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„Choice Shift in Groups: An experimental Comparison between Social Comparison Theory and Persuasive Arguments Theory“

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Erklärung

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Abstract

The thesis at hand addresses the question, how and why the attitude of a person towards risk changes, whenever it comes to an exchange of views in a group – the so-called choice shift. To answer this question with an experiment, it has to be clarified, what can be understood under utility and how situations with an uncertain outcome can be depicted. The Utility Theory of v. Neumann and Morgenstern plays an important role here. With their findings it is possible to assign each outcome of a lottery (decision under risk) to a value, which is then combined to describe a person's overall attitude towards risk. Prospect Theory extends this process further, by also considering other influences, like the probability of the occurrence of an event. Based on the findings in the area of utility theory, the sociological influences of groups can be described. The most influential ones are the so-called social comparison theory (SCT) and the persuasive arguments theory (PAT). The first is based on the assumption, that certain characteristics are evaluated higher than others. This leads to a change in persons' behaviour towards those preferred values. The SCT sets up a high contrast towards PAT. Here it is assumed, that there are certain arguments supporting or weakening a position, opinion or behaviour appearing in a group discussion. This leads to Choice shift, but in comparison to SCT, here the opinion actually changes. Until today it was only possible to compare both influences on a meta-analytical level. To close this gap, an experiment was conducted with 78 students at the University of Vienna. Based on a study of Shupp and Williams, their maximum willingness to pay was measured over lotteries from 10%, 20% until 90%. Afterwards, the procedure was repeated, only this time within a group of three. Up until this point the participants did not know about this phase. In the end of the experiment, they had to choose between the answers, they gave in a group and the ones of the single round. In case the behaviour towards risk really did change, he/she would prefer the group questionnaire. When the behaviour only changed because of SCT, he/she would choose the single sheet.

The analysis of the data comes to the conclusion, that there is a tendency of groups to being more risk-averse than individuals in the low percentage areas of the lotteries, but that the opposite is true for the high percentage lotteries. This however

can only be proven on a significant level for some of the lotteries. Comparing the overall risk disposition, groups are significantly more risk-averse than individuals.
The analysis of the main hypothesis proves that most participants are influenced by PAT more, than by SCT. The results were highly significant. These results are independent of the gender and do not lead to polarization. In adition to that, the kind of choice shift has ho influence on the kind of influence (PAT or SCT).

Keywords: choice shift, social comparison theory, persuasive arguments theory, Experiment, Willingness to Pay, Utility theory, Prospect Theory

Zusammenfassung

Die vorliegende Arbeit beschäftigt sich mit der Frage, inwiefern und warum sich die Risikobereitschaft einer Einzelperson ändert, sobald diese einem Meinungsaustausch in einer Gruppe ausgesetzt ist – der so genannten Choice Shift. Um diese Fragen mit Hilfe eines Experiments zu beantworten wird zuerst geklärt, was Nutzen ist und wie dieser in Situationen mit unsicherem Ausgang abgebildet werden kann. Die Nutzentheorie von v. Neumann und Morgenstern spielt hier eine wichtige Rolle. Hierbei wird jedem möglichen Ausgang einer Lotterie (Entscheidung unter Risiko) ein Wert für das jeweilige Ereignis zugeteilt, welcher seine individuellen Präferenzen wiederspiegelt. Die Prospect Theory bildet hierfür eine wertvolle Erweiterung, da sie zusätzliche Einflüsse wie zum Beispiel die Eintrittswahrscheinlichkeit eines Ereignisses mit einbezieht. Basierend auf diesen Erkenntnissen im Bereich der Nutzentheorie werden soziologische Theorien für Choice Shift erklärt. Die Einflussreichsten sind hier die so genannte Social Comparison Theory (SCT) und die Persuasive Arguments Theory (PAT). Erstere basiert auf der Annahme, dass gewisse Eigenschaften, in Gruppen höher angesehen werden als andere. Das führt zu einer Veränderung im Verhalten der Person hin zu diesen von der Gruppe stärker akzeptierten Werten. Die SCT steht hier im Gegensatz zur PAT. Bei dieser wird davon ausgegangen, dass es gewisse Argumente für oder gegen ein Verhalten, eine Position oder Meinung gibt, welche bei einer Gruppendiskussion anfallen. So können Argumente einer Person die Meinung einer anderen verstärken aber auch abschwächen. Dies führt auch zu Choice Shift, im Vergleich zu SCT ändert sich hier jedoch die Meinung des Probanden tatsächlich.

Es ist bis heute nur durch Meta-Analysen möglich gewesen die beiden Einflüsse miteinander zu vergleichen. Um diese Lücke zu schließen wurde ein Experiment an 78 Studenten der Universität Wien durchgeführt. Basierend auf einer Studie von Shupp und Williams wird die maximale Zahlungsbereitschaft der Probanden über Lotterien von 10%, 20% bis zu 90% gemessen. Anschließend wird eine den Studenten bis zu diesem Zeitpunkt nicht bekannte, Gruppenphase durchgeführt. Hier werden die Teilnehmer in Gruppen à drei Personen eingeteilt, um bei einer Diskussion einen ähnlichen Fragebogen noch einmal auszufüllen. In einer dritten

Phase haben sie die Möglichkeit sich für einen der beiden zu entscheiden. Sollte sich die Risikobereitschaft der Teilnehmer aufgrund der Argumente tatsächlich geändert haben, werden sie sich für den Gruppenfragebogen entscheiden. Wenn sie ihr Verhalten nur aufgrund der sozialen Erwünschtheit geändert haben, werden sie den Einzelfragebogen bevorzugen.
Die Analyse der Daten kommt zu dem Ergebnis, dass es zwar eine Tendenz gibt, dass Gruppen in den Lotterien mit niedrigerer Gewinnwahrscheinlichkeit risikoaverser sind, bei hoher Gewinnwahrscheinlichkeit jedoch das Gegenteil der Fall ist. Auch wenn es eine klare Tendenz gibt, sind die Unterschiede in den meisten Fällen jedoch nicht signifikant. Vergleicht man jedoch die allgemeine Risikobereitschaft einer Person mit der einer Gruppe ist die erstere signifikant weniger risikoavers.
Bei der Untersuchung der Haupthypothese kann auf einem höchst signifikanten Niveau nachgewiesen werden, dass die meisten Teilnehmer stärker durch PAT beeinflusst werden, als durch SCT. Diese Tendenz ist geschlechtsunabhängig. Zusätzliche Tests weisen darauf hin, dass bei dieser Art von Experiment keine signifikante Verstärkung der eigenen Meinung (Polarisierung) stattfindet und dass die Art der Choice Shift keinen Einfluss auf die Art der Beeinflussung (PAT oder SCT) hat.

Schlagwörter: Choice Shift, Theorie des sozialen Vergleichs, Persuasive Argumentationstheorie, Experiment, Zahlungsbereitschaft, Nutzentheorie, Prospect Theory

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List of Abbreviation

CDQ:	Choice-Dilemma-Questionnaire
EUT:	Expected Utility Theory
MCR:	Meta Contrast Ratio
PA:	Persuasive Argumentation
PAT:	Persuasive arguments theory
PT:	Prospect Theory
SeCaT:	Self Categorisation Theory
SC:	Social Comparison
SCT:	Social comparison theory

Symbol Directory

$E[U\ (L)]$	The expected value of a Lottery i
L_i	Lottery i
$L_i(p, x_1, x_2)$	A lottery i with the chance p of winning x_1 and $1-p$ of winning x_2
p_{im}	The probability of outcome number m of lottery i with $\sum p$=1
$U[E(L_i)]$	Utility of the expected value of a Lottery i
$U(L_i)$	The expected utility of Lottery i
x_{im}	A certain outcome m of lottery i
X (x, y ∈ X)	A finite set X including the elements x and y
xRy	x stands in a certain relationship R to y
XxX	A subset of X
$\prec$	Something is less preferred than.
$\preccurlyeq$	Something not preferred more than.
~	Absence of strict preference

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1 Introduction

"Hey, do you want a cigarette?" Almost everybody has heard this sentence once in his/her life. The first time is usually during puberty, when we want to be as cool as possible. Many people start smoking in this period of their life. But why do we begin? It's not something, our body likes from the start as it usually makes you cough during the first one. With costs between €5 and €6, it isn't cheap either. In addition to that it lowers overall health and fitness. So why should anybody start smoking in the first place?

When people are asked, how it all began, one of the most frequent given answers is that they started smoking in a group. Somebody would come up with a pack that he/she might have stolen from the parents or gotten elsewhere. Everybody would be given a cigarette and dared to smoke it. One after another takes a hit and coughs. Teenagers in the U.S.A usually try their first cigarette between the ages of 11 to 13 to look cool in front of their friends (Johnston et. al., 2012, p. 40.).

It's only later, when we are already used to it, that we start to enjoy the positive aspects of smoking, like relaxing after a long exhausting day. But nobody would come up with the idea of buying a pack of cigarettes and just start. After years of doing it, many people try to quit, but it's harder for them, as they are addicted by now. To stop the habit, they see special group sessions of people who do the same.

The example above shows, that a group is more than the sum of its people - in negative as in positive. Social groups are a main part of being human. They exist when we are born into a family, when we go to school, find a job and later enjoy playing bingo with friends at the retirement home. Groups influence our whole life and even if somebody says he makes his own decisions, this might rarely be the case. It only makes sense to ask, how groups influence our opinions and procedures.

This is of high interest, especially in the area of decision making in an economical context. Panels and teams decide over million dollar projects, jobs and the growth of an economy. It is not only important to know what the ideal decision looks like, but also how decisions are actually made in real life. This is why the field of behavioural economics has grown so fast over the last years. People only act rationally up to a certain point, because when it comes to the question of realizing a project or not, it's not always only the facts that play a role. Especially somebody's attitude towards taking risks has a high influence here and might not always lead to the best decision, from an objective point of view. This changes even more when somebody enters a group. In fact, the average opinion of the individuals usually does not coincide with the final opinion of the group.

This phenomenon came to be known as "choice shift" and is defined as the difference between the arithmetic mean of the individual's first preferences before discussion (pre-discussion preferences) and the group decision (after-discussion preference).

Over time, lots of possible theories for this observation have been discussed. Some of them have been revoked and some are still relevant today.

However, when those theories were examined, they were always focused on one theory at a time, and when a comparison was conducted, this was only done in form of a meta-analysis.

This thesis will try to close this gap, by conducting an experiment that can directly compare two of the most discussed theories of choice shift: Social comparison theory (SCT) and persuasive arguments theory (PAT).

To do so an overall insight has to be granted first. In the beginning, a framework is set up to make preferences of individuals tangible with a mathematical system. After this it is possible to form a theory about the utility we gain from a decision, especially when the outcome is uncertain. It is shown how people should make their decisions in these scenarios and how they actually do. This part will be completed with the introduction to prospect theory (PT). Even though, research has not stopped since its development in the 1970s, it is considered to be the last major breakthrough in this area.

After the discussion of the mathematical perspective of the individual decision-maker, the second part of this thesis will focus on the sociological point of view, that explains, why the attitude towards risk as well as the behaviour of a person in general, changes, when he/she is put in a group. Four of the most important theories will be explained here. After the second part, the reader has the understanding of how decisions are made alone and why they can change in a group. This is the springboard for the empirical part of the thesis at hand. By reviewing the most recent developments in the area of choice shift a hypothesis can be stated. The experiment itself was inspired by a setup conducted by Shupp and Williams (2008) in 2005. It focuses exclusively on the choice shift based on a person's attitude towards risk. With the addition of a further step, new insights can be won without endangering the comparability. This is why the description of the experiment is set up in a different way than one might expect. First, core processes that both approaches have alike are listed. Afterwards the specifications of the experiment will be shown, before the actual procedure is explained. After the practical implementation, the results are evaluated. The final conclusion will have two parts. First, along with other observations, the main hypothesis will be tested. After this is done there will be a comparison to the study of Shupp and Williams (2008). Everything will be then summarized and additional food for thought will be given to prompt future research.

2 Decision making

Decisions, easy and hard ones, are a part of our daily life. So the main question the first part will focus on is: Why do we act like we do and what influences us here? In general it can be said that we evaluate each alternative of a decision by the utility it generates for us. Even if somebody spends money on welfare the person gains utility out of the thought of doing something good. So if someone wants to find out more about the complex topic of decision making it makes sense to answer the question first: What is utility and how can it be described in a mathematical way?

2.1 What is utility?

The philosopher and founding father of the classical Utilitarianism, Jeremy Bentham, brought up the discussion about this question in the early 19th century. What is utility and how can it be measured? With the “Introduction to the Principles of Morals and Legislations” he suggested the measurement of quantities of pleasure and pain (Stigler, 1950, p. 308f.). During the Victorian Age this concept was developed further by John Stuart Mill, the son of Bentham’s pupil James Mill. In his book “Utilitarianism”, he describes this idea under the main topic of ethnics. In summary, the theory describes utility as a synonym, not for pleasure and pain, but happiness, which ought to be maximized. He defined happiness to be both, intellectual and sensual pleasure, with the first one being preferred by the human dignity. Happiness and by this also utility should be the final aim of human action (Mill, 2001). This terminology however, was a much more general concept of happiness and may not suffice to explain modern economic claims. The problem was, that it is not possible to measure, or quantify the amount of utility. One cannot measure utility in a traditional way with a scale. This is why economists today define utility by the preferences of the consumer. It is possible to compare a good or a bundle of goods with another good, respectively bundle. The only important thing is, if one bundle is preferred over another one and not by what amount.

It is however possible to assign a number to it and by this to rank it. But the only

information gained form this is that a certain bundle is preferred over another one. A number twice as high doesn't mean a twice as high utility. This means, that the scale of measurement is ordinal (Varian, 2011, p. 57f.).
As we know now, utility always depends on preferences of bundles. This means, that there is a need to briefly talk about the person having those preferences and his/her decisions. Utility theory is highly idealized and concerned with the behaviour of a "rational" person with respect to his/her decisions. Savage describes the rational decision-maker as someone following his/her logic, reasoning with his/her own mind. In economic theory, organizations can sometimes behave like individual people, which suggests that utility theory can be applied to units such as families, corporations and groups, like the ones discussed in this thesis (Savage, 1972, p. 7f.).

2.2 Binary relations in the Utility Theory

The prior chapter has shown that the measurement of utility is a comparison between goods. Binary relations are the mathematical foundation, when it comes to comparing two or more objects with each other. This is why in the following part this topic is analysed.
In the following, I will heavily rely on Fishburn's interpretation of binary relations. Even though, a broad variety of literature addresses this , his approach seems to be to most fitting, as his research focus lies on decision making.
As every action or good gives the person a certain utility, they, if compared, stand in a certain relation to each other. As mentioned before the system is based on binary relations. x and y are elements in X (x,y ∈ X). The sets used in this writing are primarily countable, which means that X is finite or denumerable. The elements x and y stand in a certain relation R to each other. This can be expressed via the term xRy or yRx. The terminology not xRy (¬ xRy is also common (Wagener, 1983, p. 2)) implies that it is false that x stands in the relation R to y. Specifically, a binary relation R on X is a subset of XxX.
A fitting example would be X being the set of all cars. Here, R_1 can mean, „is heavier than", so that xR_1y represents the statement car x is heavier than car y. There are

certain relation properties possible. In the following, the author lists the ones important for utility theory. These are the ones necessary to describe the possible binary relation R on a set X. Here R is

1. Reflexive
   if xRx for every x ∈ X
2. Symmetric
   if xRy → yRx, for every x,y ∈ X
3. Transitive
   if (xRy, yRz) → xRz, for every x,y,z ∈ X,
4. Asymmetric if xRy → not yRx, for every x,y ∈ X
   if xRy → not yRx, for every x,y ∈ X
5. Weakly connected
   if x ≠ y → (xRy or yRx) throughout X
6. Negatively transitive
   if (not xRy, not yRz) → not xRz, for every x,y,z ∈ X

There are more possible relations than only these six, but they are the ones necessary to form binary relations with the proprieties needed for the utility theory. These specific relations are called weak order, strict order and equivalence.

