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AN EXPERIMENTAL ANALYSIS OF BOUNDED RATIONALITY: APPLYING INSIGHTS FROM BEHAVIORAL ECONOMICS TO INFORMATION SYSTEMS

Franziska Brecht, Oliver Günther, Werner Güth, Ksenia Koroleva

Abstract

The paradigm of bounded rationality considers the limited ability of individuals to make consistent and rational choices. Due to the scarcity of research on this phenomenon in information systems, we conducted an experimental study investigating decision-making regarding risk preferences and social preferences. Moreover, we explored the stability of these preferences under different conditions and uncovered the role of information retrieval in individual decision-making. We find that although individuals are generally risk-averse and egoistic, none of these preferences is stable under the conditions tested which provides indices of boundedly rational decision-making. Although the information retrieved by participants generally allows to infer their preferences, the increasing amount and complexity of this information again often results in boundedly rational behavior.

Keywords: bounded rationality, experimental design, information retrieval, stability of attitudes and behavior, cognitive tracing, behavioral economics, behavioral information systems.

JEL classification: C18, C91, D03, D81

1 Introduction

Research in information systems (IS) involves two complementary paradigms, design science and behavioral science. Design science seeks to generate and validate IT artefacts, whereas behavioral science seeks to explain human behavior in an IS environment (Hevner et al., 2004). IS is therefore an interdisciplinary science in which researchers employ a variety of methodologies and theories from other disciplines. One of the most important theories in behavioral IS, the Technology Acceptance Model (TAM; Davis, 1989), is based on a theory from social psychology, the theory of reasoned action (TRA; Fishbein and Ajzen, 1975). Researchers seeking to explore TAM usually use survey instruments and thus can only measure the 'stated' behavior. 'Actual' behavior can only be measured in experiments, which require much more resources to conduct. However, empirical evidence shows that individuals do not always act in accordance with their stated preferences or behavior (e.g. Berendt et al., 2005). This gap can be explained by internal factors, such as characteristics of the individual, cognitive biases and psychological distortions, as well as external – limited time, monetary or cognitive resources. The internal factors are being extensively explored in behavioral economics under the paradigm of bounded rationality (Simon, 1957). Bounded rationality can be well applied to study the gap between stated vs. actual behavior with regards to IT adoption as well and therefore in this paper aim to apply the lessons learned from behavioral science to IS.

Our experimental study seeks to identify boundedly rational aspects in individual decision-making by testing the stability of individual preferences with regard to risk and altruism. In order to identify preferences, we first employ the *revealed-preference approach* (Samuelson, 1983), a traditional approach in empirical economics, which allows to infer motives from observable behavior, i.e. real choices as opposed to surveys or the measurement of psychological reactions. Therefore, instead of asking participants about their preferences directly, in an experimental setting our participants are required to make decisions in scenarios that involve risk and concern other individuals. In particular, the participants state their willingness to pay for a prospect (a monetary promise) that can be combined with different characteristics. By analysing the prices individuals state, we are able to infer their real risk preferences and social preferences. Further, the stability of these preferences is tested in an experimental design which involves several treatments. Specifically, we change the order in which individuals have to make their decisions, or require participants to either buy or sell the prospects of the same monetary value. If individuals were rational, the conditions would not have an impact on the decisions individuals make. Deviations from the decisions, would, however, indicate the boundedly rational aspects in their behavior. The set-up of our study is rather theoretical, but it allows for generalizability and application of our findings to a wide variety of contexts, for example to study privacy-related attitudes in IS (see e.g. Grossklags and Aquisti, 2007; Berendt et al., 2005).

In our experiment we not only explore the actual decisions that individuals make, but also the process in which the decisions are taken. For that, we do not provide the participants with information about the possible payoffs of their prospects, but require them to purchase this information for a minor fee. In order to achieve this, we use *cognition tracing* to interpret this data in connection with the decisions individuals make. On the one hand, by analysing what information individuals purchase for which decision, we can deduce individual preferences for risk and altruism. On the other hand, information retrieval behavior can provide insights into boundedly rational decision-making. Would individuals invest in purchasing information at all? Would they direct their cognitive resources to process it? Although initially the increases in the amount of information have been found to have a positive impact, after a certain point the additional information has a detrimental impact on the reasoning of individuals (Schneider et al., 1987). In e-commerce, authors repeatedly find evidence for diminishing decision quality when consumers are faced with superfluous information (e.g. Chen et al., 2009). Due to limited cognitive resources, individuals might refrain from purchasing and processing information, base their decision on an limited amount of available information (Goldstein and Gigerenzer, 1999) and forego their stated preferences as a result.

