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Sharing Information

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Sharing Information

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Abstract:

Customers write book reviews for Amazon.com and rate stores at BizRate.com. Car drivers call up radio stations to report traffic jams or radar traps. In many cases individuals share their information to the benefit of an unknown group of recipients, even though doing so is costly for the provider. In contrast to a standard public good, providers have no immediate benefit from information public goods. The paper reports the results of an experimental study on information sharing under two payoff conditions (opportunity announcement and hazard warning) and two information conditions (anonymous and identified provider). The experimental results show a substantial degree of information sharing. Information on extreme opportunities and extreme hazards is significantly more often provided than information on moderate prospects. Identification only plays a role in case of extreme opportunities and not in case of hazard warnings.

Keywords:

Information public good; online recommendation; consumer rating; word-of-mouth communication; altruism; other-regarding behavior

JEL-Classification:

C91, D03, D64, D82, H41, M31

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So for me, it's an axiom. Word of mouth is very powerful online, so that if you make a customer happy, they can tell 5,000 people. And if you make them unhappy, they'll certainly tell 5,000 people. So each customer can be his or her own ombudsman, and that's just bound to shift the balance of power toward the customer. (Jeffery P. Bezos)

More puzzling to me is why everyday people post reviews. (Steven D. Levitt)

1. Introduction

It has become a widespread practice in e-commerce to ask for customer opinions (Dellarocas 2003). Customers are asked to comment on product quality and experience or on business' service satisfaction. The comments and ratings are published on internet sites, freely accessible to other consumers. Some internet companies, such as epinions.com, CNET, BizRate.com, and resellerratings.com, are specialized in collecting and distributing comments and ratings on thousands of items and on hundreds of other internet shops. With his "axiom" on the electronic word of mouth, Jeffery Bezos, the founder of amazon.com, suggests that the unrestricted online visibility gives customer ratings and recommendations a much greater impact than they ever had offline (Business Week Online 1999). In fact, empirical studies find positive correlations between consumer rating and sales (Chevalier and Mayzlin 2006) as well as between third party ratings of online buying experience and the shareholder value of the rated e-commerce firms, (Kotha, Rajgopal, and Venkatachalam 2004). Hence, scoring high in the customer reviews is more than just prestige. It is in the firms' financial interest.

But, why do customers provide the information, even though doing so is costly and entails no obvious benefit for themselves? Why do they not free ride as economists, such as Steven Levitt (2005), generally expect them to, when confronted with a non-enforced public goods provision? Purely self-interested individuals would not engage in the voluntary provision of *information public goods.* In fact, providing information public goods is even less attractive than providing most other public goods. Providers of information public goods do not participate in the benefits, because they are already in possession of the information that they transmit to others.[1] Hence, when sharing information is costly, providing information public

[1] Technically speaking, the marginal return to the provider is zero.

goods is not a Pareto efficient outcome, because the provider incurs a cost without gaining any benefit. Thus, if information public goods are provided voluntarily, there must be some form of other-regarding preference that motivates behavior.[2]

We present an experiment that allows us to observe the provision of information public goods and to compare its prevalence in different settings. We vary the effects of the information disclosure on the recipients and the anonymity of the provider. The former variation consists of an *opportunity* and a *hazard* treatment, where information providers can either reveal an opportunity to the recipient or alert the recipient on a hazard. The latter variation consists of a fully anonymous and a voluntarily identification setting.

All combinations of our variations are of empirical relevance. The opportunity treatment resembles typical online recommendations, in which consumers inform other consumers on especially advantageous goods or services. The hazard treatment resembles not only the case of online customer warnings, but also the case of individually provided warnings coming through other media, such as traffic information passed by telephone to radio stations.[3] In both cases, the informing parties may remain anonymous or choose a nick name that is used to identify them as the source of the information.

In the field, the motivations underlying this kind of information provision cannot always be neatly separated. Those providing information public goods may often be purely altruistic, trying to help others. But, sometimes other motives may also play a role. Some websites offer minuscule financial incentives for reviews and recommendations.[4] Another motivation to provide reviews may be to gain fame and eventually start a career as a professional reviewer. Others may want to be top on the list of the “most useful reviews” that is provided by many websites. Some may try to make a product successful intending to increase the positive

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[2] Avery, Resnick, and Zeckhauser (1999) introduce smart ways to solve the free-riding problem of information provision by introducing a market for evaluations, in which early consumers are paid for their reports by late consumers. Interestingly, such markets for evaluations are still rather rare, perhaps indicating that people are willing to provide the public good without pecuniary incentives.

[3] The perhaps most frequently observed provision of hazard information goods are the traffic jam and radar trap warnings that are aired on radio. Much of the information for these airings originates from calls by car drivers, who have either been affected themselves or have noticed the congestion or the radar trap driving on a different lane. In either case, they pay for the telephone call, even though they have no obvious advantage from doing so.

