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Choice and the Relative Pleasure of Consequences

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Although pleasure played a central role in early theories of decision making, it gradually became peripheral, largely because of measurement concerns. Normative theories became more mathematical, and descriptive theories emphasized cognition over emotion. In recent years, there has been a renewed interest in emotions and choice. This article examines attempts to model pleasure and pain in terms of utilities, decision weights, and counterfactual comparisons. Research on disappointment and regret has provided both empirical and theoretical insights. Many researchers now realize that the predictability of the emotions that follow from decisions is as important as the predictability of choice.

Anyone who has ever made an important decision knows that emotions play a role. Not only do immediate emotions, or those experienced while making a choice, shape decisions but also anticipated emotions about future consequences. Anticipated feelings of guilt, dread, and excitement allow people to simulate what life would be like if they made one choice or another. This article, examines (a) the history of choice theories that have, in one way or another, incorporated anticipated emotions; (b) the results of studies that have directly investigated anticipated and actual pleasure; (c) a theory of judged pleasure; and (d) emotion-based theories of choice.

Utilities as Pleasure and Pain

Early theories of decision making began with games of chance (S. M. Stigler, 1986). Eighteenth century French nobility asked their court mathematicians how much they should offer to play a gamble, such as a 1% chance to win 100 francs, otherwise 0 francs. Mathematicians defined the fair price of the gamble as the expected value, or the sum of the products of probabilities and outcomes. If given a 1% chance to win 100 francs, otherwise 0 francs, a player should offer no more than 1 franc. That expected value is fair because it makes the long-run earnings of the gambler identical to those of the house.

This rule seemed reasonable at first, but decision makers soon noticed some unsettling implications. One who bases choices on maximizing expected values would necessarily avoid all gambles with negative expected values, which includes both lotteries and insurance. To many, lotteries provide a form of entertainment, and insurance provides peace of mind. What could possibly be wrong with that?

These observations inspired Daniel Bernoulli (1738/1954) to propose that people assess the pleasure or psychological satisfaction of wealth, rather than wealth per se, a construct he called utility. Bernoulli assumed that utility increases rapidly at first, then gradually slows as a function of wealth. He formalized this intuition with a logarithmic function, as shown in Figure 1. The pleasure associated with a change in wealth is directly tied to one's total wealth. To a pauper, the pleasure of winning 100 francs is great, but to a millionaire, it is very small indeed. Later, Bentham (1789/1984) followed Bernoulli's lead and further developed the concept of utility as the balance of pleasure and pain. During the 19th century, Jevons (1871), Walras (1874), Menger (1871), and Marshall (1890) proposed mathematical theories based on the idea that utility is a psychological entity, measurable in its own right. (See Edwards, 1954; Fishburn, 1988; and G. J. Stigler, 1950, for details.)

Bernoulli (1738/1954) made another suggestion. Decision makers should select the option that maximizes their expected utilities. This choice rule, combined with a logarithmic assumption of utility, implies that preferences are risk averse. When faced with a choice between a sure thing and a gamble with an equivalent expected value, such as $10 for sure or a choice with a 10% chance of winning $100, otherwise $0, decision makers should prefer the sure thing. These simple ideas formed the basis of classical utility theory.

Utilities as Mathematical Abstractions

During the late 19th and early 20th centuries, economists became interested in measuring preferences over commodity bundles consisting of different items. The utility of a bundle is not the sum of the individual utilities because items interact. What good is a gun without a bullet or a left shoe without a right one? This observation led Edgeworth (1881) and others to develop indifference curves, as shown in Figure 2. An indifference curve represents different commodity bundles having the same overall utility. For example, four apples and two oranges might be equivalent in overall utility to one apple and eight oranges. Such curves are simple and powerful, and require only preference orderings.

In the indifference curve framework, it no longer makes sense to treat utilities as measures of pleasure or pain. The numbers have only ordinal meaning, so any set of values assigned to bundles can be replaced with any other set with the same rank order. Eventually, indifference curves were accepted over the classical approach

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because they provided reasonable answers to economic questions with far fewer assumptions.

In the middle of the 20th century, a mathematical breakthrough occurred that marked the beginning of modern utility theory. Von Neumann and Morgenstern (1947) showed that if decision makers rank order their preferences for gambles and those preferences are consistent with a small set of axioms, choices can be represented as if decision makers are selecting options that maximize their expected utilities. Expected utility theory permits the derivation of utilities for risky outcomes. Utilities now have interval meaning based on theoretically defensible axioms, not on ad hoc, unobservable assumptions.

In this neopositivist framework, utilities cease to be psychological states and become measurable choice propensities. One cannot say that A is preferred to B because A has greater utility than B. Instead, A has greater utility than B simply because people prefer it over B. Von Neumann and Morgenstern (1947) provided a theoretical rationale for maximizing expected utilities that was logically coherent and internally consistent, but had no need or place for hedonic content.

Seven years later, another breakthrough occurred. Savage (1954) proposed a theoretical synthesis of von Neumann and Morgenstern's (1947) expected utility theory and de Finetti's (1937) ideas about subjective beliefs. That account is called subjective expected utility theory. In this account, people select the option that maximizes their expected utilities, as proposed by von Neumann and Morgenstern, but rather than weighting each utility by the probability it will occur, people weigh each utility by their belief it will occur. Beliefs differ from objective probabilities because they reflect the degree of confidence in an outcome, not necessarily its relative frequency of occurring. Beliefs are governed by Bayesian principles. Subjective expected utility theory soon became, and remains, the dominant approach to normative choice (Edwards, 1992).

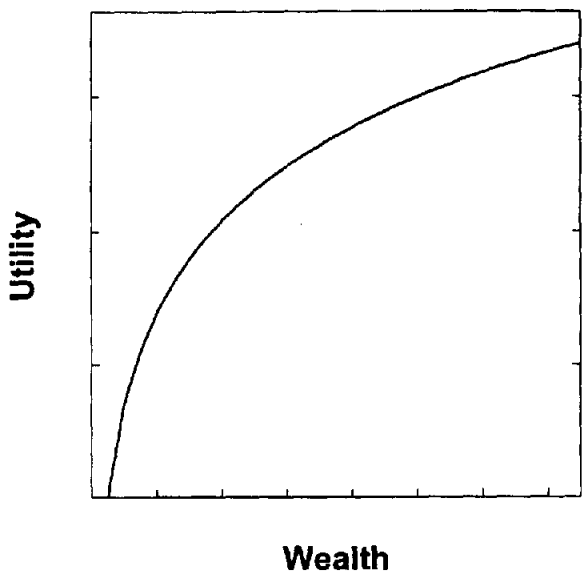

Figure 1. Logarithmic utility curve, as proposed by Bernoulli (1738/1954).

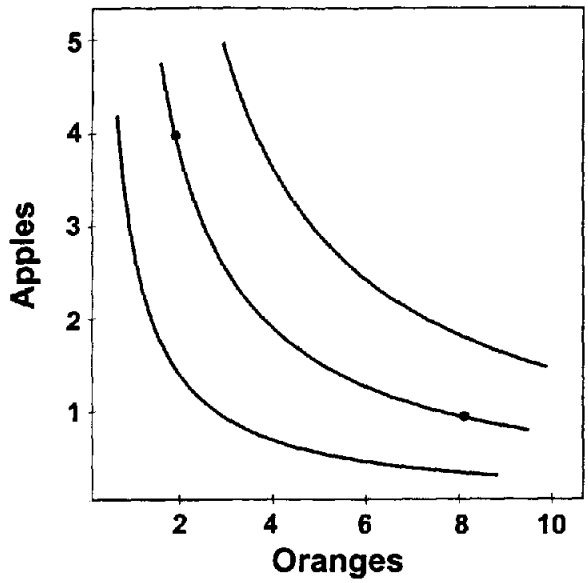

Figure 2. Indifference curves for apples and oranges. Points on the same curve represent commodity bundles consisting of different items with the same overall utility.