The research questions we address in the paper can be summarized as follows:

- *Can we deduce risk and social preferences from actual behavior?*
- *How stable are these preferences under different conditions?*

To address our research questions, we first present related literature and develop hypotheses. Then we extensively describe the set-up of our experiment. The results section follows which not only covers the general overview, but answers specific research questions mentioned above. Subsequently, we discuss these results and conclude with a summary of our findings.

2 Related literature and hypotheses

Rationality, as seen from a neoclassical perspective, aims at maximizing monetary gains. However, uncertainty, incomplete information, limited time for decision-making and the inability to process information are the reasons why individuals' behavior is merely boundedly rational (Simon, 1957). The knowledge on boundedly rational economic behavior is, however, still very limited (Selten, 1998). Only single aspects of such behavior have been investigated empirically, among them risk preferences such as the Ellsberg paradox (Ellsberg, 1961), social preferences such as altruism (e.g. Brennan, 1975), or the non-stability of preferences in general when deciding under different circumstances (e.g. Gilboa and Schmeidler, 1995). Researchers in IS, predominantly in the area of privacy research, have been trying to use boundedly rational aspects in order to explain human behavior: Acquisti and Grossklags (2004) explain the dichotomy between privacy attitudes and behavior by certain psychological distortions, e.g. optimism bias or self-control problems, such as the preference for immediate gratification. The authors show that even if individuals want to genuinely protect themselves, psychological distortions induce them to trade-off privacy for small rewards or convenience benefits (Acquisti and Grossklags, 2004). In an online shop experiment, Berendt et al. (2005) find that individuals forget about their privacy concerns which they stated before the experiment and reveal very personal details without any reason to do so (Berendt et al., 2005).

In our study we investigate the classical scenario in behavioral economics - preferences of individuals when they make decisions that involve risk and the welfare of other individuals. Güth et al. (2008) find that individuals are generally risk-averse. As to the social preferences, experiments show that more than 50% of participants voluntarily share money with other participants (Camerer, 2003) and individuals are on average altruistic (Güth et al., 2008). Several models within the framework of rational choice theory try to explain such pro-social behavior, by e.g. inequality aversion (Fehr and Schmidt, 1999), altruism (Andreoni and Miller, 2002), and Rawlsian 'social welfare' preferences (Charness and Rabin, 2003). Therefore, in a scenario where a decision maker is being forced to put the prospect of another individual on the market, we expect that the decision maker is more likely to protect the prospect of the passive partner, even if she/he could benefit from selling it. Vice versa, when provided with the opportunity to buy prospects for another individual, we expect a considerable investment from the decision maker. Therefore, we hypothesize:

H1: Individuals price prospects with a risky payoff lower than prospects with a fixed payoff.

H2: Individuals refrain from the maximum benefit in support of the prospect of another individual.

The stability of preferences with regard to different domains or situations has been subject of other studies as well. For example, Weber et al. (2002) compare risk preferences across e.g. financial and social decisions and find that risk preferences are highly domain specific, i.e. individuals are not consistently risk-averse or risk-seeking across all domains. One of the most prominent is the so-called endowment effect, i.e. the tendency of individuals to value goods more once their property right has been established (Kahneman et al., 1990). The endowment effect is reinforced by loss aversion, referring to the individual preference of avoiding losses as opposed to acquiring gains (Kahneman et al., 1990). In our experiment we want to explore if individuals state the same reservation prices if they are allowed to sell the prospects or to acquire them. We hypothesize that:

H3: Individuals price prospects higher when selling them than when buying them.

