The impact of altruism and envy on competitive behavior and satisfaction

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Abstract

This paper argues that it is important to include the other party's payoff in a competitor's utility (satisfaction) function. Examples of the impact are provided as well as implications for multi-stage games (competitions). A sample of 200 provides empirical support for the critical role other party results play in satisfaction, in particular the importance of relative payoffs. Several implications emerge, including a parsimonious explanation for the exponential pattern of shares in mature markets.

1. Introduction

The mere mention of the word competition brings to mind battles where one person's gain can only come at the expense of the other's. Of course, zero-sum thinking is not a requirement, as phrases like coopetition suggest. Still, the primary model of bargaining is of zero-sum games. Further, parties are typically assumed to place no weight on the outcome the other party receives except for (a) that necessary to keep the party in the current or future negotiations or (b) some (usually minimal) concern about fairness. Yet there are a number of reasons why a party might positively (e.g., friendship, charity) or negatively (e.g., war) value outcomes received by other parties. In this paper we refer to positively valuing the other's payoff as altruism and negatively valuing it as envy. While we provide some evidence as to their existence, the main purpose of this paper is to explore the impacts of altruism and envy on bargaining outcomes.

Work exploring the impact of others' welfare on own preferences has begun to appear in many fields including marketing (Corfman and Lehmann, 1993) and economics (Rabin, 1991; Levine, 1996). Essentially, these approaches expand the valuation function to include both own and other's payoffs.

In this paper, we explicitly include other parties' payoffs in a party's own value function, expanding on Assunção and Lehmann (1992). We then examine the impact of doing so for particular functions. The focus here is on the consequences of this type of utility function; we leave process issues and the comparison of different models of this type to future work. We demonstrate how relatively small amounts of altruism or envy can substantially affect the outcomes. One interesting consequence is that, under certain conditions, the model suggests side agree-

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ments may develop where one party freely gives the other payoffs not contained in the original scope of the negotiations. Another implication of a simple extension of the model is an explanation for the distribution of shares according to Zipf's Law.

2. Background

Concern about other parties' results (happiness) has been the subject of numerous articles. For example, equity theory (cf. Messick and Cooke, 1983) suggests that, at least in some cultures, a standard exists for dividing things up other than "winner take all". The same concept shows up in the literature on distributive justice (cf. Land and Tyler, 1988). The basic point of this paper is that parties may prefer results which divide up resources so that the other party benefits (altruism) or, alternatively, situations where the other party is damaged (envy), even if they are worse off themselves in terms of payoff.

More specifically, the notions of altruism and envy present an interesting perspective on individual satisfaction with outcomes in multi-person games (i.e., competition). Altruism has a long history in bargaining studies (cf. Deutsch and Kotik, 1978) and the concept of fairness has been related to preference (Messick and Sentis, 1979; Kahneman et al., 1986). Recently these concepts have begun to be applied to game theory (Rabin, 1991; Levine, 1996; Bolton, 1999; Güth, 1999). In this paper we extend this work by examining the implications to the parties of different satisfaction functions. Unlike some other papers (e.g., Fishburn and Sarin, 1997), however, we do not focus on social welfare as a whole.

A major issue involves whether utility (and by extension satisfaction) are cardinal and comparable across individuals. While the cardinality assumption implicit in this paper has a long tradition (e.g., Keeney and Kirkwood, 1975), objections can be raised on theoretical grounds. In addition, measurement issues related to differences in the use of a scale (i.e., some people tend to spread answers—sometimes called extremism—and others cluster around the midpoint) can confound true differences in utility (satisfaction). Still, this paper makes the assumption that a cardinal satisfaction function exists for each party.

Some argue that no one should consciously place value on other parties' outcomes beyond that which is necessary to keep the other party in the game and hence to obtain current and future personal benefits. There is no doubt such conscious strategic behavior exists; phrases like "leaving them a carrot" represent exactly such behavior. However, it is just as plausible that such behavior is unconscious, in effect, programmed into DNA molecules through generations of evolution when cooperation meant survival. Evolutionary biologists have identified altruism in many species (Tangley, 1999). Further, the teachings of multiple religions and cultures encourage a conscious consideration of others, taking joy in others' happiness and welfare. In any event, the purpose of this paper is not to prove the existence of altruism or to establish its source. Rather, we demonstrate some of its consequences, assuming it exists.

3. Satisfaction with outcomes

A number of different models of utility for own and opponents' solutions have been tested (Corfman and Lehmann, 1993; Lowenstein et al., 1989). Here we focus initially on a simple linear model of satisfaction of this type:

$$\mathrm{Sat}_A = W_{AA} P_A + W_{AB} P_B \tag{1}$$

where $P_A, \ P_B =$ payoffs to $A, \ B$ and $W_{AA}, \ W_{AB} =$ weight placed by A on payoffs to $A, \ B$.