Pleasure, Pain, and Emotions of Outcomes

It was generally agreed that subjective expected utility theory set the standard for optimal choices; the next step was to find out if it could describe actual choices. Economists and psychologists began to look at choice behavior with an eye for deviations from rationality. Puzzles and paradoxes emerged that were not easily explained by subjective expected utility theory (Allais, 1953; Ellsberg, 1961). Some years later, Kahneman and Tversky (1979) proposed a descriptive account of the anomalies in risky choice called prospect theory.

Kahneman and Tversky (1979) constructed a set of choice problems that illustrate how actual choices deviate from expected utility theory. For example, preferences often reverse around the status quo. When offered a choice between $3,000 for sure and an 80% chance to win $4,000, most people prefer the sure thing, but when faced with a choice between a sure loss of $3,000 and an 80% chance to lose $4,000, people often prefer the gamble. This result, called the reflection effect, suggests that people have risk-averse preferences in the gain domain but risk-seeking preferences in the loss domain.[1] Such shifts in risk attitudes are inconsistent with the normative theory, which focuses solely on final assets.

Prospect theory was designed to explain the reflection effect, among others. According to prospect theory, psychological value, formerly called utility, is assessed relative to the status quo and reflects changes in wealth, not total wealth, after Markowitz (1952). Both wins and losses have decreasing marginal value, though not at the same rate. The pain of a loss is posited to increase more rapidly than the pleasure of an equivalent gain. Kahneman and Tversky (1979) called this property loss aversion and said that

[1] There is some controversy about the generality of the reflection effect. See Schneider & Lopes (1986) for a discussion.

"the aggravation that one experiences in losing a sum of money appears to be greater than the pleasure associated with gaining the same amount" (p. 279).

Thaler (1985) examined whether the assumptions about value in prospect theory capture the pleasure associated with joint events, such as two gains, two losses, or a gain and a loss. The value of a joint event, (x, y), can be represented as the sum of two separate values if events occur separately—$v(x) + v(y)$—or as the value of the sum if events occur together—$v(x + y)$. Prospect theory implies that two gains occurring separately generally have greater value than one large gain equivalent to the sum. Likewise, one large loss generally has greater value than two losses occurring separately. Predictions for joint events consisting of mixed outcomes depend on the exact values of x and y.

Thaler (1985) hypothesized that judgments of relative pleasure follow these predictions. He asked participants to read stories about people who experienced joint events separately or together. For example,

> Mr. A was given tickets to two lotteries involving the World Series. He won $50 in one lottery and $25 in the other. Mr. B was given a ticket to a single, larger World Series lottery. He won $75. Who was happier? (p.203)

Judgments of relative pleasure were generally consistent with the assumptions about value from prospect theory.

Thaler and Johnson (1990) went on to investigate whether choices between joint events that are described separately or together are also predictable from prospect theory. They asked participants to make choices between pairs of options that differed in descriptions but had identical final outcomes. For example, some participants chose between $15 and a 50% chance to win $19.50 or $10.50. Others were told to assume they had just won $15, then they were asked to choose between the status quo and a 50% chance to win $4.50 or lose $4.50.

Thaler and Johnson (1990) suggested that people actively edit the options to maximize their value as predicted from prospect theory. This account implies that choices should be identical across different descriptions. Instead, choices varied. Participants preferred the sure $15 in the first choice and the gamble in the second choice. Decision makers were often risk averse in the gain domain unless they had just experienced a windfall gain. Thaler and Johnson proposed another account called quasi-hedonic editing in which choices are represented in the form they are given and joint events are described by the value function in prospect theory.

Fear, Hope, and Emotions of Uncertainty

The value function in prospect theory is not the only way to account for the empirical anomalies. Several theorists turned to the decision weights, formerly called subjective probabilities, to explain the effects. Some promising ideas are called rank- and sign-dependent theories. In these accounts, a decision weight is allowed to vary with the probability of the outcome, the sign of the outcome, and the rank order of the outcome in the set of possibilities (Lopes, 1984, 1990; R. D. Luce, 1991; R. D. Luce & Fishburn, 1991, 1995; Quiggin, 1982; Tversky & Kahneman, 1992; Yaari, 1987). These weights are transformations of cumulative or decumulative probabilities. The exact form of the transformation reflects the degree of concern for achieving the best outcome and avoiding the worst outcome in the gamble. In some theories, these concerns have been described in emotional tones, such as hope and fear (Lopes, 1990), security and potential (Lopes, 1984, 1987, 1990), optimism and pessimism (Birnbaum & Stegner, 1979; Wakker, 1990), and related feelings about risk and uncertainty.

To illustrate, suppose a decision maker focuses greater attention on less extreme outcomes or those closer to zero. That is, a decision maker assigns greater weight to smaller wins than larger ones, perhaps due to a fear of getting nothing. That same decision maker would assign greater weight to smaller losses than larger losses, perhaps due to a hope of avoiding the worst outcome. This pattern of decision weighting can also describe reflection effects. When evaluating a choice between $3,000 for sure or an 80% chance to win $4,000, otherwise $0, the decision maker would prefer the sure win over the gamble, exhibiting risk-averse preferences in the gain domain. When offered a choice between a $3,000 loss and an 80% chance to lose $4,000, otherwise $0, the decision maker would prefer the gamble, displaying risk-seeking preferences in the loss domain.

In recent years, evidence against these theories has been accumulating (Birnbaum & McIntosh, 1996; Chechile & Cooke, 1996; R. D. Luce, 2000). Rank- and sign-dependent theories have difficulties with choices between gambles having more than two outcomes. Furthermore, these theories do not allow crosstalk, or interactions across options in a choice set.

Others have explored the emotions of uncertainty in perceived risk. Fischhoff, Lichtenstein, Slovic, Derby, and Keeney (1981) identified affective dimensions involved in the perception of risky technologies, including dread, perceived lack of control, and fear of the unknown. Individuals differ on these dimensions; environmental hazards are viewed as riskier by women than men and by Blacks than Whites. This research and that of others (Loewenstein, Weber, Hsee, & Welch, 1999; Peters & Slovic, 1996, 1999) emphasizes the affective, rather than the cognitive, determinants of perceived risk, such as the vividness with which consequences are imagined, prior experiences with risk, and immediate emotions.

Multiple Reference Points

Prospect theory was the first descriptive account of risky choice to introduce the status quo as a reference point in the value function. Although essential, the status quo is not the only reference point used to evaluate outcomes. Others have been applied both within and across options. For example, an outcome of $0 might be painful in the context of an 80% chance to win $4,000, otherwise $0, but pleasurable in the context of an 80% chance to lose $4,000, otherwise $0. Loomes and Sugden (1986), Bell (1985), and Gul (1991) proposed that decision makers anticipate the disappointment they would feel if they obtained the worst outcome and the elation they would feel if they received the best outcome. Those anticipated feelings modify the utility function. Choices are based on maximizing expected utilities, and utilities are modified by anticipated disappointment and elation.

In addition to option outcomes, across-option outcomes have also been used as reference points. Decision makers seem to evaluate their outcome relative to "what might have been" under another choice (Roese & Olson, 1995). Decision theorists refer to the emotions associated with these comparisons as anticipated regret and rejoicing (Bell, 1982; Loomes & Sugden, 1982), and many studies have demonstrated their effects on choice. Ritov and

Baron (1990), for example, showed that women who anticipated regret about their child dying from a vaccination were less likely to have the child vaccinated, even when the chances of dying were much greater from the disease than the vaccination. Simonson (1992) demonstrated that consumers who imagined purchasing an unfamiliar product that later malfunctioned were more likely to buy a familiar, easily justifiable product. Parker, Stradling, and Manstead (1996) showed that beliefs and attitudes about unsafe driving changed dramatically after people were reminded about the regret they would feel if their dangerous driving led to accidents involving persons and property. Finally, Tetlock and Boettger (1994) demonstrated how social pressure to be accountable can amplify anticipated regret and loss aversion when the option that maximizes expected utilities requires the decision maker to impose losses on identifiable constituencies.

