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**MIÉRT FOGADUNK EL KEVESEBB PÉNZT A
SZÁMÍTÓGÉPEKTŐL MINT AZ EMBEREKTŐL?**

BEHAVIOUR ECONOMICS THROUGH THE ULTIMATUM GAME

**WHY DO WE ACCEPT MORE FROM COMPUTERS THAN FROM
PEOPLE?**

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Abstract

In our essay we would like to show the new field of economic sciences, behavioural economics through the ultimatum game. We analyzed former ultimatum game results and then we conducted our own experiment. In our own ultimatum game experiment, not only did we retest the findings of previous studies, but we were curious if there is a difference between people playing the game with computers or other people. In the end of our essay, we found significant differences between the two cases and we formulate ideas on why these distinctions happened. We also draw conclusions on the topic in general and we try to envisage the future.

INTRODUCTION

The classical and neoclassical economic models came from some of the greatest minds ever to live on this planet. Even though these standard models are so beautiful, simple and elegant, anyone who looks at them carefully, finds that there is something odd about them. The assumptions that the classical and neoclassical economic models make are contrary to our everyday experiences and intuitions. Examples of such presumptions include perfect information, profit maximization and unbounded rationality.

The ultimatum game is a perfect tool in the toolbox of behavioural economics to show where the classical models need a little improvement. Since its introduction (Güth et. al.1982) it has become one of the most popular standard experiments in economics. The ultimatum game is a showpiece of irrational behaviour unexplainable by classical economic models (Nowak et. al.2000). These are the reasons we consider the ultimatum game to be relevant and worth exploring.

We structured our essay as follows: in the beginning we take a look at the history and background of behavioural economics and the ultimatum game. We then go on to analyze the most important researches, the ultimatum game has been involved over the past 30 years. After that, we show our experiment, compare the results with previous ones' and point out the differences and similarities. At the end, we summarize our findings and outline the future of the ultimatum game.

BACKGROUND

The ultimatum game was first developed in 1982 by Güth, Schmittberger and Schwarze. Although Fouraker and Siegel used a game very similar to the ultimatum game in their 1963 experiment, it is only considered a game with ultimatum aspect (Fouraker et.al.1963). The basic ultimatum game has the rules as follows: Two people play the game, who have to allocate a given sum of money between them. The first player is the proposer, the second is the responder. The proposer allocates the money as he wants and the responder can either accept or reject this offer. If he accepts, the proportion of the money allocated by the proposer will be given to the players, but if he rejects the offer, neither of them get any money. But, let's not get ahead of ourselves, we should first examine the history behind the ultimatum game a little deeper.

Adam Smith's *The Wealth of Nations* in 1776 is often said to be the birth of classical economics. The framework in which he put his ideas and models were followed by many classical economists (David Ricardo, Thomas Malthus, John Stuart Mill). Later on neoclassical economists came and they introduced the concepts of perfect information, profit maximisation and unbounded rationality. We should look at these concepts one by one to see what they are conjecturing. Perfect information means that no matter how complex the situation is, people can always identify the available and unavailable choices and know how to rank these choices from best to worst. Profit maximisation refers to people only striving to gain as much profit as possible regardless of the circumstances. Unbounded rationality as a notion comprises the assumption that people always make rational decisions, not taking into account the cognitive limitation of their minds and the finite amount of time they have to make those decisions.

Rightly so, going over these facts, an apt reader will question the credibility of these economists and their models, but we should take a look at the reasons they postulated their principles this way. Economists are and always have been aware of these defects of their models, but they claim that departures from the axioms (unbounded willpower, etc) are negligible on the large scale and they do not affect the economy as a whole (Herbert A. Simon,1994). Also, when these principles were first conceived, psychology did not even exist as a discipline. Economists were the prominent psychologists of their time and they did not even know about it. Adam Smith, before

writing *The Wealth of Nations*, authored another book *The Theory of Moral Sentiments* which is full of insights about human psychology. He wrote: "How many people ruin themselves by laying out money on trinkets of frivolous utility? What pleases these lovers of toys is not so much the utility, as the aptness of the machines which are fitted to promote it. All their pockets are stuffed with little conveniences.... of which the whole utility is certainly not worth the fatigue of bearing the burden" (Smith, 1759). His book is riddled with insights about human psychology and through this quote we can clearly see that he did not have a simple-minded view of human nature. The man, described by Smith, wanted to maximize his right to make decisions but was sensitive morally and socially and was even susceptible to altruism (Perlman and McCan 1998, 239).

Later on, when psychology was emerging but was still not very scientific, economists found its basic principles too unstable to be the foundation of economics. After all, they wanted economics to be just as widespread and as accepted as any other natural science. The neoclassical revolution deepened the economists' distaste for psychology which led to the slow but ever growing abandonment of it from economics (Camerer et. al. 2002).

Even though, the mainstream rejected psychology, there were always economists who wanted to tie these two disciplines together. In the early times of neoclassical economics, there were some economists who tried to build their models on the foundation of hedonic psychology. It is a discipline by Jeremy Bentham where individuals seek to maximize pleasure and minimize pain (Bentham, 1789). William Stanley Jevons and a few others were fascinated by Bentham's ideas about human nature and thought that a commodity's utility must be measured by an addition that is made to a person's happiness (Jevons, 1871). These hedonic psychological underpinnings for economics, explained a few phenomena better, so it had a few advantages. The idea that individuals maximize pleasure, could explain why preferences in general are transitive and why people behave irrationally from time to time. However, there was a big problem with hedonics. It was based on the psychological discipline of introspection which is the self-observation of inner thoughts, sensations and desires. Now we can see how unscientific psychology was at the time because the most basic principle of introspection excluded the idea of peer review by other scientists. These defects lead economists like Mitchell, Veblen and Clark to turn away from hedonic psychology. The institutionalists (as they are sometimes called) believed that hedonistic assumptions are at fault but they also thought that they would be wrong to ignore psychology. Mitchell emphasized that economists needed a just

psychological basis for their ideas and believed that if they found one then not only would psychology contribute to economics but vice versa (Mitchell, 1914, 2-3). Clark also argued that if an economist dismisses the ideas of psychology he will make himself think of his own principles, which is simply bad psychology (Clark, 1914, 4).