Of course, more complex models exist. Corfman and Lehmann (1993) presented and estimated four different models based on different combinations of own and other's payoffs:

Model A:

$$\begin{aligned}\mathrm{Sat}_A = {} & \alpha + W_{A1} P_A + W_{A2} P_A^2 + W_{d1} |P_A - P_B| Z_1 \\ & + W_{d2} |P_A - P_B|^2 Z_1 + W_{d3} |P_A - P_B| Z_2 \\ & + W_{d4} |P_A - P_B|^2 Z_2 ;\end{aligned} \tag{2}$$

Model B:

$$\begin{aligned}\mathrm{Sat}_A = {} & \alpha + W_{A1} P_A + W_{A2} P_A^2 + W_{B1} P_B Z_1 \\ & + W_{B2} P_B^2 Z_1 + W_{B3} P_B Z_2 + W_{B4} P_B^2 Z_2 + \epsilon ;\end{aligned} \tag{3}$$

Model C:

$$\mathrm{Sat}_A = \alpha + W_{A1} P_A + W_{A2} P_A^2 + W_{d1}(P_A - P_B) + W_{d2}(P_A - P_B)^2 + \epsilon; \tag{4}$$

Model D:

$$\mathrm{Sat}_A = \alpha + W_{A1} P_A + W_{A2} P_A^2 + W_{B1} P_B + W_{B2} P_B^2 + \epsilon; \tag{5}$$

where

$Z_1 = \text{dummy variable} = 1 \quad \text{if } P_s > P_o;$

$Z_2 = \text{dummy variable} = 1 \quad \text{if } P_s < P_o.$

Examination of these models reveals how difficult (or, in some cases, impossible) it is to algebraically or empirically distinguish among these models. The adjusted R^2s were 0.74, 0.73, 0.73, and 0.73, respectively, although they clearly outperform a model based on the product of the parties' own payoffs ($R^2 = 0.46$). Since our interest is in the implications of these models, we do not focus on testing different models. Rather we pick one and explore its consequences. More specifically, we initially focus on the simple linear form of model (1), a special case of Model D.

Note that model (1) does not explicitly include either endowment effects or diminishing marginal utility (i.e., the squared terms in Model D). Consequently, it strictly applies only to relatively small payoffs (both absolutely and in relation to wealth). We make this simplification in order to facilitate analysis.

4. Properties of the model

The results of a competition are assumed to be determined by the satisfaction functions of the two parties. Specifically we focus on solutions which maximize the product of net value (satisfaction) to the two parties. Under the condition that the weight on other's payoff is zero, this reduces to the classic Nash (1950) solution. While other solutions exist (e.g., Kalai and Smorodinsky, 1975) and the Nash solution is not a perfect predictor of settlements (Gupta and Livne, 1988; Neslin and Greenhalgh, 1983, 1986), maximizing the product of net payoffs does generally provide a close approximation to actual results.

Consider the simple case where each party to a two-party (A and B) competition only values their own payoff. Thus:

$$\mathrm{Sat}_A = W_A P_A \qquad \text{and} \qquad \mathrm{Sat}_B = W_B P_B$$

Assuming a (0, 0) conflict point (i.e., if the parties do not agree, they both get nothing and hence 0 satisfaction), the Nash solution would be to maximize $(W_A P_A - 0)(W_B P_B - 0) = W_A W_B P_A P_B$. For a zero-sum game, this leads to equal division of payoffs regardless of W_A and W_B.

Now, consider the slightly more complex case based on model (1) where:

$$\mathrm{Sat}_A = W_{AA} P_A + W_{AB} P_B$$

and

$$\mathrm{Sat}_B = W_{BB} P_B + W_{BA} P_A \tag{6}$$

Also, arbitrarily assume $P_A + P_B = 1$ (i.e., a constant-sum game). Here, the analogous problem and solution becomes:

$$\max_{P_A} \left[W_{AA} P_A + W_{AB}(1 - P_A) \right] \times \left[W_{BB}(1 - P_A) + W_{BA} P_A \right] \tag{7}$$

or

$$\max_{P_A} \left[W_{AB} W_{BB} + (W_{AB})(W_{BA} - W_{BB}) P_A + (W_{BB})(W_{AA} - W_{AB}) P_A + (W_{AA} - W_{AB})(W_{BA} - W_{BB}) P_A^2 \right] \tag{8}$$

$$\therefore \frac{\mathrm{d}}{\mathrm{d} P_A} = W_{AB}(W_{BA} - W_{BB}) + W_{BB}(W_{AA} - W_{AB}) + 2(W_{AA} - W_{AB})(W_{BA} - W_{BB}) P_A. \tag{9}$$

Setting this equal to 0 produces:

$$P_A = \frac{W_{AB}(W_{BA} - W_{BB}) + W_{BB}(W_{AA} - W_{AB})}{2\left[W_{AB}(W_{BA} - W_{BB}) + W_{AA}(W_{BB} - W_{BA}) \right]}. \tag{10}$$

Note that the results depend on relative selfishness (concern about self vs. other) and the magnitude and sign of the term reflecting concern about others.