Regret theories have been developed to describe these effects. Loomes and Sugden (1982) and Bell (1982) suggested that decision makers anticipate regret if their outcome is worse than that of another choice and rejoicing if their outcome is better. Those anticipated feelings modify the utility function. Choices maximize expected utilities, and utilities are modified by anticipated regret and rejoicing.

In other accounts, decision makers are assumed to minimize the chances of experiencing regret (Larrick & Boles, 1995; Ritov, 1996). Zeelenberg, Beattie, van der Plight, and de Vries (1996) and Zeelenberg and Beattie (1997) showed how regret avoidance can lead to greater risk seeking or risk aversion, depending on the exact form of outcome feedback, and Josephs, Larrick, Steele, and Nisbett (1992) demonstrated that regret avoidance varies with the individual's vulnerability to regret, operationalized as self-esteem. They proposed and found that decision makers with higher self-esteem are unaffected by outcome feedback, whereas those with lower self-esteem make choices to avoid regret if they expect complete feedback, but not otherwise.

Reference points based on comparisons across options are extremely important from this theoretical perspective because they imply that the value of an option depends on the other options under consideration. Despite evidence for such crosstalk, including violations of strong stochastic transitivity and similarity effects (R. D. Luce, 1977; Mellers & Biagini, 1994), "crosstalk" has never been viewed as an essential property of choice. In fact, relatively few theories can describe the effects. Regret theories are an exception, and they describe the effects with seemingly plausible emotions.

Direct Assessments of Anticipated Pleasure

Mounting evidence has demonstrated that choices vary with anticipated emotions, such as disappointment and regret. However, inferences about those emotions have often been indirect. Theorists typically make assumptions about functional forms of regret and disappointment without empirical assessment. By measuring those emotions directly, researchers can examine factors that influence the degree and magnitude of the emotions. For example, decision makers are more likely to feel regret if the negative events that occur are under their control (Markman, Gavanski, Sherman, & McMullen, 1995). In the same spirit, decision makers are more likely to feel regret from negative events that are the result of actions, rather than inactions (Baron & Ritov, 1994; Gleicher et al., 1990; Kahneman & Tversky, 1982; Landman, 1987; Ritov & Baron, 1995). However, Inman and Zeelenberg (2000) demonstrated that repeated choices with negative outcomes, such as the purchase of a product that regularly malfunctioned, produce greater regret from inaction than action. Gilovich and Medvec (1995), who investigated the temporal course of regret, also argued that people feel greater long-term regret from inactions than actions.

An even better approach, though not always feasible, is to simultaneously measure anticipated emotions and choice. Mellers, Schwartz, & Ritov (1999) have used this method. Participants were given pairs of gambles on a computer screen. Each gamble was displayed as a pie chart with different regions representing wins and losses. On each trial, participants selected the gamble they preferred to play. Then, a spinner attached to the center of the chosen gamble began to rotate. Eventually, it stopped in a region and pointed to a hypothetical outcome. Participants anticipated the pleasure they would have felt if the outcomes had been real. Subsequent studies examined the actual pleasure of real monetary outcomes.

Sometimes, spinners appeared in the center of the chosen gamble and the unchosen gamble. They rotated independently and eventually stopped, at which time participants learned their own hypothetical outcome and that of the other gamble. Once again, participants anticipated the pleasure they would have felt if outcomes had been real. In other studies, outcomes were real. In all cases, pleasure was measured on a category rating scale from positive to negative affect.

The most important findings from these studies can be summarized with three effects—outcomes, comparisons, and surprise. Figure 3 shows the anticipated pleasure of monetary outcomes. Panel A presents outcome effects. As imagined wins increase, anticipated pleasure increases. Panels B and C show comparison effects within options and across options, respectively. Panel B presents disappointment effects within a gamble. Anticipated pleasure is presented as a function of the imagined outcome with separate curves for the gamble's other outcome. Less pleasure is anticipated with imagined outcomes when the gamble's other outcome is better. Conversely, greater pleasure is anticipated when the other outcome is worse. Boles and Messick (1995) have reported similar results.

Panel C shows regret effects across gambles. Anticipated pleasure is presented against imagined outcomes (averaged over the other possible outcome) with separate curves for the other gamble's outcome. Once again, less pleasure is anticipated if the other gamble's outcome is better, and more pleasure is anticipated if the other gamble's outcome is worse.

Panels B and C show the separate effects of disappointment and regret. Effects can also co-occur. An imagined loss of $8 is judged as very painful when both reference points are $32 wins. Yet that same loss is judged as slightly pleasurable when both reference points are $32 losses. Regret is usually greater in magnitude than disappointment, perhaps because that counterfactual comparison is under the decision maker's control.

Panel D shows surprise effects. In gambling studies, a surprising outcome is one with a small probability of occurring. The more surprising the imagined outcome, the stronger the anticipated emotions, an effect that Kahneman and Miller (1986) called emotional amplification. Other factors besides objective probabilities

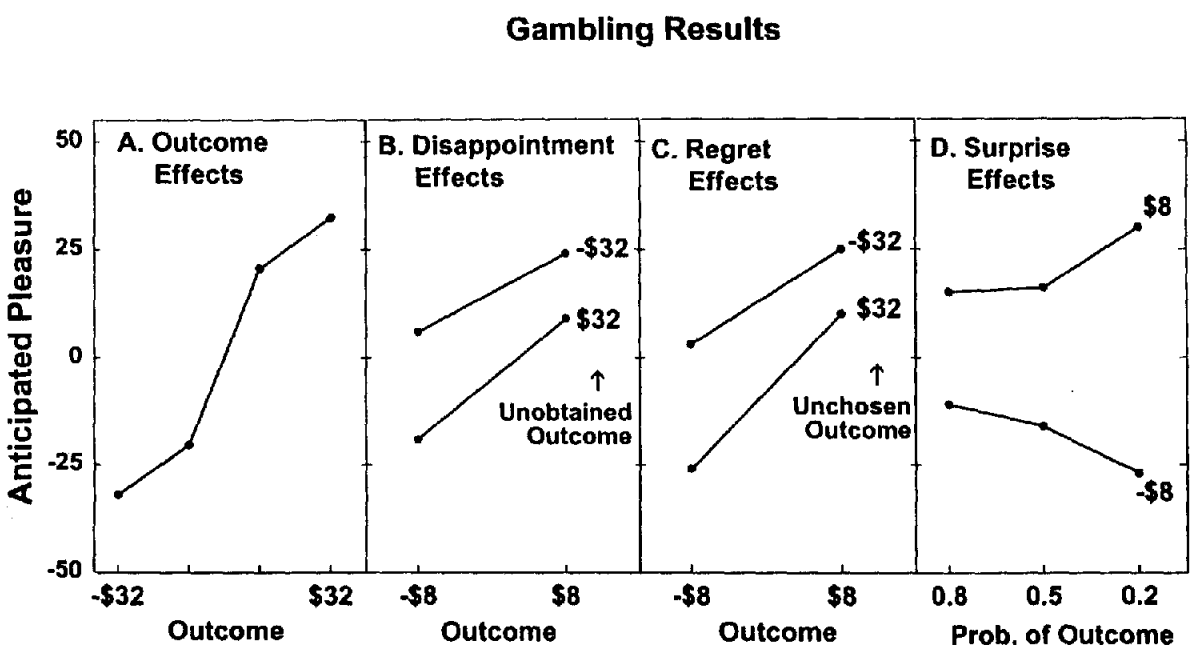

Figure 3. Results of laboratory studies with gambles showing outcome, comparison, and surprise effects.

influence surprisingness, such as the illusion of control over an outcome (Langer, 1975), the ease with which one can imagine the outcome occurring (Miller, Turnbull, & McFarland, 1989), and the arousal level of the decision maker (Gorn, Pham, & Sin, 2000).