- A *weak order* ⇔ R on X is asymmetric and negatively transitive
- A *strict order* ⇔ R on X is a weakly connected weak order
- An *equivalence* ⇔ R on X is reflexive, symmetric, and transitive (Fishburn, 1970, p. 10f.)

2.3 Preference

With these relations, it is now possible to define preference as a weak order. If we, for example, take the relation < and use it with real numbers it is a weak and also a strict order. On the other side, = represents an equivalence on the real numbers. When it comes to preferences in general (e.g. if you prefer an orange over an apple), it is easier to describe it without the usage of numbers. The terminology is shown below. Here, the necessity of chapter 1.2 becomes clear.

1. $\prec$ is read as that something is less preferred than.
2. $\preccurlyeq$ is read as that something not preferred more than.
3. ~ represents the absence of strict preference and is read as indifferent

In mathematical terms speaking $x \prec y$ is also defined as a weak and a strong order, $\preccurlyeq$ as a weak order and ~ as an equivalence (Fishburn, 1970, p.12f.). As already mentioned this thesis focuses on the decisions, humans make in uncertain situations. This being said, decision-making cannot only focus on the mathematical theory but also has to keep the sociological and psychological part in mind. Still, the most important parts of decision-making were published by mathematicians and economists. The psychological part usually was used to underpin the findings in decision theory (Luce, 1965, p. 252f.). This chapter is the foundation of decision-making in general.

2.4 Decision-making

Now, that it is clear, how bundles can be ranked, this part shows how they influence our decisions, because all of them are based on the direct or indirect utility we generate from them. A decision is a choice between at least two alternatives.
However, the variables that influence the decision process can be separated into three parts. First is the person making it. The preferences decide over the choice that has to be made. Second are the attributes of the decision itself and the third is the decisions or responses of other people that has to be taken into account. The latter is the main topic of game theory. This work however will reduce its research on the first two parts, as the focus of this thesis lies on decisions that are independent from other people's strategies.

2.4.1 Certain and uncertain decisions

One criterion of a choice is, if it is made under certainty or uncertainty. In the first case, the person knows the outcome. The pervious car example form chapter 2.2 is based on a decision under certainty. If I have to choose between two cars and I prefer a bigger to a small one, the choice is clear and I simply go and buy the bigger one[1]. Here, the person making the decision knows the outcome of each choice. These kinds of choices are mostly discussed under multi attribute utility theory (Dyer, 2005.). Decisions under uncertainty depict the hypernym for, as the name suggests, choices where the outcome of the choice is not clear. This can be divided into two sub forms. Either the probabilities of the different states are known or not. In the first case is called decision under risk, the second one decision under ambiguity. In the beginning, introduced by Knight (1921), there was only the distinction between certainty and risk. Risk meant, that the deciding person knows the likelihood of an event. Later this concept was extended by Ellsberg (1961), who introduced the term ambiguity to describe a choice, where this is not the case.

A fitting example for risk is described by two lotteries, one involving a coin and one a dice. Each of the objects depicts a lottery L_1 and L_2, somebody has to choose between. In case that the person goes with the coin toss, he/she has a 50% chance of winning €10 and a 50% chance of going home with €0. On the other side, the person can also throw a dice. Here the chances of winning are lower. Only in case of throwing a 6, the person gets paid. However, instead of €10, the pay-out is €100. The choices between L_1 and L_2 are called decision under risk. Those lotteries where there are only two different outcomes are the standard versions, when it comes to experiments for decisions under risk. This is written in the following way $L_i(p, x_1, x_2)$, where p represents the chances of winning the outcome x_1 and where x_2 represents the second possible outcome for which the chances are (1-p). In case of the dice lottery, this can be written as L_2(1/6, €10, €0).

Ambiguity however defines a situation with a lack of information. It doesn't always need to be a scenario with no information at all but one with not enough to form a unique subjective belief distribution. In the extreme case is not possible to define a probability distribution at all (Ellsberg, 1961).

[1] In this scenario it is assumed that money has no influence on the decision.

The example of he coin and dice toss can be changed from risk into ambiguity very easily. At the moment where the amount of dice sides is unknown, risk turns into ambiguity. Someone might think, that nobody would dare to play a gamble, where the probabilities of winning are unknown. Still, many of humanity's most important discoveries were in fact decisions under ambiguity. The first heart transplantation or the discoveries of new continents are good examples, as nobody knew the chances of being successful. This is why one should not underestimate the importance of decisions under ambiguity.

Still, decision-makers prefer risk to ambiguity, even if they have no reason to. When a person has to decide between a situation, where the probabilities are known and one where they are not, subjects prefer to go with the first one. This was discovered by Ellsberg (1961) and is now referred to as the Ellsberg-Paradox. In the original experiment, test subjects first were given an urn. It was filled with 30 red balls and an unknown amount of black and yellow balls. The total count in the urn summed up to 90. The participants now had to choose between two gambles. The first would earn them $100 if they drew a red ball (gamble I), the second would grant them the same amount if they would draw a black one (gamble II). The second lottery had the same distribution of balls in the urn. However here the subjects had to decide between the two following gambles. $100 if they drew a red or black ball (gamble III) or $100 if they drew a yellow or black ball (gamble IV). Between gamble I and II respectively III and IV, the possible distributions were equally likely, which means there were no differences in probabilities. Still, participants preferred gambles I and IV, as the choice in this case was a risky one with the distribution known to the player. This leads to the conclusion that people in general prefer risk to ambiguity, even if the chances of winning or losing are actually the same in both scenarios (Ellsberg, 1961, p. 654).

The most discussed and also interesting topic seems to be decisions under risk. These are especially relevant in business decisions today, where probabilities different projects succeeding or failing have to be weighted against each other.

2.4.2 Utility of a decision under risk

The key part of decision-making however is the deciding person. No matter what the outcome, in business or not, the last word usually has a person. Coming back to the example of cars, it always depends on the person, what is preferred. It becomes more interesting when the decision is changed from certain to risk, because here the additional variable of an uncertain outcome plays a role. One might think, that the most rational way to make a decision under risk would be to maximize the expected value as this also maximizes the utility and that they are the same. This however is not the case.

A coin toss over €10, with a 50% chance of winning €10 or "winning" €0 has an expected value μ of €5. This is calculated by the formula $\sum_{i=1}^{n} p_i x_i$, with p_i being the probability of the outcome x_i. By this proposition, when deciding between gambles, a rational acting person should always try to maximize the expected value, as it would also maximize his/her expected utility, because more money is always better than less.

According to Pascal and Fermant, when we have to choose between different gambles, this is done by accepting the one that offers the highest expected return. In this case, the personal preferences should be ignored (Biswas, 1997, p. 3.). The maximum amount that should be paid to participate in such a gamble, in this scenario, would be €5. This argument is supported by the law of large numbers. In case, the coin toss is repeated for n times, then the average outcome of each lottery approaches μ and in the end differs from it only by ε, a number that converges to 0 as n approaches infinity. This is true for $\varepsilon > 0$ (Peterson, 2009, p. 71.).

The problem here is, that it's a quite theoretical approach. The decisions we make usually can't be repeated for an endless amount of times. Another weakness of making decisions only by the expected value and by this putting it on the same level as utility was illustrated by Bernoulli already in 1738. This is known today as the "St. Petersburg Paradox". Suppose, the coin from before will not be tossed one time, but repeatedly, as long as tails appears. The gambler earns 2^n Euro if head comes up in the nth toss. In case tail shows up already at the second time, the player would earn €4, when n =4 the gain would already be €16 and so on. In this case

$\mu = \sum_{t=1}^{n} 2^n \left(\frac{1}{2}\right)^n$ which can be reduced to $\mu = n$. As the game can theoretically go on to infinity the expected value is $\mu = n = \infty$. This means, everybody who takes part in the game, from an expected value perspective, should be willing to pay an "endless" amount of money for the chance of participating. This example shows, that for a human decision-maker, the expected value differs from the utility he gets out of a decision. The problem however was, how this could be achieved.

The first approach in this area can be traced back to Bernoulli (1954) as well, who attempted to explain why people in general were averse to risk. The major breakthrough however didn't happen until 1953, when Neumann and von Morgenstern came up with expected utility theory. Here, each possible outcome is allocated a separate utility, which then gets weighted. This made it possible to construct a cardinal utility function on the outcome space (Biwas, 1997, p. 4.). The most important thing for its construction were its axioms.

2.4.3 The axioms of Neumann and v. Morgenstern

In order to create the EUT certain axioms are needed, to generate the mentioned cardinal function. They are logically embedded into the mathematical system and intended to be not just postulates but assumptions, which no reasonable person could reject (Anand, 1992, p. 10). The rational decision-maker always acts according to those rules. There are two reasons for these axioms to be included into the thesis. First, it is inalienable for a basic understanding of utility theory. The second reason lies in the attached criticism of the axioms. With this, I want to rivet the reader's attention closer on the reason for this thesis: the problem of inconsistency of mathematical theory and reality. Literature gives a wide variety of different interpretations of these axioms. There are versions fitting for specific cases like catastrophic scenarios (Chichilnsky, 1996), or interpretations that focus on the mathematical part (Neumann, Morgenstern, 1944, p. 26ff.), respectively the interpretation (Anand, p. 12 ff.). Note, that these axioms have been presented in different ways by various authors. Of course, the following passage will be strongly oriented on the findings of von Neumann and Morgenstern, yet uses influences of other authors to give a better understanding of the topic and address the focus towards lotteries. This means, that all axioms are applied to the decision theory. For this we consider different lotteries L that have different outcomes x.

2.4.3.1 Axiom 1: Completeness

From a general point of view, the rational decision-maker is always sure which item he/she prefers. This also goes for different lotteries. The preference ordering holds between any two outcomes. This means, that for any L_i and L_j either $L_i \succcurlyeq L_j$ or $L_j \succcurlyeq L_i$ is true (Anand, 1992, p. 12.). This of course has to apply also for the different possible outcomes x of the lottery.

2.4.3.2 Axiom 2: Transitivity

All different lotteries have to underlie transitivity, which means that they cannot counter each other out. A person that prefers an apple over a peach and a peach over a tomato should also prefer the apple over the tomato. In mathematical terms speaking, when it comes to lotteries, this means that when $L_i \succ L_j$ and $L_j \succ L_k$ this implies that $L_i \succ L_k$ respectively $L_i \succ L_j \succ L_k$ (Anand, 1992, p. 13.).

2.4.3.3 Axiom 3: Independence

For this axiom, any two lotteries L_i and L_j satisfying $L_i \succcurlyeq L_j$ can be combined with any third lottery L_k without endangering the preferences. Here the probability of this lottery is displayed as q with $q \epsilon (0, 1)$. This means that,

$$(1-q)L_i + qL_k \succ (1-q)L_j + qL_k$$

This axiom can be easily clarified with drinks beverages. A person that prefers a litre wine to a litre beer (in this case, both choices can be seen as a lottery with p=1), will also prefer a lottery of winning a litre wine with a chance of 40% or a litre water with a chance of 60%, to a second lottery with beer instead of wine and the same probabilities.

2.4.3.4 Axiom 4: Continuity

This axiom is also employed with the combination of different lotteries. Whenever there are three lotteries, where $L_i \succ L_j \succ L_k$, a q exists that leads to the following equation:

$$L_j \sim qL_i + (1-q)L_k$$

This axiom can be explained with beverages as well. When (1l wine) ≻ (1l beer) ≻ (1l water) it is possible to form a bundle of wine and water (e.g. 0,6l wine and 0,4l water) where the decision-maker is indifferent to 1l beer.

2.4.3.5 Axiom 5: Reduction of Compound lotteries

This axiom is not always mentioned when it comes to utility theory, as it is more of an addition. Still it makes sense to include it, when it comes to decisions under risk, including lotteries. In the case of a compounded lottery, the prize of it is another lottery. For this axiom a decision-maker is indifferent between any compound lottery and a simple lottery involving $x_1, x_2, \dots, x_n$ as possible outcomes where the probabilities of the simple lottery are computed according to ordinary probability laws. In particular, if

$$L_i = (p_{i1}x_1, p_{i2}x_2, \dots, p_{in}x_n)$$

then,

$$(q_1 L_1, q_2 L_2, \dots, q_s L_s) \sim (p_1 x_1, p_2 x_2, \dots, p_r x_n)$$

, where $p_i = q_1 p_{i1} + \cdots + q_s p_{is}$ (Biswas, 1997, p. 17.). This axiom makes sure, that the only thing that matters for the decision-maker is the outcome not the process. Participating in a compounded lottery where somebody has a 50% chance to participate in a lottery where the chances of winning €10 are 50% should not be different to a 25% chance of winning €10, when it comes to the evaluation of the lotteries.

2.4.4 The Utility Function

With these axioms satisfied it is possible to generate a utility function that represents the preferences of a decision-maker on an ordinal scale. The proof that this is true has been made by Neumann and v. Morgenstern and for that reason will not be discussed in this thesis[2]. The importance of their distribution lies in the derivation of a linear utility representation for preferences, even though their formulation seems far removed from the one that Bernoulli originally came up with. Now it is possible to formulate the following:

$$x \succ y \iff u(x) > u(y)$$

This means, that for any two bundles, there exists a function assigning a value to each of them (Fishburn, 1984, p. 2.). The question here is, if this is also possible for lotteries, as preferences over lotteries cannot be derived from preferences over outcomes. This is, because each individual will evaluate risk subjectively. So two subjects might have the same preference ordering over certain outcomes, but might have different preferences over lotteries involving these outcomes. This means, each possible outcome of the lottery has to be applied to its own utility. This utility will then be weighted by the probability of its outcome. This generates the following expected utility function for a lottery.

---

[2] For the proof cf. Von Neumann (1944) pp. 25.

$$U(L) = \sum_{x \in X} p(x)u(x)$$

Which means that

$$L_i \succ L_k \Leftrightarrow \sum_{x \in X} p_i(x)u(x) > \sum_{x \in X} p_k(x)u(x)$$

In this case U is defined as the expected utility of a lottery while u represents the utility of the outcomes. Now, the function generates a real number for each outcome, which adds up the overall utility of a lottery.

2.4.5 Attributes of an Outcome:

Of course, a decision always consists of at least two options; the person has to choose between. Depending on these options, it is based on one or on multiple attributes. An obvious single-attribute scenario would be the choice between a money transfer of €10 or €100. The different options x and y are all part of the same set X (x, y ∈ X). Many decisions in our life however seem to be single-attribute ones, while in fact they are multi attribute decisions. These different attributes are $x_1, x_2, \ldots, x_n$ respectively $y_1, y_2, \ldots, y_n$. A good example is the choice between an apple x and a peach y. For many of us, the choice is simple, depending on our taste in fruits. However, there are factors like size of the fruits, their freshness or the colour that play a role. What we consider as an attribute in a decision depends on the person and the situation. In many daily scenarios, our mind works very intuitively, like in the case of the apple. We don't have to think about the different attributes, we just choose. For other decisions like the purchase of a vacation, we realize that there are different peculiarities and take them into account. Here we (usually) actively consider attributes like price, location or weather before we make our decision (Kahneman, 2011.)[3]. Each attribute can be equipped with a weight λ_i, where $\sum_{i=1}^{n} \lambda_i = 1$. Depending on the situation, there are different ways to formulate a final function for a weighted multi-attribute function. The most common ones is the addition of the attributes together with the weight. This results in the statement that

$$x \prec y \;\Leftrightarrow \sum_{i=1}^{n} \lambda_i u(x_i) \;<\; \sum_{i=1}^{n} \lambda_i u(y_i) \qquad \text{for all } x, y \in A$$

(Fishburn, 1970, p.83; Dyer 2005, p. 282; Huber 1974, p. 1394.). This would make sense for the example of the vacation, mentioned earlier. When a person has to decide between two wellness hotels, he might weight the price with 0,5 the distance from his home with 0,1 and the hotel itself with 0,4. Together with the utility that each attribute generates for the decision-maker, the hotel with the higher score is chosen. Another way of generating the value of a multi attribute decision is via multiplication. In this case

$$x \prec y \;\Leftrightarrow \prod_{i=1}^{n} \lambda\lambda_i u(x_i) \;<\; \prod_{i=1}^{n} \lambda\lambda_i u(y_i) \qquad \text{for all } x, y \in A$$

(Dyer, 2005, p. 282.; Huber, 1974, p. 1396.). Even though it might seem abstract at first, there are many fitting examples for this kind of formulation. To calculate the utility of an acre, for a framer it does not make sense to add up the length and the width. Here, a multiplication model fits better, when it comes to a comparison of two or more fields. The more attributes a person has to consider when making a decision, the more complex it gets. Without anticipating to much already, this is why in the experiment conducted in this thesis, as well as most designs reduce the attributes of the decisions to a number as low as possible. The more factors that have to be taken into account, the higher the chance of a delusion of the final result.

