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Abstract

Virtual worlds are gaining in popularity and are proposed as a test laboratory for the real world. In these virtual worlds users act via their avatars and make decisions for them. In this paper, we analyze the decision making in virtual worlds in an experiment conducted in a virtual world, as well as in the real world over the internet, for the same set of subjects. For this purpose, we develop hypotheses for decision making in the context of a classic economic experiment (the Dictator Game). We find similar decisions in the virtual and the real world with respect to sharing. Altruism has a significant influence in the real world setting but not in the virtual world; fairness is insignificant in both settings. We identify the feeling of presence in one's avatar and potential satiation effects as factors that influence decisions regarding the allocation of resources in the virtual world.

Keywords: Virtual Worlds, Decision Making, Parallelism, Experiments

1. INTRODUCTION

Virtual worlds have been established as a significant usage and business domain. Virtual worlds are defined as a "synchronous, persistent network of people, represented as avatars, facilitated by networked computers" (Bell 2008). They commonly describe environments that allow participants to communicate and interact with each other in a real time, persistent, and virtual space through a digital representation with an avatar (Bell 2008). In the last decade, several virtual worlds, such as 'EverQuest', 'Second Life', 'World of Warcraft', and 'Habbo Hotel' have seen an explosive growth in participation. In September 2008, Blizzard Entertainment reported that World of Warcraft has reached more than 10.9 million paying subscribers worldwide, paying up to US$15 per month and thus yielding annual revenues of well over one billion US$ (http://us.blizzard.com/en-us/company/press/pressreleases.html?080915). Increasingly, companies view virtual worlds as significant business opportunities that go beyond the direct revenues, mainly from paid subscriptions, but also from sales of virtual products such as property, furniture and other items. Producers of real world goods and services are establishing a virtual online presence for branding purposes. For example, Adidas, Nokia and Samsung have used virtual worlds as a tool for communication and distribution. Similar efforts are aimed at exploiting virtual worlds for market research purposes. The most cited example of market research in a virtual world is the designing of a new hotel chain called Aloft owned by Starwood Hotels. Architects and designers first developed a 3D prototype for Second Life and encouraged users to visit their virtual building. Based on their feedback, they made changes to the building. Starwood then built real world hotels based on this feedback and the corresponding prototype in Second Life.

Early research supports the notion that virtual worlds are good representations of the real world. Chung et al. (2003) find a strong evidence for identification and immersion of a person with her avatar. This suggest that market research methods developed for interactive and multi-media can be transferred and applied to such virtual environments (Dahan and Hauser 2002). However, newspaper and trade journals reports seem to indicate that many efforts to advertise or sell goods in virtual worlds have failed. For example Moses (2008) reported empty virtual properties and low interest by avatars in virtual worlds such as 'Second Life'. Retailers are realizing that their traditional approaches do not translate directly into 'Second Life', and that an avatar, while a representation of a person, may not have the same human needs and wants and does not necessarily decide and act like the real person (Junglas and Steel 2007; Semuels 2007). Thus, it is necessary to understand human decision making for their avatars in virtual worlds.

In this paper we study decision making in virtual worlds. We seek to analyze the extent to which parallelism between decision making in virtual and real worlds exists; i.e., does the same participant make the same decisions (for her avatar) in a virtual world as she would make (for herself) in the real world? Specifically, we use a classic economic experiment (the Dictator Game) to test our research question. Virtual worlds offer a unique setting for controlled experiments, since researchers have higher level of control and observability in this environment. Such experiments, where subjects' decisions have economic consequences for them, can be incentive-aligned. We analyze individuals' decision making for their avatars in virtual worlds by comparing these decisions to those in the real online world. Further, we analyze the impact of subjects' motives and their feeling of being present in the virtual world via their avatars (Witmer and Singer 1998) on their decision making in virtual worlds.

The remainder of the paper is as follows: In the next Section 2, we review related research. In Section 3, we develop hypotheses. In Section 4, we outline the design of our experimental, test the hypotheses and discuss the results. Section 5 presents our general discussion and conclusions.