[4] For example, amazon.com experimented with giving writers of first review the chance to win a prize.

network effects.[5] Of course, our list of potential motives for the provision of information public goods is not exhaustive. Next to other motives that we did not mention, any mixture of various motivations is also conceivable.[6]

Our experimental setup enables us to avoid the difficulties separating mixed motives in the field. We deliberately exclude all other incentives and concentrate only on *sharing information* in a one-shot game, in which the provision of information public goods is purely altruistic.[7] The experimental procedure allows us to use a 2x2 factorial design to examine how payoff and anonymity constellations affect information sharing.

Our experimental data show high rates of information sharing with significant differences in the treatments. We find that extreme outcomes are reported significantly and substantially more often than moderate outcomes, no matter whether they are positive or negative. This seems in line with earlier findings on non-electronic word-of-mouth, which indicate that extreme satisfaction and dissatisfaction lead to higher levels of word-of-mouth activity than medium levels (Anderson 1998). Furthermore, we find that the possibility of identification, which is chosen by a little more than two-thirds of our subjects in each of the two payoff treatments, only enhances the frequency of reporting extreme opportunities (high positive outcomes), but not the frequency of reporting any other value. Comparing those who choose to be anonymous in the identification setting with those who take on a name, we observe a significantly higher percentage of extreme value reports in the hazard treatment, but not in the opportunities case. In other words, deliberately anonymous subjects only report extreme hazards, while subjects taking on an id also report moderate gains.

Finally, we use a sample of review data on classical music CDs from amazon.de to check the conclusions of our experimental results in the field. In agreement with other studies (Chevalier and Mayzlin 2006), we find that most reviews are positive. Assuming that hardly anyone has an extremely negative (hazardous) experience when buying a classical music CD, this result can be interpreted as observing that consumers tend to report extremely positive experiences

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[5] For example, having many people read the same book, increases chances of having an intellectual exchange on the book, or having many people buy the same electronic game, increases chances of updates and extensions.

[6] In a survey study, Hennig-Thurau, Gwinner, Walsh, and Gremler (2004) find "[…] that the concern for other customers, extraversion/positive self-enhancement, social benefits, economic incentives, and to a lesser extent, advice seeking, all serve to motivate […] the number of comments written on opinion platforms." (pp. 48-49)

[7] In this study we consider non-manipulated truthful information sharing only.

more frequently than mediocre experiences. Furthermore, we find that as in our experimental results on the opportunity treatment about two-thirds of the reviewers identify themselves and that deliberate identification is not correlated to ratings.

The paper is organized as follows. Section 2 presents the experimental model and briefly discusses its theoretical properties. In section 3 the experimental procedure is described. Section 4 reports the experimental results and in section 5 we conclude. Section 6 reports some "anecdotal evidence" from reviewing at amazon.de.

2. The Game

The structure of the game

We consider a game with seven players that form a chain, i.e. they decide one after the other. There is a basket containing 60 items. 25 percent of the items have an extreme value and 75 percent of the items have a moderate value. The extreme and the moderate value are chosen such that a random draw from the basket has an expected value of zero. At the beginning of the chain no item value is reported and thus no item value is known to the first player.

The game commences with the first player in the chain randomly drawing 20 items from the basket. The player is informed that she is the first player in the chain and that no item values are reported yet. The player decides which of the drawn items to keep. Keeping items means realizing their values as payoffs. Since all item values are hidden for the first player, she decides in absolute ignorance of the item values. Risk-seeking players should take all items. Risk-neutral players can take any arbitrary number of items. Risk-averse players should not keep any item. Players with other-regarding preferences, however, may keep items, even if they are risk-averse, given that their utility from giving information to the successors is greater than their disutility from taking the risk of incurring a loss.

After a player has decided how many (and which) of the items to keep, she may report the value of each of the yet unreported items that she has kept. Reporting the item value is costly, but makes it potentially visible for all successors in the chain.[8] The remaining players 2 to 7 are in an identical decision situation, except that the number of disclosed item values varies.

[8] A successor only sees the value if the item is one of those that she has randomly drawn.

Before making a decision they are informed about their position in the chain and the number of item values that are reported by the predecessors. Again each player randomly draws 20 items from the basket. In case any items are drawn that have been reported by predecessors, the player is informed of these values. Otherwise, the items values are unknown to the player. The player decides which of the drawn items to keep. Again, the player may report the value of each yet unreported item that he has kept, so that the item value becomes potentially visible for all successors in the chain. Each player's payoff is the sum of the values of kept items minus reporting cost of one point per reported item value.

Linking the game to the field

The basket of 60 items represents the complete set of goods under consideration, e.g. digital cameras. We assume that each customer is only able to examine a subset of the goods. Hence, in our experiment, we restrict the relevant set per subject to a random sample of 20 items. Some of these items have possibly been rated by previous customers, while others have totally unknown values. We assume that the evaluation reveals the true value of the item, which is identical for all customers. This is obviously a simplification, especially in the case of experience goods such as books or CDs. In the case of technical goods, the assumption is less restrictive, because quality criteria are more likely to be inter-subjectively verifiable.

The items a player keeps are the items a customer chooses to consume.[9] The value associated with an item is the net benefit of consuming the item. If the value is positive, the consumer's benefit is increased, if it is negative, the consumer's benefit decreases.