[3] This assumption is based on the theory of the two ways of thinking, or the two systems. Here some decisions are based on a more fast and intuitive (e.g. recognizing a face) and other more profound and slow way of thinking (e.g. solving a mathematical equation). Depending on the kind of choice we make, one of the two systems reacts. A summary the system of thinking fast and slow can be found in Kahnemann (2011).

2.4.6 Risk preferences of a decision-maker in the EUT

As the title and the chapters before already imply, each person has his/her own attitude towards risk. The St. Petersburg Paradox form chapter 2.4.2 made this clear. The more a person is willing to spend to take part in a gamble the more utility he/she gains from it. A person which is willing to spend €10 has another preference over risk than a person which is only willing to pay €5.

To measure the attitude towards risk, the so-called certainty equivalent is introduced. It is the amount of pay-off that a person would have to receive to be indifferent between this payment and a given, uncertain lottery. In case of the coin toss over winning either €10 or nothing, the expected value μ is €5. This is compared to the amount that has to be paid to the person, where he/she is indifferent to participate in the gamble – his/her certainty equivalent. When this amount is lower than €5, the person gains a lower utility out of the gamble, than it is actually "worth" (from the viewpoint of the expected value). In this case, the person has a risk-averse attitude, where $U[E(L)] > E[U\,(L)]$. The first term represents the utility that is gained from the expected value of the lottery. In other words: the utility that a safe payment, as high as the expected value of the lottery, would generate for the participant. The certainty equivalent is then compared to the expected utility of the lottery $E[U\,(L)]$. Possible functions to represent this behaviour would be $U[E(L)] = (E(L))^a$ where $1 < a$. This results in a convex utility function

The opposite would be a risk-seeking or risk-acceptant decider. Here, the participant has to be paid a certainty equivalent higher than €5 to give up his/her participation in the lottery. This would mean $U[E(L)] < E[U\,(L)]$. In this case a possible function can be represented by the same function $U[E(L)] = (E(L))^a$, only this time with $0 < a < 1$. The result, of course is a concave utility function. The last possible form is the risk neutral decider with $U[E(L)] = E[U\,(L)]$. He/she does not make a difference between the safe payment in the amount of $U[E(L)]$ or participating in the lottery. The utility function in this case is linear.

The different shapes of this behaviour are displayed in the graphic below.

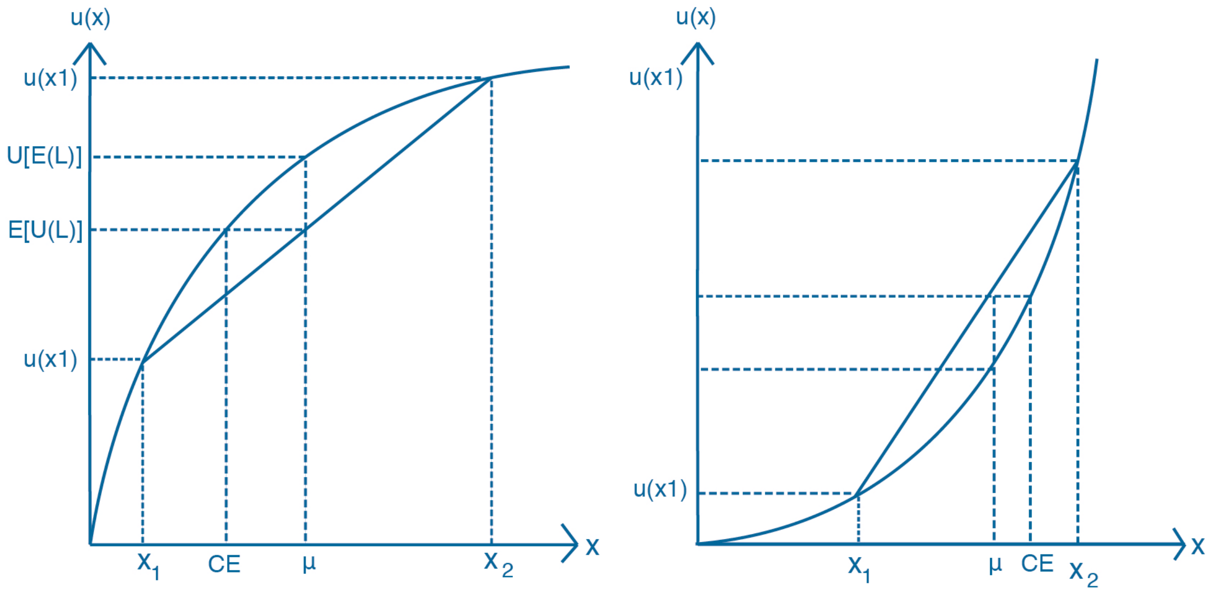


Fig. 1: Graphical illustration of risk-averting (left) and risk-seeking behaviour (right)

2.4.7 Critique of the EUT

Even though expected utility theory seems like an utilizable theory, it is only as good as it can be applied to reality. Several papers however have proven, that human nature cannot be explained using such a simple formula. The EUT only works, when the axioms are satisfied. One of the first to prove, that this might not always be the case was Maurice Allais. He set up an experiment where a violation of the independence axiom could be monitored (Allais, 1953). For this, participants had to make tow decisions. Each time they had to choose between two situations. The first decision being

Situation A: Receiving 100 million for sure

Situation B:
- 10% chance to win 500 million
- 89% chance to win 100 million
- 1% chance to win nothing

And the second one,

$$\text{Situation D} \quad \begin{cases} \text{10\% chance of winning 500 million} \\ \text{90\% chance of winning nothing} \end{cases}$$

$$\text{Situation C} \quad \begin{cases} \text{11\% chance of winning 100 million} \\ \text{89\% chance of winning nothing} \end{cases}$$

In theory, every person that would prefer situation A to situation B, should also prefer Situation C to D. However, in the first case, most people chose Situation A and in the second, they chose Situation D. These different preferences however are inconsistent with the axioms. This is because:

$$U\,(100 \text{ million}) > 0.1{*}\mathrm{U}(500 \text{ million}) + 0.01{*}U(0) + 0.89{*}U(100 \text{ million})$$
$$\Leftrightarrow$$
$$0.11{*}U(100 \text{ million}) > 0.1{*}U(500 \text{ million})$$

Because D is preferred to C this results in:

$$0.1U(500 \text{ million}) + 0.9U(0) > 0.11U(100 \text{ million}) + 0{,}89U(0)$$
$$\Leftrightarrow$$
$$0.1U(100 \text{ million}) > 0.11U(100 \text{ million})$$

The two contrary inequalities prove the existence of the so-called “Allais paradox”, which implies a violation of the independence axiom (Allais, 1953, p. 527.). Over the years, more and more experiments have revealed the flaws of EUT. The Allais paradox is not the only one to violate an axiom. There are multiple other experiments that are inconsistent with EUT. Ellsberg (1961), which was referred to in chapter 2.4.1, for example, depicts a violation of the independence axiom as well. These axiom-violating observations can be grouped into five major phenomena of choice:

2.4.7.1 Nonlinear preferences

What served as an introduction to the flaws of EUT, the Allais paradox is the quintessence of nonlinear preferences. Kahneman and Tversky later repeated this experiment only this time the outcomes were not as high. As expected the results were similar. It is shown clearly, that we value probabilities differently, depending on the situation. The difference between 100% and 99% has a higher impact on the decision, than between 10% and 11%. These observations can also be made in choices that do not involve sure outcomes (Camerer & Ho, 1994).

2.4.7.2 Loss aversion

In addition to that, we also rate gains differently than losses. A mundane example is promising a child to visit Disneyland during the holidays and then telling him/her that it was just a joke 10 seconds later. Even though the child's situation has not changed, it might start crying. This is because the disutility we experience from a loss is higher than the utility we get out of a gain. In order to avoid these losses, decision-makers are willing to take higher risks, than they would when it came to the same amount of gain. This results in a risk-seeking behaviour when it comes to losses and to risk aversion when it comes to gain (Kahneman & Tversky, 1984, p.342.).

2.4.7.3 Framing

Depending on how a choice is presented to a decision-maker, the answer may vary. The reason for this lies also in the loss aversion of decision-makers. When somebody is presented with an option that is formulated more like a gain than a loss, he frames it different than when it's the other way around (Kahneman, 1984, pp. 343.). This creates a conflict with the axiom of reduction of compounded lotteries, because of the influence a different presentation can have. An example made by Kahneman in an Interview was the description of meat. People tend to prefer a product that stats “90% fat free” to one claiming to have “only 10% fat”, even though it is actually the same (YouTube, 2013).

2.4.7.4 Source dependence

What was already introduced in chapter 2.4.1 with the experiments of Ellsberg (1961) can be generalized under the name source dependence. A decision-maker’s choice does not only depend on the degree of uncertainty but on the source as well. More recent findings of Heath and Tversky (1991) even suggest that people prefer a vague bet in an area they have expertise in to a clearer bet on a topic they are not so familiar with.

2.4.7.5 Risk-seeking

Most findings suggest, that decision-makers usually tend to be more risk-averse, than seeking. However, this is not always the case. Especially when it comes to gambles where the chances of winning a large prize people are willing to pay way more than the expected value. This can be seen daily, when somebody buys lottery tickets in the hope of being set for life after the next drawing of numbers. The second observation is connected with loss aversion. Decision makers try to avoid losses. When they have the choice between a sure loss and a lottery with a substantial probability of a larger loss as well as the chance of avoiding a loss altogether, a risk-seeking behaviour can be monitored (Tversky & Kahneman, 1994, p. 298.).

2.4.8 Prospect Theory:

All these findings support the thought, that EUT isn’t enough to describe human behaviour. This resulted in the development of the “prospect theory” by Daniel

Kahneman and Amos Tversky in 1979 for which they were honoured with the Nobel Prize in 2002. This theory divides the decision into two phases: Framing and valuation. In the first phase, the decision-maker constructs a representation of all contingencies, acts and outcomes of his options. In phase two, all of the value of each prospect is generated and a choice is made according to it. Up until now, experiments supporting this idea have often been repeated, altered and played with hypothetical and real monetary amounts (Kahneman & Tversky, 1992, p. 299.). To encounter the problems generated by loss aversion, nonlinear preferences and risk-seeking behaviour it is suggested that the overall utility of a lottery does not only depend on the value and the utility a person gains out of it, but also the probability. This leads to a two-weighted function that is displayed below.

$$U(L) = \sum_{i=1}^{n} w(p_i)v(x_i)$$

In this case $w(p_i)$ represents the probability weighting function. It accounts for the findings, of risk-seeking behaviour and nonlinear preferences. How the function is exactly shaped is still under debate. The most accepted one however is still the one Kahneman and Tversky originally proposed (Peterson, 2009, p. 289.).

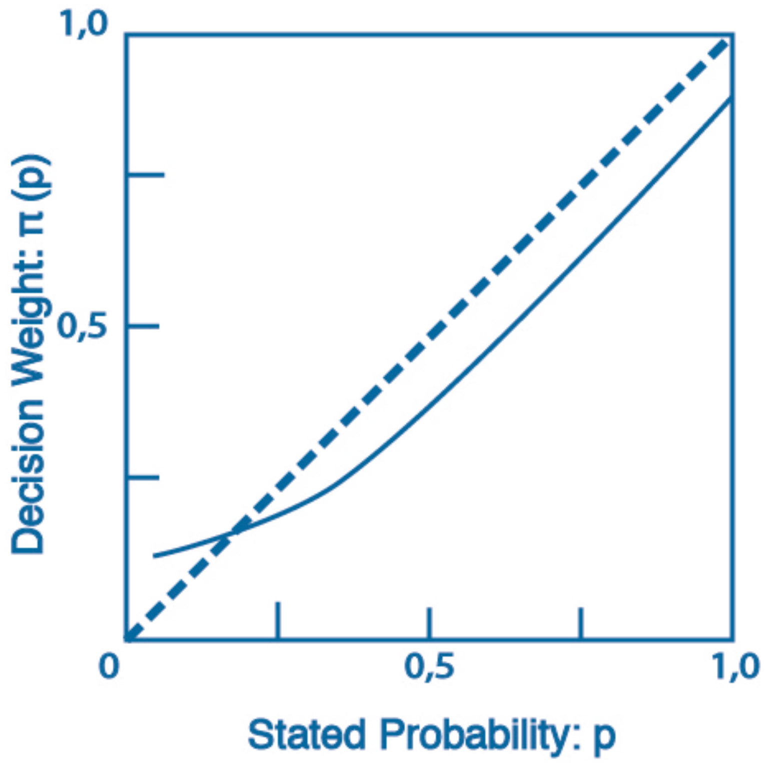


Fig. 2 The hypothetical weighting function of Kahneman and Tversky

The function shows how, especially in the very low probability regions, people tend to overestimate their chances of winning. As soon as the bold line falls below the dotted one, people tend to underestimate them. The second aspect that was integrated into prospect theory was the difference of people evaluating loss and gain. The value of loss and gain are not linear. The best representation for this is an s-shaped function, where losses have a steeper slope than gains. Kahneman and Tversky illustrated this in the following graphic:

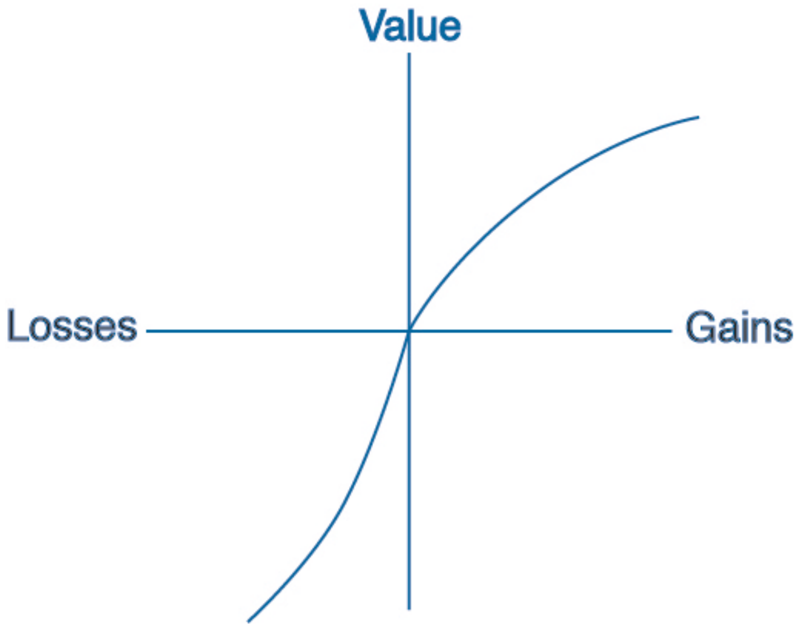


Fig. 3 A hypothetical value function

Once the shape of the weighting functions has been established, prospect theory can be applied to predict the choices of a decision-maker (Peterson, 2009, p. 290.). Still it is not the perfect tool to predict decisions under risk. As one might have noticed, not all of the new findings can be incorporated into PT. For example, even though there are lots of ideas what govern the representation of acts, outcomes and contingencies, a formal theory of framing is not available. The result however is simple and leads scientists that do research in this area more and more to a behavioural economic view of decision-making, because "Theories of choice are at best approximate and incomplete. One reason for this pessimistic assessment is that choice is a constructive and contingent process. When faced with a complex problem, people employ a variety of heuristic procedures in order to simplify the representation and the evaluation of prospects. These procedures include computational shortcuts and editing operations, such as eliminating common components and discarding nonessential differences (Tversky & Kahneman, 1992.)."
Even though it is incomplete, to this point of time, prospect theory is the best way of describing human behaviour, when it comes to making choices. This is why the findings of the experiment will all be analysed according to PT.