2. RELATED LITERATURE

In this section, we first review literature on decision making in virtual worlds. Next, we discuss economic experiments as a test for decision making. Finally, we review literature on the application and applicability of economic experiments in virtual environments.

2.1 Decision Making in Online Environments

Decision making by individuals in online environments has been found to be similar to that in offline environments, and thus is appropriate for evaluating decisions made by users. Several studies have analyzed if Internet markets are more efficient or individual decisions exhibit greater rationality than in offline environments.. These studies found that Internet markets show no greater efficiency than markets in offline environments (Brynjolfsson and Smith 2000; Clemons et al. 2002), that consumers exhibit less than optimal information gathering and search behavior (Johnson et al. 2004), and that individuals' decisions are still prone to errors (Spann and Tellis 2006). These results indicate that individual decisions in online environments can be representative of those in offline environments.

However, little is known about decision making in virtual worlds as a special form of the online environment. In virtual worlds users may play a role and typically find a self-contained world with its own rules, social norms and economic systems which might influence the decision making (Chung et al. 2003).

It has been suggested that virtual environments can serve as social laboratories that may be used to contribute to future experimental research. Junglas and Steel (2007) discuss the ability of virtual worlds to provide social laboratories but do not experimentally test their claims. The promise of virtual worlds as test laboratories for the real world, as proposed by Junglas and Steel (2007), is intriguing. However, such an approach requires that the individuals' decisions for their avatars are representative for their decisions in the real world. Messinger et al. (2008) survey individuals' about the relationship between their avatars and themselves. They find that individuals make their avatars similar to themselves and that they consider their virtual-world behavior is more outgoing and risk-taking and less thoughtful/more superficial. However, they do not test this behavior in a decision experiment.

A theoretical argument for the parallelism of the individuals' decision making for their avatars in virtual worlds can be based on the notion of "presence", which was developed for virtual environments and is defined as "the subjective experience of being in one place or environment, even when one is physically situated in another" (Witmer and Singer 1998). Presence is based on high involvement and immersion. It is necessary for the players to fully immerse into the virtual world. They feel that they are interacting directly with the environment. Immersion can also emerge through strong identification with a character in a movie or a book. When identifying with a character in a movie or book, subjects tend to put themselves in the character's place and experience what that character experiences (Witmer and Singer 1998). Based on this notion of presence, decision making is assumed to be guided by one's own preferences and personality if she feels to be present in the virtual world via her avatar. Thus, we expect that the participants' identification with their avatars has a positive influence on the parallelism of their decision making in the virtual and the real world.

2.2 On the Validity of Economic Experiments

Economic experiments are a widespread approach to test decision making in controlled environments. The original goal of experimental economics was to test the predictions on market and individual behavior derived from economic theories (Davis and Holt 1992). For example, economic experiments tested the efficiency of market institutions such as the double auction trading mechanisms for different informational structures of market participants and yielded results mostly consistent with economic theory (Sunder 1995). Experimental tests of individual decision making, on the other hand, often found deviations from rational behavior according to economic theory (Kahneman et al. 1991).

Previous research, experimentally testing hypotheses derived from economic models in simple bargaining or decision situations, found that subjects' decisions are not purely driven by rational utility maximization (Bolton and Ockenfels 2000). Rather, subjects' motivation for factors such as altruism and fairness has been identified as drivers of apparent non-rational behavior (Andreoni and Miller 2002). The Dictator Game is an example for such experimental results that diverge from utility-maximizing behavior and can be explained by motives of altruism and fairness. In the Dictator Game, two subjects are in a game where the first subject has to decide how to split $10 with a second subject. The first subject can keep the whole amount, give away the whole amount or share the $10 at any proportion. The second subject has no influence on that decision and can only accept the share that is

given to him. Results of such studies have shown that subjects share significant amounts with their counterpart and thus behave irrationally (Forsythe et al. 1994).