Each consumer may report the value information to succeeding customers. This information provision is associated with a small cost, which models the cost of writing a report or calling the radio station from a mobile phone. As at any online rating site, there is no way of telling who used the information and no way of receiving a reward in the future. Basically, there is no traceable interaction between information providers and information recipients, except through the evaluation.

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[9] Since we assume that the item payoffs are net of the item price, our subjects only need to decide to keep or not to keep.

The experimental parameters and treatments

We consider four variations of the game that translate into the four treatments of the experiment. Two variations concern the payoff structure. In the *opportunity setting*, the extreme value is +12 and the moderate value is -4. In the *hazard setting*, the extreme value is -12 and the moderate value is +4. The opportunity setting is inspired by situations like amazon.com, where the sharing information helps to select rare excellent books and to avoid the more likely mediocre books. The hazard setting is inspired by the radio announcement of traffic jams and radar traps, where the provided information helps to avoid rare costly speed control. In addition, we study two information settings. In one case, the information provider remains anonymous, while in the other case the information provider may choose an identification. Most of the B2C and C2C internet pages allow for an identification of the provider, whereas the radio transmissions of traffic jams and radar traps are typically anonymous.

The individually rational and the socially optimal solution of the game

In a world with customers who are solely motivated by maximizing their own monetary payoff, no player would provide any value information, since it only bears costs but no monetary benefits. Hence, the inefficient outcome of zero information provision results.

In the social optimum, however, a certain level of provision occurs. The degree of provision depends on the subjects' propensity to keep items with unreported values. Individual rationality requires that a player keeps all drawn items with reported positive values and avoids any drawn items with reported negative values. The question is how a player deals with items with unreported values. If a player never keeps an unreported item, the information on a negative value is of no use for that player. In contrast, for a player who always keeps all items with unreported values the information on a positive value has no additional benefit. Suppose that a fraction q of players keeps items with unreported values and a fraction $1-q$ of players does not keep items with unreported values.[10] Assume player i, who has $7-i$ successors in the chain, reports an item value. Since that item will randomly be drawn by each of her successors with probability 1/3 the expected benefit from reporting a positive item value v_p is

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[10] Note that q can also been interpreted as the probability with which individual players keep items with yet unreported values. Note further that we assume that q does not depend on the position of the player in the chain.

(1) $(7-i)\cdot\frac{1}{3}\cdot(q\cdot 0+(1-q)\cdot v_p)$

and the expected benefit from reporting a negative item value v_n is

(2) $(7-i)\cdot\frac{1}{3}\cdot(q\cdot(-v_n)+(1-q)\cdot 0)$.

In this case, a successor, who can avoid the negative item value that he would have taken otherwise, gains $-v_n$. The benefit from reporting is greater than the reporting costs of 1, if

(3) $i \leq \frac{7(1-q)v_p - 3}{(1-q)v_p}$

for positive value items and

(4) $i \leq \frac{7q(-v_n) - 3}{q(-v_n)}$

for negative value items. If, for example q=1/2, i.e. half of the successor population keeps items with unreported values and the other half does not, then reporting an extreme value item (+12 in the opportunity setting and -12 in the hazard setting) is socially optimal for all players up to player 6 ($i \leq 6.5$) and reporting a moderate value item (-4 in the opportunity setting and +4 in the hazard setting) is socially optimal for all players up to player 5 ($i \leq 5.5$). The overall benefit generated by this behavior, however, is allocated in a very asymmetric way. The earlier the player's position in the chain the higher is the expected cost from reporting and the lower is the benefit from reporting by predecessors.

3. The Experimental Procedure

The experiment consists of 4 treatments (2x2-design), varying the payoff structure and the information structure, as described above. The four resulting treatments are OppAnon, OppName, HazAnon, HazName, where "Opp" denotes the opportunity setting, "Haz" denotes hazard setting, "Anon" denotes the anonymous setting, and "Name" denotes identification setting.

The experiment was conducted as a pen and paper experiment with cubicles placed in the entrance to the cafeteria of the University of Erfurt. The subjects, students of all majors, were recruited on the spot. In the cubicle, they received a sheet with written instructions and a decision sheet, on which each subject was informed about the own position in the chain and the number of items that had been reported by predecessors in the chain (see Appendix).

A monitor supervised the random draw of 20 items (covered cards) out of a basket with 60 items. Item values that were reported by predecessors were noted on the item. The subjects, however, could see these values only for the cards drawn. The unreported item values were not visible, even after the draw. The subject noted the numbers of all items drawn and the values that were reported. Then, the subject decided which items to keep. The values of the hidden items that were kept were then revealed to the subject, so that the subject could calculate her earnings.

Next, the subject indicated for each of the yet unreported items that she kept whether the values should or should not be reported to the successors. In case the subject decided to report the value, the monitor noted the value of the item on the card. In the treatments, where identification was possible, the subjects could also write a name on each reported item. The monitor did not control whether this was the true name and whether it was identical for all reported items of a subject.

After the subject made all necessary decisions, the monitor calculated the subject's payoff and the subject was paid immediately. Subjects on average earned €4.04 (maximum €5.52 and minimum €2.72) including a show up fee of €4. Student IDs were used to ensure that no subject could play the game for a second time. Hence, we observe true one-shot decisions.