Table 1
Satisfaction with different payoffs[a]

Payoff to A	Payoff to B	A's satisfaction	B's satisfaction	Product of satisfaction
0.50	0.50	0.50	0.50	0.25
1.00	0.00	0.90	0.40	0.36
1.44	−0.44	1.18	0.31	0.37
2.00	−1.00	1.60	0.20	0.32

[a] $\mathrm{Sat}_A = 0.9P_A + 0.1P_B$; $\mathrm{Sat}_B = 0.6P_B + 0.4P_A$.

If we further simplify by assuming $W_{AA} + W_{AB} = 1$ and $W_{BB} + W_{BA} = 1$, the result becomes:

$$P_A = \frac{(1 - W_{AA})(1 - 2W_{BB}) + W_{BB}(2W_{AA} - 1)}{2[(1 - W_{AA})(1 - 2W_{BB}) + W_{AA}(2W_{BB} - 1)]} \tag{11}$$

In the case where the parties have equal strength of preferences (i.e., $W_{AA} = W_{BB}$), then the optimal solution divides the payoff equally. The interesting results occur when $W_{AA} \neq W_{BB}$. For example, if A values their own payoff 0.8 and the other party's 0.2, and B values their own payoff 0.7 and 0.3, then the predicted solution is for A to get 71% of the payoff (due to their greater "selfishness"). Now, consider the case where A is more selfish ($W_{AA} = 0.9$) and B is less so ($W_{BB} = 0.6$). Substituting in Eq. (11) produces:

$$P_A = \frac{(0.1)(-0.2) + (0.6)(0.8)}{2[(0.1)(-0.2) + (0.9)(0.2)]} = 1.44.$$

In other words, the optimal solution is for B to give A all of the available payoff *and* add 0.44 to it from his or her own pocket. While this may seem at first unintuitive and/or irrational, upon reflection it makes sense given the utility function. It also may seem familiar to parents deciding how to behave vis-à-vis children. The result is due to the reference point being based on utility rather than payoffs. (Including a reference point based on payoffs is an interesting topic for future research.) Starting at a 50–50 solution, on the margin, B loses less by giving up payoff to A than A gains by taking it. Eventually, however, each decrease in B's satisfaction becomes larger in percentage terms than A's gain, so B does not simply give all their resources to A (Table 1). While B's payoff becomes negative (which is not allowed in the classic Nash solution), B's satisfaction (utility) is (and always will be) positive in the solution and hence above the conflict point satisfaction of zero which results from no payoffs to either party. Of course, decreasing marginal value for payoffs leads to more equal payoffs. Hence, if we include P_A^2 and P_B^2 terms and they are negative, as in Corfman and Lehmann (1987) and Lowenstein et al. (1989), the "side payment" becomes less likely. Still the payoff results based on the linear model shown in Table 2 are quite interesting.

5. Implications of the model

5.1. Envy can decrease total satisfaction

Notice that the previous competition was a friendly one in which each player had a positive value for the

Table 2
Optimal payoffs and resulting satisfaction in a one-period competition[a]

Player B's self-weight	Player A's self-weight 0.6	0.7	0.8	0.9
0.6	0.5, 0.5 (0.5, 0.5)	1.13, −0.13 (0.75, 0.37)	1.33, −0.33 (0.89, 0.33)	1.44, −0.44 (1.18, 0.31)
0.7		0.5, 0.5 (0.5, 0.5)	0.71, 0.29 (0.63, 0.42)	0.81, 0.19 (0.75, 0.38)
0.8			0.5, 0.5 (0.5, 0.5)	0.6, 0.4 (0.58, 0.44)
0.9				0.5, 0.5 (0.5, 0.5)

[a] Cell entries are: Payoffs A, B (Satisfaction A, B).

other (i.e., was partly altruistic). Consider the case where at least one party is envious of the other (i.e., they have a negative weight on the opponent's payoff). For example, examine the case where one party is purely self-motivated so $W_{AA} = 1$ and the other is somewhat envious ($W_{BB} = 0.8$, $W_{BA} = -0.2$). Substituting into Eq. (10) produces:

$$P_A = \frac{0 + (0.8)(1)}{2[0 + (1)(0.6)]} = 0.4.$$

Here, envy leads to a reduced payoff for A. Interestingly, total satisfaction (social welfare) becomes $0.4 + 0.56 = 0.96$, which is less than the $0.5 + 0.5 = 1$ that would result if both parties were self-centered. Hence, envy can be "costly" in terms of total (social) welfare.

5.2. Hatred can perpetuate a stalemate

A strong form of envy (rivalry) occurs when damage to the other party is more important than benefit to oneself, e.g., $\mathrm{Sat}_A = 0.4 P_A - 0.6 P_B$. If both parties are equally hateful, then the best settlement involves equal division. However, this leaves both parties with negative utility ($\mathrm{Sat}_A = \mathrm{Sat}_B = 0.4 \cdot 0.5 - 0.6 \cdot 0.5 = -0.1$). Hence, there is no motivation to settle, since the result of no settlement leads to zero payoff to both parties and hence a utility of 0 (which is greater than -0.1).

