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CONTRASTING RATIONAL AND PSYCHOLOGICAL ANALYSES OF POLITICAL CHOICE

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We contrast the rational theory of choice in the form of expected utility theory with descriptive psychological analysis in the form of prospect theory, using problems involving the choice between political candidates and public referendum issues. The results showed that the assumptions underlying the classical theory of risky choice are systematically violated in the manner predicted by prospect theory. In particular, our respondents exhibited risk aversion in the domain of gains, risk seeking in the domain of losses, and a greater sensitivity to losses than to gains. This is consistent with the advantage of the incumbent under normal conditions and the potential advantage of the challenger in bad times. The results further show how a shift in the reference point could lead to reversals of preferences in the evaluation of political and economic options, contrary to the assumption of invariance. Finally, we contrast the normative and descriptive analyses of uncertainty in choice and address the rationality of voting.

The assumption of individual rationality plays a central role in the social sciences, especially in economics and political science. Indeed, it is commonly assumed that most if not all economic and political agents obey the maxims of consistency and coherence leading to the maximization of utility. This notion has been captured by several models that constitute the rational theory of choice including the expected utility model for decision making under risk, the riskless theory of choice among commodity bundles, and the Bayesian theory for the updating of belief. These models employ different assumptions about the nature of the options and the information available to the decision maker, but they all adopt the principles of coherence and invariance that underlie the prevailing notion of rationality.

The rational theory of choice has been used to prescribe action as well as to describe the behavior of consumers, entrepreneurs, voters, and politicians. The use of the rational theory as a descriptive model has been defended on the grounds that people are generally effective in pursuing their goals, that the axioms underlying the theory are intuitively compelling, and that evolution and competition favor rational individuals over less rational ones. The objections to the rationality assumption were primarily psychological. The human animal, it has been argued, is often controlled by emotions and desires that do not fit the model of calculating rationality. More recent objections to the maximization doctrine have been cognitive rather than motivational. Following the seminal work of Herbert Simon (1955, 1978) and the emergence of

cognitive psychology, it has become evident that human rationality is bounded by limitations on memory and computational capabilities. Furthermore, the experimental analysis of inference and choice has revealed that the cognitive machinery underlying human judgment and decision making is often inconsistent with the maxims of rationality. These observations have led to the development of a descriptive analysis of judgment and choice that departs from the rational theory in many significant respects (see, e.g., Abelson and Levi 1985; Dawes 1988; Kahneman, Slovic, and Tversky 1982; Tversky and Kahneman 1986).

We contrast the rational theory of choice with a descriptive psychological analysis, using a series of questions involving political candidates and public referenda. These problems are used to illustrate the differences between rational and descriptive theories of choice and to test their predictions. Some of the questions probed our respondents' views about familiar political issues, such as the Equal Rights Amendment and the prevalence of crime in black neighborhoods compared to white neighborhoods. In other cases involving the test of general hypotheses, such as risk aversion, we introduced hypothetical problems in order to achieve experimental control and eliminate the influence of irrelevant factors. The use of hypothetical problems raises obvious questions regarding the generality and the applicability of the finding. Nevertheless, we believe that the use of carefully worded questions can address key issues regarding people's values and beliefs so long as respondents take the questions seriously and have no particular reason to disguise or misrepresent their true preferences. Under these conditions hypothetical questions can be used to compare alternative theories of political choice that cannot be readily tested using available survey and voting data. Our results, of course, do not pro-

vide definitive conclusions about political decision making, but they may shed light on the formation of political judgment and stimulate new hypotheses that can be tested in national election surveys in the years to come.

We focus on expected utility theory, which is the major normative theory of decision making under risk (von Neumann and Morgenstern 1947; Raiffa 1968; Savage 1954). This model is contrasted with prospect theory, a descriptive analysis developed by Kahneman and Tversky (1979, 1984). The first section deals with the role of the reference point and its impact on the choice between political candidates. In the second section we test the assumption of invariance and contrast it with a psychophysical analysis of numerical scales. The third section deals with the perception and the weighting of chance events, and the role of uncertainty in choice. The fourth section addresses the classical issue of the rationality of voting. It contrasts, again, a rational analysis based on the probability of casting a decisive vote with a less rational analysis that incorporates an element of self-deception. The implications of the present analysis are discussed in the fifth and final section.

Reference Effects, Risk Attitudes, and Loss Aversion

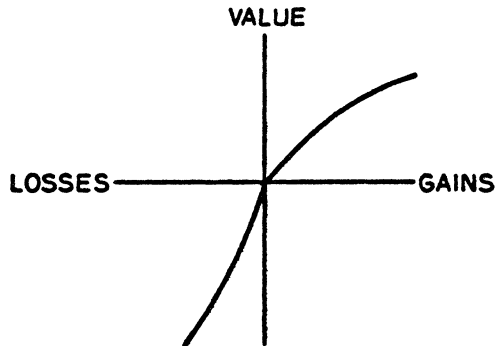
The standard utility function, derived from the expected utility model, has two essential characteristics. First, it is defined on wealth, or final asset position. Thus, a person with wealth W accepts an even chance to win \$1,000 or lose \$500 if the difference between the utility of $W + \$1,000$ and the utility of W (the upside) exceeds the difference between the utility of W and the utility of $W - \$500$ (the downside). Second, the utility function is concave; that is, the subjective value of an additional dollar diminishes with the total amount of money one has. The first

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assumption (asset integration) is necessitated by basic considerations of coherence. The second assumption (concavity) was introduced by Bernoulli (1954) to accommodate the common observations of risk aversion, and it has played an essential role in economics. A person is risk-averse if he or she prefers a sure outcome over a risky prospect that has an equal or greater expected value. For example, most people prefer \$100 for sure over an even chance to win \$200 or nothing. Risk aversion is implied by the concavity of the utility scale because the utility of $2x$ is less than twice the utility of x .