The next economist who differed from neoclassical economics was John Maynard Keynes. In his book *The General theory* he argues that the expected utility model does not always demonstrates actual behaviour and he criticizes the unbounded rationality and willpower of individuals and speculates that economic behaviour is motivated by other aspects of human nature.

In the second half of the twentieth century came the birth of behavioural economics with the ideas of Herbert A. Simon and George Katona. In both of their opinion neoclassical models fail to accurately demonstrate human choice behaviour. Herbert A. Simon was concerned with the empirical validity of neoclassical assumptions and stressed that more empirical tests were needed to understand behaviour as accurately as possible. He believed that economic theories needed to be modified according to the results these tests yield (Simon, 1987, 221). He also thought that neoclassical theory which ignores the computational and knowledge limits of economic actors cannot be the foundation for economic choice behaviour (Simon, 1994). To impose limitations on human actors in economic models, he coined the term bounded rationality. Bounded rationality is the idea that when people make decisions their rationality is constrained by the limited information they have, the cognitive limitations of their minds and the finite time they have to make the decision. Another way to look at it is that people making decisions are missing the resources and/or abilities to come to the optimal decision and they only act rational after they have simplified the choices. Simon coined it satisficing, because the decision-maker looks for a satisfactory solution rather than the optimal one. The theory of bounded rationality not only wants to shed light on the actual process of decision making but looks for the reasons why the final decision is made (Simon, 1987, 267). George Katona agreed with the ideas of Simon but his major concern with neoclassical economics was that it did not take into account the importance of intervening variables. He thought that intervening variables (motives, attitude and expectations of consumers) influenced spending, saving and investing greatly and through psychology these economic behaviours should be investigated (Katona, 1975, 4). He thought that without the psychological analysis of intervening variables, our understanding of

economic behaviour would remain incomplete and our predictions about behaviour mistaken (Katona, 1951, 31).

FORMER ULTIMATUM GAME EXPERIMENTS

In this chapter we investigate and analyze behaviour in former ultimatum games. Since its introduction (Güth et al, 1982) this game has fascinated economists. Over the last 30 years, hundreds of papers have been written in many countries all focusing on this simple game which rules can be told in a minute. So what is it that is so interesting about this game that it gets all this attention from economists? The reason is that the outcome of the ultimatum game predicted by our economic models has never been achieved in the past 30 years.

Standard game theory assumes that the participants of the game (assumes for all people) always try to maximize their utility so the responder should accept any amount that is more than zero. Knowing this, the proposer should give the smallest amount of money possible to the responder and he will take it because the other alternative is getting nothing. For example if the money given to the proposer to be allocated among them is 10\$, then the sub-game perfect equilibrium is 1 cent, so it is the amount the proposer gives to the responder who then accepts it. However, ultimatum games with small and large amount of money to be allocated, culturally diverse experiments, blind, double-blind, face-to-face and experiments with any form over the years provide hard evidence that people do not adhere to the rules of game theory. The proposers usually give non-negligible amounts and responders reject positive offers if deemed unfair. In most cases, offers average between 30% and 40% with often a 50% mode. It is not advisable for the proposer to keep a large sum of the money as offers below 25% are rejected half of the time. But these are just generalizations so we should look at the experiments one by one to see the differences and similarities among them.

As we have mentioned before, the first ultimatum game experiment was conducted in 1982 by three German economists Güth, Schmittberger and Schwarze. The participants were economic students of Cologne University where the experiment took

place. The size of the stakes to be divided ranged between 4 and 10 German marks (DM). 42 students were divided to be allocators and recipients so 21 ultimatum games were played. The modal offer was (7 out of 21 cases) an equal split and the mean of the offers was 37%. Also 5 positive offers were rejected 3 of which were 1 DM and one of which was 3 DM. . When this data came out they were surprised to see that both the behaviour of the allocators and the recipients were completely inconsistent with game theoretic predictions. We see that when the recipient does not accept a positive offer there must be something of greater value for him than the amount of money proposed to him. We can say that there are non-monetary arguments in his utility function. Their unwillingness to accept unfair offers are more important to them than the money given to them. The behaviour of the allocators can be explained by two motives. Allocators making significantly positive offers can have a proclivity to fairness or might worry that their unfair offers will be rejected or both. Through other experiments we will further analyze these demeanours. Güth, Schmittberger and Schwarze wanted to investigate a little bit further the behaviour of the recipients so they conducted another experiment. In this case 37 new subjects were told that they would play the ultimatum game twice, first as the allocator then as the recipient and 7 DM will be the amount to be allotted. Even though the mean offer was even more generous than in the previous game equaling 45%, this might have been caused by the fact that the participants knew that they were going to play both sides and it made some of them to care for a fair bargaining result. Certainly, a rational participant should not make a decision in one game based on his choice in another but we cannot expect people to be able to plainly differentiate decision in one game from one in another game. Güth et al. also tested for the consistency of the subjects' behaviour and found that the demanded amounts as proposer and the expected amounts as responder were in conflict – i.e. the sum of demanded and expected amounts were higher than 7 DM – only in 13.5% of the cases (5 out of 37). This result also suggest that most participants do not behave independently when playing different roles of a game.