We collected 7 independent chains (observations) in each of the four treatments. The chains were all run in parallel, so that the subjects lined up at the same time were never members of the same chain. This was clearly stated in the instructions. Due to the random sampling in the game, it was also impossible to identify other members of the own chain later. We had planned chains of seven generations, but due to time constraints most chains actually reached the player 6 and a few ended with the player 5. In these cases subjects did not know that they were actually the last player in the chain. For our evaluation we use the data for the first five players of all chains. In total 153 subjects participated in the experiment.

Our statistics base on two-tailed non-parametric tests (Mann Whitney u-test and Wilcoxon matched pairs signed ranks test) and we report comparisons as being not significant, if they fail to achieve a significance level of 10 percent two-tailed. For significant differences we report the corresponding significance level.

4. Results

Over all treatments 60.7% of all subjects reported at least one item value. As figure 1 shows, in every position – except the first – more than half of all subjects exhibit information sharing behavior. The number of information sharing subjects is not influenced by the position of the player in the chain, even though the potential benefit of information sharing for others decreases from round to round.

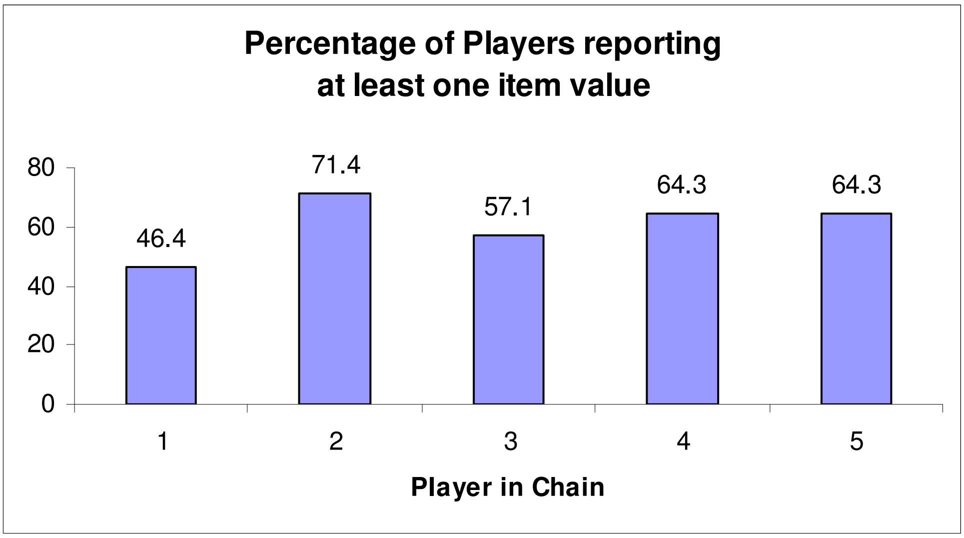

Figure 1 – Percentage of players reporting at least one item value

Individual rationality requires keeping all items with reported positive values and refusing all items with reported negative values. Indeed only three of our subjects exhibit behavior that is in conflict with this rule. Hence, reporting actually creates social benefits.

The degree to which social benefits can be created also depends on the fraction of hidden value items that are kept (c.f. section 2). The observed fraction q of hidden value items kept is on average 61.1 percent and is very similar for all positions in the chain. Inserting the observed value $q = 0.61$ in the inequalities (3) and (4), we can show that sharing information on extreme value items (+12 or -12) is socially beneficial in all positions up to the position 6 in the chain of players. Reporting of a moderate value item (+4 or -4) is socially beneficial only for the players up to position 5. Figure 2 shows the expected net social benefit (total benefit of all 7 players minus reporting costs) of reporting an item's value.

As displayed in figure 2, it is socially beneficial to report all unreported item values in the positions 1 to 5, when $q = 0.61$. We observe, however, that subjects on average reported item values only in 15.1 percent of the cases in which they could. Hence, we conclude that while the reporting of item values occurs more often than expected under pure payoff maximization, it does not occur to the extent that would be necessary to achieve the social optimum.