Moreover, authors show that decisions often depend on the sequence (or order) in which they are made. In experiments, an order bias (see Perreault, 1975) is usually anticipated due to demand effects and learning effects. The former occur when participants form an interpretation of the experiment's purpose and unconsciously change their behavior accordingly (Rosenthal and Rosnow, 2009), whereas the latter refer to benefits of increased experience in decision-making as participants proceed along the stages of the experiment. We assume that in general the appraisal of prospects decreases as the sequence of decisions concerning these prospects proceeds. Therefore we hypothesize that:

H4: Individuals price prospects higher when they price them first, compared to a scenario in which they price these prospects second.

Finally, we want to investigate the role of information retrieval in the decision process. To the best of our knowledge, no study so far has explored the information retrieval behavior with respect to appraisal of prospects that involve risk and welfare of others. We assume that the degree to which decision makers purchase information and the type of information that is chosen, can be used to imply the corresponding preferences of the decision makers. We expect two concepts, ambiguity aversion and loss aversion to influence the information retrieval behavior of individuals. On the one hand ambiguity aversion might motivate participants to purchase information in order to know the expected payoff of their prospect. Ambiguity aversion describes a preference for known risks over unknown risks (Camerer and Weber, 1992) and is demonstrated in the Ellsberg paradox (Ellsberg, 1961). The paradox states that individuals prefer lower payoffs when they know the probability of the outcome compared to higher payoffs with unknown probabilities. On the other hand, loss-aversion may induce the decision makers to refrain from purchasing information to avoid sure losses. Additionally, by the type of information participants purchase, we might be able to infer risk and social preferences. For this, we used the mouse lab technique, which allows to measure which information participants purchase and correlated it with thinking steps (Huck, 2004, p. 133), thus revealing participants' preferences.

3 Experimental protocol

We simulated a software-based virtual marketing platform on which the purchase price is determined by a computerized, random draw. The only available commodity are prospects that promise a monetary payoff. Each of the prospects could either yield a 'fixed' payoff or a 'risky' payoff. Specifically, a risky prospect either yields a high payoff with probability p or a low payoff with probability (1-p). Participants had to specify a price at which they were willing to buy respectively sell a prospect (reservation price). The additional information about the values of the payoff of the prospects was available to participants at a fixed price. For every prospect, the payoff took the form of a payment in an experimental currency unit (ECU).

Participants had to decide about the prospects that pay off for them (decision maker's prospect, DM) or that pay off for an unknown passive partner (PP). As far as the prospects for the PP are concerned, the experiment represented a dictator game. Such games are characterized by the power of one decision maker (DM) to determine unilaterally which share of a certain commodity a PP (PP) will receive (Güth et al., 1982). In our experiment, interaction between the decision makers, i.e the participants and their PPs was impossible. Therefore, each participant had to state four reservation prices in the two phases of the experiment: two for own and two for other's prospects (*within-subject design*).

In order to test the stability of preferences, we introduced different treatments. In order to account for a possible endowment effect, participants had either to state their willingness to pay (WTP) in order to buy a prospect or their willingness to accept (WTA) in order to sell a prospect. Further, in order to account for a possible order effect, participants either first stated reservation prices for their own

prospects (order treatment 'DM first') or with the PP's prospects first (order treatment 'PP first'). The overview of the treatments (*between-subject design*) is presented in Table 1.

In our experiment participants had to decide whether they want to purchase information, which kind of information and how to use this information in order to state their reservation price. A list of pieces of information was provided by means of a mouse lab (Figure 1). In order to retrieve a piece of information, participants first clicked on it to purchase it and could then click on it again to see the information. Additionally, when purchasing some pieces of information, participants had to process them before using them for decision-making. Specifically, the information about the payoff of the risky prospect could either be purchased as single information (amount of high and low payoff and the respective probabilities) or as aggregated information in form of the expected value during each phase.

Time order of phases		WTP	WTA
DM's prospects PP's prospects	'DM first'		
PP's prospects DM's Prospects	'PP first'		

Table 1. 2x2-factorial between-subject design.

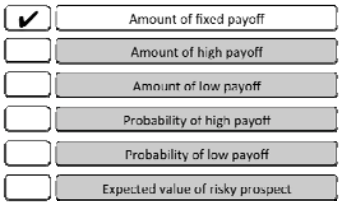

Figure 1. Mouse lab window.