6. A model with carryover effects

Neither model (1) nor the four models from Corfman and Lehmann (1993) have memory; i.e., last period's results have no impact on present satisfaction. It is possible that satisfaction depends not only on payoffs in the same period, but also how well they or the other party did in the past.

Functionally, the impact of past results can be incorporated in two ways. First, past results can impact the weights used to form satisfaction (cf. Corfman and Lehmann, 1993). Second, they can directly impact satisfaction. Here we assume satisfaction directly depends on the difference between own present and previous satisfaction:

$$\mathrm{Sat}_A = W_B + W_A P_{At} + W_B P_{Bt} + W_{c1}(P_{At} - P_{At-1}) + W_{c2}(P_{Bt} - P_{Bt-1}).$$

While algebraically this reduces to a function of own and other's current and previous payoffs, in this form it has interesting implications.

The impact of getting what appears to be the less good end of a deal can be complex, leading to either increased or decreased desire to, effort expended toward, and expectations of doing well/better the next time. Several potentially conflicting effects may occur, resulting in an altered satisfaction function in future periods.

6.1. Equity

The desire for equity (Adams, 1963) could drive someone who does relatively less well to try to compensate for past losses by getting more in the future. In a cooperative group, this can lead to increased preference for a party's own results and hence to the turn-taking behavior documented by Corfman and Lehmann (1987), among others. More generally, one would expect a loser to increase his or her self-weight and in the extreme, place a negative weight on the other party's results.

6.2. Adjusted expectations

An alternative force involves learning the rules of the game. That is, one gradually adapts to whatever the results tend to be. While the first reaction may be to redress an (unjust) imbalance, after a number of losses a player may become resigned to a lesser payoff. Put differently, they will have lower expectations. Since satisfaction relates to the gap between results and expectations, these lower expectations will lead to increased satisfaction at lower payoff levels. On the other hand, winning (doing well) may increase expectations and hence lower satisfaction with a constant payoff, consistent with adaptation level theory (Helsen, 1964). This suggests early unequal payoffs may lead to long-term persistence rather than equity.

6.3. Future regret minimization

If a person expects to lose, they are likely to (a) put less effort into winning (i.e., become resigned to losing) and (b) adjust their utility function so that future losses are less painful. In other words, they

Table 3
Sample games

Stage	A's function	B's function	Payoff		Satisfaction	
			A	B	A	B
Case A: Self-focused vs. increased envy						
1	$1.0P_A + 0P_B$	$0.7P_B + 0.3P_A$	0.875	0.125	0.875	0.350
2	$1.0P_A + 0P_B$	$0.8P_B - 0.2P_A$	0.400	0.600	0.400	0.400
3	$1.0P_A + 0P_B$	$0.8P_B - 0.2P_A$	0.400	0.600	0.400	0.400
4	$1.0P_A + 0P_B$	$0.8P_B - 0.2P_A$	0.400	0.600	0.400	0.400
Total			2.075	1.925	2.075	1.550
Case B: Similarly magnanimous opponents						
1	$0.8P_A + 0.2P_B$	$0.7P_B + 0.3P_A$	0.710	0.290	0.630	0.420
2	$0.8P_A + 0.2P_B$	$0.8P_B + 0.2P_A$	0.500	0.500	0.500	0.500
3	$0.8P_A + 0.2P_B$	$0.8P_B + 0.2P_A$	0.500	0.500	0.500	0.500
4	$0.8P_A + 0.2P_B$	$0.8P_B - 0.2P_A$	0.500	0.500	0.500	0.500
Total			2.210	1.790	2.130	1.920

will eventually learn to value a lower share of the pie as a good deal. That is, in addition to lowering expectations (Kopalle and Lehmann, 2000), a party will alter the parameters of their valuation function so that lower payoffs produce greater value. In the extreme, a party can concede at the beginning rather than endure the pain of losing.

The impact of "winning" is in many, but not all, ways the mirror image of the effect of losing. At first a sense of equity may lead to a tendency toward increased concern about the other's welfare and hence a less favorable deal in the next negotiation. However, after growing accustomed to winning, a sense of entitlement is likely to emerge. Combined with the tendency of losses to loom larger than gains (Kahnemann and Tversky, 1979; Hardie et al., 1993), winners may eventually become less concerned about their opponent and more self-centered.