Although risk aversion is quite common, particularly for prospects with positive outcomes, risk seeking is also prevalent, particularly for prospects with negative outcomes. For example, most people find a sure loss of \$100 more aversive than an even chance to lose \$200 or nothing. To explain the combination of risk aversion and risk seeking, prospect theory replaces the traditional concave utility function for wealth by an S-shaped function for changes of wealth. In this theory, therefore, the carriers of values are positive or negative changes (i.e., gains and losses) defined relative to a neutral reference point. Furthermore, the value function is assumed to be concave above the reference point and convex below it, giving rise to risk aversion in the domain of gains and risk seeking in the domain of losses. As in the classical theory, it is assumed that the difference between \$100 and \$200 is subjectively larger than the (numerically equivalent) difference between \$1,100 and \$1,200. Unlike the classical theory, however, it is assumed that the difference between a loss of \$100 and a loss of \$200 is subjectively larger than the numerically equivalent difference between a loss of \$1,100 and a loss of \$1,200. Thus, the value function of prospect theory is steepest at the origin and it gets shallower as one moves away from the reference point in either direction. An

Figure 1. A Hypothetical Value Function



important property of the value function—called loss aversion—is that the downside is considerably steeper than the upside; that is, losses loom larger than the corresponding gains. A typical value function with these characteristics is given in Figure 1.

Attitudes towards Risk

Expected utility theory and prospect theory yield different predictions. The classical theory predicts risk aversion independent of the reference point, whereas prospect theory predicts risk aversion in the domain of gains and risk seeking in the domain of losses (except for small probabilities). Furthermore, prospect theory implies that shifts in the reference point induced by the framing of the problem will have predictable effects on people's risk preferences. These phenomena are illustrated in the following four problems, each involving a choice between alternative political prospects.

The respondents to these and other problems reported in this article were undergraduates at Stanford University or at the University of California at Berkeley. The problems were presented in a questionnaire in a classroom setting. Each problem involved a simple choice between two candidates or positions on a

public referendum. The respondents were asked to imagine actually facing the choice described, and they were assured that the responses were anonymous and that there were no correct or incorrect answers. The number of respondents in this and all subsequent problems is denoted by N , and the percentage who chose each outcome is given in parentheses.

Problem 1 ($N = 89$)

Suppose there is a continent consisting of five nations, Alpha, Beta, Gamma, Delta, and Epsilon. The nations all have very similar systems of government and economics, are members of a continental common market, and are therefore expected to produce very similar standards of living and rates of inflation. Imagine you are a citizen of Alpha, which is about to hold its presidential election. The two presidential candidates, Brown and Green, differ from each other primarily in the policies they are known to favor and are sure to implement. These policies were studied by Alpha's two leading economists, who are of equal expertise and are impartial as to the result of the election. After studying the policies advocated by Brown and Green and the policies currently being pursued by the other four nations, each economist made a forecast. The forecast consisted of three predictions about the expected standard of living index (SLI). The SLI measures the goods and services consumed (directly or indirectly) by the average citizen yearly. It is expressed in dollars per capita so that the higher the SLI the higher the level of economic prosperity. The three projections concerned

1. the average SLI to be expected among the nations Beta, Gamma, Delta, and Epsilon
2. the SLI to be expected by following Brown's policy
3. the SLI to be expected by following Green's policy

The forecasts made by each economist are summarized in the following table:

	Projected SLI in Dollars per Capita		
	Other Four Nations	Brown's Policy	Green's Policy
Economist 1	\$43,000	\$65,000	\$51,000
Economist 2	\$45,000	\$43,000	\$53,000

Suppose that as a citizen of Alpha, you were asked to cast your vote for Brown or Green. On the basis of the information provided, whom would you vote for? [Brown, 28%; Green, 72%]

A second group of respondents received the same cover story as in Problem 1, but the economists' forecasts about the other four nations were altered. The forecasts made about the candidates remained the same.

Problem 2 ($N = 96$)

	Projected SLI in Dollars per Capita		
	Other Four Nations	Brown's Policy	Green's Policy
Economist 1	\$63,000	\$65,000	\$51,000
Economist 2	\$65,000	\$43,000	\$53,000

Suppose that as a citizen of Alpha, you were asked to cast your vote for Brown or Green. On the basis of the information provided, whom would you vote for? [Brown, 50%; Green, 50%]

Comparing the responses to problems 1 and 2 shows that the choice between Brown and Green was influenced by the projected SLI in other countries. This effect can be explained in terms of the value function of prospect theory. Because the two economists were said to be impartial and of equal expertise, we assume that respondents gave equal weight to their projections. Hence, the actuarial expected value of Brown's policy (\$54,000) is about the same as that of Green's policy (\$52,000). However, Brown is riskier than Green in the sense that the outcomes projected for Brown have greater spread than those projected for Green. Therefore, Brown would profit from risk seeking and Green from risk aversion. According to prospect theory, an individual's attitude towards risk depends on whether the outcomes are perceived as gains or losses, relative to the reference point.

In Problems 1 and 2 it seems reasonable to adopt the average SLI projected for the other nations as a point of reference,

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because all five nations were said to have comparable standards of living. The reference point then will be about \$44,000 in problem 1 and \$64,000 in problem 2. Outcomes projected for Brown and Green would, therefore, be treated as gains in the first problem and as losses in the second. As a consequence, the value function entails more risk aversion in problem 1 than in problem 2. In fact, significantly more respondents opted for the relatively risk-free Green in problem 1 (72%) than in problem 2 (50%) ($p < .005$ by chi-square). Another factor that may have contributed to the finding is a tendency for people to discount the highly discrepant projection for the risky candidate, Brown (i.e., the one made by Economist 1 in problem 1 and by Economist 2 in problem 2). Although this consideration may have played a role in the present case, the same shift in attitudes towards risk have been observed in many other problems in which this account does not apply (Tversky and Kahneman 1986).

To address whether the predictions based on the value function apply to other attributes besides money, we included in the same questionnaire one of two problems in which the rate of inflation was the outcome of the choice.