So the data which is of greater value is the behaviour of the recipients. Nearly all of them answered that they would not accept any offers which were lower than 1 DM (two of them indicated otherwise: 0.01 DM, 0.1 DM respectively) and the mean offer came out to be 2.5 DM. There were also ten participants who responded that they would only accept the offer if it was an even split. This result clearly shows that game theoretical predictions are

false and other than the need to maximize their payoffs, there are factors which influence the decision making process of people. (Güth et. al,1982)

In 1986 two related experiments were conducted by Kahneman, Knetsch and Thaler. In the first one, the second experiment of Güth et. al. were replicated in order to exclude the idea that subjects responded as they did because of confusion about the task or some other reason. The subjects were undergraduate psychology and commerce students from the University of British Columbia. A simple ultimatum game was played with the stake size of \$10 (canadian dollar) where participants were asked what they would do both as allocators and as responders. Steps were taken to eliminate subjects who did not understand the game. First, before the actual game, two preliminary questions were asked to see if the student grasped the concept of the ultimatum game. 22 out of the 137 participants were dropped because they did not answer one or both of these diagnostic questions. The second method they used to eliminate ambiguity was not to ask directly the amount of the offer that recipients would accept (like Güth et. al. did in their experiment), but to only ask yes or no questions like: if the other player offers you \$0.50, will you accept or reject it? There were a series of question like these with increments of \$0.50. They divided their sample to 3 groups which size was 43, 37 and 35 respectively. The mean minimum acceptable offer ranged from \$2 to \$2.59 which were similar results yielded by Güth et. al. After this experiment we can most certainly state that students did understand the game and nonetheless they made their choices nearly the same as students did in the experiment of Güth et. al. The relevance of this experiment is that the behaviour observed do not follow the models of game theory as a significant proportion of positive offers were rejected by responders. This can be explained by the responders' reluctance to be part of an unfair transaction or their propensity to punish unjust proposers or maybe both. In the second experiment Kahneman, Knetsch and Thaler wanted to find answers to two questions. First, in a game where offers cannot be rejected, will allocators be as fair as we observed in the ultimatum games and second will participants punish those allocators who have been unfair on their own cost. This time the experiment was conducted in an undergraduate psychology class at Cornell University with a 161 students. This time the subjects played a game where the proposer's offer could not be rejected by the responder. It is called a dictator game and it is a useful tool to see whether people behave the same way if there is no retaliation to their decisions. The participants were instructed to divide \$20 anonymously with the responder having no ability to reject

offer. They were also told that 8 pairs were going to be randomly selected and be paid according to their allotment. Proposers could allocate the \$20 in two ways: either keeping \$18 and giving \$2 or proposing an equal split. The results they got were staggering as 122 out of 161 participants proposed an equal split. It is very robust evidence that it is not just proposers' fear of being rejected if they offer small amounts of money that makes them fair but here we can conclude that people have a taste for fairness even though nobody is going to know that they are fair and square (as games are anonymous) they get some utility out of being fair which is worth more to them than money. In the second stage of the experiment, groups of three students were matched together and one in every group was designated to decide whether to split \$12 with a student who was unfair in the previous part (kept \$18 to himself and gave \$2) or share \$10 equally with someone who was fair (offered an equal split in the preceding stage). The second stage was designed to investigate if students would sacrifice \$1 in order to split with a previously fair person and at the same time punish another who has been unfair. A great majority (74%) made the decision to divide the \$10 with a fair participant. We can also see a strong correlation between the decisions made in the two stages of the experiment. Out of 122 subjects who decided to split the \$10 in the first part, 107 chose to share with a fair student in the second stage. In comparison, only 12 of 39 participants who previously took the \$18 split with a fair student in the second part of the experiment. (Kahneman et. al. 1986)

There are three types of theory when it comes to decision making under uncertainty. Normative theories describe how rational actors behave, descriptive theories illustrate how actors really behave and prescriptive theories tell us how actors behave when they face their own limitations. (Bell et. al, 1988)

Thaler suggests that in order to explain the behaviour in ultimatum games (or any other bargaining game for that matter) we should find 3 kinds of approaches of game theory. The behaviour predicted by assumptions about rationality and selfishness of game theory makes it a normative theory. We are trying to postulate how people do behave (descriptive theory) with the evidence provided by experiments. But we have few researches which try to develop prescriptive game theory. (Thaler, 1988)

Next, we investigate an issue about the ultimatum game that has been on researchers' minds from the very beginning. This is the concern of the size of the stakes

used in the experiments. Many economists have hypothesized that if the amount of money to be allocated was larger, then participants would behave in a different way. They thought that it is one thing to turn down an offer of \$1 or \$2 at a stake size of \$10 to punish the unfair proposer, but when it costs \$10 or \$20 (at a stake size of \$100), participants might consider it too high a price to do so.

Telser argued very reasonably behind this hypothesis in 1993. He thought about fairness as a commodity, the consumption of which was maximized in the ultimatum game when there was an equal split. He assumed that fairness was inversely proportional to its price. What he meant about this idea was that when the stakes were raised the price of fairness increased; therefore the percentages offered would represent a larger amount of money so offers would be accepted more often. (Telser, 1993)

Already in the first experiment, as paying every subject at a stake size of \$100 would be very costly, Güth et. al. proposed ideas on how to remedy this problem (Güth et. al.). They suggested paying only a few participants chosen randomly but years went by and seminar after seminar, economists could not let go of the idea that if the stakes are raised, the results would change in the ultimatum game.

Then in 1994 Elizabeth Hoffman, Kevin A. McCabe and Vernon L. Smith conducted an experiment with stake sizes of \$100 to settle the debate. The ultimatum game took place at the University of Arizona Economic Science Laboratory and subjects were recruited from classes and by telephone to partake in an experiment. 50 pairs played the game with a \$100 stake size in two conditions. 27 pairs played under the condition that chance determined who would be proposer or responder, while the other 23 pairs were asked to answer a series of current event questions before the game to assign the roles. As only 12 subjects played the game simultaneously, the person who ranked first (answered the most questions correctly) became the seller and got paired up with the participant who ranked seventh, being designated as buyer. The subject ranked second, played with the subject ranked eighth, and so on. The wording of the instructions was also changed to test the hypothesis whether it affects decisions of the participants. Then proposers/buyers were asked to divide \$100 (in units of \$10). In order to have a good comparison, another experiment was conducted earlier with exactly the same conditions but with \$10 stake sizes. After the data had been processed, Hoffman et. al. were dumbfounded to see that the differences were not between high and low stakes but

between the two conditions (random and contest entitlement). The proportions offered by first movers in the \$10 and \$100 games differed insignificantly from each other under both conditions. But we can see that no matter how much the stakes are, when people feel they earned the right to be proposers they offer less than when roles are simply assigned randomly. However, we note that many responders completely disregard the amount of money they would receive and punish unfair allocators the same way as in games with low stakes only this time at a cost of \$10 or even \$30. (Hoffman et. al. 1994)