Mellers & McGraw (2000) have also measured the anticipated emotions of decision makers who were selected on the basis of having made a choice. In these real-world studies, we asked participants to anticipate their pleasure with various outcomes. After the choice was resolved, they rated their actual pleasure with the outcome. In a grading study, students in an introductory psychology course predicted their grade and anticipated their feelings about all possible grades. The following quarter, they told us their actual grade and emotional reactions. In a dieting study, clients at a commercial weight loss program predicted weekly weight changes and their emotional reactions to various changes. At the end of the week, they told us their actual weight change and their emotional reactions. Finally, in a pregnancy study, women waiting for test results at Planned Parenthood estimated the likelihood of being pregnant and predicted their feelings about obtaining both positive and negative test results. Ten minutes later, they learned their test results and judged their actual emotions.

Figure 4 presents selected outcome, comparison, and surprise effects. The left panel shows outcome effects in the dieting study. Anticipated pleasure increases with imagined weight loss. The middle panel shows comparison effects in the grading study. Anticipated pleasure is presented against imagined grades with separate curves for expected grades. The lower the reference point, the greater the anticipated pleasure with any grade. Finally, the right panel shows surprise effects in the pregnancy study. Anticipated emotions of women who preferred not to be pregnant are presented against imagined surprise. Surprise is the confidence of pregnancy for negative test results and the confidence of no pregnancy for positive test results. Anticipated emotions are stronger with more surprise than less.

Other reference points can influence pleasure. For example, with repeated gambling, the pleasure of an outcome varies systematically with previous wins and losses. Both levels and trends of cumulative earnings influence pleasure (Ariely, 1998; Hsee & Abelson, 1991; Hsee, Abelson, & Salovey, 1991). Mellers and Tishchenko (2000) investigated these reference points in a gambling study with repeated play. Participants made a series of choices between gambles with monetary outcomes ranging from \$4 wins to \$4 losses. Overall earnings, which were continuously displayed on the computer screen, were actually under the control of the experimenter, despite the fact that individuals could differ in their choices. Participants were presented with pairs of gambles having at least one common outcome on every trial. Regardless of the choice, all individuals received the common outcome.[2]

With this basic structure, cumulative earnings were manipulated across groups of participants. In both groups, earnings started at \$0. In one group, they gradually increased to \$28, then slowly returned to \$0, as shown in Figure 5. In the other group, they gradually declined to -\$28, then slowly climbed back up to \$0. After the experimental trials, cumulative earnings for each individual were adjusted to a payment between \$6 and \$10.

At seven points in each series, identical pairs of gambles were presented to all participants. In one group, cumulative earnings at those points took the form of a rising then falling trend, with values of \$0, \$8, \$16, \$24, \$16, \$8, and \$0. In the other group, cumulative earnings at those seven points took the form of a falling then rising trend, with values of \$0, -\$8, -\$16, -\$24, -\$16, -\$8, and \$0. Level effects are assessed by comparing the pleasure of identical out-

[2] The presence of a common outcome was downplayed by randomizing the order of outcomes both within a gamble and across gambles. Participants were also interviewed after the experiment, and only a few said that they felt the experiment was rigged.

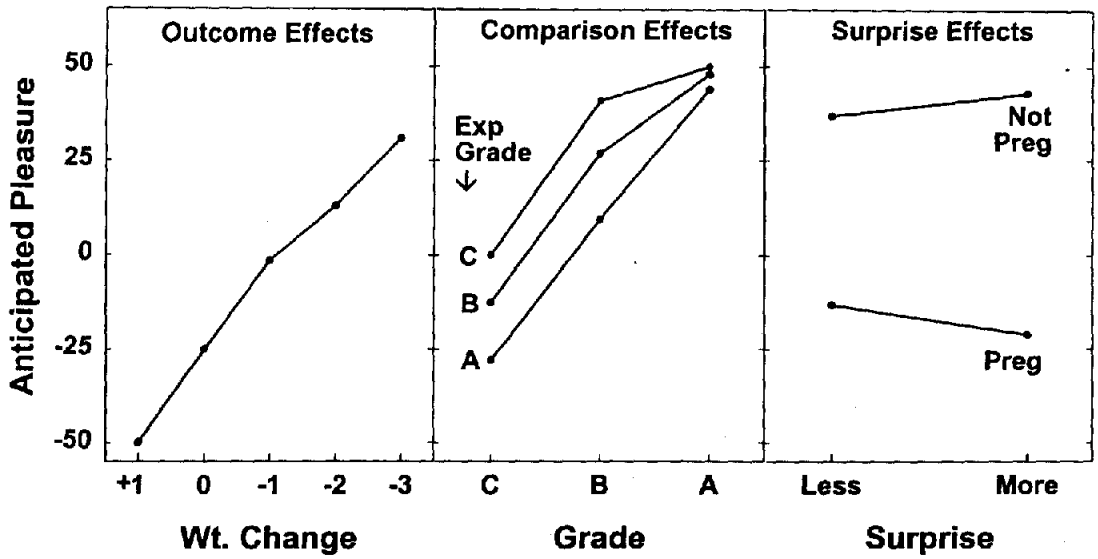

Figure 4. Selected results of real-world studies showing outcome effects from the dieting study in the left panel, comparison effects from the grading study in the middle panel, and surprise effects from the pregnancy study in the right panel.

comes for equivalent trends. Trend effects are assessed by comparing the pleasure of identical outcomes at the same level, trend effects become apparent.

Figure 6 presents the judged pleasure of a $1 win for the seven common gamble pairs, plotted against cumulative earnings. Reactions to a $1 win are initially similar but quickly diverge. Those who experience cumulative losses feel increasingly less pleasure from a $1 win, relative to those who see their cumulative earnings increase. When trends reverse, the pleasure of $1 follows suit; less pleasure is derived from $1 when cumulative earnings fall falling, and relatively more pleasure is derived from $1 when earnings rise. When both groups return to $0, the group with the rising trend receives greater pleasure than the group with the falling trend. In short, both level and trend serve as reference points that influence the pleasure of outcomes.

When reference points are less obvious, comparisons can be triggered by several factors. People are more likely to make counterfactual comparisons that undo the initial and final events in a causal sequence (Kahneman & Miller, 1986). They are also more likely to imagine how a bad outcome could have been better than

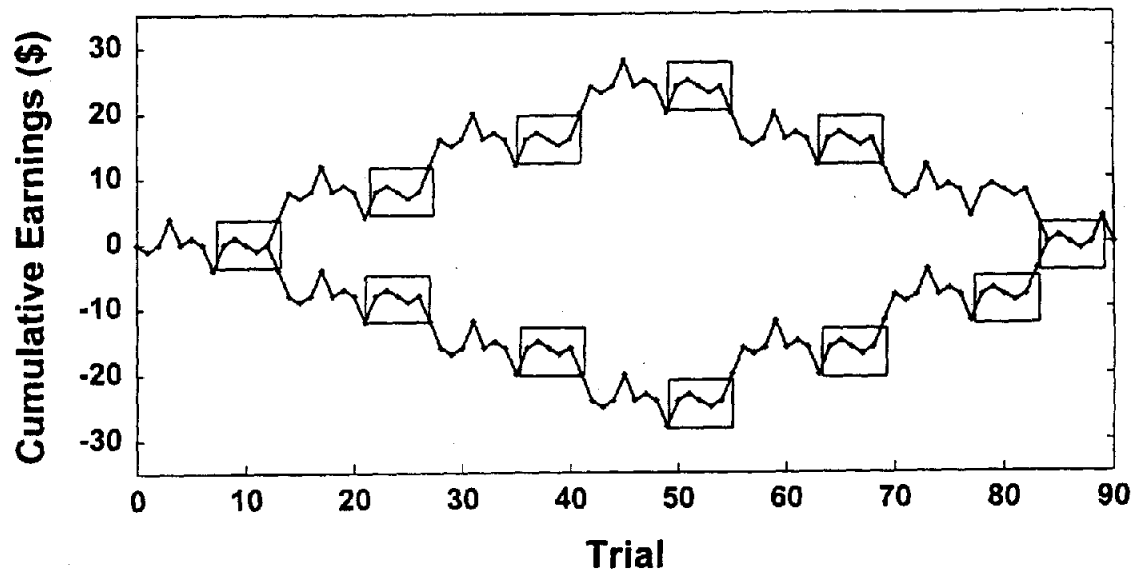

Figure 5. Cumulative earnings in the two groups of a gambling study with repeated play, plotted against trial number. Cumulative earnings differ in both levels and trends. Boxes represent identical sets of trials presented at different points in the series for both groups.