Problem 3 (N = 76)

Now imagine that several years have passed and that there is another presidential contest between two new candidates, Frank and Carl. The same two economists studied the candidates' preferred policies and made a projection. This time, however, the forecast concerned the projected rate of inflation. The forecasts made by each economist are summarized in the following table:

	Projected Rate of Inflation (%)		
	Other Four Nations	Frank's Policy	Carl's Policy
Economist 1	24	16	4
Economist 2	26	14	26

Suppose that as a citizen of Alpha, you were asked to cast your vote for Frank or Carl. On the

basis of the information provided, whom would you vote for? [Frank, 74%; Carl, 26%]

A second group of respondents received the same cover story as in problem 3, but the economists' forecasts about the other four nations were altered. The forecasts made about the candidates remained the same.

Problem 4 (N = 75)

	Projected Rate of Inflation (%)		
	Other Four Nations	Frank's Policy	Carl's Policy
Economist 1	4	16	4
Economist 2	6	14	26

Suppose that as a citizen of Alpha, you were asked to cast your vote for Frank or Carl. On the basis of the information provided, whom would you vote for? [Frank, 52%; Carl, 48%]

The analysis of problems 3 and 4 closely follows that of problems 1 and 2. The expected rate of inflation was 15% for both candidates. However, this value was below the expected continental rate of 25% in problem 3 and above the expected continental rate of 5% in problem 4. Because high inflation is undesirable, values below reference are likely to be viewed as gains, whereas values above reference are likely to be viewed as losses. Assuming that the continental rate of inflation was taken as a point of reference, the results confirmed the prediction of prospect theory that the more risky candidate (Carl) would obtain more votes in problem 4 (48%) than in problem 3 (26%) ($p < .01$ by chi-square).

Together, the responses to problems 1-4 confirm the prediction of prospect theory that people are risk-averse in the domain of gains and risk-seeking in the domain of losses, where gains and losses were defined relative to the outcomes projected for other countries. These results may shed light on the so-called incumbency-oriented voting hypothesis.

Numerous investigators have shown that the evaluation of an incumbent party is responsive to fluctuations in the national economy. In general, incumbent presidents and congressional candidates of the same party benefit at the polls from improving economic conditions whereas they suffer from deteriorating conditions (Kramer 1971). These results can be understood, in part, as a consequence of the divergent attitudes towards risks for outcomes involving gains and losses. Following Shepsle (1972), we maintain that incumbents are usually regarded by voters as less risky than the challengers, who are often unknowns and whose policies could drastically alter the current trends, for better or for worse. If people are risk-averse for gains and risk-seeking for losses, the less risky incumbent should fare better when conditions are good than when they are bad. This analysis assumes that the reelection of the incumbent is perceived by voters as a continuation of the current trends, which is attractive when times are good. In contrast, the election of the challenger offers a political gamble that is worth taking when "four more years" of the incumbent is viewed as an unsatisfactory state.

It is important to distinguish this analysis of incumbency-oriented voting from the more common explanation that "when times are bad you throw the rascals out." In the latter account, voters are thought to regard a credible challenger as having to be better than the incumbent, who "got us into this mess to begin with." The present account, in contrast, is based on the notion that the challenger is *riskier* than the incumbent, not necessarily better overall. In problems 2 and 4, the risky candidates profit from hard times even though their expected value was no better than that of the relatively riskless candidates. Obviously, however, a challenger whose expected value is substantially below the incumbent's is unlikely to be

elected even in the presence of substantial risk seeking.

In light of this discussion, it is interesting to share an unsolicited response given by one of our participants, who received problem 4 in the winter of 1981. This respondent penciled in *Carter* over *Frank*, the less risky candidate, and *Reagan* over *Carl*, the riskier candidate. Recall that in this problem the outcomes were less desirable than the reference point. Evidently, our respondent—who voted for *Carl*—believed that the erstwhile incumbent *Carter* would have guaranteed the continuation of unacceptable economic conditions, while the erstwhile challenger *Reagan*, with his risky "new" theories, might have made matters twice as bad as they were or might have been able to restore conditions to a satisfactory level. Because economic and global conditions were widely regarded as unacceptable in 1980, the convexity of the value function for losses may have contributed to the election of a risky presidential prospect, namely *Reagan*.

Loss Aversion

A significant feature of the value function is that losses loom larger than gains. For example, the displeasure associated with losing a sum of money is generally greater than the pleasure associated with winning the same amount. This property, called *loss aversion*, is depicted in Figure 1 by the steeper slope for outcomes below the reference point than for those above.

An important consequence of loss aversion is a preference for the status quo over alternatives with the same expected value. For example, most people are reluctant to accept a bet that offers equal odds of winning and losing x number of dollars. This reluctance is consistent with loss aversion, which implies that the pain associated with the loss would exceed the pleasure associated with the gain, or $v(x) <$

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$-v(-x)$. This observation, however, is also consistent with the concavity of the utility function, which implies that the status quo (i.e., the prospect yielding one's current level of wealth with certainty) is preferred to any risky prospect with the same expected value. These accounts can be discriminated from each other because in utility theory the greater impact of losses than of gains is tied to the presence of risk. In the present analysis, however, loss aversion also applies to riskless choice. Consider the following example: Let $x = (x_i, x_u)$ and $y = (y_i, y_u)$ denote two economic policies that produce inflation rates of x_i and y_i and unemployment rates of x_u and y_u . Suppose $x_i > y_i$ but $x_u < y_u$; that is, y produces a lower rate of inflation than x but at the price of a higher rate of unemployment. If people evaluate such policies as positive or negative changes relative to a neutral multiattribute reference point and if the (multiattribute) value function exhibits loss aversion, people will exhibit a reluctance to trade; that is, if at position x (the status quo) people are indifferent between x and y , then at position y they would not be willing to switch to x (Kahneman and Tversky 1984). We test this prediction in the following pair of problems.