A year later, Lisa Cameron increased the stakes even more with her idea to move the experiment to a country where the gross domestic product per capita is notably lower than in the United States. She conducted her experiment in Indonesia where in 1994 GDP per capita was \$670 which is less than 3% of the United States'. By having the experiment conducted in Indonesia she could increase the implied monetary stakes by four times, not to mention that if we consider the average earnings of participants, this factor is much larger. The research was conducted in the Faculty of Sociology and Politics at Gadjah Mada University in Yogyakarta, Central Java. They had 4 sessions in which they played two ultimatum games each. Subjects could only partake in one session and they were told that the games were anonymous and they would never play with the same person twice. During one session the first ultimatum game was always played for 5000 Rupiah (\$1=Rp2160 at the time) and the stake of the second round varied from Rp5000, Rp40,000, and Rp200,000 respectively. Note that the fourth session was played with hypothetical money.

Ultimatum games played in Indonesia in 1995

Table 1

GAME 1	GAME 2	GAME 3	GAME 4
Real Money	Real Money	Real Money	Hypothetical
I. Rp5000 II. Rp5000	I. Rp5000 II. Rp40,000	I. Rp5000 II. Rp200,000	I. Rp5000 II. Rp 200,000
N=29 pairs	N=35 pairs	N=37 pairs	N=40 pairs

Source: Cameron (1995)

She set up the framework of the experiment this way, because making participants play the ultimatum game two times in a row allowed her to control the huge amount of player heterogeneity which is usually observed in these experiments. In order to separate the

effect of experience and the effect of increased stakes she had subjects play for the same amount of money twice in the first session. According to the questionnaires, which participants could fill in optionally at the end of the experiment, the stake size of Rp200,000 was 3 times the average monthly expenditure of the subjects. But even the second highest stake of Rp40,000 represents a much more value relative to monthly income compared to the previous highest stake size to be used in the US (Hoffman et. al, 1994). When analyzing the results, the first thing that comes to attention is that the low stake ultimatum games conducted in Indonesia, USA (Hoffman et. al, 1994) and around the world (Roth et. al, 1991) yield very similar results. In fact, Cameron chose Rp5000 to match the purchasing power of \$10 to \$15 which is usually the amount to be allocated in ultimatum games, therefore the researches can be compared easily. The mode of the allocators' demanded percentage in games played for Rp5000 was 60%, the median 57% and unfair offers were often rejected. If we compare proposers' demands of Round 1 and Round 2, we see that their mean decreased in case of increased stake size. In game 2 the mean dropped from 56,29% to 55,25% and in Game 3 from 61,51% to 58,08% respectively.

Comparison between experiments of Cameron, Roth et. al., Hoffman et. al.

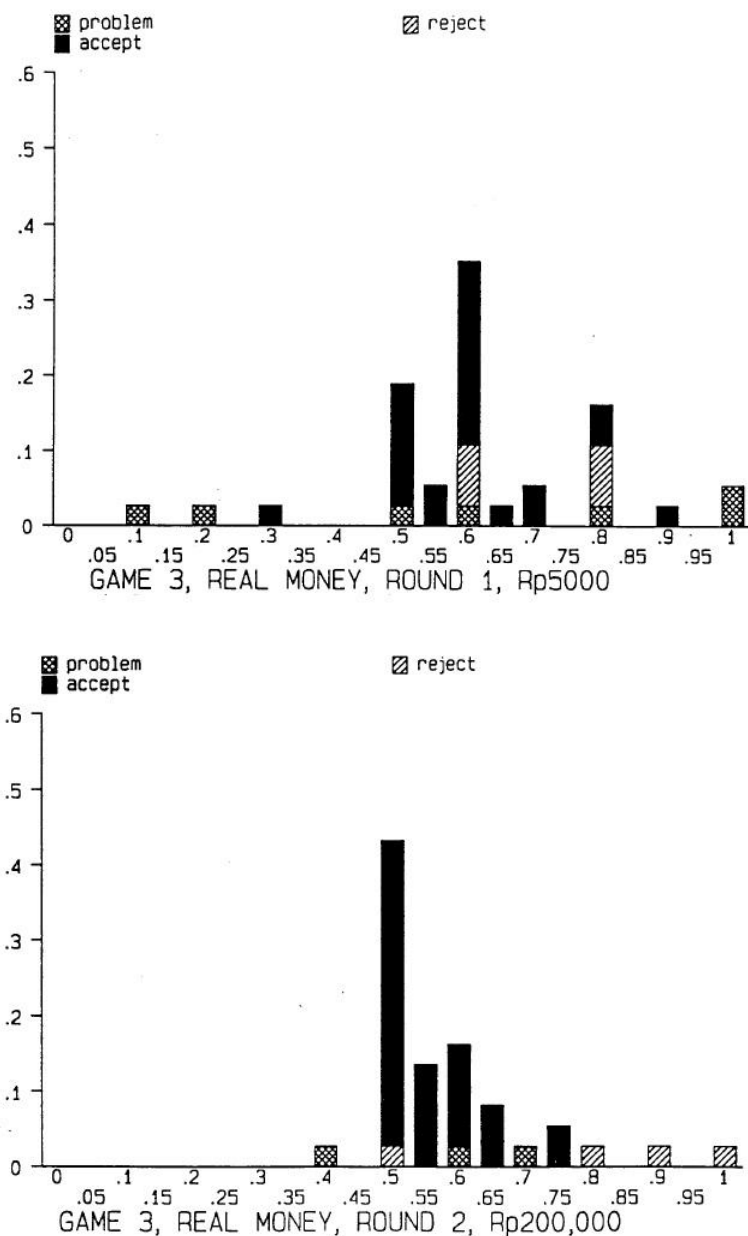
	Indonesian Results (Pooled Round 1, real money Rp5000 games)	Roth, Prasnikar, Okuno-Fujiwara, Zamir (1991)	Hoffman, McCabe, Smith (1994)
Amount	Rp5000 (= \$2.32)	US\$10	US\$10
Mean	0.5734	0.55	0.5625
Median	0.60	0.525	0.55
Mode	0.60	0.50	0.5
Std. Deviation	0.1866	0.0975	0.0719
No. of Demands < 50%	15 (14.9%)	2 (7.4%)	0 (0%)
No. of demands = 50%	27 (26.7%)	14 (51.9%)	12 (50%)
No. of demands > 50%	59 (58.4%)	11 (40.7%)	12 (50%)
No. of Demands >=60%	54 (53.5%)	10 (37.0%)	4 (16.7%)
No. of Demands >=80%	19 (18.8%)	1 (3.70%)	0 (0%)
Acceptance Rate (p-value of test against Indonesian results)	81.3%	77.8% (p-value=0.6980)	91.6% (p-value=0.1436)
Mann-Whitney Test Against Indonesian Results		p-value = 0.2511	p-value = 0.6249
N	101	27	24