A complete analysis of the consequences of past competitions on future satisfaction is beyond the scope of this paper. We will, however, examine the impact in a simple multi-period game where past results impact the weights in the satisfaction function. Assume in the first stage (period), player B, who is fairly altruistic ($W_{BB} = 0.7$, $W_{BA} = 0.3$), encounters player A, who is purely self-centered ($W_{AA} = 1.0$, $W_{AB} = 0$). The resulting payoff is then:

$$P_A = \frac{1}{2}\left[\frac{0 + (0.7)(1)}{0 + (1)(0.4)}\right] = 0.875$$

This produces satisfaction levels of 0.875 and 0.35 for A and B, respectively. Now, assume that in the second stage A remains self-centered, but B feels unfairly treated and alters their satisfaction function to $W_{BB} = 0.8$, $W_{AA} = -0.2$ (i.e., they think it is clearly their turn to win and that A should be "punished" for being greedy). The next result, based on Eq. (10), should then be:

$$P_A = \frac{1}{2}\left[\frac{0 + (0.8)(1)}{0 + (1)(0.6)}\right] = 0.4$$

The satisfaction A derives from the first two periods is then $0.875 + 0.4 = 1.275$, while B's total satisfaction is $0.35 + 0.40 = 0.75$. Note that had party B simply become completely self-centered ($W_{BB} = 1$, $W_{BA} = 0$), they would have had a greater satisfaction (0.5 vs. 0.4) in the second period even though their payoff would have been lower (0.5 vs. 0.6). In other words, both parties would have been better off. An interesting research issue, therefore, is the extent to which individuals adopt satisfaction functions that maximize their ultimate satisfaction. Continuing with the example, since B remains behind, assume the satisfaction functions stay the same for periods 3 and 4. Thus, by period 4, A's total payoff is 2.075 and satisfaction is 2.075, compared to B's 1.925 total payoff and 1.550 satisfaction.

Next, consider A's initial position. Had A been less self-centered in period 1, they might have had a satisfaction function with $W_{AA} = 0.8$ and $W_{AB} = 0.2$. In this case, the first period would produce the result of $P_A = 0.71$ (see Table 3). Also assume this produced a milder reaction on the part of party B so that in the next period B's satisfaction was still mildly altruistic ($W_{BB} = 0.8$, $W_{BA} = 0.2$). The result would be an equal division of payoffs in period 2. Assume both parties keep these satisfaction functions in periods 3 and 4. Therefore, by the fourth period, A's payoff will be 2.210 and satisfaction 2.130. At this point, A's total payoff and satisfaction are greater than they would be if they are more self-centered in period one. In addition, B's satisfaction has increased from 1.550 to 1.920. In other words, by A's being more altruistic and B responding less strongly to an unequal distribution in Period 1, both parties can end up more satisfied even in a fixed-sum game.

Obviously, these results depend on the reaction function of a party's satisfaction to results. Also clearly a number of different strategies can be employed in relation to managing one's own satisfaction. Still, the message is fairly clear: excessive greed early can damage the greedy party in the long run (something which may be clearer to supposedly unthinking animals than it is to many intelligent managers).

7. Empirical evidence

This paper has focused on exploring the consequences of a particular type of satisfaction function. The intent here is not to formally test a particular model. Rather the study has two main purposes. First, it was designed to provide more evidence that other's payoff influenced own satisfaction, and more specifically to estimate the relative impact of other's payoff on satisfaction. Second, the study examines the impact of past results on the current period's satisfaction.

7.1. Method

In order to assess individuals' actual satisfaction function with payoffs in a competitive situation, a study was run similar to that of Corfman and Lehmann (1993). Specifically individuals reported satisfaction with the results of a sales competition between two stores in the same market for various combinations of sales in the current and previous period. Respondents were given a scenario with two main retail competitors of equal size and profit margins whose sales typically totaled about US$20 million. They were then placed in the role of manager of one of the two competitors, and asked how satisfied they would be (on a 0–100 scale) with eight combinations of sales in millions: $(10,10)$, $(15,15)$, $(14,6)$, $(18,2)$, $(2,18)$, $(6,14)$, $(12,15)$, and $(15,12)$. To simulate past results, they were placed in either one of four conditions in terms of last period's results: $(10,10)$, $(12,14)$, $(6,14)$, and $(14,6)$ or in a control condition where previous results were not given. Since they did not actually experience these results, their reactions may understate the magnitude of reaction to past outcomes. Still it provides a useful directional indication of their response.

Subjects were intercepted at a shopping mall in a large northeastern US city by a professional market research firm, and compensated for their participation. The task required about 5 minutes and was embedded in a larger study on an unrelated topic. One hundred ninety-nine usable responses were obtained. The median household income of the sample was US$52,000, indicating they were relatively well off.

7.2. Basic results

To get an initial view of the results, average satisfaction (across all five conditions) was computed (Table 4) and plotted (Fig. 1). The results

Table 4
Average satisfaction with different payoffs

Payoffs A, B	A's satisfaction
10, 10	46.2
15, 15	53.8
14, 6	72.6
18, 2	90.2
2, 18	7.4
6, 14	12.6
12, 15	28.0
15, 12	54.7