In the end of the experiment, the stated reservation prices were compared with computer-generated selling (buying) prices, based on the incentive-compatible random price mechanism (Becker et al. 1964). For each participant, the comparison of the stated with the generated prices revealed whether she/he bought prospects (WTP) respectively sold her/his prospects (WTA). The higher the reservation prices, the higher was the probability to sell (WTA) or to buy (WTP) a specific prospect. The price comparison took place at the end of the experiment, in order to reduce learning effects.

4 Results

4.1 General results

An overview of the means and standard deviations for the reservation prices that participants stated for all prospects, is presented separately for each treatment group in Table 2. We find that participants bid more for their own prospects in the WTA than in the WTP treatment group providing indices of the endowment effect. They bid almost always more in the order treatment group 'DM first' than in the order treatment group 'PP first' for DM's prospects indicating an order effect. Further, participants bid much less for the PP's prospects than for their own prospects, revealing a rather egoistic behavior. Note that only when stating reservation prices larger than 1 ECU participants could possibly – depending on the random price – not sell the prospect of the PP (WTA) or buy a prospect for the PP (WTP). Therefore, the larger the reservation prices for the PP's prospect, the more altruistic the participant is. We notice that participants were stating higher reservation prices for the PP's prospects in order treatment 'PP first' as opposed to 'DM first'.

Mean (Standard Deviation) of reservation prices		DM's prospects		PP's prospects	
		fixed	*risky*	*fixed*	*risky*
WTA	'DM first'	8.33 (1.58)	10.41 (2.39)	3.02 (3.63)	3.43 (4.21)
	'PP first'	7.85 (3.25)	9.27 (3.76)	4.48 (4.20)	5.13 (4.35)
WTP	'DM first'	6.33 (1.80)	8.96 (3.24)	2.48 (2.61)	3.56 (3.90)
	'PP first'	6.61 (3.28)	8.03 (3.68)	4.86 (4.24)	4.79 (4.79)
Value of the prospect		7.5	10	7	9.5

Table 2. Overview of reservation prices for all prospects.

In order to test the significance of our explored variables, we conduct a general least squares panel regression of reservation prices for all participants over all treatments. Due to the within-subject design we apply a panel data regression, as each participant stated eight reservation prices (four reservation prices for DM's prospects and four for PP's prospects). In order to incentivize participants to purchase information in every phase we had to vary the payoffs across prospects. Therefore, we normalized the dependent variable: for reservation prices appraising risky prospect we subtracted the expected value of the risky prospect, whereas for the fixed prospects we subtracted the fixed payoff. The independent variables account for the different prospect characteristics: risk, person, as well as the treatment variables: order ('DM first' vs. 'PP first') and treatment (WTP vs. WTA). In order to account for the combined impact of the variables, we include the interaction effect of order and person. All other interaction effects do not make sense theoretically.

Variable / Treatment	Coefficient (Standard Error)
Risk (0 - no risk, 1 - risk)	-1.27*** (0111)
Person (0 - DM, 1 - PP)	-4.72*** (0.157)
Order Treatment (0 - 'DM first', 1 - 'PP first')	-0.85*** (0.259)
WTA/WTP Treatment (0 - WTA, 1 - WTP)	-1.56*** (0.235)
Order*person	2.54*** (0.224)
Intercept	0.93*** (0.224)
R-squared	0.257
N	2928

*Table 3. Regression for prospects, normalized reservation prices (*** - 1% significance).*

The results presented in Table 3 reveal that all main variables (Risk, Person, Order, WTA/WTP, Order) are significant at 1% level. More specifically, we find that participants are generally risk-averse, i.e. they state lower reservation prices for risky prospects in comparison to fixed ones. Further, the reservation prices are much higher for DM's prospects compared to PP's prospects. The coefficient for the variable 'person' is the highest, which indicates that this variable has the highest influence on reservation prices. We confirm the significance of the endowment effect: the participants state higher reservation prices in order to sell prospects than to buy them. Further, we also confirm an order effect: our participants state on average higher reservation prices when they state reservation prices first for themselves (the DM) compared to when they state reservation prices first for the PP (cf. section 'Stability of preferences'). Although participants bid less for the PP's prospect than for their own prospect, and less in the order treatment PP first than DM first, when order*person are interacted we observe a softening effect: participants bid more for the PP's prospect when they consider these prospects first.