Problem 5 ($N = 91$)

Imagine there were a presidential contest between two candidates, Frank and Carl. Frank wishes to keep the level of inflation and unemployment at its current level. The rate of inflation is currently at 42%, and the rate of unemployment is currently at 15%. Carl proposes a policy that would decrease the rate of inflation by 19% while increasing the rate of unemployment by 7%. Suppose that as a citizen of Alpha, you were asked to cast your vote for either Frank or Carl. Please indicate your vote. [Frank, 65%; Carl, 35%]

Problem 6 ($N = 89$)

Imagine there were a presidential contest between two candidates, Frank and Carl. Carl wishes to keep the rate of inflation and un-

employment at its current level. The rate of inflation is currently at 23%, and the rate of unemployment is currently at 22%. Frank proposes a policy that would increase the rate of inflation by 19% while decreasing the rate of unemployment by 7%. Suppose that as a citizen of Alpha you were asked to cast your vote for either Frank or Carl. Please indicate your vote. [Frank, 39%; Carl, 61%]

It is easy to see that problems 5 and 6 offer the same choice between Frank's policy (42%, 15%) and Carl's policy (23%, 22%). The problems differ only in the location of the status quo, which coincides with Frank's policy in problem 5 and with Carl's policy in problem 6. As implied by the notion of multiattribute loss aversion, the majority choice in both problems favored the status quo ($p < .001$ by chi-square). The reluctance to trade is in this instance incompatible with standard utility theory, in which the preference between two policies should not depend on whether one or the other is designated as the status quo. In terms of a two-dimensional value function, defined on changes in inflation and unemployment, the present results imply that both $v(19, -7)$ and $v(-19, 7)$ are less than $v(0, 0) = 0$.

We have seen that the combination of risk aversion for gains and risk seeking for losses is consistent with incumbency-oriented voting: incumbents profit from good times, and challengers from bad times. We wish to point out that loss aversion is consistent with another widely accepted generalization, namely that the incumbent enjoys a distinct advantage over the challenger. This effect is frequently attributed to such advantages of holding office as that of obtaining free publicity while doing one's job and being perceived by voters as more experienced and effective at raising funds (Kiewiet 1982). To these considerations, the present analysis of choice adds the consequences of the value function. Because it is natural to take the incumbent's policy as the status quo—the reference point to

which the challenger's policy is compared—and because losses loom larger than gains, it follows that the incumbent enjoys a distinct advantage. As we argued earlier, the introduction of risk or uncertainty also tends to favor the incumbent under conditions that enhance risk aversion; that is, when the general conditions are good or even acceptable, voters are likely to play it safe and opt for the relatively riskless incumbent. Only when conditions become unacceptable will the risky challenger capture an edge. Hence, the properties of the value function are consistent with the generally observed incumbency effects, as well as with the exceptions that are found during hard times.

Loss aversion may play an important role in bargaining and negotiation. The process of making compromises and concessions may be hindered by loss aversion, because each party may view its own concessions as losses that loom larger than the gains achieved by the concessions of the adversary (Bazerman 1983; Tversky and Kahneman 1986). In negotiating over missiles, for example, each superpower may sense a greater loss in security from the dismantling of its own missiles than it senses a gain in security from a comparable reduction made by the other side. This difficulty is further compounded by the fact, noted by several writers (e.g., Lebow and Stein 1987; Ross 1986), that the very willingness of one side to make a particular concession (e.g., eliminate missiles from a particular location) immediately reduces the perceived value of this concession.

An interesting example of the role of the reference point in the formation of public opinion was brought to our attention by the actor Alan Alda. The objective of the Equal Rights Amendment (ERA) can be framed in two essentially equivalent ways. On the one hand, the ERA can be presented as an attempt to eliminate discrimination against women.

In this formulation, attention is drawn to the argument that equal rights for women are not currently guaranteed by the constitution, a negative state that the ERA is designed to undo. On the other hand, the ERA can be framed as legislation designed to improve women's status in society. This frame emphasizes what is to be gained from the amendment, namely, better status and equal rights for women. If losses loom larger than gains, then support for the ERA should be greater among those who are exposed to the frame that emphasizes the elimination of discrimination than the improvement of women's rights. To test Alda's hypothesis, we presented two groups of respondents with the following question. The questions presented to the two groups differed only in the statement appearing on either side of the slash within the brackets.

Problem 7 (N = 149)

As you know, the Equal Rights Amendment to the Constitution is currently being debated across the country. It says, "Equality of rights under law shall not be denied or abridged by the United States or by any state on account of sex." Supporters of the amendment say that it will [help eliminate discrimination against women/improve the rights of women] in job opportunities, salary, and social security benefits. Opponents of the amendment say that it will have a negative effect by denying women protection offered by special laws. Do you favor or oppose the Equal Rights Amendment? (check one)

Not surprisingly, a large majority of our sample of Stanford undergraduates indicated support for the ERA (74%). However, this support was greater when the problem was framed in terms of eliminating discrimination (78%) than in terms of improving women's rights (69%).

Just as the formulation of the issue may affect the attitude of the target audience, so might the prior attitude of the audience have an effect on the preferred formulation of the issue. Another group of respondents first indicated their opinion on

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the ERA, either pro or con. They then responded to the following question.

Problem 8 (N = 421)

The status and rights of women have been addressed in two different ways, which have different social and legal implications. Some people view it primarily as a problem of eliminating inequity and discrimination against women in jobs, salary, etc. Other people view it primarily as a problem of improving or strengthening the rights of women in different areas of modern society. How do you see the problem of women's rights? (check one only)

Of those who indicated support of the ERA, 72% chose to frame the issue in terms of eliminating inequity, whereas only 60% of those who opposed the ERA chose this frame. This finding is consistent with the common observation regarding the political significance of how issues are labeled. A familiar example involves abortion, whose opponents call themselves prolife, not antichoice.

Invariance, Framing, and the Ratio-Difference Principle

Perhaps the most fundamental principle of rational choice is the assumption of invariance. This assumption, which is rarely stated explicitly, requires that the preference order among prospects should not depend on how their outcomes and probabilities are described and thus that two alternative formulations of the same problem should yield the same choice. The responses to problems 7 and 8 above may be construed as a failure of invariance. In the present section, we present sharper tests of invariance in which the two versions of a given choice problem are unquestionably equivalent. Under these conditions, violations of invariance cannot be justified on normative grounds. To illustrate such failures of invariance and motivate the psychological analysis, consider the following pair of problems.