3 Group Behaviour

Up until now, the thesis was focusing on decisions under risk of people making them alone. However in many parts of life, we have to make choices in groups or have to decide how we act in one. Only because decisions are made in groups does not necessarily mean, that they affect all group members. Maybe we also want to absorb other people's opinions on a topic before deciding something. In many cases, the judgement of a group is superior to the one of an individual. Surowiecki (2005) described this as the "wisdom of the crowds". He refers to an experiment conducted by Jack Treynor (1987), showing that when it comes to judgements, individuals perform much worse, than a pool of their opinions. When participants had to guess the number of coins in a bottle, the chances of them, guessing a number close to the right amount were very low. People tended to guess either way too much or way to less coins. If the answers however were pooled together, the group came to an astonishingly good judgement. The reason for this is simple. Each of the subjects' guesses is based on the same bottle with coins. The estimation error of each person however is independent of the other ones guesses. This means they cancel each other out. This is only possible, when those observations are independent and don't correlate with each other. The simple experiment has an essential message that can be applied to businesses as well. When the management of a company has to make a decision the prior opinions should be noted in secret first and than be compared. This leads to overall better decision-making. The initial opinion of an individual however is only a small part of this group-based process. The wisdom of the crowds only works when people don't have the possibility to influence each other. This however is only rarely the case when it comes to decision-making in groups, as the process usually also includes discussions about each individuals perspective and thoughts on a topic.

This part of my work will focus on groups, more specifically on how preferences are influenced here. Even though the field of group dynamics has traditionally been the turf of psychologists, they rarely grapple with topics like network structures and its outcomes. This specific interest seems to be employed by sociologists (Friedkin, 1999, p. 856.). This is why the following part of the thesis will mostly rely on sociological findings and theories. First, it is important to know, what kind of changes can appear, when it comes to group decisions. After that the reasons are going to be explained by the four most common theories.

3.1 Choice shift

Choice shift is the hypernym to describe the phenomenon that people's decisions, opinions and willingness to take risks, differ when they are alone, compared to when they are in groups. Choice shift occurs when, after a group's interaction on an issue, the mean final opinion of group members differs from the members' mean initial one (Friedkin, 1999, p. 857.). A simple example would be a group of friends who choose to donate €5 to a good cause when they are by themselves. In a group however, each one donates an average amount of €7. As mentioned already, psychologists who dealt with this topic, usually were focussing on how decisions are made, rather than on what the outcomes were (Stoner, 1971, p. 2). James Stoner was one of the first scientists, discovering the existence of choice shift in this area. Even though he couldn't explain why this was happening, with his experiment, he detected that risk aversion tends to be lower for a group, than the average risk aversion of the people the group consists of (Stoner, 1961). This experiment however didn't use a lottery design, but was based on the classic questionnaire of Wallach and Kogan, the so-called Choice-Dilemma-Questionnaire (CDQ).

The form of this experiment contains twelve realistic situations involving decisions. In each one, participants are given a situation and have to choose between two courses of action. Course 1 has a relatively certain outcome but also a low utility[4], while the other one, course 2, contains a higher uncertainty. The second course has an uncertain outcome, which is either lower or higher than the first course's utility. The questionnaire lists different probabilities of occurrence for the high utility in course number 2. The participants are asked at which point they are willing to switch from course 1 to 2. However, there is no actual utility/pay-out for the participants.

[4] As the scenarios don't always involve decisions over money, utility seems to be the most fitting summary.

An example taken from the questionnaire is the case of Mr. D., a football coach whose team is behind in points. He has two tactics to choose from. An easy one that would almost under certainty lead to a tie and a second, more complicated one, that could make his team win the game but may also lead to defeat. The participant has to decide at which probability for tactic 2 to work, he would change from action one to two (Wallach, Kogan, 1961). The design, Stoner used her, was originally designed to compare risk aversion between individuals. In his experiment however, the participants had to fill out the forms alone and then were put into groups of six, afterwards. Comparing the first with the second round the result was obvious. When the subjects reached decisions as members of a group they tended to advocate significantly more risky courses of action than they had chosen when they reached decisions as individuals.
A part of Stoners recommendation for future analyses was to find out more about the reasons for this phenomenon. To summon up, Choice shift means that there is a difference between the individuals' mean decision and the final opinion of the group. However there are definitions describing the possible outcomes in a finer way, listed below.

3.1.1 Polarization

The terminology *polarization* originated from the findings of Serge Moscovici and his colleagues (e.g. Moscovici, Zavalloni, 1969). It describes the behaviour of the average post-group response tending to be more extreme in the same direction as the average of the pre-group responses (Mayrs, Lamm, 1976, p. 603.). Group polarization is said to occur when the choice shift goes in the same direction as the mean initial opinion. The average of participants in an experiment might be risk-seeking (risk-averse) in a certain situation. When they are put in a group, polarization would mean, that they tend to be more risk-seeking (risk-averse), than before. They are drawn to a certain „pole" of the decision spectrum (Friedkin, 1999, p. 857.). It is important to note, that the term polarization refers to an increase in extremity in the average opinion. It does not mean, that there is a split into two different poles of opinions, as the term polarisation might also be interpreted as. This also means, that every group polarization is a case of choice shift, but its not necessary, that a case of choice sift also involves group polarization. However, the result of most experiments dealing with choice shift, usually substantiate choice shift <u>and</u> group polarization. This means, that the experiment in chapter 3.1 is also an observation of group polarization.

Before the introduction of the term group polarization, the phenomenon was known under the notion risky shift. This however is now widely recognized to be a misnomer that unfortunately biased many scientists to research only on risk-taking, rather than a more general point of view (Mayrs, Lamm, 1976, p. 603.). Pruitt however came up with the demand to refer to this phenomenon with group polarization rather than with risky shift. The reason for this were the findings mentioned above. The first results in this area were all shifts towards a more risky behaviour. Hence the term risky shift was used first (Pruitt, 1971, p. 339).

Sometimes, the term Extremization is mentioned. It refers to a shift away from neutrality, regardless of the direction. This is different from polarization, as here a shift towards an already preferred pole can be observed (Mayrs, Lamm, 1976, p. 603.).

3.1.2 <u>Risky shift and cautious shift</u>

The last addition to a possible form of choice shift is the risky and the cautious shift. The two terms describe the direction of the choice shift, where polarization describes the starting and the end point of an occurring choice shift. As the names already indicate, if the difference between the mean level of individual judgements and the mean after group discussion is positive, a risky shift occurs. A measure for this will be introduced in chapter 4.3.3, when the experiment will be discussed. In case that the difference is negative the term cautious shift is used, as the participants tend to be more cautious than before (Murdoch, 1970, p. 98.). The experiment of Wallach and

Kogan also describes an experiment, where a risky shift appears.

3.2 Reasons for choice shift

Since its discovery, there have been various explanation attempts for choice shift. Over time, these theories have been changed, discarded or redefined. The main ideas have been summarized by Pruitt (1971) or Isenberg (1986). Until today, many of the abundant explanations for the phenomenon of choice shift were discounted as inapplicable (Zuber et Al., 1992, p. 50.). Four main explanations remain until today and will be listed and explained below: *Self-categorisation theory (SeCaT), social comparison theory (SCT), persuasive arguments theory (PAT) and social decision schemes (SDS)*. The often-mentioned *Information Integration Theory* will not be listed below, as it is only an extension of persuasive arguments theory (Zuber et Al., 1992, p. 51.). Even though they all take different positions in this discussion, they all have one thing in common and that is communication. A discussion between the group members was proven to be the most important part when it comes to choice shift (Shaw, 1976, p.72.). In the following chapter, these theories will be presented and discussed. Even though all four have their justification, only two can be applied to the conducted experiment. The other two cannot be investigated as they involve two or more groups interacting with each other, which was not intended in my design. Another reason is, that SCT and PAT are seen as the main influences for choice shift. For reasons of integrity, all of the theories will be explained in the following chapter. As it can be seen here, these ideas all have a different take on choice shift, but don't stand in a direct competition to each other.

3.2.1 Self-categorisation theory

Self-categorisation theory was developed in 1987 by Turner et. Al. (Turner et. Al., 1987) and represents a further development of Taifel and Turner's social-identity theory. As the model itself has undergone many changes over time, I will base my description on the most recent findings on the topic. This theory couldn't be mentioned in Pruitt or Isenberg's summaries as it was developed later.

Social-identity theory is based on Taifel's experimental research and tries to explain processes between groups, more specifically, the minimal conditions for discrimination. In his setup, which came to be known as the minimal group paradigm, participants were randomly assigned into two groups. Later they could distribute money[5] between a member of their own or one of the other group (ingroup-outgroup), as well as two participants of the same (ingroup-ingroup) and the other (outgroup-outgroup). The results showed, that people would prefer their own group members (ingroup) to others (outgroup), when it came to the distribution of the money. On the other side, ingroup-ingroup and outgroup-outgroup distribution setups were always treated fairly. The experiment was repeated with schoolboys between 14 and 15 years, who were divided into groups over their preference of the painters Paul Klee and Wassily Kandinsky[6] as well as their ability to count dots on a wall. The results were similar to the ones described before (Taifel, 1971). After the experiment, Taifel came up with three assumptions about group behaviour. First, there may be discrimination against an outgroup, even if there is no reason for it in the individual's own interest. The second consequence is that there may be such discrimination in absence of any previously existing attitudes of hostility or dislike towards the outgroup. And the third one is that the generic norm may manifest itself directly in behaviour towards the outgroup before any attitudes of prejudice or hostility have been formed (Taifel, 1971, p. 99.).

These findings later helped to develop the SeCaT. It represents a generalization of Taifel's findings and can only explain group polarization, not choice shift in general.

> "Self-categorisation theory is a theory of self-perception, which anticipates that aspects of social behaviour, especially group behaviour, can be explained by variations of self-perception. That is, the way people act in social situations, depends on the way that they perceive themselves in those situations, and in particular, the way that they perceive themselves to be similar to or different from other people (McGarty, 1999, p. 110.)."

[5] They had to assign points to each individual, which was later converted into money

[6] Even though this was only a side experiment, this version became the more known one.

It does so on the basis of the actors' conformity to an extreme norm or prototypical position of the group. For this self-categorization, a three-step process is necessary. Even though, the first two ones are also important, the third step is the one where the change in behaviour occurs. For these three processes, I will go with the example of a free climber club and a chess club.

1. Ingroup

The first and most important part is the moment when the group is put together or a new member enters the group. Here, the participants are perceived, defined, or recognized as members of distinct social groups (Friedkin, 1999, p. 859.). People in the free climber club usually tend to be interested in climbing mountains. Once a new member enters the group, the first step is enabled via exchange of information about favourite mountains or sports equipment. In addition to the interest in climbing, people in this club might see themselves also as more risk-taking and active than other persons. This separates them from a chess club, an organisation, where people might see themselves as more strategic and smarter than others.

2. Outgroup:

In the second step the group members then try to find out, what separates them from other groups. This includes typical or representative attributes, behaviours and norms. This results in groups, likely to be perceived as being stereotypically extreme (Friedkin, 1999, p. 859.). In order to do so, consciously or unconsciously, the groups categorize themselves. This category system is defined by a hierarchical order, which is build up like a pyramid. Each level is defined by categories with sub-categories. These sub-groups or stimuli must be differentiable but condensable in a higher ranked category (McGarty, 1999, p. 111.). The chess and free climber club obviously both belong to the category club, but when we add a surf club, we can summarize the free climber club and the just mentioned surf club in the category of outdoor clubs, before changing over to clubs in general. This system is flexible and depends on the situation (Rosch, 1978).

3. Members

In the third step, the identity of the ingroup is then attributed to each person (Mackie, 1986, p. 720.). In terms of group polarization, this important step is only possible when the first two have already appeared in a certain way. So the question is, how this part of social-identification leads to group polarization and what influences its peculiarity.

The main argument of the appearing group polarization is, that people want to be conforming to the shared ingroup norm. It is based on the person's readiness to use a social category for self-definition. Two aspects determine this: Normative and Comparative Fit.

The first one refers to the content aspect of the match between category specifications and the instances being represented (Turner, 1999, p. 11). In our case, the free climbing club members must differ less from each other, than they do from the chess club (for example in riskiness, or interest in mountains). Comparative fit (originally structural fit), is defined by the prototypicality of the ingroup. In our case of the free climb club this could be a risk-seeking behaviour. This norm however is not the groups average but rather the position most prototypical for the group. This prototypicality of the ingroup is defined by the so-called Meta-Contrast Ratio (MCR). As described before the first two processes of the sequence are processing ingroup similarities and outgroup differences. What is seen as the lather depends on the situation. The free climbing and the chess club for example can compete in the category of clubs. The formulary for the MCR was introduced by Turner (Turner, 1987) as well and is defined in the following algebraic formula:

$$MCR = \frac{\sum_{d=1}^{n_d} \sum_{i=1}^{n_x} \sum_{j=1}^{n_y} | x_{di} - y_{dj}| / (n_d n_x n_y)}{\sum_{d=1}^{n_d} \sum_{l=1}^{n_x} \sum_{m=1}^{n_x} |x_{dlm} - y_{dml}| / ((n_d n_x)(n_x - 1) \; for \; dml \neq dlm}$$

Here "…$\mathrm{n_d}$ is the number of relevant dimensions; n_x is the number of members of some category X, n_y is the number of members outside category X; and the x and y values are positions of a member of one or the other category on a particular dimension" (McGarty, 1999, p. 112.). When the value of this ratio is greater than 1 than category X will be perceived to be an entitative category. As the formula is rarely optimized empirically by self-categorization researchers it makes sense to convert the formula in the following way to ease its understanding.

$$\mathrm{MCR} = \frac{\text{average perceived difference between categories}}{\text{average perceived difference within a cathegory}}$$

What is seen as a relevant category is, of course, highly dependent of the situation, as every group can belong to multiple different categories and sub-categories (Turner, 1999, p. 10.). If we compare the free climbing club to the apnoea diving club, both seem very different from each other. One is a sport you do in the mountains and one is exerted in water. On the other side, if we add a chess club to the mix, they become very similar to each other, because they both represent a more dangerous and extreme sport than chess. This means, that similarity does not generate categorization, but categorization generates similarity.

Normative fit however refers to the match between category and reality in terms of content and not just comparative fit of dimension (McGarty, 1999, p. 113.). This means, that a group is seen more similar if it represents expectations of the perceiver. The members of the free climber club in our example would appear more similar to each other when they also represent stereotypical characteristics like risk loving behaviour. Penelope Oakes and her colleagues proved this in an experiment in 1991, where they separated six actors into two groups and let them act out a scripted debate. Three were playing science and three were playing arts students. A stereotypical feature of the first group would be a positive attitude towards working very hard, while the stereotype of the arts students would be more social life orientated. When the debate-observers, who were the test-subjects, were interviewed later, the perceived similarity of the members inside a group was higher when the groups took a stereotypical position towards working hard and having a social life. In case of arts students preferring working to a good social life, it was the other way around – the group was seen as more diverse (Oakes et Al., 1991). Note, that in both discussions the MCR was the same.