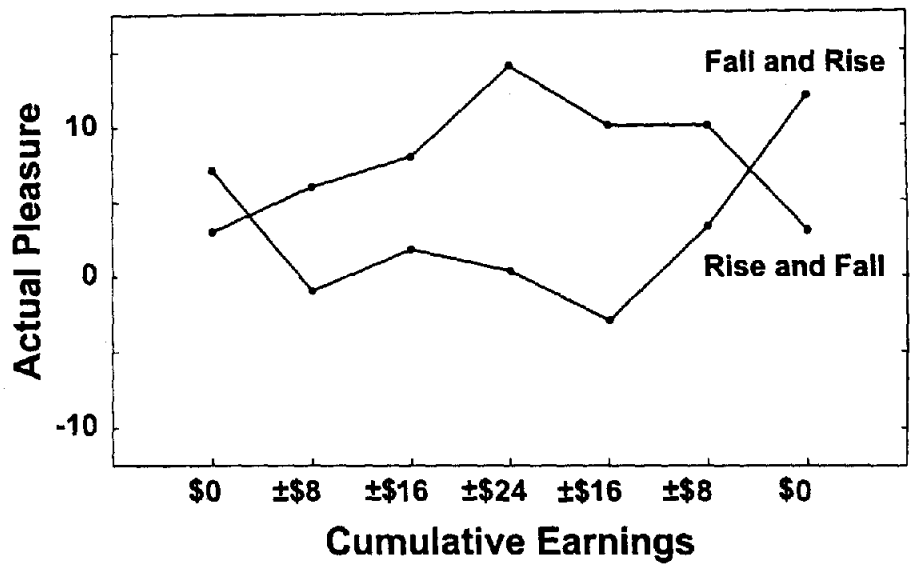

Figure 6. Actual pleasure associated with a $1 win shown against cumulative earnings, with a separate curve for each group.

how a good outcome could have been worse (Gavanski & Wells, 1989; Landman, 1987).

Although better outcomes often provide less pleasure and worse outcomes often lead to more, directional effects of comparisons can reverse. Comparisons made with someone whose situation is worse need not increase the pleasure of one's own outcome. Sometimes they give rise to feelings of pity, sadness, and remorse about the suffering of another. Likewise, comparing one's own outcome with that of someone who did better need not decrease the pleasure of one's situation. Such comparisons can lead to pride and satisfaction with the success of another (Buunk, Collins, Taylor, Van Yperen, & Dakof, 1990; Tesser, 1988).

A Theory of Anticipated Pleasure

The effects of outcome, comparisons, and surprise shown in Figures 3 and 4 are generally consistent with decision affect theory (Mellers & McGraw, 2000; Mellers, Schwartz, Ho, & Ritov, 1997; Mellers et al., 1999). Imagine someone who is considering an option with Outcomes A and B. The anticipated pleasure of Outcome A is

$$R_A = J[u_A,u_B)(1 - s_A)], \quad (1)$$

where J is a linear function that relates anticipated pleasure to a numerical response, u_A is the utility of A, and $d(u_A,u_B)$ is a within-option comparison called the disappointment function. The function operates on the difference between utilities within an option, $u_A - u_B$. The impact of the comparison is determined by $(1 - s_A)$, an expression that represents the surprisingness of Outcome A, where s_A is the belief that A will occur.

Now, suppose the decision maker imagines the outcomes of both options. The anticipated pleasure of A when the imagined outcome of the other option is C can be written:

$$R_{A(C)} = J[u_A + d(u_A,u_B)(1 - s_A) + r(u_A,u_C)(1 - s_A)(1 - s_C)], \quad (2)$$

where J, u_A, $d(u_A,u_B)$, and $(1 - s_A)$ are the same as in Equation 1, and $r(u_A,u_C)$ is an across-option comparison called the regret function. This function operates on the difference between utilities across options, $u_A - u_C$, and is weighted by the surprisingness of the joint event, A and C. When events are independent, the impact of the comparison is $(1 - s_A)(1 - s_C)$, where s_A and s_C are the beliefs A and C will occur, respectively.

Data fitting of decision affect theory has revealed a systematic pattern in the comparison functions. The incremental displeasure of an outcome that is worse than the reference point is greater in magnitude than the incremental pleasure of an outcome that is better. Disappointment, thus, has greater impact than elation, and regret has greater impact than rejoicing. Mellers et al. (1999) formalized disappointment and regret functions as power functions or step functions, depending on the gambles. Asymmetries are permitted, though not forced, by allowing exponents or step sizes to vary with the sign of the comparison. Parameters associated with negative comparisons are almost always larger than those associated with positive comparisons.[3]

Decision affect theory has led to new insights about overconfidence and pleasure. Research in judgment and decision making has shown that people are often overconfident in their abilities in skill-based tasks (Yates, 1990). Mellers and Ness (2000) investigated the effects of overconfidence on the pleasure of success and failures in cognitive and physical tasks. In the cognitive task,

[3] The asymmetry in the comparison functions may seem similar to loss aversion, but some important differences exist between them. First, loss aversion applies to real losses, whereas the asymmetry in comparison functions applies to the relative losses of imagined outcomes. Second, the asymmetry in comparison function applies to imagined gains, as well as imagined losses. Even in the imagination, a gain can feel like a loss if hopes of an even larger gain are dashed.

participants were given a list of words to spell. After receiving each word, they attempted to spell it, judged their confidence in the spelling, learned the correct answer, and rated their emotional reaction to the outcome.

Figure 7 shows the percentage of correct responses plotted against average confidence. If students had been perfectly calibrated, their points would have fallen along the identity line. Instead, points fell below the identity line, consistent with overconfidence. Figure 8 shows actual feelings associated with correct and incorrect answers plotted against surprisingness. Surprisingness is the judged confidence of success with incorrect answers and the judged confidence of failure with incorrect answers. Success felt good, and a surprising success felt slightly better. In addition, failure felt bad, and a surprising failure felt even worse.

Figure 8 shows that overconfidence has detrimental effects on the pleasure of outcomes for two reasons. When people are overconfident, successes are less surprising than warranted and therefore, less pleasurable. In addition, failures are more surprising than warranted and therefore, more painful. In short, holding skill constant, overconfidence decreases the actual pleasure of a risky task. Similar results have been found in the domain of sports (McGraw, Mellers, & Ritov, 2000).

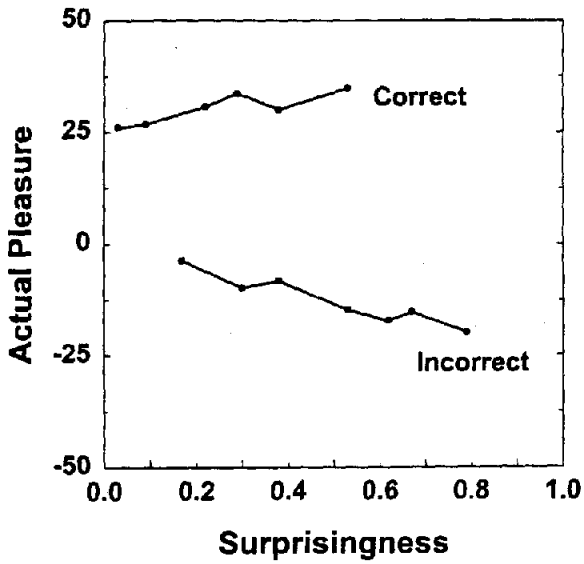

Figure 8. Actual pleasure associated with correct and incorrect answers in the spelling bee, plotted against surprisingness. Surprisingness is confidence in correct and incorrect spellings for incorrect and correct answers, respectively.