Source: Cameron (1995)

Table 2

Although these outcomes are not significant, they provide robust evidence against the hypothesis that in case of increased stake size the behaviour of proposers move closer to the sub-game perfect equilibrium of game theoretic predictions. We can also differentiate between the effect of learning and the effect of high stakes as we see that differences between percentage demands between Round 1 and 2 are significantly uniform only when stake size increases. In Game 2 the number of demands above 80% fell from 5 to 0 whereas in Game 3, which has the highest stake size, the number of demands greater than 60% dropped from 25 to 15 and demands over 80% decreased significantly from 9 to 3.

Round one and two of high stake size ultimatum game in Indonesia



Source: Cameron (1995)

We cannot see this behaviour when stake size remains constant. Now, let's take a closer look at the responders' demeanour. It has been assumed by economists that if the stakes are raised then responders would accept smaller percentage offers as they represent a higher amount of money (Rabin, 1993; Telser, 1993). Cameron's paper also proves this hypothesis wrong. Even though we could see that most of the offers became fairer as the stakes got higher (therefore not many offers were rejected), there are some examples which evidence to the contrary of this assumption. Regardless of how much the stake were there were always some participants who rejected positive offers (8,8% of offers were rejected in Game 2 and 10,3% in Game 3). Cameron instanced one participant who rejected an offer of Rp41,000 even though he checked himself in the lowest monthly income category available on the questionnaire which makes this amount of money his average monthly income. In conclusion to ultimatum games with high stakes, we say the experiments did not provide any evidence to movement towards the game theoretic predictions. We found evidence of both proposers and responders making decisions which move away from the outcome suggested by game theory when stakes are raised. (Cameron, 1995)

Concerning the effect of demographic variables, usually collected during the experiments, many papers showed that age and academic major cause insignificant differences in proposed amounts of ultimatum games. Evidences of gender effect are mixed: some papers report differences in behaviour of male and female subjects, but mainly there is no significant difference between proposed shares of the pie. However, we have to note, many papers show that female subjects reject less frequently than males which is often explained by the psychological fact that females tend to forbear conflicts more than males.

Economists wondered since the introduction of the ultimatum game whether the behaviour patterns observed were universal among people or different social or economic environments yield miscellaneous patterns of demeanour. Next they asked the question that if they assume that the latter is true, what socio-economic factors affect behaviour and how much? Researchers tried comparing experiments from different countries, but they knew that they could not rely on these comparisons as the experiments were too multifarious. They knew that in order to be able to find these cultural differences,

researchers have to control experimental instructions, stake and sample size and other circumstances so that these factors would not influence the subjects.

The first researchers ever to conduct such a carefully controlled and extensive cross cultural experiment were Alvin E. Roth, Vesna Prasnikar, Masahiro Okuno-Fujiwara and Shmuel Zamir. They conducted four experiments in Israel, Japan, the United States and Yugoslavia (today Slovenia) in the year 1991. In order to control between-country variables they needed to find solutions to the experimenter, language and currency effects. Since the experiments were conducted by several experimenters in different locations, uncontrolled distinctions could have arisen due to idiosyncrasies of the researchers. They solved this problem by inviting all experimenters to Pittsburgh where each of them conducted a session of the experiment, therefore allowing themselves in the future to check whether the differences of the cross-country experiments were apparent in the data collected in Pittsburgh thus confirming an experimenter effect. As instructions had to be translated to Hebrew, English, Japanese and Slovenian, they needed to solve the problem of language. They did it by using fluent translators (in both English and the other language) and by translating the instruction in parallel to each other using the same vocabulary. They also wanted to control currency effects (as they had to pay subjects in dinars, dollars, shekels and yen) so they established a baseline in Pittsburgh by including stake sizes between the range of \$10 to \$30. Units were also controlled by making price proposals in terms of 1000 tokens with increments of five tokens in all countries. Nearly all of the subjects were economic students of the University of Pittsburgh, the University of Ljubljana, the Hebrew university (this is where a mixture of economics, business and psychology students played), Keio University and the University of Tokyo with stakes of \$10 to \$30, 400,000 dinars, 20 shekels and 2,000 yen respectively. They played ten ultimatum games in a row, but for now we are mainly interested in the first game where we cannot contribute anything to the learning effect. They conducted the experiments through sessions of 20 participants in order to have every buyer react to 10 sellers. As they expected the results of all experiments differentiated greatly from the game theoretic predictions but they could not see much difference between one another. However, small but quite interesting distinctions could be found. They concluded from the results that participants in Israel offered somewhat lower percentages (mode was 40%) than subjects in Pittsburgh (mode 50%). Also It could be noted that, on average, Israeli people were willing to accept lower offers than in other countries. Offers were observed to be highest,

on average in the United States and Yugoslavia. Roth et. al. explained these small deviations by the differences in cultures of what is perceived to be fair and what is expected during bargaining situations. (Roth et. al.1991)

Now that we have analyzed a few former experiments we move on to the ultimatum game we have conducted.