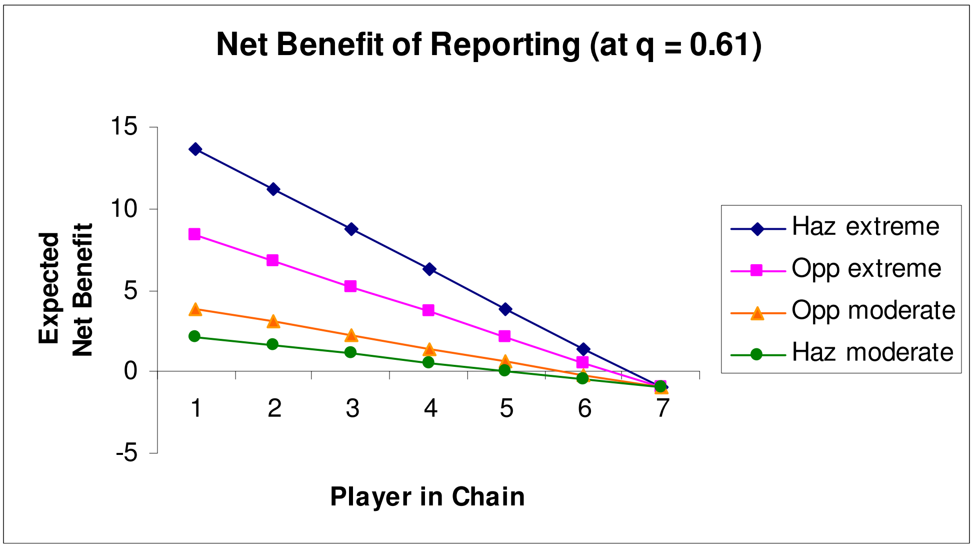

Figure 2 – Net benefit of reporting item values when $q = 0.61$

Players earlier in the chain have the potential to create greater social benefits than their successors. On the one hand, the earlier the information is shared, the more successors can benefit. On the other hand, the opportunity for reporting items is greater in earlier than in later rounds, because the probability of drawing unreported items decreases. Note, however, that with information sharing earlier positions in the chain are disadvantaged compared to later positions, because they have less information to avoid losses and to realize gains. Hence, while information sharing by subjects early on in the chain has a greater potential for increasing the social benefits, these subjects may be reluctant to share information, since they are disadvantaged with respect to their individual income. In fact, as displayed in figure 3, we observe that the subjects in the first position of the chain exhibit the lowest degree of information sharing. But, the figure also shows that the distribution of information sharing does not follow a clear trend across all positions in the chain. It seems that the extent to which subjects share information is independent of the expected social benefits and independent of the distribution of expected income across positions.

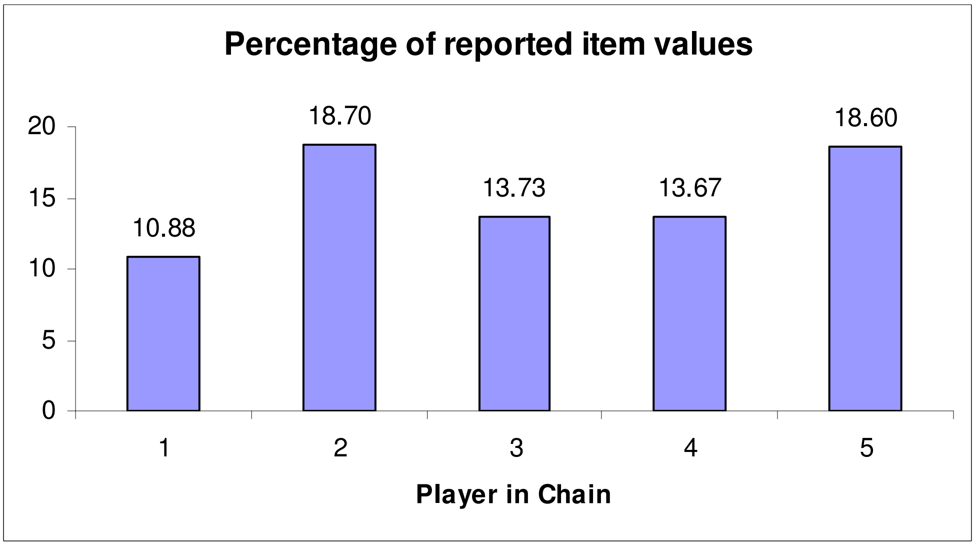

Figure 3 – Percentage of items values reported that were previously unreported

Extreme versus moderate value items

The expected net social benefit of reporting an extreme value item is higher than that of reporting of a moderate value item (c.f. figure 2). Indeed, in the experimental data, we find that extreme value items are reported much more frequently than moderate value items and that the ordering of the levels of reporting is the same as suggested by the net social benefit. In the opportunity treatments, there are no significant differences in rounds 1 to 4, but there is a weakly significant difference in round 5 (p=0.073, two-tailed, u-test). In the hazard treatments, the difference is more pronounced with no significant difference only in round 1 and significant differences in all following rounds (p=0.001, p=0.002, p=0.003, p=0.003, for rounds 2 to 5, respectively, two-tailed, u-test). Figure 4 shows the percentage of the accumulated reported item values for the extreme and the moderate values in the opportunity and the hazard treatments.

Another observation from figure 4 is that extreme hazards seem to be reported more often than extreme opportunities. This difference, however, is not significant in any of the rounds. Similarly, the difference between the frequencies with which moderate opportunities and hazards are reported is not significant in any of the rounds. Hence, we do not observe a significant difference between the frequencies of reporting extreme or moderate values across treatments. But, we do observe significant differences between the frequencies of information sharing comparing extreme and moderate values in each treatment.