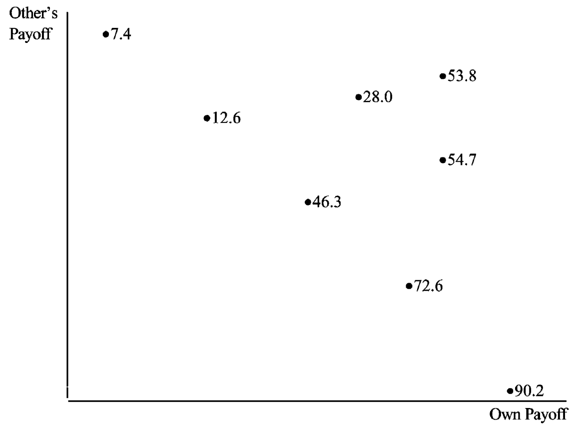

Fig. 1. Average satisfaction at different payoffs.

show considerable emphasis on relative payoffs. For example, going from a (10, 10) to a (15, 15) situation only increases satisfaction of the first party from 46.2 to 53.8, whereas going to (14, 6) increases it to 72.6 (even though 14 is less than 15) and going to (6, 14) decreases it to 12.6. Also envy was clearly evident since subjects were noticeably more satisfied with a payoff of 10 in (10, 10) than with a higher payoff of 12 in (12, 15). Not surprisingly, the results also show some evidence of both decreasing marginal impact and asymmetry, with doing worse than the opponent somewhat more distasteful than doing better by the same amount, consistent with prospect theory. More interesting, there is evidence that payoff changes were especially important when payoffs were close to equal. For example, a gain of 4 units of sales was worth only 5.2 when the change was from (2, 18) to (6, 14) and 17.6 when the change was from (14, 6) to (18, 6). However, a 3-unit change from (12, 15) to (15, 12) produced a much larger 26.7 increase in satisfaction. This suggests the utility function may include a "win–lose" term which reflects the ranking of the firm in terms of sales. (We return to this point later.)

The impact of previous results can be seen in Table 5 where average results are given by condition. Inspection shows that the lowest satisfaction occurred when the past result was (14, 6). This suggests subjects were "spoiled" by success and came to expect it even though the information provided clearly suggested that (10, 10) would be the expected outcome. More generally, it suggests that past results have had an impact.

In order to examine the effects of situation and condition more carefully, a two-way ANOVA with interactions was run. These results found both main effects significant at the 0.0001 level with situation accounting for 66.7% of the variance in satisfaction. Condition accounted for a significant but modest 1.5% of the variance and the interactions between situation and condition accounted for a significant but modest 1.6%. In order to control for subject differences, we included the mean subject response as an additional variable. The subject mean accounted for 9.9% of the variance, showing modest heterogeneity exists.

7.3. Model estimation

Since heterogeneity appears to be fairly modest, we focus on the average results. We first regressed the overall average (across past results condition) satisfaction against own sales and the other's sales (i.e., the situation). The results (Table 6) show that both own and other's sales are significant. The model gives:

$$\text{Satisfaction} = 41.96 + 3.03\,(\text{Own sales}) - 2.70\,(\text{Other's sales})$$

This suggests own sales are evaluated positively and others negatively.

Table 5
Average satisfaction by situation and condition

Situation	Condition: previous period result				
	Control (no result given)	10, 10	12, 14	6, 14	14, 6
10, 10	49.2	43.2	47.9	53.4	36.6
15, 15	60.0	46.0	62.8	58.5	43.6
14, 6	74.3	71.7	83.2	74.2	58.6
18, 2	93.0	82.9	90.8	92.9	91.1
2, 18	6.1	10.7	7.7	7.4	5.3
6, 14	13.4	12.9	10.8	15.7	10.1
12, 15	26.3	26.5	39.3	28.4	19.2
15, 12	58.7	53.3	67.6	46.9	46.1
Overall mean	40.3	38.0	44.3	42.1	34.8
Sample size	42	38	40	41	38

One problem with interpreting the results is that multiple models are algebraically equivalent. For example, if the model is written in terms of difference between self and other, it becomes:

$$\text{Satisfaction} = 41.96 + 0.33\,(\text{Own sales}) + 2.70\,(\text{Own sales} - \text{Other's sales}).$$

Now it appears that doing better than the other is important rather than doing well yourself or the other doing poorly per se. If we further rearrange terms to account for the size of the pie (Own + Other's sales) and the difference, this becomes:

$$\text{Satisfaction} = 41.96 + 0.17\,(\text{Own} + \text{Other's sales}) + 2.87(\text{Own} - \text{Other's sales})$$

This form suggests relative results matter much more than absolute ones (i.e., the division of the pie matters more than its size).

These results are inconclusive with respect to the exact process individuals follow in evaluating payoffs. Still, it seems clear that, as figure A suggests, relative results play a major role in determining satisfaction.

Next, we used the average satisfaction for the 32 combinations of current and past payoffs as input into a second regression. In addition to own and other's sales, we included other's past results. (We also used past own results in place of other's past results. Due to collinearity between own and other's past results, the overall model fit was similar and the sign for own past results negative. Still, this model fit slightly better so we report it here.) The results (Table 7) were:

$$\text{Satisfaction} = 27.9 + 2.96\,(\text{Own sales}) - 2.69\,(\text{Other's sales}) + 1.29\,(\text{Other's last sales}).$$

This suggests, somewhat perversely, that we are happier when the other party did better last time.