Comparing the Relative Pleasure of Consequences

How does anticipated pleasure, as described by decision affect theory, relate to choice? Mellers et al. (1999) offered a theory based on subjective expected pleasure to describe emotion-based choice.[4] This theory, as well as others (Inman, Dyer, & Jia, 1997; Loomes & Sugden, 1987; Zeelenberg, van Dijk, Manstead, & van der Pligt, in press), incorporates reference points both within and across options. To illustrate, consider again a person making a choice between an option with Outcomes A and B and another with Outcomes C and D. To assess the overall pleasure of the first option, the decision maker anticipates the pleasure of A and B, weights each anticipated feeling by the chances it will occur, and sums over outcomes, as follows:

$$s_A R_A + s_B R_B \tag{3}$$

where s_A and s_B are subjective probabilities of Outcomes A and B, respectively, and R_A and R_B are predictions of anticipated pleasure based on decision affect theory. The subjective expected pleasure of the second option follows suit:

$$s_C R_C + s_D R_D , \tag{4}$$

and the decision maker selects the option with the greater average pleasure.[5]

Subjective expected pleasure theory is similar, though not identical, to subjective expected utility theory. In fact, subjective expected utility theory is a special case of subjective expected pleasure theory when the comparison functions are symmetric about zero. However, as discussed earlier, empirical evidence shows that comparison functions are almost always asymmetric.

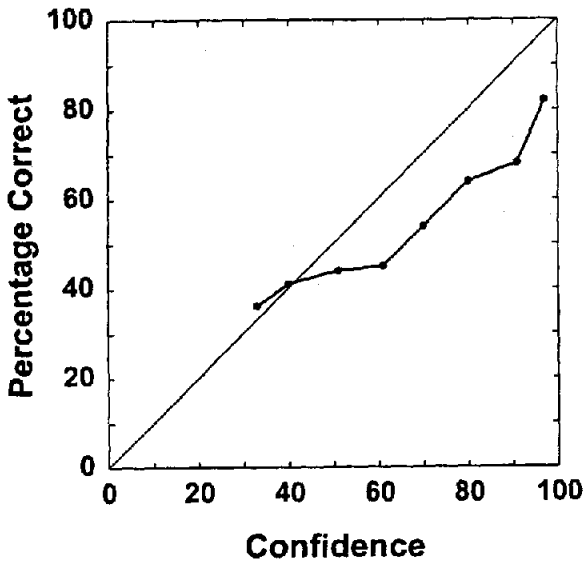

Figure 7. Overconfidence in a spelling bee.

[4] Pleasure can be derived from the senses, from acts of virtue, or from relief of pain. Similarly, pain can arise from the frustration of not achieving a goal, from injustice, or from the cessation of pleasure. Therefore, maximizing subjective expected pleasure does not necessarily imply an egoistic variant of hedonism, as some have asserted.

[5] In some cases, the decision maker may imagine two outcomes occurring. If so, the anticipated pleasure of the first option is $s_A s_C R_{A(C)} + s_A s_D R_{A(D)} + s_B s_C R_{B(C)} + s_B s_D R_{B(D)}$, and the anticipated pleasure of the second option is $s_C s_A R_{C(A)} + s_C s_B R_{C(B)} + s_D s_A R_{D(A)} + s_D s_B R_{D(B)}$. The decision maker then selects the option with the greater subjective expected pleasure.

Although the theories are rarely, if ever, equivalent, there is a surprising degree of theoretical overlap.[6]

Individuals who base choices on maximizing subjective expected pleasure theory can differ in several ways. Some individuals might anticipate greater pleasure with good outcomes, or less pain with bad outcomes, and exhibit greater risk-seeking preferences. Such individuals might also overestimate the chances of favorable outcomes or underestimate the chances of unfavorable outcomes and also display greater risk seeking. Other individuals might anticipate greater pain with bad outcomes, or less pleasure with good outcomes, and have more risk-averse preferences. Risk aversion can also result from an overestimation of the probability of painful outcomes or an underestimation of the likelihood of pleasurable outcomes. This characterization of individual differences is compatible with others, including attention to security or potential (Lopes, 1990), optimism or pessimism (Birnbaum & Stegner, 1979; Wakker, 1990), or high and low self-esteem (Josephs et al., 1992).

Tests of Subjective Expected Pleasure Theory

To test subjective expected pleasure theory in our gambling studies, Mellers at al. (1999) fitted judgments of anticipated pleasure to decision affect theory.[7] Predictions, referred to as R_A or $R_{A(C)}$ in Equations 1 and 2, were used to calculate the subjective expected pleasure of each gamble. Predictions for each gamble pair were generated by assuming that decision makers maximize their subjective expected pleasure, as shown in Equations 3 and 4. Correlations between predictions and choice proportions are shown in Table 1 for five gambling studies (Mellers et al., 1999). Values ranged from 0.66 to 0.86, suggesting that choices between gambles are generally predictable from the theory that decision makers anticipate the pleasure and pain of monetary outcomes and select the gamble with greater average pleasure.[8]

A reasonable way to evaluate subjective expected pleasure theory is to ask whether it improves the predictability of choices over and beyond subjective expected utility theory. The theories can be distinguished because anticipated pleasure differs from utilities. First, when derived from normative theories, utilities are typically assumed to be independent of subjective probabilities. Anticipated pleasure, as predicted from decision affect theory, varies with beliefs as well as utilities. Second, utilities are typically assumed to increase monotonically with amount won, but anticipated pleasure can decrease with amount won, depending on comparison and surprise effects. Smaller surprising wins can be more pleasurable than larger expected wins. Third, the utility functions are one-to-one mappings, but the anticipated pleasure is not a one-to-one function of utility because it also depends on beliefs and comparisons.

To investigate the empirical overlap between theories, Mellers et al. (1999) calculated correlations between choice proportions and predictions of subjective expected pleasure theory, after partialing out predictions based on subjective expected utility theory.[9] Correlations, also shown in Table 1 and labeled $SEP_{(SEU)}$, range from 0.64 to 0.03. All five values are positive, and four differ significantly from zero. In most cases, the predictability of choices was better when based on anticipated pleasure rather than utility.

Another way to evaluate subjective expected pleasure theory is to compare it with other theories. Suppose people make choices to minimize anticipated displeasure, without regard for pleasure. Correlations between choice proportions and predictions of this minimax rule are low and even negative, ranging from -0.47 to 0.36 across the five studies. Suppose people select gambles to maximize anticipated pleasure, without regard for displeasure. Correlations between choice proportions and predictions of this maximax theory are higher but still range from only 0.03 to 0.47. Last but not least, suppose people make choices to avoid anticipated regret. That is, they select gambles to minimize the chance of experiencing regret, as suggested by Josephs et al. (1992), Ritov (1996), and Zeelenberg et al. (1996). Correlations between choice proportions and predictions of this theory are even higher and range from 0.45 to 0.61. Although intriguing possibilities, none of the theories consistently predicts choices better than subjective expected pleasure theory.

Table 1
Correlations Between Choice Proportions and Subjective Expected Pleasure

Experiment	Maximize SEP	Maximize $SEP_{(SEU)}$
1	.74	.64
2	.86	.44
3	.72	.03
4	.71	.30
5	.66	.25

Note. SEP = subjective expected pleasure; SEU = subjective expected utility.

[6] When the J function in Equation 1 is assumed to be linear, the subjective expected pleasure associated with the first option can be written $s_A[a + b[u_A + d(u_A,u_B)(1 - s_A)]] + (1 - s_A)[a + b[u_B + d(u_B,u_A)(s_A)]]$. This expression is also $a + b[s_Au_A + (1 - s_A)u_B + d(u_A,u_B)(s_A)(1 - s_A) + d(u_B,u_A)(s_A)(1 - s_A)]$. If d is symmetric about zero, the expression reduces to $a + b[s_Au_A + (1 - s_A)u_B]$, which is linearly related to the subjective expected utility of the option. With complete feedback, the connection between theories is more complex. Additional assumptions are required before subjective expected utility theory is a special case of subjective expected pleasure theory.