OWN EXPERIMENT

I found ultimatum games results a perfect example of the failure of game theoretic predictions. I thought about why people reject positive offers and considered punishing the unfair proposer a powerful factor. We have seen that if responders have no opportunity to punish allocators for their unfairness then results are completely different (Bolton et. al.1995). We can say about people who reject positive offers in ultimatum games that even though they do not know anything about the person who treated them unfairly, they care more about punishing that unknown individual than getting the money. What if, we thought, recipients had no reason to punish the allocators and how could it be arranged? Responders want to punish allocators because of the conscious choice they made to be unfair, but what if allocators are replaced with an entity who is not capable of making its own choices. To go even further, we place something into the position of the allocator that does not even know the concept of being fair or unfair. The entity that has these properties is a computer.

We designed our experiments as follows. All of the subjects were assigned to the role of responder. The allocator were told them to be either a computer program who generated an offer or a person who decided to offer an amount previously. In previous studies it has been demonstrated that the terminology used to describe the computers, is an important factor. We used the word "generate" because we wanted to make sure that in the eyes of the subject the computer is a non-intelligent entity thus allowing us to make the comparison between people and computers. Our hypothesis was that offers generated by computers are less frequently rejected than offers by human subjects.

We conducted our experiments in two locations: Budapest Business School and the University of Corvinus. We were helped by Dr. Kovács Tamás in BBS and Neszveda Gábor in Corvinus. We collected data from 163 people at BBS and 62 people at Corvinus (altogether 225). All participants from BBS were sophomores who study business and subjects from Corvinus were all undergraduate business students. The experiments were conducted in the end of the classes of our teachers which means that the games were

played in 7 sessions. Subjects were given written instructions but Dr. Kovács Tamás and Neszveda Gábor answered questions if it was necessary.

We used hypothetical stakes in the ultimatum games as we did not have the funding to use real stakes. There are few researches on the area of real vs. hypothetical stakes so it is quite a controversial topic. Although Cameron concluded in 1999 that hypothetical offers were not statistically different from offers in both low and high real stakes games (Cameron, 1999), there were researchers who found inconclusive results in this area (Forsythe et. al,1994). We should note that psychologists use hypothetical stakes in their experiments all the time and they argue that experiments yield the same results. We are not saying that hypothetical stakes did not influence the games, but we are arguing that similar results were achieved.

Every subject played an ultimatum game as a responder, with either a computer or a person as the allocator. The hypothetical stakes were 10,000 HUF and subjects were given offers of 1%, 5% ,10% , 20%, 30% respectively. So 10 subgroups were made as percentages were offered by computers and people. We managed to collect large samples from the 5% and 30% groups but our other groups also contain at least 15 participants. Every participant was given a sheet of paper containing an ultimatum game and a demographic questionnaire. Two of the forms which was handed out and another which was given in the experiment of Lisa Cameron in 1995 in Indonesia can be found in the Appendix for comparison. So first, subjects decided whether to accept or reject the offer and then they filled in the demographic questionnaire. We asked for pieces of information like gender, monthly expenditure, the frequency of them going out, their residency, age, microeconomics mark and attitude towards people.

The acceptance rates of the offers

Table

		1%	5%	10%	20%	30%
computer	accept	53%	67%	75%	80%	83%
	reject	47%	33%	25%	20%	17%
person	accept	24%	52%	72%	78%	76%
	reject	76%	48%	28%	22%	24%

Source: Own table

Our hypothesis was that people would be willing to accept lower offers (or more lower offers) from computers than from people. In the table we can see the acceptance rates of the offers. The acceptance rate is the percentage of the offers that were accepted. It is a measure of the efficiency of the outcomes, as every rejection can be understood as an inefficiency because neither the allocator nor the responder got any money. We can clearly see that the acceptance rate is higher at every offered percentage when computers were the allocators. Of course, we can also observe that as the amount of the offers gets closer to complete fairness the acceptance rate also rises.

Average money foregone per responder

Table 3

	1%	5%	10%	20%	30%	Total
computers	46,6	166,66	250	400	500	289,622
people	76,47	242,42	277,78	444,44	727,27	389,075
Total	62,5	206,4	264,7	424,21	619,04	342,222

Source: Own table

We measure, from another point of view, the difference between computers and people with the index of average money forgone per subjects. It shows the average amount of money that was lost by responders because of offer rejections. With these indices, we can illustrate the differences between computer and human allocators. The biggest differentiation we observed, was at 30%-70% splits as subjects lost one and a half times more money on average to people than to computers.

Number of participants/percentage offered

Table 4

		1%	5%	10%	20%	30%	total
computer	accept	8	20	12	12	25	77
	reject	7	10	4	3	5	29
	total	15	30	16	15	30	106
person	accept	4	17	13	14	25	73
	reject	13	16	5	4	8	46
	total	17	33	18	18	33	119

Source: Own table

We also conducted a two-sample z-test in order to know whether there is a significant difference between the acceptance rates offered by computers and people. As our z-test came out to equal 1.817, it does not fall into the rejection region at 5% significance therefore we can conclude that we can differentiate between subjects playing the ultimatum game with computers and people. The reason we think participants behaved

differently with computers than people is that subjects understood that it is no one's fault that they got an unfair offer (since computer programmes generated the offer randomly). When subjects played with people in the role of allocators they more often felt the need to punish those proposers who behaved unfairly with them because participants know that they could have just as easily chosen to be fair.

We composed a demographic questionnaire in order to test other hypotheses as well. We asked for the gender of the participants to see whether gender and the inclination to reject or accept an unfair offer are significantly related variables. Previous researches indicated that the relation between gender and offer acceptance can only be seen if the participant knows from who he/she gets the offer (Solnick, 2001). So we used contingency analysis to observe whether there is a relationship between these two variables. We analyzed the differences between the response to offers from computers and persons both separately and together but we did not find any significant relationship between them. The χ^2 -values were 0.4408, 0.0657 and 0.0367 respectively, none of them is significant at the 5% level. Therefore we conclude that a participant's gender is independent from making decisions in the ultimatum game.