Table 6
Overall mean satisfaction regression

	Coefficient	t
Constant	41.96	2.61
Own sales	3.03	3.07
Other's sales	−2.70	−3.45

$R^2 = 0.94$.
$F_{2,5} = 41.77$.

Table 7
Average satisfaction vs. situation and condition regression

	Coefficient	t
Constant	27.90	2.80
Own sales	2.96	7.30
Other's sales	−2.69	−6.66
Other's last sales	1.26	2.10

$R^2 = 0.92$.
$F_{3,28} = 103.91$.

Since last own and last other's sales are negatively correlated, what it really suggests is that lower expectations due to less positive past results may lead to greater satisfaction. Looking at this model in another way leads to:

$$\text{Satisfaction} = 27.9 + 0.27\,(\text{Own sales}) + 2.69\,(\text{Own sales} - \text{Other's sales}) + 1.29\,(\text{Other's last sales})$$

This suggests there is an important (carryover) effect of past payoffs.

Taken together with comments made by study participants, these results suggest there may be a strong impact of other's payoff on satisfaction, in particular a strong impact of relative payoff. It also appears that individuals tend to adjust expectations to past results in forming satisfaction judgments. We explore possible consequences of these tendencies in the next section.

8. Implications and issues

This section focuses on some general implications and issues raised by allowing for altruism and envy in competitors' utility functions.

8.1. Adaptive behavior: Endogenous utility

The notion of fixed utility in individual choice has begun to give way to the concept that utility evolves over time. Causes of this evolution include context and situation (Simonson and Tversky, 1992; Bettman et al., 1998), satiation (McAlister, 1982), and learning and acculturation (Carpenter and Nakamoto, 1989). Such endogenous preferences seem likely to apply to competitors' preferences as well.

The role of expectations is crucial in the evolution of utility. Outcomes are often evaluated with respect to reference points (Oliver, 1980). For example, satisfaction is formed based on expected performance. Thus, since expectations evolve over time (Winer, 1986), so will the satisfaction (utility) function.

An interesting issue regarding expectations involves the reaction to settlements. In many cases a 50–50 split may be the implicit initial expectation. When the actual result differs from 50–50 (say 60–40), two opposing forces operate—adaptation and compensation. On the one hand, competitors might adjust their expectations and hence their sights closer toward past results. On the other hand, they might adjust them *away* from the past results in order to compensate for past "injustice". More specifically, a self-oriented competitor who got 60% of the available payoff may adjust expectations up from 50% toward what was actually received (60%). On the other hand, a self-oriented competitor who got 40% may adjust expectations away from 40% (e.g., toward 60%) in order to compensate for the past result. Exactly which of these occurs, or more generally the relative impact of these two forces, is a topic for further research.

8.2. Strategic behavior

Accepting non-optimal results in one period in order to improve results in future ones is both essentially the definition of strategic behavior and widely practiced. In this context, it could mean giving up a bit of payoff now because doing so leads to the opponent's utility function being more favorable in future competitions (or negotiations). While important, however, this mode of strategic behavior occurs without altering the utility function.

A different, and to some extent more interesting, form of strategic behavior involves altering the utility function in order to increase satisfaction. Basically, this means deciding to value that which is attainable and to not value that which is not. Just as most of us put little value on a Mediterranean villa since we have no prospect of being able to afford one, so companies may value limited goals (e.g., share of a defined segment or sales vs. last year's rather than relative sales vs. a stronger competitor). Throughout history people have adjusted their sights based on that which is reasonably attainable. This type of adjustment alters a competitor's utility function and, in a self-fulfilling prophecy sense, outcomes as well.

Still a third type of strategic behavior involves misrepresentation of one's utility function. This can be especially beneficial in situations where the opponent is envious (i.e., seeks to harm the other competitor). By disguising their true utility, a competitor can lure an opponent into behavior which turns out not to be harmful (as in Br'er Rabbit's "anywhere but the briar patch"). Of course, concern about damage to one's reputation in multi-stage competitions tends to limit the advantages of misrepresentation. Still it seems likely that, under certain circumstances, misrepresentation may be viable.

