoring consistency.

[3]Of course, this does not rule out the possibility of humans also having some internal goals concerning their predictive activity (as well as the consistency of their beliefs), just as they can translate any biological or social function into an internal goal of their own.

anticipated regret and disappointment are not the sole feelings that may affect decisions. More general models have recently been proposed (Parker et al., 1995; Perugini and Bagozzi, 2001; Richard et al., 1995) which build upon Ajzen's (1991) theory of planned behavior and try to widen it by introducing, among the other things, a variety of anticipated emotions as determinants of purposive behavior.

4.1 Expected and Non-pre-felt Emotions

By "expected and non-pre-felt emotions" we mean those emotions the agent predicts to feel as a consequence of a candidate decision, but the agent is not actually feeling here and now. The main point to be remarked is that a "not-yet-felt" but *expected* emotion can enter the overall evaluation of which goals are worth pursuing, adding a new way of linking emotions to decision making. Thus, expecting to feel an emotion is sufficient for changing the decision process or its results, although the agent does not have to feel that emotion either at the time of the expectation or later. That is, the prediction may be wrong, and the agent may happen to experience something different (see, for instance, Kahneman and Snell, 1990). However, what matters for decision making is the expected emotion.

Expected emotions belong to the set of tools an agent can use for discriminating among different choices. Thus, evaluating which choice leads to the best outcome includes the associated emotions one would like to feel, or at least those one would be more able to stand (in the case of choices implying unpleasant emotions). In other words, while anticipating some future course of action, the agent is also likely to anticipate that he or she would feel some particular emotion; this (positive or negative) expected emotion induces the goal (not) to feel it, and this goal enters the decision-making process with a given value, possibly modifying the value of the available options.

It is worth pointing out that the valence of an anticipated emotion is not necessarily consistent with the perceived value of a certain outcome. That is, the affective consequences of a goal attainment (success) are not necessarily (or not only) positive; in the same vein, the affective consequences of goal failure are not necessarily (or not only) negative. Whereas decision theorists mainly focus on such aspects as the expected "pleasure" (elation, satisfaction) associated with a success or the expected "pain" (disappointment, regret, sense of guilt) associated with a failure, we wish to stress that some expected negative emotion may be associated with a goal attainment, and vice versa, some positive emotion with a goal failure. This implies that expected emotions may affect decision making very heavily, going even *against* the choice of highly desired outcomes. For instance, while considering how to obtain an advancement at work (a goal attainment I value very positively) and anticipating some way for cheating a colleague of mine (which is instrumental to my goal), I expect to feel guilty; this expectation can induce the goal not to feel guilty, to such a point that I give up the option of cheating and possibly even the goal of obtaining the advancement, if there are no other means available (Fig. 7).

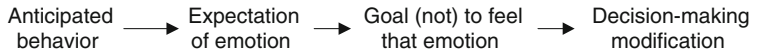

Fig. 7 Expected and non-pre-felt emotion and decision making

4.2 Expected and Pre-felt Emotions

The expected emotion can also induce an anticipated feeling. While anticipating a possible behavior and its context, I am in fact likely to "self-empathize," so to say, or "foretaste" the emotion I expect to feel, at least to some degree of intensity (if not to the same degree as when the anticipated situation is actualized). For instance, going back to the previous example, I may feel guilty at the prospect of cheating my colleague, that is, I may "hallucinatorily" experience what I (believe I) would feel if I cheat my colleague. In such cases, the impact of the expected emotion on decision making is probably stronger than that of expected but non-pre-felt emotions. In fact, here the mere cognitive expectation about some emotional reaction is reinforced by its "foretaste" (Fig. 8).

Sometimes, the expectation that one will feel a certain emotion e_2 may elicit an emotion e_1 which is different from the expected one. For instance, at time t_1 I may feel fear at the prospect of feeling guilty at time t_2. In such cases, the emotion experienced at time t_1, rather than being a foretaste of the expected emotion, is an expectation-based emotion (see above) in the strictest sense. In comparison with the expectation-based emotions we have already considered, here the difference lies in a further specification; the expectation concerns an emotion (the emotion I will or would feel at time t_2). Thus, an expectation of emotion may either favor the foretaste (pre-feeling) of the emotion expected or elicit some other emotion (a sort of "meta-emotion") *about* the expected emotion. And in any case, such feelings are likely to impact on the decision-making process.