Smith (1982) proposes five sufficient conditions for the validity of economic experiments to be able to test hypotheses about economic behavior in a controlled environment. These conditions are (Smith 1982): (1) nonsatiation, (2) saliency, (3) dominance, (4) privacy, and (5) parallelism. Conditions (1) to (4) are sufficient for internal validity, i.e., a controlled economic experiment (Smith 1982). Thus, based on these conditions we can test hypotheses on subject's behavior within the experiment's economic environment. However, in order to generalize and transfer the experimental results to other situations, the condition (5) is sufficient for external validity (i.e., parallelism).

The appropriate test of parallelism depends on the specific theory tested in an experiment: The falsification test shows whether a particular experimental result in the laboratory can be falsified with field data (Smith 1982). Several studies test parallelism by direct comparisons of the outcomes of an experimental setting between different samples recruited from a student and a professional (field) pool (e.g., Smith et al. 1988; Drehmann et al. 2005). In these situations, both the student and the field pool were confronted with the same experimental context (e.g., laboratory setting or Internet experiment). However, a stricter test of parallelism may require changing the experimental context to the relevant field setting. List and Levitt (2005) argue that the specific experimental context and subjects' knowledge of being watched are more critical difficulties for the extrapolation of experimental results to the real world than using small stakes or having self-selection of participants in a laboratory experiment.

Hence, our approach for evaluating parallelism in virtual worlds is not to test different subject pools (recruited from students and professionals), but to test the individuals' decisions in different contexts: We compare the results of an experimental setting within a virtual world to the results of a similar experiment with the same subject pool but in a real (online) world setting.

2.3 Economic Experiments in Online Environments

Finally, we review research on the application of economic experiments in online environments such as the Internet. Anderhub et al. (2001) test economic experiments over the Internet as alternative to such experiments in a physical laboratory setting. They find similar results in general economic behavior for both settings in case the same software was used. They conclude that the Internet is an appropriate environment for experimental economics.

Kim et al. (2002) develop and propose a virtual, artificial environment for economic experiments, esp. with respect to market transactions. However, their virtual environment, developed in the late 1990s, does not have a similar multimedia representation as today's virtual worlds. Further, they do not test parallelism. Hinz and Spann (2008) study the impact of information diffusion on bidding behavior in secret reserve price auctions in a virtual world but do not test parallelism. Fiedler and Haruvy (2009) study decision making in a trust game in Second Life and the lab, but with different sets of participants and no test of parallelism. Without parallelism, results found in such virtual environments cannot be generalized.

3. HYPOTHESES

We compare the results from a classic economic experiment in a virtual world with the results from this experimental setting with the same set of subjects in the real online world. For the test of parallelism between the virtual world environment and the real world environment, we are interested in analyzing and – if applicable – comparing the motivational influencers on individuals' decision making. For our test, we use the Dictator Game, which is a classic game to study decision making in experimental economics.

As outlined above, the Dictator Game involves two subjects in the allocation of an endowment (e.g., $10). One of the subjects, the proposer, determines a split of money between him/herself and the anonymous second subject, the responder. The responder has no option to reject the offered split from the proposer and thus is entirely passive. A utility-maximizing proposer would be expected to keep the whole endowment and defer nothing to the responder. However, previous studies have shown that

proposers did on average allocate money to the responders and thus behave irrationally, which has been attributed to motives of altruism and fairness (Forsythe et al. 1994). An advantage of the Dictator Game is that decisions are not confounded by strategic considerations with respect to reciprocity, which can be an element in other games such as the Ultimatum Game (Hoffman et al. 1996).

We derive hypotheses on the influence of altruism and fairness on the proposers' split decisions in virtual worlds, i.e., the percentage of the endowment of gold that they keep themselves.

Altruistic behavior is characterized as behavior which is carried out to benefit another person without anticipation of rewards from external sources (Macaulay and Berkowitz 1970). Altruism in the context of the Dictator Game is represented by proposers' decision to keep less than 100% of the endowment for themselves and to offer the remainder to the responder. Thus, altruism can be identified as a motive to allocate money to the responders. If decision making in a virtual world is similar to decision making in real worlds, then altruism should result in sharing parts of the endowment. We hypothesize that altruistic proposers keep less of the endowment for themselves:

H_1: Altruism has a negative influence on the share of the endowment kept by proposers in the virtual world.