Problem 9 (N = 126)

Political decision making often involves a considerable number of trade-offs. A program that benefits one segment of the population may work to the disadvantage of another segment. Policies designed to lead to higher rates of employment frequently have an adverse effect on inflation. Imagine you were faced with the decision of adopting one of two economic policies.

If program J is adopted, 10% of the work force would be unemployed, while the rate of inflation would be 12%. If program K is adopted, 5% of the work force would be unemployed, while the rate of inflation would be 17%. The following table summarizes the alternative policies and their likely consequences:

Policy	Work Force Unemployed (%)	Rate of Inflation (%)
Program J	10	12
Program K	5	17

Imagine you were faced with the decision of adopting program J or program K. Which would you select? [program J, 36%; program K, 64%]

A second group of respondents received the same cover story about trade-offs with the following description of the alternative policies:

Problem 10 (N = 133)

Policy	Work Force Employed (%)	Rate of Inflation (%)
Program J	90	12
Program K	95	17

Imagine you were faced with the decision of adopting program J or program K. Which would you select? [program J, 54%; program K, 46%]

The modal response was program K in problem 9 and program J in problem 10. These choices constitute a violation of invariance in that each program produces the same outcomes in both problems. After all, to say that 10% or 5% of the work force will be unemployed is to say, respectively, that 90% or 95% of the work force will be employed. Yet respondents showed more sensitivity to the out-

comes when these were described as rates of unemployment than as rates of employment. These results illustrate a "psychophysical" effect that we call the *ratio-difference principle*.

Psychophysics is the study of the functional relation between the physical and the psychological value of attributes such as size, brightness, or loudness. A utility function for money, therefore, can also be viewed as a psychophysical scale relating the objective to the subjective value of money. Recall that a concave value function for gains of the form depicted in Figure 1 implies that a difference between \$100 and \$200 looms larger than the objectively equal difference between \$200 and \$300. More generally, the ratio-difference principle says that the impact of any fixed positive difference between two amounts increases with their ratio. Thus the difference between \$200 and \$100 yields a ratio of 2, whereas the difference between \$300 and \$200 yields a ratio of 1.5. The ratio-difference principle applies to many perceptual attributes. Increasing the illumination of a room by adding one candle has a much larger impact when the initial illumination is poor than when it is good. The same pattern is observed for many sensory attributes, and it appears that the same psychophysical principle is applicable to the perception of numerical differences as well.

Unlike perceptual dimensions, however, numerical scales can be framed in different ways. The labor statistics, for example, can be described in terms of employment or unemployment, yielding the same difference with very different ratios. If the ratio-difference principle applies to such scales, then the change from an unemployment rate of 10% to 5%, yielding a ratio of 2, should have more impact than the objectively equal change from an employment rate of 90% to 95%, yielding a ratio that is very close to unity. As a consequence, program K

would be more popular in problem 9 and program J in problem 10. This reversal in preference was obtained, although the only difference between the two problems was the use of unemployment data in problem 9 and employment data in problem 10.

The ratio-difference principle has numerous applications to political behavior. For example, many political choices involve the allocation of limited funds to various sectors of the population. The following two problems demonstrate how the framing of official statistics can effect the perceived need for public assistance.

Problem 11 (N = 125)

The country of Delta is interested in reducing the crime rate among its immigrant groups. The Department of Justice has been allocated \$100 million (\$100M) for establishing a crime prevention program aimed at immigrant youths. The program would provide the youths with job opportunities and recreational facilities, inasmuch as criminal acts tend to be committed by unemployed youths who have little to do with their time. A decision must be made between two programs currently being considered. The programs differ from each other primarily in how the \$100M would be distributed between Delta's two largest immigrant communities, the Alphans and the Betans. There are roughly the same number of Alphans and Betans in Delta. Statistics have shown that by the age of 25, 3.7% of all Alphans have a criminal record, whereas 1.2% of all Betans have a criminal record.

The following two programs are being considered. Program J would allocate to the Alphan community \$55M and to the Betan community \$45M. Program K would allocate \$65M to the Alphan community and to the Betan community \$35M. The following table summarizes these alternative programs:

Program	To Alphan Community	To Betan Community
Program J	\$55M	\$45M
Program K	\$65M	\$35M

Imagine you were faced with the decision between program J and program K. In light of the available crime statistics, which would you select? [program J, 41%; program K, 59%]

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A second group of respondents received the same cover story and program description as in problem 11, with the criminal statistics framed as follows:

Problem 12 (N = 126)

Statistics have shown that by the age of 25, 96.3% of all Alphans have no criminal record whereas 98.8% of all Betans have no criminal record. . . . In light of the available crime statistics, which would you select? [program J, 71%; program K, 29%]

It should be apparent that the crime statistics on which respondents were to base their choice were the same across the two problems. Because of the ratio-difference principle, however, the Alphans are perceived as much more criminal than the Betans in problem 11—roughly three times as criminal—but they are seen as only slightly less noncriminal than the Betans in problem 12. As hypothesized, respondents selected that program in which differences in allocations between the groups matched as closely as possible differences in perceived criminality, resulting in a large reversal of preference ($p < .001$ by chi-square).