[7] Mellers and McGraw (2000) did not present tests of subjective expected pleasure theory in the real-world studies because these tests are weaker. Participants in each study were selected on the basis of a prior choice that was identical for all individuals. Better tests would have included other participants who had chosen a different option. Nonetheless, some predictions of subjective expected pleasure are provided in Mellers and McGraw (2000).

[8] Mellers et al. (1999) could not fit subjective expected pleasure theory directly to choices (i.e., independent of emotions) because the disappointment and regret functions were unstable. Parameter estimates varied greatly depending on starting values, and a large number of estimates provided similar lack of fit indices. This instability did not occur when disappointment and regret functions were estimated from the fit of decision affect theory to anticipated pleasure.

[9] Because subjective expected pleasure theory was fitted indirectly to choices, it seemed appropriate to fit subjective expected utility theory indirectly, as well. We used parameters from decision affect theory (utilities and beliefs) to construct predictions. Although we could have fitted subjective expected utility theory directly to choices, this approach would have given one theory an enormous advantage over the other.

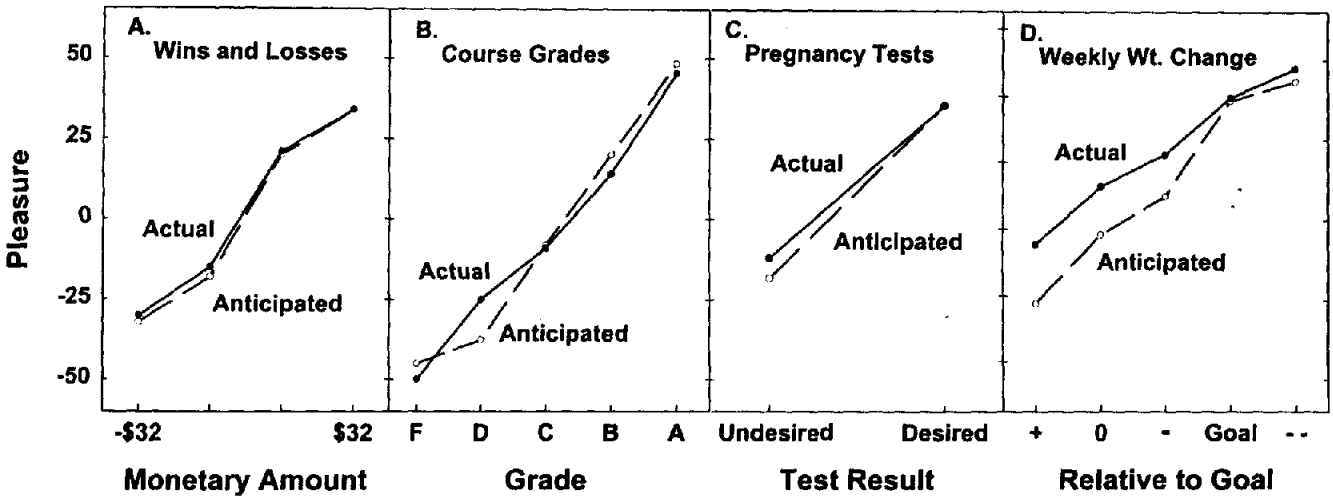

Figure 9. The accuracy of hedonic forecasts in four studies. Mean anticipated and actual pleasure associated with outcomes, shown as dashed and solid lines, respectively, in the gambling, grading, pregnancy, and dieting studies.

How Well Can Decision Makers Anticipate Pleasure and Pain?

If decision makers base their choices on comparisons of subjective expected pleasure, the accuracy of their forecasts becomes a critical concern. Inaccurate predictions could easily lead to suboptimal choices. Mellers et al. (1999) investigated the accuracy of hedonic forecasting by comparing judgments of anticipated pleasure against those of actual pleasure in both the laboratory and real-world studies. Studies differed in at least two respects. First, the duration between judgments varied considerably. In the pregnancy study, judgments of anticipated and actual pleasure were made approximately 10 minutes apart. In the gambling and dieting studies, judgments were made approximately 1 week apart. Finally, in the grading study, anticipated and actual pleasure were assessed 4 months apart. Second, participants' familiarity with outcomes also differed. Many women in the pregnancy study had neither been pregnant nor faced the possibility. However, students in the grading study had presumably estimated their course performance on numerous prior occasions during the years before college, and many dieters have struggled with weight problems for much of their lives. Participants in the gambling studies may have had the most experience with outcomes based on years of familiarity with small monetary exchanges.

Figure 9 shows judgments of anticipated and actual pleasure as dashed and solid lines, respectively, plotted against outcomes. Panel A presents results from a representative gambling study, averaged over both trials and individuals. The means are extremely close, perhaps because of experience with small wins and losses. Panel B shows judgments of anticipated and actual pleasure with final grades in an introductory psychology course. Again, curves are very close. Although judgments were made 4 months apart, college students were fairly accurate in forecasting their classroom performance. Panel C shows judgments of anticipated and actual pleasure for women taking pregnancy tests. Actual pleasure is greater than anticipated, especially with undesirable outcomes. These deviations may be expected, given some women's lack of experience with pregnancy, but they are also surprising given the fact that only 10 minutes passed between judgments. Panel D presents judgments of anticipated and actual pleasure for dieters. Again, actual pleasure is greater than anticipated, especially with undesirable outcomes. In sum, Figure 9 shows that when deviations occur, they tend to be associated with negative outcomes more than positive ones, with overestimates of actual displeasure.

Making accurate hedonic forecasts is not easy, and systematic errors have been identified (Loewenstein & Schkade, 1999). One's immediate emotions can have undue influence on one's perception, attention, and information processing strategies.[10] Such feelings can range from moments of boredom to overpowering, visceral states (Loewenstein, 1996). When happy, people overestimate the probability of favorable outcomes, and when sad, they overestimate the chances of unfavorable outcomes (Johnson & Tversky, 1983; Nygren, Isen, Taylor, & Dulin, 1996; Wright & Bower, 1992). When happy, people are better at retrieving happy memories, and when sad, they are better at recalling sad events (Bower, 1981). People also project their immediate feelings into their memories. For example, Levine (1997) investigated the emotions of Ross Perot supporters in the 1992 election. She asked supporters how they felt about him in July, at the moment he withdrew from the election. He reentered the race in October and lost in November. In November, when emotions had softened, Levine asked the same supporters about their emotions in July.

[10] The distinction between anticipated emotions and immediate emotions is not precise, and influences can go in both directions. Anticipated emotions can influence immediate emotions; people with severe phobias, for example, often have the same physiological reactions when anticipating an outcome involving the feared object as they do when actually experiencing it. The power of the imagination should not be underestimated. Likewise, immediate emotions can influence anticipated emotions. Annoyance from traffic or depression from a gloomy day can shift affective forecasting in a similar, mood-congruent direction. Despite its blurriness, the distinction is often helpful for organizing underlying processes.

Those who had been angry in July underestimated their anger, and those who had been sad underestimated their sadness.

This tendency to project immediate feelings into memories can also lead to overestimation of affect. McFarland and Ross (1987) measured the romantic feelings of dating couples at the beginning of their relationship and 2 months later. Those whose feelings became more negative over time overestimated their initial bad feelings, and those who felt more positive over time overestimated their initial good feelings.

The strategies people use to make decisions also vary with immediate emotions. Some positive emotions can promote more flexible and creative problem solving (Isen, 1993), and some negative moods, such as sadness, can lead to greater analytical thinking, greater processing of cues, and longer response times (M. Luce, 1998; M. Luce, Bettman, & Payne, 1997; M. Luce, Payne & Bettman, 1999). Angry moods have been linked to faster and less discriminate use of information (Fiedler, 1988; Forgas, 1992; Forgas & Bower, 1987; Keinan, 1987).