4.2 Risk preferences and social preferences

Following the revealed preference approach, from the normalized reservation prices (see Table 2 for an overview) we deduced the participants risk and social preferences. Based on the mechanism proposed by Rabin (1993), we were able to categorize the participants according to their social and risk preferences. For social preferences, for each participant we calculated the mean of the two stated reservation prices for the fixed and risky PP's prospects. We then performed a median split of the stated means across all participants (median = 3 ECU). Participants bidding on average more than 3 ECU in favor of the PP were categorized as altruistic. Participants bidding 3 ECU or less were categorized as egoistic. Inferring risk preferences was done in a similar way. For each participant, we calculated the difference between the reservation prices for the risky prospect and the fixed DM's prospect. We then determined the median of all means which was equal to 0.5 ECU. Participants above this threshold were categorized as risk-tolerant; participants whose mean was equal or smaller than 0.5 ECU were categorized as risk-averse.

4.3 Stability of preferences

In order to investigate the stability of preferences, we seek to extensively explore the already identified in the regression analysis the endowment and order effects. We already confirm a demand effect and an order effect by means of the regression in Table 3. In order to get deeper insights, we compared the prices stated in each of the treatments by conducting a Mann-Whitney U test for independent samples as the reservation prices are not normally distributed (Table 4).

Based on the results presented in Table 4, we can see that the endowment effect exists only for the reservation prices of DM's prospects, but not for the reservation prices of PP's prospects. Further, the endowment effect for the DM's prospects is independent of the order in which the prospects where stated (order treatment 'DM first' and 'PP first'). Further, we confirm the existence of an order effect for almost all prospects in both WTA and WTP treatments (Table 4), except for fixed DM's prospect and risky PP's prospect in the WTP treatment. This means that participants state higher reservation prices for their own prospects in the order group 'DM' first compared to the participants in the order group 'PP first'. Correspondingly, participants state lower reservation prices for the PP's prospects in the order treatment group 'DM first' compared to participants in the order treatment group 'PP first' (cf. Table 2 for the differences and cf. Table 4 for the significance of this effect).

Investigated effect	Differences	DM's prospects		PP's prospects	
		fixed	*risky*	*fixed*	*risky*
Endowment effect	WTA vs. WTP ('DM first')	2.00***	1.45***	0.54	-0.13
	WTA vs. WTP ('PP first')	1.24***	1.24***	0.38	0.34
Order effect	'DM first' vs.'PP first' (WTA)	0.051*	0.041**	0.060*	0.029**
	'DM first' vs.'PP first' (WTP)	0.761	0.078*	0.000***	0.143

Table 4. Endowment and order effects for the reservation prices.

4.4 Information retrieval

In order to explore the process by which participants made their decisions, in this section we analyse their information retrieval behavior. Figure 2 gives an overview of the information that the participants purchased for their own as well as the prospects of the PP. We observe that almost all participants acquired information about their own fixed payoff, whereas different information about the payoff of the risky prospect was acquired by not more than 60% of the participants. This already indicated that participants were cognitively overloaded by the amount of information they could purchase. Moreover, more participants purchased information about the high payoff and high probability than about the low payoff and probability. Although participants purchased much less information about the payoff of the PP's prospects than about their own prospects, the pattern of information purchase is similar.

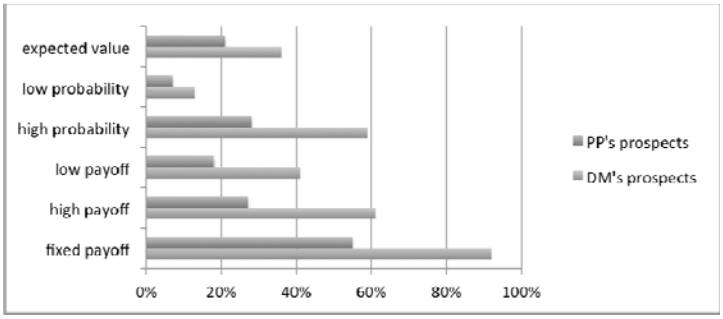

Figure 2. Information retrieved for DM's prospects and PP's prospects.