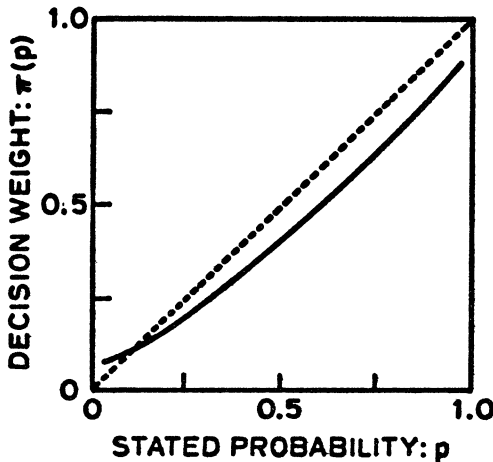
The preceding two problems illustrate an important social problem concerning the perception of crime rates among minority and nonminority segments of the population. It is generally believed that the members of minority groups, such as blacks, have much higher crime rates than do the members of nonminority groups, such as whites (Tursky et al. 1976). Indeed, according to the actual crime statistics compiled by the FBI in 1982, 2.76% of black citizens were arrested for a serious crime compared to .68% of white Americans. The between group difference does appear quite large. Problems 11 and 12 suggest, however, that judgments about the divergent crime rates in the two communities may be altered by how the data are framed. The apparently large difference between crime rates of 2.76% and .68% can be reframed

as a relatively small difference between law-obedience rates of 97.24% and 99.32%.

Quattrone and Warren (1985) showed a sample of Stanford undergraduates the 1982 crime statistics, framed either in terms of the percentages of blacks and whites who were arrested for crime or the percentages who were not. Other respondents were not exposed to these data. As implied by the ratio-difference principle, the respondents who were exposed to the crime commission statistics considered the crime rate to be substantially higher in black communities than in white communities, whereas those exposed to the law-obedience statistics considered the communities to be more at par in crime. Furthermore, the subjects who were not shown the FBI crime data gave responses that were virtually indistinguishable from those given by subjects exposed to the crime commission statistics. This comparison suggests that people may generally formulate beliefs about the proportions of blacks and whites who commit crime, not the proportions who abide by the law.

In another question the subjects who had consulted the FBI statistics were asked to allocate \$100M targeted for the prevention of crime between the two racial communities. It was observed that subjects exposed to the crime commission statistics allocated more money to the black community (mean = \$58.4M) than did the subjects exposed to the law obedience statistics (mean = \$47.2M). Hence, the basic results of this section were replicated for nonhypothetical groups. Moreover, a second study by Quattrone and Warren demonstrated that the same reversals due to framing are obtained when racial differences in crime must be inferred from a set of photographs rather than being explicitly pointed out in a neat statistical table. Taken as a whole, the results suggest that the decision of how to frame the data can have significant political conse-

Figure 2. A Hypothetical Weighting Function



quences for individuals as well as for entire social groups. We suspect that the more successful practitioners of the art of persuasion commonly employ such framing effects to their personal advantage.

The Weighting of Chance Events

A cornerstone of the rational theory of choice is the expectation principle. In the expected utility model, the decision maker selects that option with the highest expected utility that equals the sum of the utilities of the outcomes, each weighted by its probability. The following example of Zeckhauser illustrates a violation of this rule. Consider a game of Russian roulette where you are allowed to purchase the removal of one bullet. Would you be willing to pay the same amount to reduce the number of bullets from four to three as you would to reduce the number from one to zero? Most people say that they would pay more to reduce the probability of death from one-sixth to zero, thereby eliminating the risk altogether, than to reduce the probability of death

from four-sixths to three-sixths. This response, however, is incompatible with the expectation principle, according to which the former reduction from a possibility (one bullet) to a certainty (no bullets) cannot be more valuable than the latter reduction (from four to three bullets). To accommodate this and other violations of the expectation principle, the value of each outcome in prospect theory is multiplied by a decision weight that is a monotonic but nonlinear function of its probability.

Consider a simple prospect that yields outcome x with probability p , outcome y with probability q , and the status quo with probability $1 - p - q$. With the reference point set at the status quo, the outcomes are assigned values $v(x)$ and $v(y)$, and the probabilities are assigned decision weights, $\pi(p)$ and $\pi(q)$. The overall value of the prospect is

$$\pi(p)v(x) + \pi(q)v(y).$$

As shown in Figure 2, π is a monotonic nonlinear function of p with the following properties:

1. Impossible events are discarded, that is, $\pi(0) = 0$, and the scale is normalized so that $\pi(1) = 1$. The function is not well behaved at the endpoints though, for people sometimes treat highly likely events as certain and highly unlikely events as impossible.
2. Low probabilities are overweighted, giving rise to some risk seeking in the domain of gains. For example, many people prefer one chance in a thousand to win \$3,000 over \$3 for sure. This implies

$$\pi(.001)v(\$3,000) > v(\$3),$$

hence

$$\pi(.001) > v(\$3)/v(\$3,000) > .001,$$

by the concavity of v for gains.

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3. Although for low probabilities, $\pi(p) > p$, in general, $\pi(p) + \pi(1 - p) < 1$. Thus low probabilities are overweighted, moderate and high probabilities are underweighted, and the latter effect is more pronounced than the former.
4. For all $0 < p, q, r < 1$, $\pi(pq)/\pi(p) < \pi(pqr)/\pi(pr)$; that is, for any ratio of probabilities q , the ratio of decision weights is closer to unity when the probabilities are small than when they are large; for example, $\pi(.4)/\pi(.8) < \pi(.1)/\pi(.2)$. This property implies the common response to the Russian roulette problem because $\pi(1/6) - \pi(0) > \pi(4/6) - \pi(3/6)$.

Although the description of π has involved stated numerical probabilities, it can be extended to events whose probabilities are subjectively assessed or verbally implied. In these situations, however, the decision weights may also be affected by the vagueness or other details of the choice.

Certainty and Pseudocertainty

Many public policies involve the allocation of funds for projects whose outcomes cannot be known with certainty. The following problems illustrate how preferences among risky projects may be affected by the properties of π , and the results are contrasted with those predicted by the expected utility model.

Problem 13 ($N = 88$)

The state of Epsilon is interested in developing clean and safe alternative sources of energy. Its Department of Natural Resources is considering two programs for establishing solar energy within the state. If program X is adopted, then it is virtually certain that over the next four years the state will save \$20 million (\$20M) in energy expenditures. If program Y is adopted, then there is an 80% chance that the state will save \$30M in energy expenditures over the next four years and a 20% chance that because of cost overruns, the

program will produce no savings in energy expenditures at all. The following table summarizes the alternative policies and their probable consequences.