Apart from altruism, participants' preference for fairness can have an influence on proposers' split decisions in the Dictator Game. Although the responder in the Dictator Game is entirely passive and has no option to retaliate, the proposer's decision to share may be guided by fairness considerations (Andreoni 1990). Based on social exchange norms, proposers may be motivated to allocate a fair split of the endowment to the responders (Adams 1965; Fiske 1992). These considerations should translate in virtual worlds as well. Thus, we hypothesize that fairness reduces the share of the endowment proposers keep for themselves:

H_2: Fairness has a negative influence on the share of the endowment kept by proposers in the virtual world.

Further, subjects' feeling of presence in the virtual world via their avatars has an influence on their decision making in the virtual world (Witmer and Singer 1998). Chung et al. (2003) find evidence that presence is rooted in the user's identification with an avatar. In their research, identification is a measure of perceived similarity, likeness, or homophily of the self to the avatar. Therefore, a strong feeling of presence will base subjects' decisions for their avatars on their own preferences and personality in the real world and thus positively influence the parallelism with the real world. Consequently, presence will increase subjects' utility and their preference function for virtual money. Thus, we hypothesize that after controlling for altruism and fairness, presence increases the share of the virtual endowment proposers keep for themselves:

H_3: Presence has a positive influence on the share of the endowment kept by proposers in the virtual world.

4. EXPERIMENTAL STUDY

4.1 Experimental Setting

The goal of our experimental study is to test whether the virtual world environment yields similar results when compared to 'real' environments with respect to proposers' split decision in the dictator game and the influence of altruism and fairness on this decision. We use a virtual world without direct convertibility between real money and the virtual money. We decided to choose the currently most popular virtual world, which is called 'World of Warcraft' (WoW). WoW is a massively multiplayer online role-playing game (MMORPG) released by Blizzard Entertainment in 2004 and with about 11.5 million subscribers as of 2008 (http://www.wired.com/gamelife/2008/12/world-of-warc-1/), it has been the most successful game in the growing market for MMORPGs. In this virtual world, the player controls an avatar, exploring the world, fighting monsters, completing quests and interacting with non-player-characters or other players in a fantasy setting with elves, orcs and demons. The game economy is based on virtual money ("Gold") that cannot be directly converted into real money. However, user can find offers for the purchase or sale of Gold for WoW on external platforms such as eBay. This is, however, against the

Terms of Use and End User License Agreement. For these reasons, selling and purchasing Gold is inconvenient, risky and controversially discussed among the game's community itself.

In this virtual world, a number of interesting economic phenomena are observable, for example last-minute-bidding in auction houses for virtual items, bidding in sequential auctions and price inflation. By manipulating or experimentally varying institutional or individual arrangements, researchers could easily learn more about the virtual economy and infer solutions for real world problems. This, however, is only possible given the parallelism of decision making, which we will test in our experimental study.

4.2 Study Design

The goal of our experimental study is to test decision making in virtual worlds via a within-subject economic experiment, the Dictator Game, in the virtual and the real online world for the same set of subjects drawn from the virtual world population.

In order to test decision making in virtual worlds, we created a combined between-subject and within-subject design. We experimentally manipulated the level of the endowment to be allocated in the virtual world between two groups (High and Low virtual endowment). The low-virtual endowment group received 10 Gold for the split decision and the high-virtual endowment group received 50 Gold. Both groups had to complete a small questionnaire at the end of the experiment. The low-virtual endowment of 10 Gold is set to be at the lower end of an acceptable remuneration for this experiment. Based on expert interviews, the high-virtual endowment of 50 Gold compensates even very skilled players for their opportunity costs of time, i.e., they could earn 50 Gold on average in one hour play time.

The questionnaire contained items for subjects' feeling of being present in the virtual world via their avatars as well as constructs related to potential influencers on individual's split decisions, i.e., fairness and altruism. We measure presence by subjects' level of agreement to the questionnaire item "I identify strongly with my avatar", measured on a 7-point Likert scale from 1= „do not agree at all" to 7= „completely agree". Related, we measure fairness and altruism by subjects' level of agreement to multi-item measures based on Ahmed and Jackson (1979) and Lee and Ashton (2004) (see Appendix).