In order to determine the impact of the type of information purchased on the decisions the participants made, we conduct a Mann-Whitney U test of independent samples on the reservation prices stated by participants who purchased a specific type of information as compared to those who did not. The results presented in *Table 5* reveal that participants who bought the information about the fixed payoff bid significantly less for the fixed prospect than other participants.

Concerning the risky prospect, we want to explore whether participants who possessed 'full information' for their decision about a risky prospect made better-informed decisions than other participants. Specifically, a 'fully informed' participant with regard to the risky prospect either requires the expected value or the high payoff, the low payoff and one of the probabilities. Although judging by the results presented in Table 5 full information does not influence the reservation prices, an impact of single pieces of information on the reservation price can be observed. Specifically, participants who purchase at least the high payoff or the probability for the high payoff state significantly higher reservation prices than those who have not bought these pieces of information. At the same time, individuals who bought the information about low payoff for the risky prospect bid significantly less than others.

DM's prospect		fixed	risky				
Information acquired		Fixed payoff	Full info	High payoff	Low payoff	High Prob.	Low Prob.
Retrieved	Mean / St. Dev.	7.24 / 2.52	9.5 / 2.87	10.1 / 3.05	8.4 / 3.34	10 / 3.14	8.8 / 3.86
	N	325	223	189	125	180	40
Not retrieved	Mean / St. Dev.	7.8 / 4.00	9.1 / 4.15	8.5 / 3.62	9.8 / 3.39	8.7 / 3.57	9.4 / 3.37
	N	41	143	177	241	186	326
Significance		0.018**	0.784	0.00***	0.00***	0.001***	0.237

Table 5. Reservation prices for DM's prospects of the 'retrieved info' vs. 'not retrieved info' groups.

In order to deduce risk preferences from information retrieval behavior, we split the participants into groups by means of the median split procedure described above into risk-averse and risk-tolerant ones. With the help of Kendall's correlation coefficient we check whether there is a correlation between the type of information participants retrieved and their revealed preferences. Concerning the correlation between risk preferences and information retrieval, in *Table 6* we see that participants who do not purchase any information are rather risk-averse. Moreover, participants who purchase at least the information about the high payoff or the probability of the high payoff are risk-tolerant. Accordingly, participants who purchase at least the information about the low payoff are risk-averse. However, there is no significant correlation between the purchase of the probability for the low payoff and risk preferences. Further, participants who purchase the expected value turn out to be rather risk-tolerant. Interestingly, those who are 'fully-informed' are evenly divided between those who are risk-tolerant and those who are risk-averse and therefore, no significant correlation can be observed.

Information acquired about DM's risky prospect (number of participants)	Risk Preferences		Kendall's Correlation
	Risk-Tolerant (0)	Risk-Averse (1)	
high payoff info (189)	116	73	-0.218***
low payoff info (125)	52	73	0.133***
high probability (180)	110	70	-0.203***
low probability (40)	18	22	0.041
Expected Value (114)	77	37	-0.225***
Full: high + low + probability (111)	54	57	0.029
No information at all (30)	3	27	0.244***

Table 6. Correlation between information retrieval for DM's prospects and risk preferences.

Moreover, we investigate if participants who purchased information about the PP's prospects state significantly different reservation prices than those who did not. For fixed prospects this information

concerns the payoff of the fixed prospect of the PP. For the risky prospect we explore the effect of being 'fully informed' about the risky prospect of the PP as well as the effect of purchasing at least one piece of information (i.e. high or low payoff, or high or low probability of the PP's prospect) on the reservation prices. The results of an independent samples Mann-Whitney U test in *Table 7* reveal that participants who retrieved any type of information about the PP's payoffs generally state significantly higher reservation prices than participants who did not retrieve that information.

PP's Prospect		Fixed prospect	Risky Prospect	
Information acquired		fixed Payoff	Full	At least one
Retrieved	Mean / St. Dev.	5.23 / 3.36	6.12 / 3.48	6.69 / 4.02
	N	185	102	172
Not retrieved	Mean / St. Dev.	2.27 / 3.72	3.57 / 4.46	2.13 / 3.44
	N	181	264	194
Significance		0.00***	0.00***	0.00***

Table 7. Reservation prices for PP's prospects of the 'retrieved info' vs. 'not retrieved' groups.