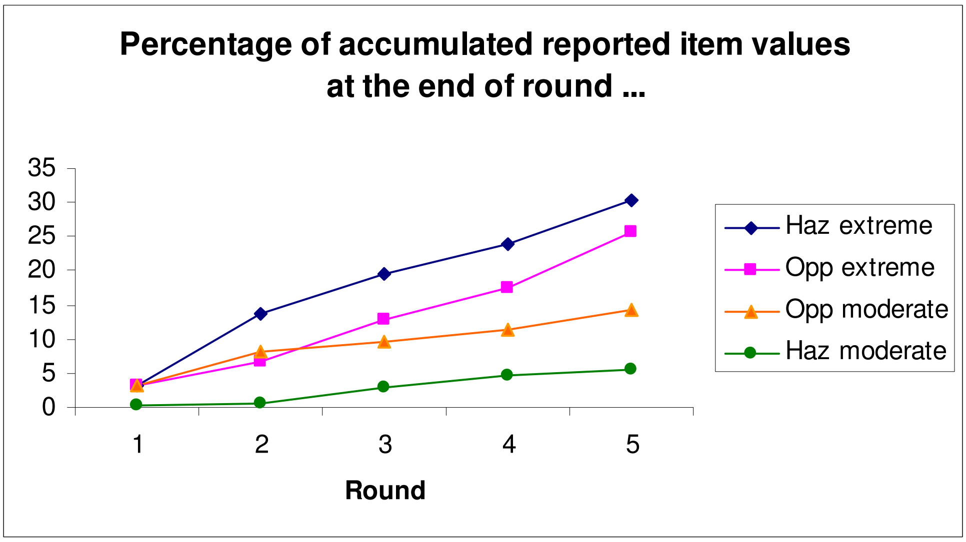

Figure 4 – Development of accumulated reported item values

The role of Identification

Having the possibility to identify a value report with a name has no effect in the hazard treatment. We neither find a significant difference for the moderate value items nor for the extreme value items in the hazard treatment. Figure 5 visualizes this result.

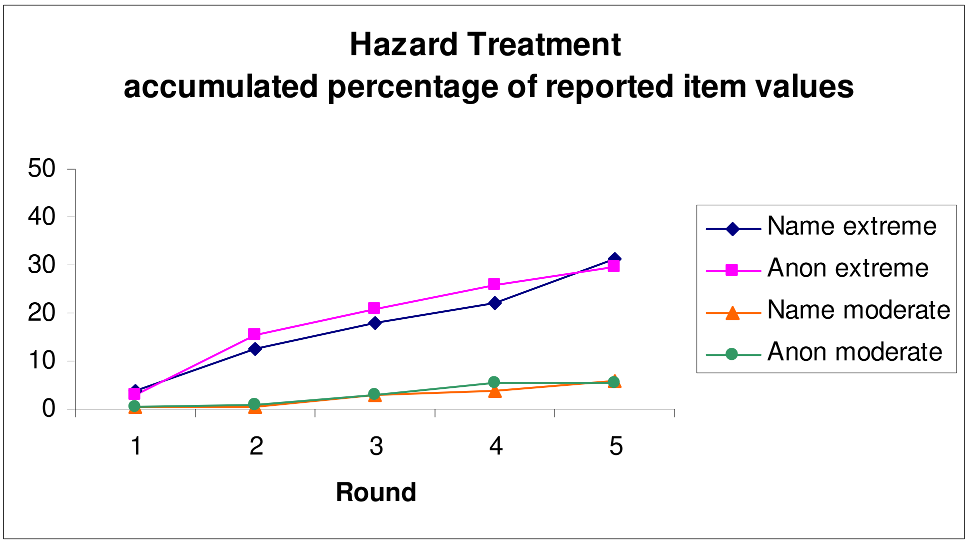

Figure 5 – Development of accumulated reported item values in the hazard treatment

In the opportunity treatments, however, we find that identification enhances the reporting of extreme value items. There is no significant difference in round 1, but the difference is significant in rounds 2 to 5 (p=0.047, p=0.065, p=0.016, and p=0.004, respectively, two-tailed, u-test). But notice that we do not observe any significant differences in the frequencies of reported moderate item values when comparing the results with and without identification. Figure 6 displays the development of information sharing in the opportunity treatments.

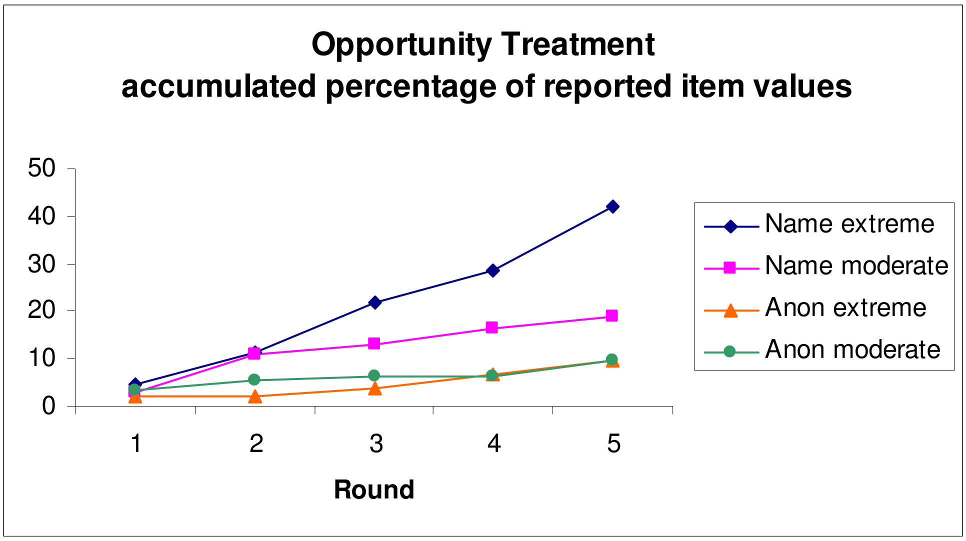

Figure 6 – Development of accumulated reported item values in the opportunity treatment