To ensure privacy, the instructions and interactions between the subject's avatar and the instructor were communicated using a communication channel that is called "whisper". This communication channel is usually used for 1-to-1 private conversations in WoW and impedes listening of a third party. This setting is consistent with the single blind Dictator Game where a subject's messages are private with respect to other subjects but not to the experimenter (Hoffman et al. 1996). The subjects were remunerated according to their own decision using the most common transfer mechanisms that are implemented in WoW.

As within-subject manipulation, we invited all subjects who participated in the two between-subjects virtual world groups to participate in a Dictator Game in the real economic environment via the Internet. In this real world Dictator Game, subjects could decide the allocation of 10€ (~$15) between themselves and a second player. We expect that 10€ is the average hourly wage for the WoW population since we expect the participation of a high number of high-school and college students. As payment method for the remuneration we offered optionally a PayPal money transfer or an Amazon gift coupon of the amount of the decision outcome. Both payment methods solely require the subjects' email address for execution. The subjects' decisions in the Dictator Game were again followed by a small questionnaire.

Based on this within-subject manipulation between the virtual and real world, we can directly compare individual decision making in these two settings. We can test the parallelism on the group level across subjects looking at the distribution of allocation splits as well as testing the parallelism on the individual level within subjects by a paired t-test.

To invite players to the first part of the experiment, we used an avatar that we developed especially for the purpose of this experiment and which we moved to one of the central cities in this virtual world. We then started inviting players randomly to our experiment. After their decision in the

Dictator Game, subjects had to answer the follow-up questionnaire and after completion, subjects received their payoff via a trade window or via the inGame mail system. Subjects were not informed about the second part of the experiment involving real money in the real online world at this point of time to eliminate strategic behavior.

About two weeks after the first part of the experiment, we invited the players with an inGame mail to participate in the second part of the experiment. The second part was web-based and conducted on an external platform branded under the university's logo on the Internet. It was communicated that participation was possible for ten days. According to their split decision and their chosen payment method, subjects received an Amazon gift coupon or a PayPal money transfer within one week.

4.3 Results

We recruited a total number of 223 participants for the first part of our experiment, which we conducted within the virtual world WoW. The majority of participants was male (69%) and the average age was 26 years. For the between-subject variation of this first experimental part, we randomly assigned 113 participants to the low-virtual endowment treatment of 10 Gold and 110 participants were randomly assigned to the high-virtual endowment treatment of 50 Gold. Both groups do not differ with respect to demographics, experience (years played, inGame-level) and involvement (weekly hours playing) in WoW. On average, subjects in the Dictator Game keep 50.6% of the virtual endowment (10 or 50 Gold) for themselves. Interestingly, there is no significant difference ($p>.7$) for this share of the virtual endowment kept by the proposer between the two groups: subjects in the low-virtual endowment group keep on average 51.2% of 10 Gold and subjects in the high-virtual endowment group keep on average 50.0% of 50 Gold.

We invited all participants of the first part of our experimental study to the second part of the experiment in the real online world. The response rate was 34.5% (77 participants). The propensity to enter the second part of the experiment differed significantly ($p<.05$) between the two experimental groups in the first experimental part, with 32 participants originating from the low-virtual endowment treatment (10 Gold) and 45 participants originating from the high-virtual endowment treatment (50 Gold). However, both groups do not differ with respect to demographics, experience (years played, inGame-level) and involvement (weekly hours playing) in WoW. In the real online world, subjects keep on average 57.5% of the endowment of 10€ for themselves. There is no significant difference ($p>.6$) in the share of the real money endowment kept between subjects originating from either of the two groups of first part of the experiment.