In order to deduce social preferences from information retrieval behavior regarding the prospects of the PP, we split the participants into altruistic vs. egoistic ones by means of the median split procedure described above. Concerning the correlation between social preferences and information retrieval, judging by Table 8 we find that participants who are purchasing any type of information about the payoffs of the prospects of the PP are rather altruistic. Inversely, participants who did not purchase any information at all about the payoff of the PP are rather egoistic.

Information acquired about PP's prospects (number of participants)	Social Preferences		Kendall's Correlation
	Egoistic (0)	Altruistic (1)	
Payoff of the fixed prospect (185)	51	134	0.493***
Any info about payoff of risky prospect (172)	37	135	0.573***
No information at all (146)	127	19	-0.572***

Table 8. Correlation between information retrieval for PP's prospects and social preferences.

5 Discussion

The overview of our hypotheses is presented in Table 9. Regarding risk preferences, we find that participants bid less if the prospects are risky (H1). In general, measuring risk preferences based on reservation prices for risky prospects is effective. With regard to social preferences (H2), we find that most participants behave rather egoistically when they had to bid for prospects that pay off for the PP (cf. Table 2 and Table 3), which contradicts the findings of Güth et al. (2008). However, measuring altruism by means of reservation prices is ambiguous: we categorize all participants as altruistic who bid more than 3 ECU (median of all participants) for the PP's prospect. When bidding 3 ECU, the probability that a participant will buy (WTP) or not sell (WTA) the PP's prospect is low, as the random price follows a uniform distribution from 1-18 ECU. Moreover, in the WTA scenario participants stating low prices might be motivated to earn at least something from selling the prospect of the PP. Further, we assume that there is a certain demand effect for those participants who are altruistic, i.e. that they felt 'forced' to think about the passive partner when being confronted with her/his prospects and are not necessarily intrinsically altruistic.

However, we find that these preferences are not stable across different conditions. First, we find that individuals price the prospects higher when they want to sell them than when they want to buy them, providing evidence for the existence of an endowment effect (H3). However, the endowment effect did not occur when participants were pricing the PP's prospects. This result is surprising, as altruism is

much more 'costly' in the WTP than in the WTA treatment: in the former, participants have to incur sure losses, whereas in the latter they forego the opportunity to earn more in order to behave altruistically. Second, in support of the order effect, we find that the participants stated higher reservation prices for their own prospects when they considered them first, than when they stated them second. The lower reservation prices in the second scenario are probably due to the learning effect. Interestingly, we find a similar order effect when participants are pricing PP's prospects: the prices are higher if they are confronted with the PP's prospects first. Although this partially may be explained by the demand and learning effects, it also provides evidence that participants tend to be more altruistic if they are confronted with PP's prospects before making decisions about their own prospects.

Hypotheses		Results
H1	Individuals price prospects with a risky payoff lower prospects with a fixed payoff.	Yes
H2	Individuals refrain from the maximum benefit in support of the prospect of another individual.	No
H3	Individuals price prospects higher when selling them than when buying them.	Yes
H4	Individuals price prospects higher when they price them first, compared to a scenario in which they price these prospects second.	Yes

Table 9. Overview of hypotheses.

What concerns the impact of information retrieval on the stated reservation prices, we find significant differences between participants who bought a certain type of information vs. those who did not. First, we observe that the median of the reservation prices of those who did not buy the information about the fixed prospect is equal to 10 ECU, which is exactly the payoff of the prospect during the trial run where participants were given that information for free. Although participants were explicitly told that the values of the prospects will be different during the phases, they still used this information to state their reservation prices. This can be due to an 'anchoring effect' (Tversky and Kahneman, 1974) which describes a biased estimate toward an arbitrary value before making a numerical estimate (Jacowitz and Kahneman, 1995). Decision-making based on such heuristics provides indices of bounded rationality in individual behavior.