Policy	Savings in Energy Expenditures
Program X	\$20M savings, with certainty
Program Y	80% chance of saving \$30M, 20% chance of no savings

Imagine you were faced with the decision of adopting program X or program Y. Which would you select? [program X, 74%; program Y, 26%]

The same respondents who received problem 13 also received the following problem. Order of presenting the two problems was counterbalanced across booklets.

Problem 14 ($N = 88$)

The state of Gamma is also interested in developing clean and safe alternative sources of energy. Its Department of Natural Resources is considering two programs for establishing solar energy within the state. If program A is adopted, then there is a 25% chance that over the next four years the state will save \$20 million (\$20M) in energy expenditures and a 75% chance that because of cost overruns, the program will produce no savings in energy expenditures at all. If program B is adopted, there is a 20% chance that the state will save \$30M in energy expenditures and an 80% chance that because of cost overruns, the program will produce no savings in energy expenditures at all. The following table summarizes the alternative policies and their probable consequences:

Policy	Savings in Energy Expenditures
Program A	25% chance of saving \$20M, 75% chance of no savings
Program B	20% chance of saving \$30M, 80% chance of no savings

Imagine you were faced with the decision of adopting program A or program B. Which would you select? [program A, 39%; program B, 61%]

Because the same respondents completed both problems 13 and 14, we can examine the number who selected each of the four possible pairs of programs: X and

A, X and B, Y and A, Y and B. These data are shown in below.

Problem 13	Problem 14	
	Program A	Program B
Program X	27	38
Program Y	7	16

The pair most frequently selected is X and B, which corresponds to the modal choices of each problem considered individually. These modal choices pose a problem for the expected utility model. Setting $u(0) = 0$, the preference for X over Y in problem 13 implies that $u(\$20M) > (4/5)u(\$30M)$, or that $u(\$20M)/u(\$30M) > 4/5$. This inequality is inconsistent with that implied by problem 14, because the preference for A over B implies that $(1/4)u(\$20M) < (1/5)u(\$30M)$, or that $u(\$20M)/u(\$30M) < 4/5$. Note that programs A and B (in problem 14) can be obtained from programs X and Y (in problem 13), respectively, by multiplying the probability of nonnull outcomes by one-fourth. The substitution axiom of expected utility theory says that if X is preferred to Y, then a probability mixture that yields X with probability p and 0 otherwise should be preferred to a mixture that yields Y with probability p and 0 otherwise. If $p = 1/4$, this axiom implies that X is preferred to Y if and only if A is preferred to B. From the above table it is evident that more than half of our respondents (45 or 88) violated this axiom.

The modal choices, X and B, however, are consistent with prospect theory. Applying the equation of prospect theory to the modal choice of problem 13 yields $\pi(1)v(\$20M) > \pi(.8)v(\$30M)$, hence $v(\$20M)/v(\$30M) > \pi(.8)/\pi(1)$. Applied to problem 14, the equation yields $\pi(.2)/\pi(.25) > v(\$20M)/v(\$30M)$. Taken together, these inequalities imply the observed violation of the substitution axiom for those individuals for which $\pi(.8)/\pi(1) < v(\$20M)/v(\$30M) < \pi(.2)/\pi(.25)$. Recall that for any ratio of probabilities q

< 1 , the ratio of decision weights is closer to unity when the probabilities are small than when they are large. In particular, $\pi(.8)/\pi(1) < \pi(.2)/\pi(.25)$. Indeed, 38 of the 45 pairs of choices that deviate from expected utility theory fit the above pattern, $p < .001$ by sign test.

It should be noted that prospect theory does not predict that all respondents will prefer X to Y and B to A. This pattern will be found only among those respondents for whom the value ratio, $v(\$20M)/v(\$30M)$, lies between the ratios of decision weights, $\pi(.8)/\pi(1)$ and $\pi(.2)/\pi(.25)$. The theory requires only that individuals who are indifferent between X and Y will prefer B to A and those who are indifferent between A and B will prefer X to Y. For group data, the theory does predict the observed shift in modal preferences. The only pair of choices *not* consistent with prospect theory is Y and A, for this pair implies that $\pi(.2)/\pi(.25) < \pi(.8)/\pi(1)$. This pair was in fact selected least often.

The modal preferences exhibited in the preceding two problems illustrate a phenomenon first reported by Allais (1953) that is referred to in prospect theory as the *certainty effect*: reducing the probability of an outcome by a constant factor has a greater impact when the outcome was initially certain than when it was merely possible. The Russian roulette game discussed earlier is a variant of the certainty effect.

Causal versus Diagnostic Contingencies

A classical problem in the analysis of political behavior concerns the rationality of voting and abstaining. According to Downs (1957), it may not be rational for an individual to register and vote in large elections because of the very low probability that the individual would cast a decisive vote coupled with the costs of

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registering and going to the polls. Objections to Downs's view were raised by Riker and Ordeshook (1968), who argued that an individual may derive from voting other benefits besides the possibility of casting a decisive ballot. These additional benefits are collectively referred to as *citizen's duty*, or *D*, and they include affirming one's allegiance to the democratic system, complying with a powerful ethic, participating in a common social ritual, as well as "standing up and being counted." To these rational consequences of voting, we suggest adding a somewhat less rational component.

Elsewhere (Quattrone and Tversky 1984) we have shown that people often fail to distinguish between causal contingencies (acts that produce an outcome) and diagnostic contingencies (acts that are merely correlated with an outcome). For example, there is a widespread belief that attitudes are correlated with actions. Therefore, some people may reason that if they decide to vote, that decision would imply that others with similar political attitudes would also decide to vote. Similarly, they may reason that if they decide to abstain, others who share their political attitudes will also abstain. Because the preferred candidates can defeat the opposition only if politically like-minded citizens vote in greater numbers than do politically unlike-minded citizens, the individual may infer that he or she had better vote; that is, each citizen may regard his or her single vote as diagnostic of *millions* of votes, which would substantially inflate the subjective probability of one's vote making a difference.