Negative moods due to uncertainty and anxiety about an ongoing choice are common, especially with important decisions. Tversky and Shafir (1992) and Dhar (1997) have investigated decision conflict by creating enhanced choice sets that make the selection of an alternative more difficult. When good options are added to an already good choice set, people defer their decisions, search for new alternatives, or select the default option. M. Luce (1998) has studied the effects of decision conflict based on consumer choices requiring trade-offs on highly valued attributes. Conflicted decision makers use more information and work harder, but often avoid trade-offs entirely. Janis and Mann (1977) and Tetlock (1986) have found that when important values conflict, decision making becomes especially aversive. Buck passing and procrastination become popular. In sum, immediate emotions, either relevant or irrelevant to the decision at hand, can have powerful effects on choice and affective predictions.

Another source of errors in hedonic forecasting has been identified as the tendency to focus on whatever is salient at the moment, even when it has little effect later. Schkade and Kahneman (1998) noted that when people predict their emotion reactions to an event, they often focus on one factor and downplay others, a result they called the focusing illusion. They asked students in the Midwest and California to judge how happy they were and how happy other students like them who were living in the other region would be. The comparison focused participants on the advantages of California—better climate, more cultural opportunities, and greater natural beauty. Both Californians and Midwesterners thought students in California would be happier, but in fact, the two groups were equally happy.

The focusing illusion may also lead people to focus on the transition from one state to another, rather than on the future state (Kahneman, in press). Gilbert, Pinel, Wilson, Blumberg, and Wheatley (1998) asked college professors who were coming up for tenure how they expected to feel if they did or did not receive tenure. Not surprisingly, the professors expected to be happy if given tenure and extremely unhappy otherwise. Some time later, Gilbert et al. asked the professors what had happened and how they had actually felt. Those who had been denied tenure were actually much happier than they expected. Gilbert et al. explain their results with "sweet lemons": People underestimate their power and resilience, a result Gilbert et al. called immune neglect.

Focusing on transitions rather than final states can lead to the overestimation of pleasure as well as pain. Consider how most people react to the thought of winning the lottery. They believe the experience will make them extremely happy. In a classic study, Brickman, Coates, and Janoff-Bulman (1978) examined the happiness of lottery winners, matched controls, and paraplegics. They found that, at the time of the survey, lottery winners were only slightly happier than controls, and controls were only mildly happier than paraplegics. The tendency to focus on a single event or a transition state makes people underestimate their ability to adapt to altered circumstances and go on with life.

Unanswered Questions

There are many remaining questions about emotions. How do they occur at the chemical and neurological levels? With recent advances in technology, neuroscientists are gaining new insights about brain mechanisms. Le Doux (1996) has examined conditioned fear in rats, which occurs when the thalamus communicates with the amygdala. Even though sensory input can pass from the thalamus to the cortex, through the hippocampus, and on to the amygdala, it is not required to take that pathway. Fear can also occur from sensory input in the thalamus that goes directly to the amygdala. Insights about the neural pathways of other emotions, such as anger, sadness, happiness, surprise, and disgust, will help psychologists to better understand the process of making a choice.

How are emotions best represented at a psychological level? The structure of affect is a controversial topic, and three classes of theories have been offered. Discrete theories postulate a basic number of emotions marked by early ontogenetic onset and universal facial expressions. An advantage of this approach is that it distinguishes among different types of positive feelings or negative feelings. Sadness and anger, for example, are different processes with different effects on choice (Lerner & Keltner, in press). Dimensional theories characterize emotions as values along one or more continua, such as pleasantness–unpleasantness or approach–avoidance. Cacioppo and Bernston's (1994) evaluative space model postulates three dimensions—positive affect, negative affect, and arousal. An advantage of this approach is that it distinguishes between indifference and ambivalence. Indifference is the lack of both positive and negative affect, whereas ambivalence is the combination of both, as well as high levels of arousal. The third class of appraisal-based theories asserts that emotions are elicited by cognitive evaluations of antecedent conditions (Lazarus, 1991). An advantage of this approach is that it integrates emotions with other cognitive experiences, such as novelty, coping potential, goal conduciveness, or intrinsic pleasantness. Integrating and expanding these approaches is another important future research direction.

A Broader View of Emotions and Choice

Emotions have traditionally been regarded as impediments to rationality. They are said to wreak havoc on orderly thought, interfere with logical reasoning, and subvert even the most carefully laid plans. In the past, emotions have been linked to madness; the Romans, for example, viewed anger as a temporary bout of insanity (de Sousa, 1987). Emotions can clearly impinge on rationality, but they can also be adaptive. Darwin (1872) was one of the first to argue that emotional expressions are beneficial. Surprise

often leads people to open their eyes widely and obtain as much new information as possible. Chimpanzees who are threatened show their teeth and in the process, signal their ability, and sometimes their intention, to attach the aggressor. Such expressions have evolved for long-term survival.

Emotions have beneficial effects from the first few days of life. Infants smile soon after birth and laugh in the 4th or 5th month. Smiling, laughing, and crying increase the infant's chances of obtaining parental attention. In the 8th month, infants smile selectively in response to familiar faces. Those smiles further reinforce the attachment between parents and children.

Frank (1988) has stressed the economic advantages of emotions. They promote self-interest not because of any hidden gains in their expression but rather because they solve commitment problems. Some choices require difficult-to-reverse commitments that may prove contrary to short-term self-interests. Consider a couple who want to marry and have children but are reluctant to do so for fear of the other leaving when a more attractive mate becomes available. The couple could write a contract and specify large penalties for divorce. Alternatively, they could rely on the bonds of romantic love. Strong emotional commitments are often the best way to achieve long-term goals.

Emotions also set the boundaries for proper social behavior within a community. Widely known and shared feelings of fairness often deter people from behaving selfishly. The ultimatum game is one such example. Two individuals are typically paired up, and one is given a fixed sum of money, such as $10, to divide between them. The individual makes an offer, and if the other accepts, the money is divided between them. If the offer is rejected, both individuals receive nothing. The rational, economic response is to keep $9.99 and offer the other player 1 cent. A penny is better than nothing, isn't it? In fact, many people reject such offers and appear angered by the unfairness. This "irrational" response might conflict with short-term interests, but it may have long-term advantages if it protects a player from future injustices in games with repeated play.

This growing cross-disciplinary appreciation for emotions has stimulated conversations about different types of rationality. Economists often stress procedural rationality in which choices are evaluated on the basis of a closed system of preferences and beliefs. Emotions are important to the extent that they influence preferences or beliefs, but they play an ancillary explanatory role at most. Psychologists are more likely to stress substantive rationality in which choices are assessed relative to long-term fitness and survival. Scherer (1984) argued that emotions may have evolved to replace reflexes, instincts, and simple stimulus–response chains. This decoupling allows humans the opportunity to consider multiple responses to an eliciting event. Fridja (1986) noted that emotions help mobilize behavior by acting as relevance detectors. They provide useful information about internal states (Clore & Parrott, 1991; Clore, Schwarz, & Conway, 1994; Schwarz, Bless, & Bohner, 1991).

Recent work on decisions and emotions does not resolve these debates, but it does suggest that some descriptive accounts, such as subjective expected pleasure theory, have greater theoretical and empirical overlap with the normative account, subjective expected utility theory, than one might think. By substituting anticipated pleasure for utilities, subjective expected pleasure theory is sensitive not only to outcomes but also to multiple reference points and expectations. Subjective expected pleasure theory asserts that people select the option that maximizes their expected pleasure and minimizes their expected pain. Subjective expected pleasure theory can describe the fact that surprising smaller wins can be more pleasurable than expected larger ones, that a loss can feel like a win if an even larger loss was expected, and that a regrettable action can feel worse than a regrettable inaction if perceived control increases the subjective probability of the act. The predictability of these emotional experiences is as important as the predictability of choice.

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