A hybrid case, which we might call "expectation-elicited emotion," is the following: An expected event ("the boss will fire me") elicits an emotion about it (say, anger), and this emotion "tells" me what I will probably feel when the event happens, that is, the experienced emotion is the evidence on which I ground my expected emotion (Fig. 9).

This is an interesting case which testifies to the complexity of the relationships between anticipation and emotion. On the one hand, in fact, it resembles the process implied in expectation-based emotions in that here also an emotion is elicited by an

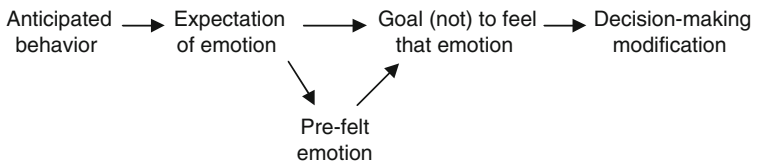

Fig. 8 Expected pre-felt emotion and decision making

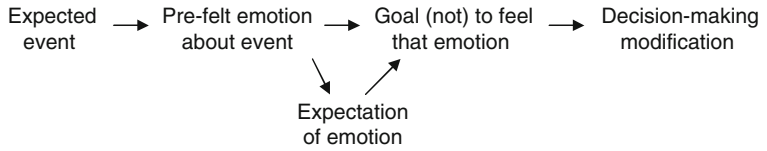

Fig. 9 Expectation-elicited emotion and decision making

expectation; whereas in the expectation-based process the emotion is experienced as regarding a *future* event (e.g., I *now* feel hope, fear, disappointment, discouragement at the *prospect* of a certain outcome), an expectation-elicited emotion implies a sort of *actualization* of the future event: while imagining my boss firing me, I feel (an amount of) the anger I will/would feel at that point in the future, when/if that event happens. On the other hand, expectation-elicited emotions are akin to expected and pre-felt emotions in that in both cases, pre-feeling the expected emotion impacts on the agent's decision making. Whereas in the expected and pre-felt emotions an expectation *about* an emotion favors its foretasting, in the expectation-elicited emotions it is the other way around: foretasting favors the expectation that I will feel that emotion (because I am pre-feeling it now), that is, foretasting plays a *premonitory* role.

5 Concluding Remarks

We have tried to analyze and systematize (a) the role of emotions in anticipation in terms of their eliciting either preparatory behaviors or anticipatory mental representations and (b) the role of cognitive anticipation in different kinds of emotions: some of them are feelings associated with expectations (like hope or fear); some are consequences of the invalidation of expectations (like surprise, disappointment, relief, discouragement, and sense of injustice); some are the anticipated representation (and possibly also feeling) of future emotions.

It is worth specifying here that the relationship between emotion and anticipation is neither of overlap nor of inclusion. We view emotion and anticipation as *partially* overlapping sets of phenomena. On the one side, in fact, anticipation is not *necessarily* emotion based. Non-emotional systems might be endowed with an "anticipatory" capacity not only in behavioral but also in cognitive terms, that is, in principle they might build internal representations of future events (predictions and expectations). On the other side, emotions are neither necessarily based on anticipatory representations nor necessarily anticipated.

However, as we have tried to show, the relationships between emotion and anticipation are manifold and very strict. Emotions produce anticipation (either anticipatory behaviors or anticipatory mental representations) and anticipation produces emotions. In particular, the capacity for anticipatory representations allows to experience "new" emotions. That is, some kinds of emotions cannot be experienced

by systems devoid of anticipatory representations: hope, anxiety, and disappointment belong to this class of emotions. Moreover, the capacity for anticipatory representations creates the possibility for expected emotions, as well as emotions *about* expected emotions (for example, fear of possible shame).

Acknowledgments Preparation of this work was in part supported by HUMAINE (European Project IST-507422) and by MindRACES (European Project IST-511931).

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