Endowment in Virtual World	*Part 1: Virtual World*		*Part 2: Real World*		
	No. obs	*Average share kept by proposer*	*No. obs*	*Average share kept by proposer*	
				Virtual World [a]	*Real World*
Low: 10 Gold	*113*	*51.15%*	*32*	*46.25%*	*55.31%*
High: 50 Gold	*110*	*50.04%*	*45*	*46.93%*	*59.00%*
All	*223*	*50.60%*	*77*	*46.65%*	*57.47%*
ANOVA [b]		*.13 (.72)*		*.02 (.90)*	*.25 (.62)*

[a] *Decision in virtual world part of experiment of subjects who completed both parts of experiment.*
[b] *ANOVA to test for between-subject differences: F-value (p-value).*

Table 1. Descriptive Statistics

Comparing respondents of the second part of our experiment with non respondents, we find no significant difference with respect to gender and involvement. However, respondents are older ($p<.05$) and more experienced ($p<.05$) than non-respondents. Further, albeit insignificant ($p>.05$) subjects keep on average a lower share of virtual endowment than non-respondents (46.7% vs. 52.7%). Hence, we conclude that we do not have a significant non-response bias. Table 1 depicts key descriptive statistics of both experimental parts.

We test parallelism, i.e., the external validity of our experimental results, by comparing within-subject the decisions in the virtual world part of our experiment with their decisions in the real world

part of our experiment. We find that subjects keep on average a significantly lower share of virtual endowment in the virtual world part of our experiment than real money in the second part of our experiment (46.7% vs. 57.5%, $p<.01$: see Table 2).

Endowment in Virtual World	*No. obs*	*Average share kept by proposer*		*Within-subject Differences* [b)]
		Virtual World	*Real World*	
Low: 10 Gold	*32*	*46.25%*	*55.31%*	*1.86 (.07)*
High: 50 Gold	*45*	*46.93%*	*59.00%*	*2.34 (.02)*
All	*77*	*46.65%*	*57.47%*	*3.00 (.00)*
Between-subject [a)]		*.02 (.90)*	*.25 (.62)*	

a) ANOVA to test for between-subject differences: F-value (p-value).
b) Paired t-test for within-subject differences: t-value (p-value).

Table 2. Test of Parallelism

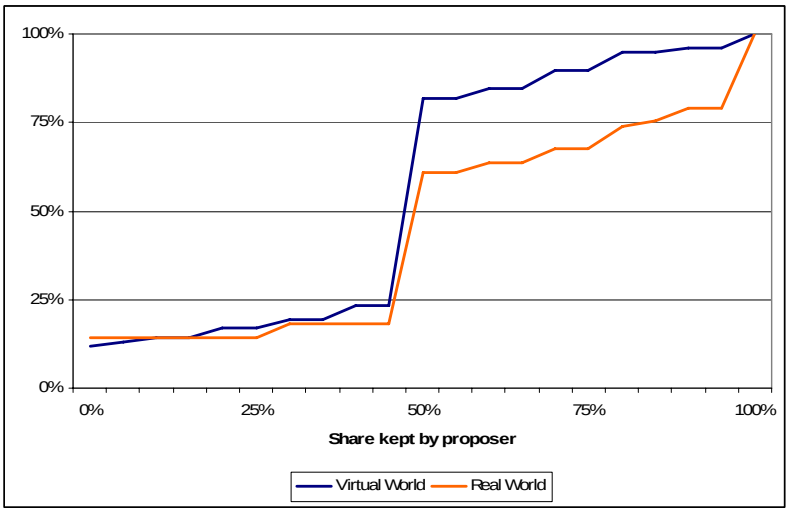

Figure 1. Cumulative Distributions of Share kept by Proposer

Figure 1 depicts the cumulative distribution of the share of endowment kept by proposers in the virtual and real world part of the experiment. The difference between these two distributions is highly significant (Wilcoxon-test: $p<.01$). Interestingly, 23% of proposers in the virtual world and 18% of proposers in the real world keep less than half of the endowment for themselves, which is a very dominant indicator of altruism and/or fairness.