The Decision to Identify by Name

In the two Name treatments, subjects were allowed to choose an identification when reporting an item value. We observe that 79 percent of the reports in the opportunity treatment and 67 percent of the reports in the hazard treatment are identified.

Subjects choosing identification in the opportunity treatment (OppName) on average reported 44 percent extreme and 56 percent moderate value items. Subjects not choosing an identification reported an average of 63 percent extreme and 37 percent moderate value items. The difference between the information sharing behavior of identified and not identified subjects is not statistically significant.

Subjects choosing identification in the hazard treatment (HazName) on average reported 66 percent extreme and 34 percent moderate value items, while those not choosing identification only reported extreme value items. The difference between the information sharing behavior of identified and not identified subjects is significant (p = 0.09, two-sided, u-test).

All in all it seems that the possibility to identify reports with names has only a single strong behavioral effect. The propensity of subjects to share information significantly increases for extreme opportunities.

5. Evidence from amazon.de

The experimental investigation was inspired by observations concerning information provision in real life situations. In order to gain a clearer picture, we deliberately excluded some of the features that might be of relevance in the real world and simplified the problem to a great extend. Therefore, the conclusions drawn from the experimental data can only give us some clues on the mechanisms that might govern the more complex real world consumer evaluations. Nevertheless, to put our experimental results to rough check of external validity, we have collected some real world data that we analyze in this section.

Our experimental evidence suggests that hazard warnings need no identification. What we actually observe is that traffic jam and radar trap warnings are often aired on radio without naming the information provider. The experimental data also show that the possibility of identification leads to more extreme than moderate value item reporting. The customer ratings at amazon.com can be interpreted as (a much richer) version of information provision in an opportunity setting with the possibility of identification by name. We conducted a (non-representative) analysis of customer ratings of classic CDs at *amazon.de.* We chose classic CDs, because we assume that there is a broad range of quality for each composer's recordings, in contrast to pop music, which is dependent on specific performers and much more sensitive to fads. We gathered rating data pertaining to recordings of the work of two composers, Chopin and Mendelssohn-Bartholdy, who had a similar number of CDs listed.

The implications from our experiment are: 1) Most reviews are for (perceived) high quality CDs (opportunities), i.e. observed average ratings are very high. 2) More than 2/3 of reviewers identify themselves. 3) There is no substantial effect of identification on the ratings. Table 1 shows our empirical finding that support the three claims.

Table 1 – Two examples of customer ratings of classical music CDs at Amazon's online shop

	available CDs		average per CD					
			all ratings		anonymous ratings		identified ratings	
	total	rated[a]	count	rating[b]	count[c]	rating	count[c]	rating
Chopin	1506	78 (5.2%)	1.56	4.62	0.49 (31%)	4.64	1.08 (69%)	4.59
Mendelssohn-Bartholdy	1391	51 (3.7%)	1.14	4.03	0.27 (24%)	4.15	0.86 (76%)	3.99

Note: The data was collected on Dec. 19, 2002, at the online CD-shop of amazon.de.

[a] In parentheses: percent of total number of available CDs.

[b] Ratings can be in the range from 0 to 5.

[c] In parentheses: percent of all ratings per CD.

The ratings are very high at 4.62 and 4.03 out of 5 possible points. Interestingly, the percentage of identified ratings is in the same range as in the experimental data (around 70 percent). The amazon.de data also show that identification has no influence on the rating, as was observed in the opportunity treatment of the experiment. Hence, in this very rudimentary empirical test, we find no reason to doubt the external validity of our experimental results.

6. Conclusions

Consumer recommendations play an important role in other consumers' decision making process (Bickart and Schindler 2001; Hennig-Thurau and Walsh 2003). Considerable amounts of costly information sharing are also observed in other situations. These costly contributions to information public goods are made by individuals, who seem to have a pecuniary disadvantage from sharing information. Our experiment excludes all possible motives except the concern for others well-being. In fact, not even image-scoring or any other form of indirect reciprocity can explain information sharing in our setting, because in our one-shot experiment neither the own reputation, nor behavioral norms in the group can create positive future payoffs for the decision-maker (Seinen and Schram 2006). We find that even in this toughest test situation, subjects are willing to give up some of their own payoff in order to inform others. Our results clearly indicate that subjects share information, even if sharing is costly and does not entail any monetary benefit to the provider.