Observed and expected frequencies for participants' reaction
and gender

Table 5

Observed frequency

Allocators: Combined

	female	male	Total
accept	88	62	150
reject	45	30	75
Total	133	92	225

Expected frequency

	female	male	Total
accept	88,6667	61,3333	150
reject	44,3333	30,6667	75
Total	133	92	225

Allocators: Person

	female	male	Total
accept	43	30	73
reject	26	20	46
Total	69	50	119

	female	male	Total
accept	42,3277	30,6723	73
reject	26,6723	19,3277	46
Total	69	50	119

Allocators: Computer

	female	male	Total
accept	45	32	77
reject	19	10	29
Total	64	42	106

	female	male	Total
accept	46,4906	30,5094	77
reject	17,5094	11,4906	29
Total	64	42	106

Source: Own table

We also asked the subjects of our experiment about their monthly expenditure. To be specific we asked them how much they usually spend in a month excluding rent and overhead expenses. We wanted to infer from the subjects' answers to their monthly income. This type of data helped us to test another hypothesis. We examined whether there is a significant relationship between the participants' reaction to offers and their monthly expenditure. From previous experimental results we hypothesized that there should not be any relationship between these two variables. As we could see there is evidence to the theory that stake size does not affect the behaviour of people in the ultimatum game. We have seen in Cameron's experiment people rejecting offers which were two or even three times their monthly income (Cameron, 1995). We also have data of subjects leaving money out of consideration when it comes to making decisions in the ultimatum game. There were subjects in our experiment who both rejected the offer of 3,000 HUF and identified themselves as being in the second lowest category (between 10,000 HUF and 20,000 HUF per month). We reason that if people are willing to give up huge amounts of money (relative to their own expenditure) their decisions in the ultimatum game are not influenced by money. We made three groups: people with expenditures under 20,000 HUF, between 20,000 HUF and 40,000 HUF and above 40,000 HUF. We used contingency analysis to test our hypothesis. The χ^2 -values were 1.665, 3.857 and 0.171 respectively. None of these values are significant at the 5% level. Therefore we can conclude that there is no relationship between subjects' reaction to offers and monthly expenditure.

Observed and expected frequencies for participants' reaction
and monthly expenditure

Table 6

Observed frequency

Allocators: Combined

	0-20000 HUF	20000- 40000 HUF	40000- HUF	Total
accept	40	65	44	149
reject	23	26	26	75
Total	63	91	70	224

Expected frequency

	0-20000 HUF	20000- 40000 HUF	40000- HUF	Total
accept	41,906	60,531	46,563	149
reject	21,094	30,469	23,438	75
Total	63	91	70	224

Allocators: Person

	0-20000 HUF	20000- 40000 HUF	40000- HUF	Total
accept	16	37	20	73
reject	15	15	16	46
Total	31	52	36	119

	0-20000 HUF	20000- 40000 HUF	40000- HUF	Total
accept	19,017	31,899	22,084	73
reject	11,983	20,101	13,916	46
Total	31	52	36	119

Allocators: Computer

	0-20000 HUF	20000- 40000 HUF	40000- HUF	Total
accept	24	28	24	76
reject	8	11	10	29
Total	32	39	34	105

	0-20000 HUF	20000- 40000 HUF	40000- HUF	Total
accept	23,162	28,229	24,61	76
reject	8,8381	10,771	9,3905	29
Total	32	39	34	105

Source: Own table

Since all of our subjects were students who learn business or economics we enquired about the grade they got from microeconomics. As microeconomics is a compulsory course in the first semester where game theory is taught, we were curious to check whether the behaviour of people who are familiar with this theory would lean towards its predictions. We had the analogy that students who finished the course with better grades (4 or 5) could use the knowledge they had about game theory better in a real life experiment (for example an ultimatum game), than those who got 2s and 3s. So we wanted to see whether the grades of microeconomics of the participants and their willingness to accept or reject an offer is significantly related. Both being qualitative variables we used contingency analyses to come to a conclusion. Our analyses yielded χ^2 -values which were 2.507, 1.072 and 0.963 respectively therefore not significant at the 5% level. We conclude that there is no relationship between the microeconomics grades of participants and their response to offers.

Observed and expected frequencies for participants' reaction
and microeconomics grade

Table 7

Observed frequency

Allocators: Combined

	2 and 3	4 and 5	Total
accept	93	52	145
reject	56	19	75
Total	149	71	220

Expected frequency

	2 and 3	4 and 5	Total
accept	98,205	46,795	145
reject	50,795	24,205	75
Total	149	71	220

Allocators: Person

	2 and 3	4 and 5	Total
accept	47	23	70
reject	35	11	46
Total	82	34	116

Allocators: Computer

	2 and 3	4 and 5	Total
accept	46	28	74
reject	21	8	29
Total	67	36	103

Source: Own table

We think that the failure of our analogy is caused by the education of microeconomics and the requisites of achieving high score on the exam. Grades are not representative of understanding the basic concepts of game theory. Students only learn to solve the given exercises necessary to pass step-by-step without ever grasping the implications of the theory. We believe that there would be a close correlation between good marks and rational behaviour if grades were representative of real usable knowledge.

Lastly, we enquired about the participants' attitude towards people. We asked subjects what they think most people's intentions are towards them. Subjects had to decide on a scale of 0 to 10 where 0 is „most people try to rip me off“ and 10 is „most people are decent and honest with me“. We wanted to see if the subjects' perception of people related significantly to the response they had to offers. We grouped the eleven choices into 3 groups representing the two ends and the middle part of the spectrum. We failed to observe any relationship between the variables through contingency analyses.

Table 8

The χ^2 -values were 4.625, 5.082 and 0.977 respectively which are not significant at the 5% level.