These two factors, comparative and normative fit, are responsible, when it comes to group polarization in SeCaT, because as mentioned before the third step is the attribution of the group's features to the person. This is not defined over the groups average, but rather over the MCR. This means, the higher the difference to the other groups in the same category the more likely, the group member is to experience polarization (McGarthy et Al., 1992). In my example, this would be more significant when the free climb club members compared themselves to the chess club members, than to the members of an apnoea-diving club (in terms of riskiness). To generate even more similarity, they behave in a stereotypical extreme way (normative fit), of becoming more risk loving.

This means, that a group is not only defined by its members, but also by the ones the group compares itself to. In terms of utility theory, a group, that sees itself to be risk loving, might become it even more, when they are provided with the information, that a competing group is more cautious, but less risk-seeking if they are competing against an even more risk-loving group. According to research, this however has not been tested yet and might be another idea of an experiment.

As a final note, I want to say, that this theory, even though it has experienced a lot of attention in the past, is not mentioned in combination with choice shift and group polarization very often. In my opinion, there is a possible reason for this. SeCaT only explains choice shift on basis of interaction between groups and not within them. This means, for this theory to work, more than one group is needed and the categorisation process is not as simple to conduct in practice than in theory.

3.2.2 Social comparison theory (SCT)

While the first theory focuses on a change in opinions due to influences between groups, the second relies on those that can occur within a group. Even though there might be overlaps, SCT differs from SeCoT in the core approach.

It is based on Allport and Hartmann's findings, that there is a positive relationship between a person's extremity and his/her confidence towards a certain topic (Allport and Hartmann, 1925).[7] The different interpretations of SCT vary, depending on the point of view. The difference doesn't lie so much in the assumptions about the process that produces a risky attitude, but more on the different takes on the values

[7] In this case, the hypothesis was tested with political attitudes

that are likely to undergo a choice shift (Pruitt, 1971, p. 346). Still, there is a major current version, which will be stated below. There are, just like in SeCoT, three steps that can be identified.

1. Valuation

First it is to say, that for some characteristics, decisions or opinions are valued positively in groups. Depending on the group, this might be intelligence, helpfulness or courage (Laughlin, Barely, 1982, p. 274.). This means, that group members try to represent those values as good as possible. They do so, by processing the available information of all participants and how the others present themselves. It always depends on the group and the situation, what can be seen as a favourable value. In a political debate for example, humour might not be as important as eloquence. As those values are important to be accepted in the group, everybody tries to fulfil and exceed those tendencies to be seen in a more favourable light (Isenberg, 1986, p. 1142.). In the beginning of these discussions, the members usually expose opinions that are less extreme than their true ones. They, step by step, revile their true tendency when feeling confirmed in their values. This even leads them to leapfrog over their true opinion towards a more extreme one (Sanders & Baron 1977, p. 304). Typical examples that often can be witnessed are conversations at house or dinner parties. In these situations, people try to present themselves in better positions they are actually in. Wine drinkers become oenophiles and the last vacation was, of course, way better than the one, the couple on the other side of the table was talking about earlier. Other examples are social media sites like Facebook or YouTube. Here it is even more noticeable than in the real world, because people can choose, what they want to present to their friends and what not. The usual post or video of a person on social media sites tries to impress people by showing them, that his/her life and situation is better than the average one. This means, that when members in groups interact with each other in the same comparing process, this results in an average shift in a direction of greater perceived social value (Isenberg, 1986, p. 1142.). The conclusion is, that group members try to differentiate themselves from the average by representing group norms in a more extreme way than the average member. In SeCaT however, group members try to differentiate themselves from the values of other groups.

2. Pluralistic ignorance

Second, a state of pluralistic ignorance is created. This is a social phenomenon, where the majority of a group rejects a certain norm, behaviour or value. However everybody assumes, that this specific norm is actually accepted by the group and doesn't disclose his true interests (Shelton & Richeson, 2005, p. 92.). A good example for this can be found in the study of Prentice and Miller. Here, students were examined about their attitude towards the alcohol practices at Princeton University. Most students thought that they were more uncomfortable with the drinking habits than the average student. Even though, most of the students were unhappy about those drinking habits, most of the students participate because they think that they are alone with their opinion, while they were actually the majority (Prentice, Miller, 1993). Other studies have found that groups of black and white people in general want to interact with each other, but think that the other ethnicity doesn't want to interact with them (Shelto & Richeson, 2005).

3 Ingroup comparison

Third, the members of the group are compare themselves to each other in the group. This means pressure is excreted on the other members to fulfil the group average (Laughlin, Barely, 1982, p. 274.). This part can be described as "group pressure" in general. People, who don't represent what is considered to be the group norm might loose respect within the group or are excluded completely. It is important to note, that this might also be a norm that no one in the group actually supports (pluralistic ignorance).

This theory exactly represents the cause for the smoking teenagers in the introduction. Especially in puberty, the value of being mature and daring is ranked high. By imitating the behaviour of many adults, a group member gains a higher social reputation, because he/she behaves more mature, by doing something only adults are allowed to do. Even if everybody knows about the negative utility of additional costs and the chances of getting lung cancer, they might also start smoking, because the social benefit and reputation are higher than the negative effects. Even if the overwhelming majority of the group is actually strictly against smoking, pluralistic ignorance lets them think differently. In the end, the other members are pressured to also start smoking, to fulfil the group average. This social utility is only persists, as long as the group exists. It is also one of the reasons, why quitting to smoke is easier in groups as well. Here the social comparison works the other way around. People of the group who smoke less gain a higher social utility in the group. Because of this, for an addicted person, the chances of success are higher in groups than alone with professional support (McEwen, West, McRobbie, 2006).

This phenomenon is also found in decision-making that involves risk. The question however is, what is valued more in a group: risk-averse or risk-seeking behaviour? With the "risk-as-value" hypothesis, the current state of research strongly favours the latter. Experimental findings (e.G., Gamba et Al., 2014; Levinger & Schneider 1969; College, 1976) suggest, that risky behaviour is favoured over risk aversion, but is not the only tendency a group can shift to. These studies have found that subjects perceive themselves as significantly more risk-seeking than their peer group and that they value riskier choices of others more than their own (Levinger & Schneider, 1969, p. 167.).

Still, it depends on the persons in the group and their attitude towards risk. Risk-seeking behaviour however seems to have a higher value than risk aversion and by this can be found more often. This means, that the utility gained by changing the opinion here is a social utility of being accepted by the group or representing its value on the outside. This however also means, that the actual opinion hasn't changed.

3.2.3 Persuasive arguments theory (PAT)

The third of the four theories is also one that might be the most obvious. The so-called persuasive arguments theory stats, that group members change their opinions based on the arguments that come up in a discussion (Friedkin, 1999, p. 858.).

When a single person has the choice between two decisions D_x and D_y, which he/she has to decide upon, he/she will think about the different arguments that support each of them. The process assumes, that the person does so, by choosing arguments out of a culturally given pool. The deciding person then evaluates each of them. Of course only those arguments can be evaluated, that come to mind. After the availability, they also may vary in direction (pro D_x or D_y) and persuasiveness. When the majority of the arguments favour a certain direction, it is very likely, that the average prior opinion reflects the direction and magnitude of this preponderance. Further thought about the different arguments can lead to a polarization of one decision. This can be illustrated via a simple example. The decision D_x is supported by the arguments x_1, x_2, x_3, x_4 and x_5, each of them are part of subset S_X. On the other side, D_y is supported by y_1, y_2, y_3 and y_4, making up subset S_Y. To simplify the example, we assume that each of the arguments is equally strong. The choice of the deciding person depends on the arguments that come to mind. Even though $|S_X| > |S_Y|$ (5 > 4), this doesn't mean, that the person automatically favours D_X. It makes the decision after which arguments come to mind. When decider thinks of x_1, y_2 and y_3, the decision will be made towards D_Y, even though the absolute amount favours D_X. However, if all arguments have the same chance of coming up in the process of thought, the chances for D_X to be preferred over D_Y are higher.

In a group, this system can lead to choice shift, because it doesn't matter how many people support an argument, but the overall amount of arguments made for a certain decision. Even though the average of deciders in a group might favour a certain choice, one person can turn everything around. Still, it is more likely, that a group discussion will lead to further polarization. The magnitude of the polarization depends on weather the initial argument samples overlap or exhaust the larger pool (Burnstein, Vinokur, 1977, p. 316f.). When we take a look at our example, we can assume that a group of 4 people have to decide between D_X and D_Y. If person A, B, C and D all come up with x_1, x_2 and y_1, they would go with D_X. This however can change if person D thinks of argument y_2 and y_3. It would mean, that the union of all arguments is x_1, x_2, y_1, y_2 and y_3. The result would be a choice shift from the average decider favouring D_X to D_Y instead. Of course it is more likely for a D_X argument to come to mind. This also explains, why the chances for the choice shift to be a form of group polarization is higher, because the more people already favour a certain direction, the higher are the chances that they exhaust the pool. The theory however leaves the structure of interpersonal influences aside. It just focuses on the actual arguments. Nevertheless, the theory is not inconsistent with an analysis of individual differences in the pattern of persuasive argumentation in a group (Friedkin, 1999, p. 859.).

3.2.4 Social decision schemes

Perhaps the most “banal” explanation for choice shift and yet not one that comes into mind are social decision schemes. Social decision scheme theory (SDST) explains choice shift based on the decision rule that is applied to the group. There are two major differences when it comes to comparing SDST to the other three. First, the theories that have been mentioned already can be applied to everything that occurs in a group. SeCaT, SCT and PAT can change a person’s opinion, the behaviour within a group or the overall attitude of a group. Social Decisions Schemes however can, as the name already suggests, only be applied to concrete decisions a group has to make. Second, the other theories do not designate extensive propositional frames, as the term *theory* might suggest. There is a formal presentation for these theories. Only SDST includes a rule for aggregation in addition to the explicit formal model (like the others also do) to measure the choice shift, depending on the decision rule (Zuber et Al, 1992, p. 50.).

When decisions in groups have to be made, the schemes of which one will be favoured plays a big role. For this theory the decision a group makes depends on the initial distribution of different opinions and the scheme upon which is decided. The focus of the SDST is not the subject’s change in opinion after discussion and decision. It is able to predict the direction of choice shift and also the amount of deviation but doesn’t do so on the base of a person’s change in opinion. These different rules can be found in all parts of our society, are fixed by constitution or custom and render a decision at the end of a debate (Davis, 1973, p. 99.).

Depending on the rule, the outcome can vary, from the groups average to strongly favour a person’s opinion.

The general model introduced by Davis (1973) suggests, that there exists a set n of mutually exhaustive and exclusive alternatives, A_1, A_2, A_3, ..., A_n. The preferences of the different decision-makers can be displayed as a probability distribution with p_1, p_2, p_3, ..., p_n across the alternatives. A group consists of r randomly sampled individuals. The internal distribution of those preferences may be represented by the occupancy numbers $r_1, r_2, \dots, r_n$ with $\sum_{j=1}^{n} r_j = r$. For some r and n, the number of distinguishable distributions of member preferences within a group is given by

$$m = \binom{n \quad + r - 1}{r}$$

The set m of occupancy numbers are the solutions to $r_1 + r_2 + \dots + r_n = r$. The probability π_i, that the group members arrange themselves according to the ith distribution, $i = 1, 2, \dots, m$ is given by

$$\pi_i = \binom{r}{r_1, r_{2,} r_3, \dots, r_n} p_1^{r_1} p_2^{r_2} \dots p_n^{r_n} ,$$

the general term of multinational expansion, $(p_1 + p_2 + \dots + p_n)^r$. Distributions of r persons into n alternatives, lead to $\pi_1, \pi_{2,} \pi_3, \dots, \pi_m$ being the different probabilities of each of them. These probabilities are further influenced by the different decision rules (Davis et Al., 1974, pp.250f.; Davis, 1973, pp. 100ff.). As it is not the focus of this thesis, I will not go into detail any further in a mathematical way. Still I want to give an impression about the most common ones[8] (Hastie & Kameda, 2005), as it is important for the experiment.

3.2.4.1 Random:

A decision by random is usually used, when there are no particular arguments for a certain decision. Depending on the specification this can mean that the odds for a

[8] Even though it is considered to be a kind of group decision, delegation will not be listed here, as it lies more of a principal agent problematic. For a better insight in this topic cf. Alonso, Matouschek, 2008.

certain decision are represented by the amount of people or not. An example would be a task that nobody wants to do. By letting chance decide, the cohesion is not endangered.

3.2.4.2 Plurality

Most decisions are generated with a form of plurality rule. When it comes to business plans, many of them are based on a binary scheme: invest in a market or not, cooperate with a company or not, hire somebody or not. It has a high transparency, is easy to understand and easy to execute as well. In addition to that, it encourages people to express their personnel believes and rather than to go conform to the group (Hastie, Kameda, 2005, p. 494.). Depending on the decision situation, plurality shows the best goodness of fit on various tasks (Zuber et Al, 1992. p. 51.).

3.2.4.3 Averaging

This is only possible with decisions that include at least an ordinal scale or higher. Here, the average is calculated out of each person's private opinion. Together with plurality, averaging is considered to be the most popular of the decision-making schemes in modern industrial democracies (Mueller, 1989).

3.2.4.4 Unanimity

This not very often used decision scheme is considered to be very useful when it comes to extensive information pooling and when deliberation processes are part of the group decision process (Sorkin et Al., 2004, pp. 476 ff.). In this case, the group has to come to one final conclusion. The most common example is the trail by jury system. Here, all the jurors have to come to one final decision that than is carried out or directs the actions of the judge (Davis, 1973, p. 105.).

4 The setup for the experiment

After focussing on the theoretical part and the recent state of research on utility theory and Choice shift, the experiment can be described. As it can be seen on the used literature, the different authors, topics and papers, the phenomenon of choice shift can be regarded from different sides. The research on usually focuses on one of the theories (e.g. Sanders, Baron, 1977, Davis, 1973). In case of a comparison, which one is more influential, this was only done on a theoretical basis (e.g. Isenberg, 1981; Burnstein, 1977). To fill this gap, an experiment was designed to find an answer. As such a design can only solve questions in a specific scenario, the focus of a comparison will lie on the two theories that are seen to be the major cause for choice shift in groups: PAT and SCT. Possible influences of SeCaT and SDT will be discussed as well. This part begins with a hypothesis, formed by recent literature. As mentioned in the introduction, the experiment is a further development of another study. To make it comparable, the major mechanics of the experiment will be explained first to avoid confusion and repetition.

4.1 Hypothesis

As shown above, the two most common theories of SC and PA are still evaluated and tested today. There are theoretical papers focussing on the comparison of both by evaluation of conducted experiments. One of the most cited and recognized papers today is “Group Polarization: A Critical Review and Meta-Analysis” by Daniel J. Isenberg, which I will focus on here. With his comparison of 22 articles he made two very important statements for the generation of the hypothesis:

1. SCT and PAT are two conceptually independent processes, which occur simultaneously (Isenberg, 1986, pp. 1148f.)

2. PAT has a higher influence on choice shift, than SCT (Isenberg, 1986, pp. 1148f.)

These findings are still relevant and accepted today and are cited in a significant amount of articles also used for this paper (e.g. Friedkin, 1999). They have been confirmed in several other articles. However it is only “only” a meta-analysis and has not been proven with an experiment yet. As one cannot answer too many hypotheses at once I focused on the statement, that PAT outweighs SCT, as it seems to be the more relevant statement concerning the argumentation in chapter 5. This means based on the theoretical analysis of Isenberg, the hypothesis I want to prove is the following:

H1: Persuasive arguments theory has a higher influence on choice shift, than social comparison theory

This has not been proven with an experiment yet. Before the process can be explained it is necessary to showcase the different possibilities how SCT and PAT can interact with each other.