Second, exploring the trade-off between the motivations of loss-aversion (by not purchasing information) and ambiguity-aversion (to find out the payoffs), we are able to uncover individual preferences regard to risk. We find that risk-tolerant participants retrieve either at least the high-payoff (and the high probability) or the expected value of the prospect. We assume that risk-tolerant participants are 'satisficed' (from satisfy and suffice; cf. Simon, 1957) with the information about the prospects' possible gains or with an aggregated value of their expected payoff. Accordingly, we find that risk-averse participants either do not purchase any information at all or at least the information about the prospects' low payoff. Therefore, we deduce a positive correlation between risk-aversion and loss-aversion, i.e. individuals who are risk-averse also refrain from buying information in order to avoid loosing money. As loss-aversion and ambiguity-aversion are opposed concepts, we can also deduce a negative correlation between risk-aversion and ambiguity-aversion, i.e. individuals who are risk-averse do not mind not knowing all relevant information. Only the fear to loose even more can motivate risk-averse participants to invest in acquiring the value of the low payoff. Although we cannot determine risk preferences of participants who purchase 'full information', it is interesting to explore why the participants were not satisfied with the expected value and were ready to invest in purchasing more information. One explanation might lie in the Ellsberg Paradox (1961). Thus, our participants might accept losses in order to be fully informed about the payoff of their prospect.

Third, based on the information retrieved about the prospects of the PP, we find that participants who purchase any information (or at least one piece of information) about the PP's prospects are altruistic. This result is quite intuitive: the sheer fact that participants are paying for the information about the PP's payoffs makes them altruistic to some extent.

5.1 Implications for IS behavioral researchers

'*External validity (of experiments) asks the question of generalizability: To what populations, settings, (and) treatment variables (…) can this effect be generalized?'* (Campbell and Stanley, 1966). Our results can be generalized to larger populations and to study other related phenomena due to several reasons. First, our sample is relatively large, even though it contains mainly students. Second, our setting is abstract, i.e. we measure risk preferences and social preferences without a specific context. Third, our experimental design includes four treatment variables (WTA vs. WTP, 'DM first' vs. 'PP first'), which allows us to measure the robustness of our results.

Our results can be applied to a wide array of problems that require behavioural rather than attitudinal responses. For example, problems in IS behavioural research such as the dichotomy between stated privacy attitudes and actual behavior, confirmed in several studies, e.g. Berendt et al. (2005) can be well measured in an experiment and explained by the paradigm of bounded rationality. For example, Grossklags and Acquisti (2007) pursue the first step in this direction by conducting a full-scale experiment in order to deduce real privacy related behaviors of individuals. The authors show a clear preference for money over data across a wide variety of scenarios, including differences between WTA and WTP when valuing privacy sensitive information, which they explain by various psychological distortions. Thus, the knowledge acquired in behavioral economics can be transferred to study also IS-related phenomena.

Moreover, we encourage IS researchers to take aspects of bounded rationality into consideration with regard to the experimental design as well as to the interpretation of experimental results. Concerning the experimental design, we recommend to include several treatments in order to verify the stability of results. Our experiment shows that preferences are generally not stable, and by measuring them only in one condition may prove inadequate to infer true attitudinal responses. With regard to the interpretation of results, we recommend to take into consideration aspects of bounded rationality: psychological distortions, cognitive biases, decision heuristics, etc. In our experiment, we show that aspects of bounded rationality influence an individual's behaviour considerably. To summarize, our study confirms the importance of careful design and analysis of the experiments in their attempt to excel the validity of the survey instruments widely used in IS.

6 Conclusion

This study uncovers aspects of boundedly rational decision-making involving risk preferences and social preferences. The revealed preference approach allows us to uncover that individuals are generally risk-averse and egoistic. Although these preferences are not stable under different conditions: individuals price prospects higher when selling them than when buying them, as well as when they price specific prospects first, compared to when they price these prospects second. This provides clear indices of bounded rationality in individual decision-making.

Moreover, our experiment shows that we can use information retrieval behavior to predict risk preferences as well as social preferences of individuals. It turns out that for many participants, risk-aversion is a stronger motivation than ambiguity-aversion, which prevents individuals from acquiring information, especially when the amount and complexity of such information increases. This might be due to the cognitive overload induced by superfluous information for decision-making.

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