We test the hypotheses developed above on the impact of altruism, fairness and subjects' feeling of being present in the virtual world via their avatars, on the share kept by the proposer in the virtual world (model 1). Further, we account for the level of Gold possession in the virtual world and if subjects have graduated from college as additional explanatory variables. The level of Gold possession can have an influence in case of satiation effects, because high wealth may be related with (almost) no extra utility of the virtual reward medium. We additionally account for a college degree, because previous studies of the Dictator Game found an influence of occupation on the share kept by proposers (Carpenter et al. 2004). Further, we test the impact of altruism, fairness and a college degree, on the share kept by the proposer in the real online world (model 2). Table 3 depicts the results for both regression models.

The results in Table 3 show that altruism has a negative influence on the share kept by the proposer in the real world. However, altruism has no significant influence in the virtual world, which is inconsistent with hypothesis H_1. Fairness is not significant both in the virtual and the real world, which is contrary to hypothesis H_2. Apparently, motives of fairness do not exert any additional effect besides altruism on proposers' split decisions. However, previous research on decision making in the

Dictator Game does not separate altruism from fairness to explain non-rational behavior (e.g., Andreoni and Miller (2002)).

	Model 1	Model 2
Dependent Variable	Share kept by proposer in virtual world	Share kept by proposer in real world
Parameter:		
Intercept	.32 (.21)	.75 (.28)***
Altruism [a)]	.01 (.02)	-.05 (.03)*
Fairness [a)]	-.00 (.03)	.00 (.04)
College Degree (Dummy)	.07 (.07)	.24 (.09)***
Presence [b)]	.03 (.01)**	
Gold possession (/10^5)	-1.34 (.00)***	
R^2-adjusted	.12	.09
F-Test	2.97**	3.45**

Notes: Unstandardized parameters (standard errors in parentheses)
* $p<.1$, ** $p<.05$, *** $p<.01$
[a)] Mean of item scores; 7-point Likert scale from 1= „do not agree at all“ to 7= „completely agree”.
[b)] 7-point Likert scale from 1= „do not agree at all“ to 7= „completely agree”.
VIF and Tolerance indicate that multicollinearity is not an issue
N=77

Table 3. Test of Altruism, Fairness and Presence

We found a positive influence of presence on the share kept by proposers in the virtual world, which is consistent with hypothesis H_3. Thus, the more subjects feel present in the virtual world via their avatars, the stronger they apparently prefer the virtual money and keep a larger share of it as proposers in the Dictator Game, thus behaving even more identical with the real world. Consequently, we would also expect that an increase in presence should reinforce subjects' preferences for altruism and fairness in the virtual world. However, an additional test for interaction effects between presence and altruism as well as fairness yields no significant results.

Further, we find a negative influence of Gold possession on the share kept by the proposer in the virtual world. This can be interpreted as an indicator of satiation effects with respect to the reward medium: Increasing wealth of a subject's avatar reduces the utility from virtual money and thus subject's preference for it – keeping a lower share of the virtual endowment as proposer in the Dictator Game. Apparently, the effects of presence and potential satiation effects, dominate the effect of altruism in the virtual environment we studied.

The possession of a college degree has a significant positive influence on the share proposers keep in the real world, which can be an indicator of more-rational behavior due to a college education. This effect, however, is also dominated in the virtual world by subject's feeling of presence and their avatars' wealth.

5. DISCUSSION AND CONCLUSION

We compare individuals' decision making in virtual worlds to their decision making in the real world. In the Dictator Game, which we used as experiment to test decision making, we found that proposers share a large part of their endowment with the responder, although they do not have to. While we observe the same or even a larger degree of sharing in the virtual world than in the real world, altruism and fairness considerations do not appear to be a significant driver of this phenomenon in the virtual world, although altruism is weakly significant in the real world. We attribute this finding to a potential problem of satiation with the reward medium where higher wealth of a subject's avatar reduces the utility from virtual money and thus subject's preference for it. Further, subjects' feeling of being present in the virtual world via their avatars ("presence"), apparently increases their preference for virtual money, letting them keep a larger share of it as proposers in the Dictator Game.