4.2 Different possibilities of combining SCT and PAT

In Figure 4, the different combination possibilities are shown. To make it easier to understand I will refer to effects from SCT as *pressure*, as it is to pressure to go conform to the opinion of the group, and *arguments,* as the name persuasive arguments theory implies. This will be needed later, when the experiment itself is explained. SCT and PAT together are influencing the first risk attitude via group discussion and form the final opinion. It is important to understand how they can be combined and form the final opinion. They can either support each other or cancel each other out when the arguments support one behaviour and the pressure another. This can be illustrated by an example. The participant A is risk-averse towards a certain decision. If both, *arguments* and *pressure* go towards a higher risk aversion, A will become even more risk-averse and his/her final opinion will result in a cautious shift. This goes also for the other direction and would mean, that the participant’s final opinion would go towards risk neutrality or even a risk-seeking behaviour. In this case it would mean a group polarization in form of a risky shift. There are many different combinations all shown in the graphic below. As I only want to analyse if PAT influences the final opinion more than SCT, it is only important to know in which way the initial opinion can be influenced, to form the final opinion. The result, e.g. if it is a risky or cautious shift, is of mere interest here. In the figure below, the lower point represents the initial, the upper point the final opinion.

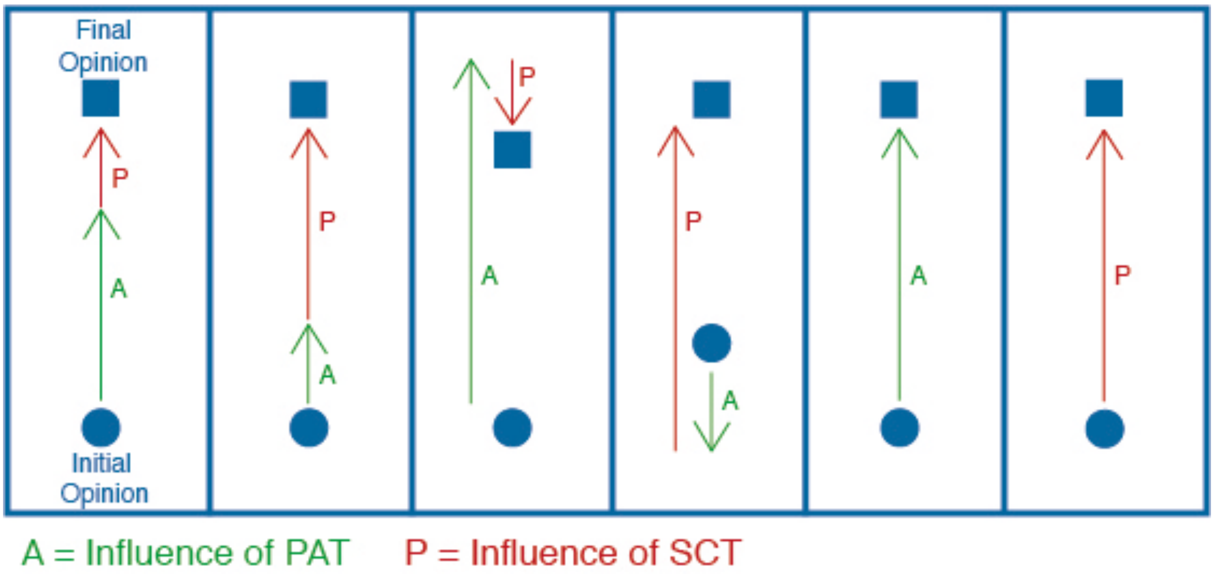


Fig. 4 Combination possibilities of SCT and PAT

1. In the first picture, the initial opinion is influenced by *arguments*, which are responsible for most of the final outcome. The other part is the *pressure* generated by the group. Both arguments go in the same direction, which means, that the person agrees to a certain part with the introduced *arguments*, but the group's *pressure* "forces" the member to change his opinion even further.

2. The second possibility is the same as before, only that this time the influence of SCT is bigger than the influence of PAT. The outcome (final opinion) is the same.

3. In this scenario, the direction of the *arguments* differs from the direction of the *pressure*. PA is so high that it even surpasses the final opinion. The pressure

coming from SC however let's the person fall back on a less extreme change in his opinion.

4. Here, the direction of the *arguments* also differs from the one of the *pressure.* The influence of SCT is so high, that the final opinion is even more extreme than the initial one.

5. (&6) These are the two remaining possibilities. In these special cases, only one of the two forces influences the decision-maker.

Other combinations of PAT and SCT are not possible. The next chapter will focus on how a possible choice shift can be measured.

4.3 A method to determine the maximum WTP

To compare different behaviour of individuals and groups, when it comes to making decisions, a method is needed to do so. As this process is a core element not only of my, but also of other studies, I will explain it in general first. After this is done the alternations can be applied, that set each of the experiments apart. It is quite difficult to generate the true willingness to pay, to measure the utility and the risk behaviour of a person. This can be illustrated with a simple example of a coin toss (50/50 lottery). We ask a woman how much she would be willing to pay for a coin toss where she wins €10 for heads and €0 for tails, L(0,5, 10, 0). In a hypothetical scenario, where she wouldn't actually win anything, she might say the truth, which differs from a "real" situation[9]. On the other side, when she can earn real cash, what would tempt her to lay her preferences open? The problem is that nobody can force her to say the truth in this scenario. The best solution for the woman would be, to say: "I'm willing to pay a maximum amount of €0." By doing so, there would be no risk for her and she

[9] The influence of hypothetical lottery earnings will be discussed briefly in chapter 4.3.2.21

could take part in the coin toss over €10. For a person to truthfully reveal his/her certainty equivalent, a special method is needed.

4.3.1 Origins of the method

Two researchers of the first to introduce an experiment to measure utility were Mosteller and Nogee in 1951. To do so they set up a scenario where participants had two choices. Either they accept a wager or don't bet at all. In the first case they took part in a lottery $L(p, x_1, -x_2)$. They were able to win an amount of x_1, but also had to face the probability to loose x_2. p and x_2 were constant and the amount that could be won changed each time. With this method it was possible to estimate the amount at which the subject was indifferent of accepting or denying the participation in the lottery, which meant a pay-out of 0. This can be displayed in the following formula.

$$u(0) = p * u(x_1) + (1 - p) * u(-x_2)$$

After this was done, the value of x_1 was changed six times which lead to the generation of a utility curve over monetary gain (Mosteller, Nogee, 1951, p 373). This approach inspired many other researchers and was developed and changed over time. The model of Becker for example altered the process and made it more complicated on the one side but more accurate on the other. It included letting the subjects tell them at what price they were willing to sell (WTS) a given lottery (Becker, DeGroot, Marschak, 1963). As it can be seen here, most of the experiments measuring utilities let the participants make a choice over a certain lottery. This doesn't change much in my design of the questionnaire as well, as it is a slight variation of the model that Becker, DeGroot and Marschak introduced.

4.3.2 Measuring the maximum willingness to pay

The method of measuring the maximum willingness to pay was taken from the study of Shupp and Williams. This had three reasons:

1. The method gives information about different kinds of lotteries
2. The results can be compared to the old study
3. It was developed out of highly accepted procedures

The method focuses on the WTP instead of the WTS. Prospect theory suggests, that due to a selling price method, subjects might value a lottery higher, when they already "own" it. This means, that a price of selling such a lottery will always be to high, due to an endowment effect (Kahnemann, Tversky, 1979). This was also determined by a study, which compared a method involving WTP and one involving WTS (Kachelmeier, Shehata, 1992). As a result of these studies, WTP is usually preferred over WTS.

For the chosen method, the subjects start with an endowment *e*, which they can use to buy their right to participate in a lottery. They are free to choose how much they are willing to spend. The minimum is 0 and the maximum is *e*.

This amount of money is the same size as the pay-out of lottery, they participate in. The amount to be won can either 0 or the full amount of *a*. This can be written as L*(p, a, 0),* where a=*e.* An example would be, that the subjects start with *e* = €20. This would mean that they, for example, could spend up to €20 on taking part in a lottery over €20 with a chance of 30% to win the amount, L(0.3, €20, 0).

The key component of this method however is, that the money, the participant is willing to pay doesn't guarantee that he will actually take part in the lottery. It only raises his chances to do so. This is, why the amount he/she is willing to pay is called bid. On the other side, there will be a randomly generated monetary amount, the so-called lottery price (not to be confused with the pay-out of the lottery). This price can lie between 0 and *a (=e)*. As one might think, the participants are only allowed to spend their endowment money. When the randomly generated price is higher than the bid of the subjects, they will not participate in the lottery over *a.* When it's the same amount or higher they will. In the first case, they keep their endowment, in the second, they subtract the chosen price from their starter money. This system forces them to revile their true maximum WTP, because the more money a person is willing to bid on a certain lottery the higher are the chances to participate. On the other side, he/she also has to pay more to do so, which raises the chances of reducing the final earnings.

To ease the comparison, the example from before will be used to explain the process. We have the following lottery L(0.3, €20, 0). The subject now has the possibility to state a bid. The expected value μ of the lottery would be 0.3*€20+0= 6€. This means, a risk neutral person would bet €6, a risk-seeking person would bet more and a risk-averse person less than the €6. The subject has the possibility to choose an amount between 0€ and 19,99€. This is the maximum amount a person is able to bet.

Let's say the person is a little bit risk-averse and decides to go with €5. This is his/her bid. After deciding, a random price will be chosen. In case that the chosen price is higher than the €5, for example €12, this would mean that the person cannot participate in the lottery over €20. Just like in real life: When the price is higher than your maximum WTP for a product, you will not buy it. The subject eventually will go home with the €20 endowment. The chances for this to happen are 75%. On the other side, there is also a 25% chance, that the random price is equal or less than €5. The price might be only €3. This would mean, that the subject would subtract €3 from the endowment of €20. He/she then participates in the 30% lottery, where he/she could win additional €20. In the case of the lottery paying, this would make the sum of money a total amount of €20-€3+€20=€37. When the lottery wouldn't pay, the participant receives €17. The expected pay-off however is €20-€3+(€20*0,3+0*0,7)=€23. The first digit is *e*, the second is the bid and the third is the pay-out, which results in the final earnings.

With this method, the participant is always best of when he/she reviles the true WTP.

4.3.3 The certainty-equivalent ratio as a benchmark

After the process of the method is described, a benchmark for the evaluation is needed. For this, the certainty-equivalent ratio (CER) is defined as the maximum amount; a subject is willing to pay for a given lottery divided by the expected value of the same. A CER equal to 1 will mark the decision-maker as risk neutral. A value higher than 1 means, that the person is risk-seeking, while a value below unity labels him as risk-averse (Shupp, Williams, 2008, p. 263).
Even though it is assumed, that the CER represents the persons risk preference, it might be influenced by some unwanted factors. Other motivations than the pay-off might play a role here. It is possible that a decision error, due to poor understanding of the experiment might lead to a different answer. A noteworthy influence on the outcome is also the possible participation in the lottery. The only variable influencing the decision should be the monetary amount that could be won. On the other side, a subject might get excitement out of the thrill of participating in the lottery itself. This nonmonetary utility might influence the person to bet higher than he/she originally would have intended to. However this factor can be ignored, as real life situations generate a certain excitement as well. These possible errors have to be taken into consideration when applying this method.

4.4 Design of the Experiment

Up to this point, two things of the experiment have been explained. First are the different compositions of PAT and SCT that lead to choice shift (chapter 4.2). Afterwards, a method was explained how this choice shift can be measured (chapter 4.3). In the following the core concept is elucidated of how this will result in accepting or negating the hypothesis.
Further more, the specifications and procedure will be listed in detail. This is done parallel to the practical implementation.

4.4.1 The core concept for researching the hypothesis

As already mentioned, the main reason for this thesis is to find out if the PAT indeed has a bigger influence on choice shift than SCT. To do so, certain components were added to an excellent experiment of Shupp and Williams published in 2008. With these alternations however, the core process stays the same and can be compared to the old study, which will be done in chapter 4.6. This means not only, that new insights can be won, but also that older ones can be reinforced or weakened.

The core process of this study was, as one might guess, comparing risk behaviour of individuals to those individuals in groups. For this, the method to determine the maximum WTP of chapter 4.3 was used over different lotteries. People had to fill out forms as individuals and later were put into groups of three, where through discussion a choice shift was generated. The participants of course didn't know about the group phase to come after the single one. Originally, those results were then compared. The difference to the experiment of Shupp & Williams was the addition of a third round, to the individual and group phase, called decision phase.

Here the subjects had to choose between the form they filled out alone and a form that they filled out in the group discussion. This third, additional round is the key element of testing my hypothesis.

I will refer to the findings I've made in chapter 4.2. As the influence of SCT and PAT can be separated, one of them has to be smaller, bigger or be equal, compared to the other. In the single phase, the person enters his/her initial preferences into the questionnaire. After that, the group phase begins. In this part the person is influenced by the other teammates and vice versa. On the one side the subject might get additional information and arguments that change his/her opinions about the risk he/she was originally willing to take (PAT). In this case the participant would become more risk-averse or risk-seeking than before. The same result might also appear, because one of the subjects in the group seems to be more risk-seeking or averse than the other persons. Due to SCT the other subjects might feel like imitating his behaviour and move away from their original preferences more to the groups extremist's opinion. These two processes however might end up in the same result, when regarded individually. The reasons however couldn't be more different. On the one side, there is a process that generates additional knowledge for the subject (PAT) and on the other side the person is influenced by other person's behaviour he wants to imitate (SCT). In case of persuasive arguments, the person's opinion stays the same, when separated from the group again. In the other situation, the person switches back to the old pretences, because now there is no more reason to adapt to the group, or the opinion of another person.

This means, even though the outcome might be the same, the reason for it can be shown, when the subject has to make an anonymous choice after being separated from the group again. This was done in the so-called decision phase of the experiment. Here, each participant had to make a last choice. They had to choose between the questionnaire he filled out alone and the one of the group. The choices that were made can be split up into the two characteristics of the hypothesis.

1. <u>Persuasive Arguments have a higher impact on the final opinion than Social Comparison does.</u>

In this scenario, the subject will always choose the group sheet. This is done because a person that is only influenced by PAT, will accept the groups opinion as his/her own. In this case the original opinion is abandoned. The group sheet is preferred as long as the utility from the arguments is higher than the disutility of going conform with the group in a way the person doesn't want to. This also stays true, when both forces influence the group decision. When a person is influenced by both forces, his/her true and final opinion might be somewhere in between the single and the group answers. The participant then will choose the answers where he/she has to face the lower loss of utility compared to his final true one. When the arguments were more influential than the social pressure, the subject will choose the group questionnaire every time. This was already shown in chapter 4.1 with the combinations of both theories for the cases 1, 3 and 6.

2. <u>Social Comparison theory has a higher impact on the final opinion than Persuasive Arguments</u>

This is the opposite scenario of point 1. Here, the subject will always prefer the individual to the group sheet. The original opinion was influenced less by arguments and more by the pressure of going conform. This leads to the person preferring his own opinion to the one of the group. This is displayed in the cases 2, 4 and 5 in chapter 4.1.

The only flaw of this procedure is, that the highly unlikely case of both forces having equal influence cannot be covered. For the hypothesis however this is not of importance, because it only tries to find out if the influence of PAT is higher than the one of SCT, not equal. This is the idea behind the experiment.

4.4.2 Specification of the experiment

Before introducing the detailed process of the experiment's implementation, details about its specification will be listed below. This is why in the following chapter; the focus will lie on the variables and the dealing with problems that might occur in the process. Minor details like the choice of the room will not discussed.