To test this hypothesis, which we call the *voter's illusion*, we had a sample of 315 Stanford undergraduates read about an imaginary country named Delta. Participants were to imagine that they supported party A, opposed party B, and that there were roughly four million supporters of each party in Delta as well as four million nonaligned voters. Subjects

imagined that they were deliberating over whether to vote in the upcoming presidential election, having learned that voting in Delta can be costly in time and effort. To facilitate their decision, they were to consult one of two prevailing theories concerning the group of voters who would determine the electoral outcome.

Some subjects considered the *party supporter's theory*. According to this theory, the nonaligned voters would split their vote fairly equally across the two parties. The electoral outcome would be determined by whether the supporters of party A or party B became more involved in the election. The political experts were split as to whether the supporters of A or B would become more involved, but all agreed that the party whose members did become more involved would win by a margin of roughly 200 thousand to 400 thousand votes. Other subjects received the *non-aligned voter's theory*, which held that the supporters of each party would vote in equal numbers. The electoral outcome would in this account be determined by whether the nonaligned voters would swing their support primarily to party A or party B. The experts were split as to which party would capture the majority of the nonaligned voters, but all agreed that the fortunate party would win by a margin of at least 200 thousand votes.

Note that the consequences of voting included in the rational analysis are held constant across the two theories. In both, the "utility difference" between the two parties, the "probability" of casting a decisive vote, the costs of voting, and citizen's duty are the same. But according to the party supporter's theory, there is a correlation between political orientation and participation; that is, either the supporters of party A will vote in greater numbers than will the supporters of party B, or vice versa. In contrast, the non-aligned voter's theory holds that political orientation is independent of participation because party supporters will turn

out in equal numbers. Therefore, only subjects presented with the former theory could infer that their decision to vote or to abstain would be diagnostic of what their politically like-minded peers would decide. If being able to make this inference is conducive to voting, then a larger "turnout" should be found among subjects presented with the party supporter's theory than among those presented with the nonaligned voter's theory. In fact, when asked, "Would you vote if the theory were true and voting in Delta were costly," significantly more subjects responded *no* under the party supporter's theory (16%) than under the nonaligned voter's theory (7%) ($p < .05$ by sign test).

An additional finding corroborated the analysis that this difference in turnout was attributable to the perceived diagnosticity of voting. Respondents were asked to indicate how likely it was that the supporters of party *A* would vote in greater numbers than the supporters of party *B* "given that you decided to vote" and "given that you decided to abstain." Responses to these two questions were made on nine-point scales with verbal labels ranging from "extremely likely" to "extremely unlikely." Subjects were informed that their decision to vote or abstain could not be communicated to others. Nonetheless, subjects exposed to the party supporter's theory thought that their individual choice would have a greater "effect" on what others decided to do than did subjects exposed to the nonaligned voter's theory, $F(1,313) = 35.79$ ($p < .001$). Similar effects were observed in responses to a question probing how likely party *A* was to defeat party *B* "given that you decided to vote" and "given that you decided to abstain," $F(1,313) = 40.18$ ($p < .001$). This latter difference was obtained despite subject's knowing that they could cast but one vote and that the likely margin of victory was about 200 thousand votes.

The observed differences between re-

spondents exposed to the party supporter's and nonaligned voter's theory cannot be readily justified from a normative perspective (cf. Meehl 1977). The present analysis of causal versus diagnostic contingencies recalls the tragedy of the commons and it applies to other phenomena in which collective action dwarfs the causal significance of a single individual's contribution. The outcomes of most wars would not have changed had one fewer draftee been inducted, and the success or failure of most charity drives do not ordinarily depend on the dollars of an individual donor. These collective actions defy a routine rational analysis for the individual because if each citizen, draftee, or donor "rationally" refrains from making his or her paltry contribution, then the outcomes would be drastically affected. For this reason, exhortations to vote, to fight, and to help those less fortunate than oneself are usually framed, "If you don't vote/fight/contribute, think of what would happen if *everyone* felt the same way." This argument is compelling. Still, just how *does* an individual's private decision materially affect the decisions made by countless other persons?

Concluding Remarks

We contrasted the rational analysis of political decision making with a psychological account based on descriptive considerations. Although there is no universally accepted definition of rationality, most social scientists agree that rational choice should conform to a few elementary requirements. Foremost among these is the criterion of invariance (or extensionality [Arrow 1982]), which holds that the preference order among prospects should not depend on how they are described. Hence, no acceptable rational theory would allow reversals of preference to come about as a consequence of whether the choice is based on rates of

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employment or rates of unemployment, crime commission statistics or law obedience statistics. These alternate formulations of the problems convey the same information, and the problems differ from each other in no other way. We have seen, however, that these alternate frames led to predictable reversals in preference.

Whether our studies paint a humbling of flattering picture of human intellectual performance depends on the background from which they are viewed. The proponent of the rational theory of choice may find that we have focused on human limitations and have overlooked its many accomplishments. The motivational psychologist, accustomed to finding the root of all folly in deep-seated emotional needs, may find our approach much too rational and cognitive. Many readers are no doubt familiar with the versions of these opposing viewpoints found in political science. *The Authoritarian Personality* (Adorno et al. 1950), for example, well illustrates the use of motivational assumptions to explain the appeal of a particular ideology to certain elements of the population.

The descriptive failure of normative principles, such as invariance and coherence, does not mean that people are unintelligent or irrational. The failure merely indicates that judgment and choice—like perception and memory—are prone to distortion and error. The significance of the results stems from the observation that the errors are common and systematic, rather than idiosyncratic or random, hence they cannot be dismissed as noise. Accordingly, there is little hope for a theory of choice that is both normatively acceptable and descriptively adequate. A compelling analysis of the uses and abuses of rationality in theories of political behavior has been presented by Converse (1975) who has detailed the often arbitrary and inconsistent criteria by which rationality has been defined. Our intention was not to reopen the discussion

about the meaning of rationality but rather to enrich the set of concepts and principles that could be used to analyze, explain, and predict the decisions made by individuals in their private lives, in the market place, and in the political arena.

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