Our results, therefore, indicate that satiation effects and the feeling of presence in one's avatar might be the most important factors for the external validity of experiments in the virtual world. If the marginal utility of virtual money is very low, e.g. due to high wealth of avatars, the reward medium may not exert the required incentives. Our results indicate that the virtual world we analyzed (World of Warcraft) may have reached a stage of maturity where the extra utility from additional virtual money may be low for certain avatars.

These findings have important implications for both, the providers of virtual worlds and other companies that want to use virtual worlds for market research purposes: The validity of market research based on virtual money decreases with a diminishing marginal utility of this medium to players. If there is not much left to buy with extra virtual money, the satiation level may be reached, thus limiting the external validity of economic decisions based on virtual money. To prevent avatars from reaching such a satiation level, developers of virtual worlds are therefore continuously adding new challenges and upgrades that can be bought with virtual money. The specific virtual world we used in our experiment, 'World of Warcraft', is quite mature in its lifecycle with many players being very well equipped. This might consequently lower the marginal utility of virtual money. However, satiation effects can be mitigated by adding new content. In the case of WoW, a new expansion pack (i.e. new content) had been released after our experiment.

Further, presence is an important driver for the parallelism of experiments in virtual worlds: The more the people identify with their avatars, the more they behave like in reality. This suggests that more realistic virtual worlds may increase the benefit of virtual worlds as social laboratory.

Concluding, we suppose that especially virtual worlds with high immersion, high identification and which have not reached a saturation level, may yield the best results in terms of parallelism. We conjecture that parallelism is best met in the growth stage of a virtual world. Presence may not be that high in the introduction stage and satiation effects may become a problem in the maturity and decline stage of a virtual world's lifecycle.

Generally, virtual experiments can be less expensive than real world laboratory experiments, and of course field experiments, if the virtual money can be acquired, e.g., through a cooperation with the operator of the virtual world. Further, the recruiting for and implementation of virtual experiments is faster in virtual, digital environments than in real world laboratory experiments. Software-based tracking of avatars' actions can additionally enable greater observability of subjects than in real world laboratory settings.

We have to acknowledge several limitations of our experimental design: The result of non-significant differences between the low-virtual endowment treatment (10 Gold) and the high-virtual endowment treatment (50 Gold) cannot be generalized. A stronger increase (decrease) of the virtual endowment level in the high (low) treatment, e.g. to 500 Gold (1 Gold), may produce significant differences. Additionally, participants who selected to participate in the experiment may be more helpful and altruistic. Further, all subjects proceeded through both parts of our experiment in the same order. We separated both parts of the experiment by about two weeks in order to avoid order effects, i.e., that subjects' response to a task is influenced by their response to a former task. However, we cannot completely rule out any order effects or peer-to-peer conversation between subjects. Further, our results are limited to one specific experiment and one specific – albeit the most popular – virtual world.

These limitations provide avenues for future research. Besides variations of the experimental endowment level and the specific experiment, decision making in different virtual worlds can be tested. Based on our results for the effect of subjects' feeling of being present in the virtual worlds via their avatars on their decision making, future research may test decision making for virtual worlds with differing degrees of realism. Further, several new virtual worlds aim at even greater realism than Second Life (e.g. www.twinity.com, a 3D online world that links the real with the virtual world based on realistic replicas of the world's most vibrant metropolises in 3D), thus yielding presumably even greater presence and thus greater parallelism. Hence, we expect that the validity of decision making in virtual world will even increase in the future.

APPENDIX: MEASUREMENT SCALES FOR ALTRUISM AND FAIRNESS

Construct	Items	Cronbach's Alpha
Altruism (based on: Ahmed and Jackson (1979))	People who have enough for themselves have a responsibility to provide for the needy Everyone should contribute generously to help those less fortunate I believe in giving generously to needy organizations	$\alpha = .711$
Fairness (based on: Lee and Ashton (2004))	I cheat to get ahead (reverse coding) I steal things (reverse coding) I cheat on people who have trusted me (reverse coding) I would not regret my behavior if I were to take advantage of someone impulsively (reverse coding)	$\alpha = .747$

Note: Cronbach's Alpha calculated for sample of participants who completed both experimental parts (N=77).

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