4.4.2.1 Specification of the sample and the sample size

For a big part of the analysis, the independent variable is the individuals' attitude towards risk over different lotteries, the CER. For this, the behaviour of N=78 students of the University of Vienna was observed. To avoid misinterpretation and communication difficulties among the students, one requirement to participate was to speak German. The chosen students either had to study a form of business, economics or a mathematically oriented program. This made sure, that the attendees had higher than average mathematical and logical understanding. These measures were taken, because compared to the mentioned models like the CDQ, where subjects have fewer options to choose from and don't have to think about bids and lotteries (see chapter 3.1), the method of this experiment is quite complex. The trade-off here is usually a higher level of noise. A low degree suggests a better predictability in terms of the utility theory, whereas a large noise parameter is considered as a high degree of randomness in participants' decision. Still, the advantages of more complex tests are obvious. A higher complexity usually goes hand in hand with a superior predictive accuracy, when understood well by the participants. On the other side, people with low skilled mathematical abilities tend to have a harder time figuring out the intended approach to the experiment. This can become a problem, because when subjects fail to understand a task in the field, they tend to resort to alternate between options (Dave et al, 2010). In a study of Holt and Laury for example, participants started to „try out" their different possibilities, when they didn't recognize their task (Shupp & Williams, 2008, p. 207.). This was a measurement taken to reduce these difficulties. Similar approaches with university students can be found in research in almost every topic on choice shift (e.g. Kachelmeier & Shehata, 1992; Holt & Laury, 2002; Kahneman & Tversky 1979). As this also goes for the study by Shupp and Williams, the choice of students as participants makes it even more comparable.

4.4.2.2 Specification of the incentive

The dependent variable is the generated CER. The incentive has two purposes. It stimulates the students to participate on the one side and is used to measure their utility on the other. For the experiment, a monetary endowment of €10 and possible wagers of €10 were found to be fitting here. In the following it is explained, why money was used at all and how the amount was achieved.

4.4.2.3 Money as an Incentive

Especially in experiments like lotteries, researchers rely on money. Same goes for the one conducted in this thesis. Everybody who once participated in a round of poker knows the reason. People act differently when it comes to risk, if money is involved. This can be observed in various findings of the last year. Even though it wasn't aimed as their main finding, an experiment of Holt and Laury (2002) shows just this. They also had a setup with a lottery, but at one point, the money participants could win was just hypothetical. As expected, the risk aversion was significantly lower, when it came to this hypothetical pay-off instead of a real one (Laury, Holt, 2002, p. 1647ff.).

4.4.2.4 The monetary amount

The behaviour towards risk is proven to depend also on the offered amount. It is questionable, if lotteries over small monetary payments reveal the true preferences of a person. An experiment held by Harrison (1986) measured risk preferences with a pay-off of only $1.00. This was even questioned by Harrison himself four years later, by pointing out that the value of inference, due to the size of the amount, might not be very high (Harrison, 1990). Experiments focusing on the link between risk aversion and different lottery prices have proven, that participants tend to make riskier decisions when the overall pay-out is lower compared to later stages, where the possible lottery payments are higher. Due to the high costs of those experiments, they are not conducted very often, but have a high impact on the topic. An experiment, which was performed in the People's Republic of China in 1992 proved just that. Because of the high difference between the dollar and the Yuan, the research group was able to pay big amounts of money to the participants. In a two-hour experiment they were able to earn around three times their normal monthly wages. The participants were way more risk-averse when it came to higher monetary amounts (Kachelmeier, Shedarta, 1992). This was also the result of the study performed by Holt and Laury, who experimented with different monetary incentives, mentioned earlier (chapter 4.4.2.1).

The amount of money, which was available for the experiment was limited. The main goal was to go with a sum that didn't generate the results of a hypothetical lottery. Another one was to make it comparable to other studies. Shupp and Williams go with lotteries where the highest pay-out was $40. As the amount of money that will be paid, matters for the reason of comparison, a fitting sum had to be found. Due to inflation, in December 2015, $40 from 2008 were worth $36,22. This translates to around €28 at the point in time where the experiment was conducted[10]. Even though compromises because of monetary reasons should be the last justification for a change in an experiment, here it doesn't endanger the experiment or the comparability. The monetary difference can be ignored, as the experiment of Kachelmeier and Shedarta (1969) stats. This is why €10 were chosen as the lottery price.

4.4.2.5 The Lotteries

There will be a total of nine lotteries, beginning with a winning probability of 10%. The next one will have a chance of 20% and so on. This goes on until the 90% level is reached. The participants have to state their WTP with the mentioned method for all of the nine lotteries – in the single and in the group round. Only one lottery will be played in the end.

4.4.2.6 The Questionnaires

The design of the questionnaires was taken from the Shupp and Williams study as well. All of them can be found in the appendix. As the experiment was run in German, the forms were held in the same language. Even though there were a total of five forms that were filled out by the students, only the following four will be discussed, as

[10] For this calculation http://www.oanda.com/lang/de/currency/historical-rates/ was used.

the last one only served as a confirmation of the money being paid out to the students.

1. Single form

The single form consisted of a short summary of the task as well as the 9 lotteries. On top of the paper, the number, assigned to the students could be filled in.

2. Group form

The group form differed from the single form in the following. The individual- was complemented by the group-number. As the basic process stayed the same, only the additional guidelines for the group round were added.[11]

3. Decision form

This form was used to capture the choice of the participant on paper. In addition to that the participants had to fill in their Name, age and studies. It also served as an orientation sheet for the subjects; on which lottery was chosen and how much money they had won.

4. The Instructions

It might seem not that important, but the instructions given to the participants play a major role when it comes to experiments. Even though the atmosphere was held friendly but professional, measurements had to be taken to reduce the experimenter's influence on the subjects to a minimum. Otherwise a bias might have occur. Of course, a regular paper with the instructions was created as well. For this, the manual of Shupp and Williams for the single phase was translated into German and the changes, like the different amounts of money, were applied.[12] This process increases the comparability of the experiment.

[11] These additional guidelines will be explicitly explained in chapter 5.4

[12] Another small difference of the experiment was how the lotteries were chosen and how the pay-out was determined. Shupp and Williams used a token-based system to so. Numbers were drawn out of a box in order to determine the lottery that was played or

4.4.2.7 The explanatory video

As mentioned before, the procedure of the experiment can be challenging for the subjects. This is why, In addition to the instructions, a video was generated to reduce the possibility of a bias even further on the one side and improve the process of understanding the procedure on the other. A lot of noise can be reduced, when the topic and the task is explained and understood properly. The goal for such a video is to maximize the effect that the participants expend on elaborating the content, while the effort of understanding the shown material is minimized (Cennamo, 1993, p. 41.). In a typical experiment, the researcher usually gives an introduction about the topic first and then hands out explanations in the form of a script. As the explanations usually tend to be 2-4 pages long, attention might decrease over time resulting in participants not understanding the topic at all or at least parts of it. After reading the manual, the subjects usually can ask questions, in case they didn't understand parts of the experiment. This may lead to a not intended influence by the examiner, which can generate a bias in the overall result. To oppose these problems, an instructional video was created to be shown before the explanation sheets were read. Apart from helping to understand the process, three additional benefits were hoped to be achieved:

1. Reduction of the loss of attention
2. Support of audio-visual learners in the process of understanding the experiment
3. Reduction of a possible bias of the examiner

Even though it is not the main part of my experiment, a lot of thought and work went into the production. The video, which can be found on the attached CD, orientates itself closely on the findings in the area of educational videos. It uses simple syntax (Reeves & Thorson, 1986), a high correspondence between video and audio (Grimes, 1990) and related cuts dividing the video into seven main parts, giving it a easy to understand structure (Lang et al., 1993). Its different segments are explained below.

1. Introduction

The participants are thanked for their participation and told about the lottery. The maximal pay-out of €20 was also mentioned, to motivate the students to give their best.

2. Questionnaire

After the introduction, the video shows a picture of the questionnaire and explains each of the nine lotteries.

3. Process

This was the most demanding part of the video. The process of entering the WTP, as well as the random generation of the purchase price was shown here. The participants were also told about how the final pay-out would be generated.

4. Examples

To clarify the process, the video also featured an example. A car with a randomly generated purchase price was chosen for this. The reason for this was, that a direct example might generate an unintended bias among the participants. As a second example, a possible pay-out was elucidated.

5. Summary

Finally the whole process was recalled with a short summary before finishing with the prompt to read the instruction sheet.

To make sure that people would actually profit from the video, it was shown at the „Master-Konveratorium“, an event, where the first results of this thesis were presented. It was held by Univ. Prof. Dr. Vetschera, and his colleagues Univ.-Prof. Dr.-Fabel and Ao. Univ.-Prof. Dr. Windsperger. The attendees were students, who had their thesis supervised by one of them. Afterwards a questionnaire was handed out, to provide feedback on the video. The students were not allowed to talk during the video or the process of filling out the form. The group was a bit more homogenous compared to the future actual participants, as it consisted only of master students of the business administration sector.

The questionnaire can be found in the appendix and includes 8 statements, which were measured with a Likert-Scale. Every item, except No. 8, was positively formulated. The possible answers were: „Stimme stark zu“ (strongly agree), „stimme zu“ (agree), „weder noch” (neither nor), „lehne ab“ (reject), „lehne stark ab“ (strongly reject) and „Keine Antwort“ (no answer). Without going too much into detail, the acceptance of the video was very positive. A high amount of 90% thinks, that an explanation video adds value to understand an experiment in general. A total of 97,5% agreed or strongly agreed, that the presentation of the video was good. 85% gave positive feedback concerning the comprehension of the lottery. 75% stated that they needed no more help and could start filling out the questionnaire right away. As nobody was confused by it, the video had no negative impact on any of the participants. This means, that it would only provide a positive impact on. This is why the video wasn’t changed after the test screening and was shown during every session of the experiment.

5 The implementation of the experiment

To avoid complications and ensure a high validity as well as a high reliability, not only the specifications have to be though through well. The whole evaluation process of the experiment can be separated into six different steps; from the participants entering the room to leaving it again. To avoid repetitions, the theoretical part of each phase will always be followed by the actual execution.

5.1 Pre-Phase

Theory

The first phase of the experiment made sure, that all of the following requirements of the subjects taking part were fulfilled:

1. Understanding and speaking German
2. Being enrolled at the University of Vienna
3. Studying either Business, Mathematics or a related major

As the experiment required it, the minimum amount of participants for each session had to be three. In case of the amount being not dividable by this number, additional participants were searched. If there weren't any possible subjects available, the experiment was executed with the attending subjects. In case the number was below three, the session was not performed. This process, of course, was kept secret from participants, as it would destroy the sample.

Praxis

This part turned out to be more challenging than expected. Verifying the subjects' characteristics didn't demand much. Only once, two students had to be sent home,

because they were unable to communicate in German. This could have been prevented, by mentioning this requirement in the Facebook post, with which the students were recruited. An experimental session had to be cancelled once, because only one student had arrived and nobody could be found to participate. Apart from these points, there were no major incidences in the pre-phase.
However, the process was difficult, because it didn't just had to hide facts about the experiment, but the students had actively be lied to. This was due to the fact that they couldn't know about the three person groups. The made up excuse for this was that I had a meeting with the professor afterwards to show him early results. For this I needed a total amount of X subjects, where X was the next number, which could be divided by three. With this lie, nobody became suspicious.

5.2 Introduction Phase

Theory

In this phase, the participants were welcomed and told about the processes up to come. It consisted of telling them that they will be shown a video first, then will read the instructions, filling out a questionnaire and play the lottery. After this happened, the students were handed the single-sheet and the instructions. They were not allowed to read the instructions before, but could take a look at the single-sheet while the video was showing. 10 minutes were given to read the instructions afterwards, before questions were answered.

Praxis

The first part of this phase was conducted fast and there were no difficulties. Depending on the room, the video was either shown on a laptop or a projector screen. Except for two sessions (2 and 15), the time for reading the instructions was always enough. Questions were asked only very few times. The most frequent one was, if the €10 had to be divided between each of the 9 lotteries or if the €10 were available for each of them. It was explained, that the latter was true. From my subjective point of view, the experiment was well understood.

5.3 Individual round

Theory

After all the ambiguities were out of the way, the individual round started. Here, each of the students still believed, that this would be the only time he/she had to make decisions. The participants were spread across the room, as good as possible so that they weren't able to copy from each other. They had 8 minutes to fill out the questionnaires that they received in the introduction phase. To signal that the subjects were done with their tests, they had to fold the paper once and put it in front of them. This also prevented them from copying from the other participants.

Praxis

The possibility to spread out the participants depended on the room the experiment was held in. Except for a setting with more than 6 people in the conference room of the university, this didn't state much of a problem. A situation like this only appeared once in session 16. With supervision however, it could be controlled as well. The questionnaires were always filled out within this time precept. There were no questions asked during this procedure and nobody took a second look at the instructions, which strengthens the assumption that everybody understood the experiment well. Copying from other participants or the attempt to do so wasn't observed either.

5.4 Group Round:

Theory

The third round started by telling the participants, that the individual round was only a test to get them ready for the group phase and would not be counted. They were told that the group round was the real experiment and the "trick" of withholding the information of a second phase was done to ensure that they would give their best. This tactic had two reasons. First, the real intention of the experiment was disguised and second, it ensured that the students were giving their best in the second round as well.
After this announcement, the participants were divided into groups and the sheets were handed out. The additional instructions, which are located on the group sheet, were read out loud. After this, questions could be asked once again. The students were allowed to look at their individual sheets, but forbidden to show them to each other. This was done due to the complexity of the experiment. The process made sure, that the participants knew their exact opinion they had in the single phase. It prevented them from guessing their original opinion, when it came to the discussion. This wouldn't be needed in a simpler experimental set up, meaning that the change in opinions couldn't happen due to participants forgetting their original one and guessing what they filled out before. They weren't allowed to show the sheets to each other because this might generate an interference with Social Comparison. Again, 8 minutes were given as a time limit for discussing and filling out the sheets. After the process was finished, the group questionnaire was also folded and put in front of each participant. After everybody had done this, the group round ended.

Praxis

Usually revealing that there would be a second round went without negative feedback. Even though it only happened four times, if one of the subjects asked, why he/she mustn't show his questionnaire to his/her other participants he/she was told the following: “The questionnaire you just filled out was quite complex and you might not remember what you filled out before. By giving you the chance of looking at the previous paper you and your group have the chance to compare your results. You mustn’t show you each other’s papers, because maybe somebody feels uncomfortable doing so. This is why you have to keep your previous questionnaires to yourself.” By doing so, the real reason could be obfuscated without jeopardizing the procedure. As anticipated, the group members were always having busy discussions. A violation of the rules, for example openly showing the sheets from the single round, wasn’t monitored. The process was always finished within the 8 minutes time limit. It is noteworthy, that each group came to accordance. The reason why this is of importance lies in the evaluation. In case, that there were differences between the group sheets within a group, this could have had three different reasons, which would have had to be evaluated. Misunderstanding of the group phase would be the first, different opinions would be the second and involuntary mistakes would be the third. This reduces the complexity of the evaluation as well as showing a high validity of the test.

5.5 Decision Phase

Theory

This is literally the deciding phase of my study, as an insight is won here, which hasn’t been covered yet. Now that the participants had two folded sheets of paper lying in front of them, they were informed about the last phase before the lottery. The students were given another 5 minutes to decide which questionnaire they would play. A very important part of this phase was the preservation of an anonymous decision. In case the other group members found out, what each member chose, the final opinion would not only be influenced by a comparison with other players of the same group but would also make them vulnerable to a comparison with the other groups. This would generate an unintended influence of self-categorisation. Both papers were folded. The decision was made by dropping the sheet, which the students did not want to play, into a bag. By doing so, an anonymous decision could be guaranteed for everyone.

Praxis

When the students were told, that there was an additional twist to the experiment, this wasn't received well, as the participants feared more work and time effort. After it was explained, that the students could choose between the two sheets, this advantage was positively received. Most of them decided very quickly within the first minute. Nobody needed the whole 5 minutes. The participants kept the sheet they preferred and gave the other one into the bag. In session 4, a noteworthy incident happened. The students thought they had to keep the sheets they didn't want to play and throw the ones they wanted to play into the bag. Luckily this problem was discovered before the lottery was played. The sheets were exchanged and the process could continue.

5.6 Lottery phase:

Theory

The outcome of this phase was not important for the actual result of the experiment. Due to completion reasons, it will be explained as well. With the decision phase ending, the students were now allowed to talk freely again and the evaluation sheets were handed out.