8.3. Explanation for market share distributions

It has been widely observed that market shares in mature markets (i.e., those in equilibrium) tend to follow an exponential pattern (e.g., Stanley et al., 1995). Why does this occur? The power law prediction ($\text{Share}_i = 1/i^a$) derives from Zipf's work on language word frequency and population of cities (Zipf, 1935; Hill, 1970). One explanation is based on the nature of the firm's objective functions. Most firms are concerned about not just share but also

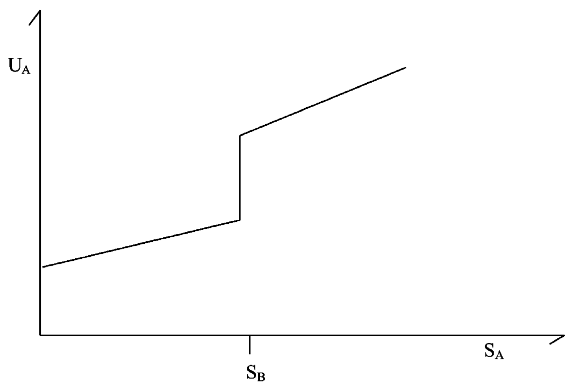

Fig. 2. Utility of firm A for different shares in a duopoly.

about relative share (i.e., ranking). Concern about ranking can be due to understanding the benefits to being number 1 or 2 (e.g., access to distribution, consideration as a major supplier), higher authority decrees (e.g., Welch at GE's famous requirement to be number one or two), or pure ego and innate competitiveness. Regardless of source, concern about relative share (ranking) may lead to an objective function which includes rank. For example, the share objective function could be:

$$\text{Objective} = W_1\,(\text{Own share}) + W_2\,(\text{If Rank} = 1) + W_3\,(\text{If Rank} = 2) + \ldots$$

This gives the firm a discontinuous utility function with a jump of $W_2 - W_3$ as they go from number 2 to number 1, etc. For a duopoly, the utility function for Firm A in terms of share has a major discontinuity when share of A equals share of Firm B (Fig. 2). As a consequence, when a firm is close in share to another (Fig. 3A), it has a strong incentive to increase share a small amount. This leads to fairly extreme (aggressive) behavior on the part of the firm (and by logical extension, its competitor) which is not a stable situation. Presumably, eventually one firm will gain a sufficient advantage that its nearest competitor cannot reasonably hope to overtake it. At this point it accepts its "place" and competes less fiercely, making shares (more) stable (Fig. 3B). The reason shares drop off exponentially is the biggest "bonus" goes to being number one, the next biggest to number two, etc. (i.e., given the relatively smaller benefit of improving one's rank from say 8 to 7, there is less incentive to do so and hence a smaller share difference is sufficient to lead to stable shares and competition.) Thus, incorporating ranking in the firm's utility function parsimoniously explains the extreme competitive behavior of Cadillac vs. Lincoln and Accord vs. Taurus and is consistent with the instability of co-CEOs and the pro-consuls in ancient Gaul, as well as some business school behavior based on published rankings. Put differently, equal is not equilibrium.

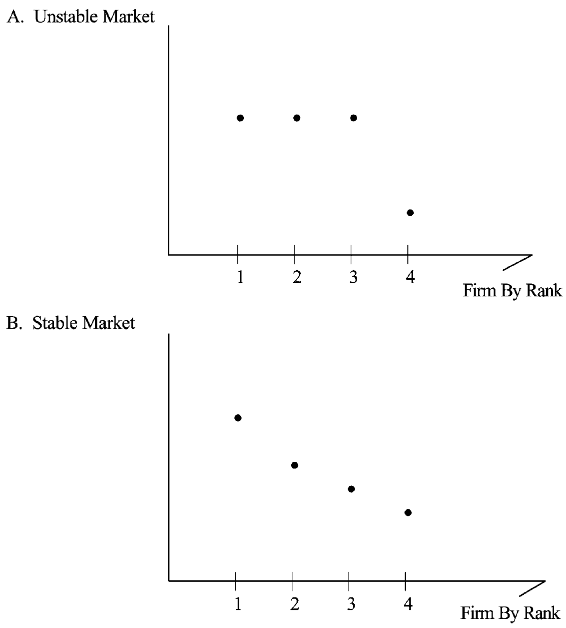

Fig. 3. Stable vs. unstable share patterns.

9. Summary

This paper has three main points. First, it argues that modelers of competitive behavior should incorporate other parties' payoffs in a party's satisfaction (utility) function. To the extent a party places some positive value on the other party's payoff, they may give up some payoff, but, at least in the long run, gain in satisfaction. Second, it redemonstrates why giving up something early on may pay benefits later *if* the other party reacts aggressively to losing. Interestingly, envy can lower both payoffs and satisfaction. Finally, the paper provided empirical evidence that many people are more concerned with their share of the pie than their absolute payoff, especially when payoffs are similar in size. Further elaboration on the processes which underlie these results and the detailed implications for competitive behavior therefore are fruitful directions for future research.

In terms of general implications, managers should be aware of the negative consequences of too strong a competitive focus. Specifically, envy and/or a concern with ranking can, at least in the short run, lead to extreme rivalry and its consequences. Importantly, this holds for a zero-sum game; more cooperative behavior is even more beneficial in an expanding pie situation.

For researchers, this hopefully points the way toward several avenues of productive research. First, it is important to establish exactly which functional form the objective (satisfaction) function follows under different conditions, and how they change over time as well as the exact process followed by decision makers. Second, it would be useful to explore axiomatic bases for utility functions which include others' payoffs. Third, and most intriguing, it will be useful to continue to explore implications of utility functions as they relate to the nature and outcomes of competition.

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