Observed and expected frequencies for participants' reaction
and attitude towards people

Observed frequency

Expected frequency

Allocators: Combined

	0,1,2,3	4,5,6	7,8,9,10	Total
accept	49	31	70	150
reject	19	25	30	74
Total	68	56	100	224

	0,1,2,3	4,5,6	7,8,9,10	Total
accept	45,5357	37,5	66,9643	150
reject	22,4643	18,5	33,0357	74
Total	68	56	100	224

Allocators: Person

	0,1,2,3	4,5,6	7,8,9,10	Total
accept	23	14	36	73
reject	12	17	16	45
Total	35	31	52	118

	0,1,2,3	4,5,6	7,8,9,10	Total
accept	21,6525	19,178	32,1695	73
reject	13,3475	11,822	19,8305	45
Total	35	31	52	118

Allocators: Computer

	0,1,2,3	4,5,6	7,8,9,10	Total
accept	26	17	34	77
reject	7	8	14	29
Total	33	25	48	106

	0,1,2,3	4,5,6	7,8,9,10	Total
accept	23,9717	18,1604	34,8679	77
reject	9,0283	6,83962	13,1321	29
Total	33	25	48	106

Source: Own table

CONCLUSION

In our essay we tried to find out the reason behind the neoclassically inexplicable behaviour of people playing the ultimatum game. We thought that the main factor for the observed irrational behaviour was due to emotions caused by the unfairness of our fellow humans, so we eliminated this agent. Our results indicate that when people know that the money is not given to them by a conscious being, they tend to behave rationally and accept it, regardless of the amount. We conclude that this stems from the fact that we are moral creatures: our minds are shaped by a culture that teaches us to punish those who are unjust and do not cooperate. Immoral behaviour is unacceptable by most of us to such an extreme extent, that there is a significant amount of people who are willing to give up two times their salary just so they can penalize it (Cameron, 1995).

We have seen how the ultimatum game has already shaped economics but we believe it is just the beginning. We think that comparing interactions with non-intelligent entities, such as computers, with intelligent ones in the ultimatum game is crucial to understand the motives and reasons of human behaviour. Behavioural economics is the new field of economics but already we can see another field evolving out of it, which we believe will describe human behaviour more accurately than ever. This fledgeling is neuroeconomics. This interdisciplinary field uses methods of neuroscience, experimental and behavioural economics and psychology to explain human decision making. and Researchers are already conducting ultimatum games inside fMRIs to see the brain activity of subjects playing. With these methods economics will come to a stage where it can help other fields of sciences refine or even form theories.

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Ön és egy kód alapján véletlenszerűen Önhöz rendelt személy egy olyan játékot fognak játszani, melyben a játékosoknak egy bizonyos összeget kell felosztaniuk egymás között a következő szabályok szerint. Az első játékos az *elosztó*, a második játékos a *válaszadó*. Az első játékos az összeg egy bizonyos felosztását javasolja, a második játékos ezt elfogadhatja vagy elutasíthatja. Ha a válaszadó elfogadja, akkor életbe lép az a felosztás, amit az elosztó javasolt, ha pedig elutasítja, akkor mindkét játékos 0 Ft-tal távozik.

Ön a *válaszadó* szerepét fogja betölteni. A pénz, amin osztozniuk kell 10.000 forint.

Az elosztó szerepét egy már korábban megkérdezett és a fenti kód alapján véletlenszerűen Önnel párba sorolt ember tölti be, aki a 10.000 forintot a következő arányban osztotta fel:

Magának megtartott: 95 % (9.500 forint)

Önnel felajánlott: 5 % (500 forint)

Kérem húzza alá a választ! Az elosztó játékos ajánlatát

elfogadom

elutasítom

KÉRDÉSEK:

1.Melyik nemhez tartozik? Férfi Nő

2.Mennyi pénzből gazdálkodik havonta? (albérleti díját és rezsit nem számítva)

10.000 forint alatt 10.000 – 20.000 forint között 20.000 – 30.000 forint között

30.000 – 40.000 forint között 40.000 – 50.000 forint között 50.000 forint felett

3.Milyen gyakran jár szórakozni barátaival/ismerőseivel?

Havonta Kéthetente Hetente Hetente kétszer Hetente többször

4.Milyen településen lakott élete nagy részében?

Főváros Város Falu Község Tanya

5.Hány éves?

6.Milyen jegyet szerzett Mikroökonómiából?

7. Mit gondol (0 és 10 között pontozva), a legtöbb ember megpróbálja Önt kihasználni ha lehetősége van rá, vagy a legtöbben inkább tisztességesen járnak el Önnel szemben?

<i>megpróbálnak kihasználni</i>							<i>legtöbb ember tisztességes</i>			
00	01	02	03	04	05	06	07	08	09	10

Ön egy olyan játékot fog játszani, melyben a játékosoknak egy bizonyos összeget kell felosztaniuk egymás között a következő szabályok szerint. Az első játékos az *elosztó*, a második játékos a *válaszadó*. Az első játékos az összeg egy bizonyos felosztását javasolja, a második játékos ezt elfogadhatja vagy elutasíthatja. Ha a válaszadó elfogadja, akkor életbe lép az a felosztás, amit az elosztó javasolt, ha pedig elutasítja, akkor mindkét játékos 0 Ft-tal távozik.

Ön a *válaszadó* szerepét fogja betölteni. A pénz, amin osztozniuk kell 10.000 forint.

Az elosztó szerepét jelen esetben egy számítógépes program tölti be, ami korábban generálta Önnek a 10000 forint felosztásának arányát:

Magának megtartott: 95 % (9.500 forint)

Önnek felajánlott: 5 % (500 forint)

Kérem húzza alá a választ! Az elosztó játékos ajánlatát

elfogadom

elutasítom

KÉRDÉSEK:

1.Melyik nemhez tartozik? Férfi Nő

2.Mennyi pénzből gazdálkodik havonta? (albérleti díját és rezsit nem számítva)

10.000 forint alatt 10.000 – 20.000 forint között 20.000 – 30.000 forint között

30.000 – 40.000 forint között 40.000 – 50.000 forint között 50.000 forint felett

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<i>megpróbálnak kihasználni</i>							<i>legtöbb ember tisztességes</i>			
00	01	02	03	04	05	06	07	08	09	10