Furthermore, we find evidence for the correlation of information sharing behavior to the extent of social benefit generated. More important information (i.e. information on extreme values) is significantly more often revealed than less important information. This observation is in line with the motive of social benefit enhancement that has also been documented in other experimental studies (e.g. Charness and Rabin 2002). We, however, also find evidence that subjects are not solely motivated by social benefit enhancement. Comparing the extent of information sharing by players in different positions of the chain, we observe that subjects in the early positions do not share significantly more information than the subjects in later positions, even though the positive impact on the expected net social benefit is the higher the earlier the information is revealed.

A possible explanation for the reluctance of subjects in early positions to share even more information may be that by doing so they would deteriorate their low relative income position even further. Note that due to the effect of information accumulation – if any information sharing is observed – later positions generally have a higher expected payoff than earlier positions. This income gap increases the more information is shared. Hence, subjects may limit their information sharing, if they are not only motivated by social benefit enhancement, but also by relative payoff considerations as suggested by a rather large body of experimental literature (e.g. Fehr and Schmidt 1999; Bolton and Ockenfels 2000). We are not first to find evidence for a mixture of these motives. Charness and Rabin (2002) report similar evidence in simpler games without informational dynamics.

Our findings have a number of implications for the design and the regulation of institutions in which sharing information enhances the social benefit. For one thing, it seems that any potential for creating social benefit should be clearly communicated to all participants, in order to activate the individuals' impetus to share information. Our experimental evidence also indicates that the motivation to enhance the social benefit may be in conflict with fairness considerations, especially for the individuals receiving the information early on. Hence, as suggested by Avery et al. (1999), it may be advantageous to introduce an additional incentive for these early adopters to reveal their information.

Finally, there are numerous open questions that can be studied using the information accumulation paradigm that we introduce in this paper. For one thing, it would be interesting to see whether the introduction of monetary incentives will enhance information sharing or crowd it out. Another interesting research issue concerns situations in which not only the intended recipient, but also a third party profits from the information sharing process. These situations seem common place in business interactions, where firms (e.g. amazon.com or YouTube.com) generate substantial profits from the voluntary information sharing process amongst their customers. The question is whether people are willing to share information to the same extent as they do in our setup, when they know that profit-seeking firms take advantage of that information.

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Appendix Instructions for the Experiment

The Chain

- In this experiment, chains of 7 participants make their choices one after the other. Each participant's choice – except for the one who is last in the chain – may influence all following participants in the chain. You will be informed about your position in the chain before you make your choice.
- You will not be informed about the identities of the other participants in your chain at any time. Furthermore, it is highly unlikely that you meet any other participant of your chain at the experiment's location, because we run many different chains simultaneously. Each participant of your chain receives the same *Instructions for the Experiment* as you.

The box and the cards

There are **60 cards** in the box of your chain, out of which you will randomly draw 20.

- Each card has a fixed **value**:
  - **75%** of the cards have a value of **– 4** ["**4**" in the hazard treatments]
  - **25%** of the cards have a value of **12** ["**–12**" in the hazard treatments]
- At the initiation of each chain, all cards are **concealed,** i.e. the values of the cards are not visible.
- If you are not first in your chain, it is possible that some cards have already been **uncovered** by your predecessors, i.e. the values of the cards are visible.
- Before you draw your card, you will be informed about **how many** of the cards have already been **uncovered**, but not about the values of the uncovered cards.

The sequence of the actions

1. ***Drawing cards:*** You randomly draw **20 cards** out of the box of your chain.
2. ***Information about the values of the uncovered cards:*** You will be informed about the value of each uncovered card that you have drawn.
3. ***Keep the card?*** For every card you draw you decide whether or not to **keep the card**. (Note: At the time of the decision, you only know the values of the uncovered cards, but not the values of the cards that are still concealed).
4. ***If you decide to***
   - **keep a card,** you receive the **value** of this card. A positive value increases your payoff, while a negative value decreases your payoff.
   - **not to keep a card**, you receive **0**.
5. ***Uncover the value for your successors?***
   - You may **uncover** any card that you have **kept** and that has **not been uncovered** yet. If you do, **all following participants of your chain** who draw one of the cards that you have uncovered will be informed about the **value of that card** before they decide whether or not to keep the card. **You will incur a cost of one point** for uncovering a card.

   [only in the names treatments:
   - As you uncover a card, provide a name that you chosen and your successors will be informed about the **name of the person, who disclosed this card**.]

The payoff

- Each participant receives an **initial endowment** of **200 points**.
- The **payoffs of the drawn cards** and the potentially incurred **cost of uncovering cards** are **added to or subtracted from** the **initial endowment**.
- At the end of the experiment, you will receive **2 Cents** for **each point**.

Decision Sheet of Participant _____

You are the ________ participant of your chain.

Number of cards already uncovered _______.

The grey parts of the table will be completed by the experimenter.

Your draw	Number of the card drawn	Value of the card if *uncovered:* value if *concealed*: "?"	Keep the card?		Uncover the value for all successors?		Payoff
			yes /no	if *yes*: value if *no*: 0	*yes /no*	if *yes*: –1 if *no*: 0	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Initial endowment	**+ 200**
Total payoff in points	
Total payoff in € **(= Total payoff in points times 0.02)**	