The students had to draw marked poker chips out of a pouch a total of 5 times. The first time, the pouch was filled with 9 tokens marked from 1 to 9. A student would blindly draw one token out of it. 1 resembled the first lottery (10%), 2 the second one (20%) and so on. This was how the lottery was chosen. The price was generated via three individual token pulls. The poker chips were label 0 to 9 this time. The first draw

would determine the first digit of the final price, the second one the middle and the third one the last digit. By drawing out the numbers 5, 5 and 6, this would mean a final price of €5,56. After this was done, it had to be figured out, if the lottery actually paid. This was done by filling the pouch with a total amount of 10 green and red tokens. The number of green tokens represented the chance of winning, the red ones of loosing. So, for example, 4 green and 6 red ones represented the 40% lottery.
Each of these steps was filled into the evaluation sheet, along with additional information like the choice, the participants had made. It also provided information, if and how much they had won.

Praxis

Being able to talk freely again, this usually resulted in conversations about who chose what sheet. The process of choosing a lottery, generating a price and playing it went flawlessly. As the lottery outcome itself is not important to the result of the study, the participants were asked if they wanted to play individual lotteries or only one. The answer was always in favour of one single group lottery. This was mainly due to saving time.
As I was adverted by the participants, the sheet contained a mistake and turned out to be a bit confusing for them as well. In the first version of the evaluation sheet, sentence stated, that they would take part in the lottery if the bid were lower than randomly generated price. The opposite is true, of course. Second, the participants who didn't take part in the lottery due to too low bids filled out some parts of the evaluation sheet, they weren't supposed to. Even though, these were mistakes that could have been avoided, the procedure of the experiment itself wasn't endangered at any time, because all the decisions were already made and the evaluation sheet was only there to help.

5.7 Pay-out Phase:

Theory

The experiment ended with the pay-out phase. Here the participants were paid and handed in all of their sheets afterwards. To finish the experiment, everybody had to sign a form that confirmed them received the payment. With dismissing the students, the session was done.

Praxis

In this phase, no incidents happened. Everybody received the money and the participants left the room.

5.8 Summary of the conduction of the experiment

Even though, the evaluation of the data is yet to come I want to give a short summary over the procedure of the experiment itself and critically reflect it. In my opinion, the experiment was a success. The video was well received; the students understood the process and no major incidents occurred. In addition to the just mentioned points, none of them became suspicious of there being a second round or the true purpose of the experiment. Despite the success, there are some minor points that I would change the next time. I would expand the distribution channels of the experiment to reach a broader base of participants. In addition to that I would specify the conditions of participation even more. The case of the two foreign students could have been prevented that way. The same goes for the mistakes in the evaluation sheet. Apart from that, I was very satisfied with how the conduction of the experiment went.

6 Results of the experiment

The analysis will be split into two major parts. First the results are presented and interpreted. This part will also answer the question, if PAT indeed has a stronger influence on choice shift than SCT. After this is done, there will be a comparison between the results of this thesis and, as far as possible, the paper of Shupp and Williams. This is why the listing of the individual results will orientate itself on the ones of the original study.
For the whole evaluation process, the programs SPSS and Excel were used. In the beginning, I will give some statistics about the participants and then go into detail with the evaluation of the risk attitude of the participants. Then I will give an answer to my hypothesis and compare my results to the ones of Shupp and William's study.

6.1 Statistical Results:

The experiment ended up with a total of 80 participants, of which 78 can be counted as valid. This gives a total of N=78. It is important to note, that for the following calculation the two invalid subjects were completely ignored for all further calculations. In the SPSS files, the 2 invalid candidates are not mentioned at all and in the Excel sheet they can only be found in the sheet "all data". The calculations however are all based on "valid data" sheet. This means, a total of 26 groups were formed. The average age of the subjects was 23,47 with a median of 23, which can be expected in a university. The distribution was in favour of the female participants (see figure 4). This also goes for the subjects' field of studies where the largest part was business students (see figure 5). A more detailed analysis of this data can be found in the appendix.

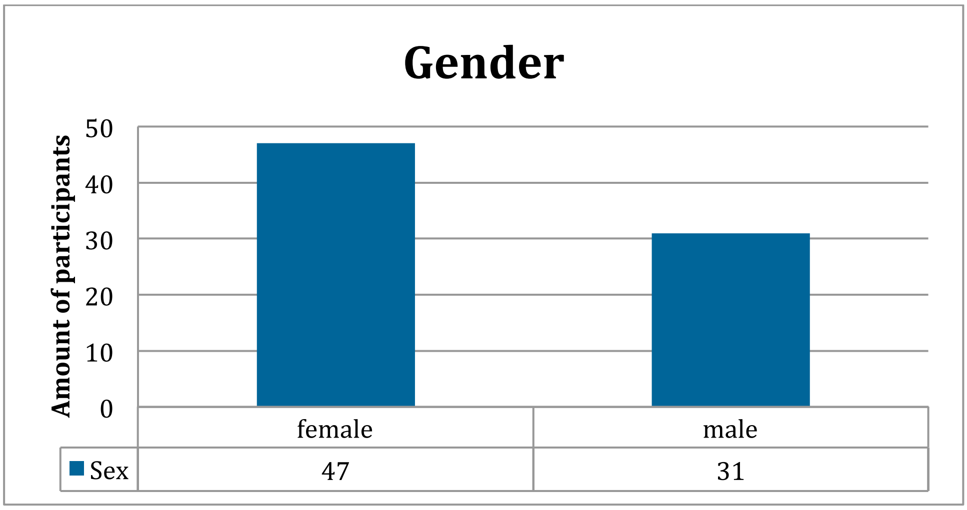


Fig. 5 Gender distribution of the participants

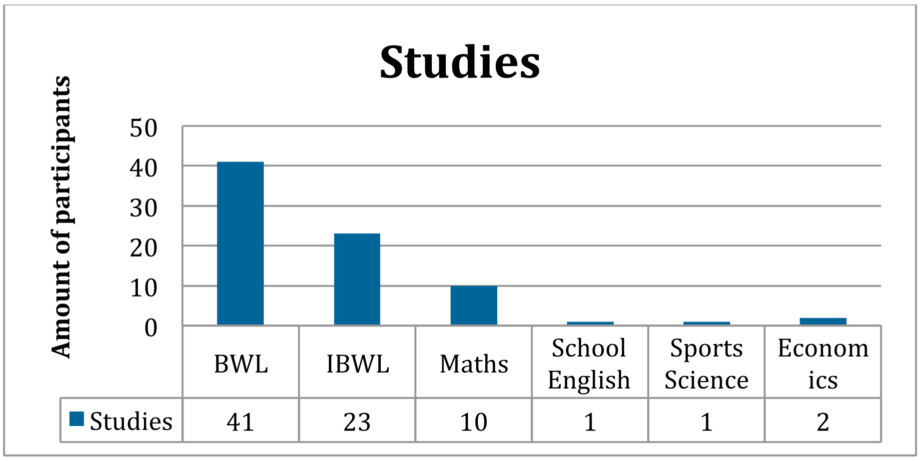


Fig. 6 Studies of the participants

In total, a number of 19 sessions were played, which led to an average number of 4,1 participants. The average prize, which had to be paid for a lottery, was €5,52. The total money paid was €935,09 or an average of €11,99 per participant. The distribution of people, who participated and actually won the lottery, can be seen in the table below.

	Did the Lottery pay in general?		
Participation in the Lottery?	**no**	**yes**	**Total**
no	27	18	45
yes	6	27	33
Total	33	45	78

Table 1: Participation and lottery pay-out

Now, that a summary of the experiment's outcome has been given, the following chapter will look deeper into the data. It will focus on the different behaviour of individuals and groups, when it comes to risk.

6.2 Comparison of the means

The hypothesis is centred on the behaviour towards risk. Taking a look at the average and the median CER of individuals and groups, the following observations can be made:

6.2.1 Mean:

Taking a first look, it can be said that individuals and groups develop similarly over the different lotteries. The only time that an average risk-seeking behaviour could be monitored was at the 10% lottery for individuals. In the area of the 10% to 30% lotteries, the mean CER was going down for individuals and groups alike. At the 40% lottery, the means went up again, for both, individuals and groups. At 60% their level stayed almost the same. However it can be noted that the CER for the individuals is always higher, expect for the 80% and 90% lotteries.

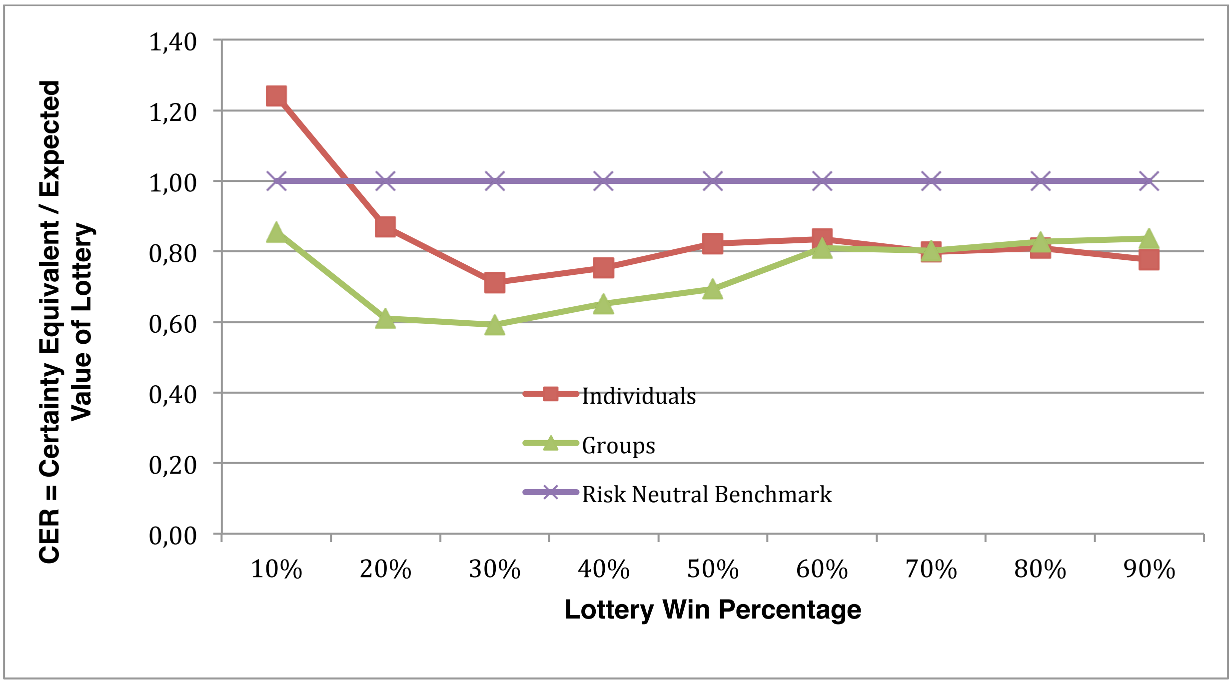


Fig. 7: Mean Certainty Equilibrium Ratio (CER) comparison

6.2.2 Median

Taking a look at the median, the development is similar to the mean. The graphics show that the group is only more risk-averse at 90%. The reason for this difference between the median and the mean in the lower percentage regions lies in the high influence of outliers where people in a view cases started with €8.00 or €9.00. This is made clear, by the figures 8 and 9, which display them via a boxplot.

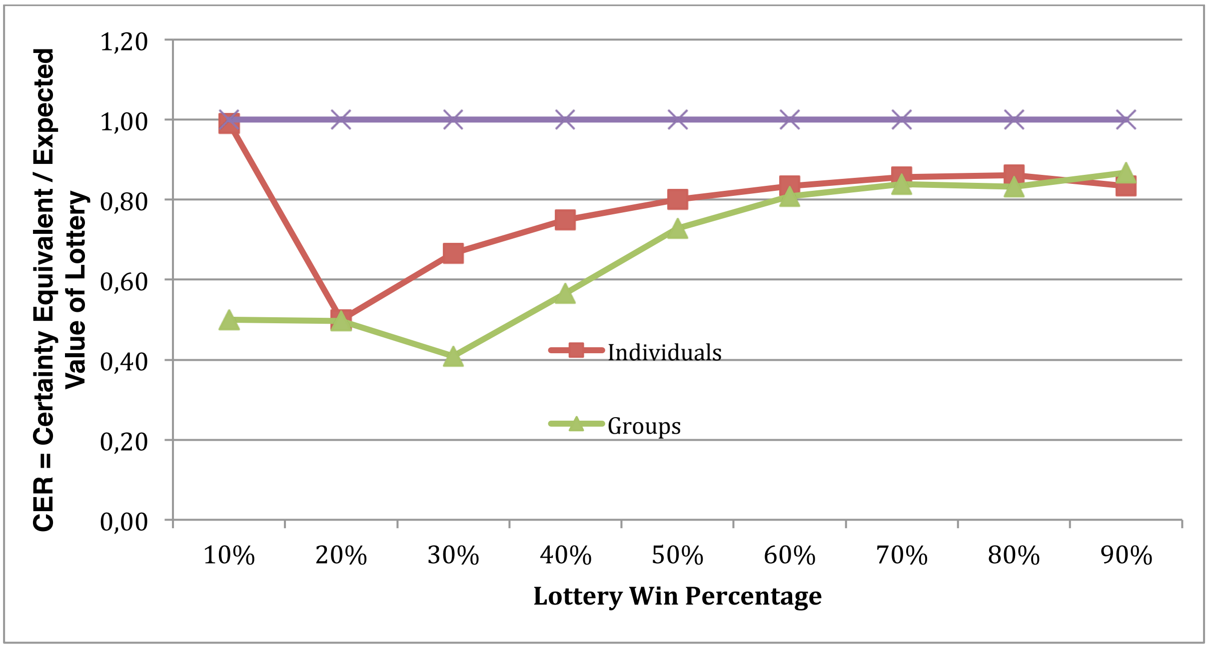


Fig. 8: Median Certainty Equivalent Ratio (CER) Comparison

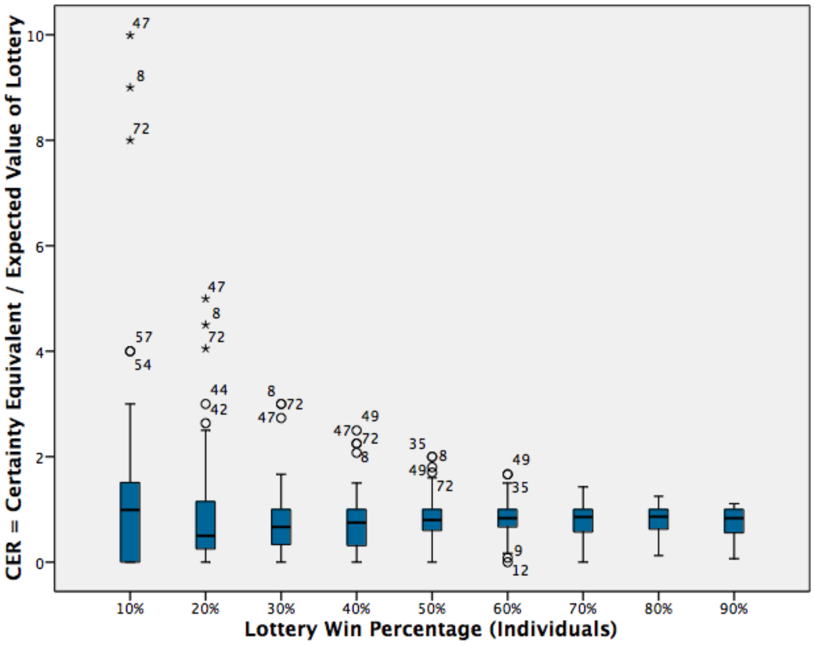


Fig. 9: Boxpolt showing the outliers for the individuals

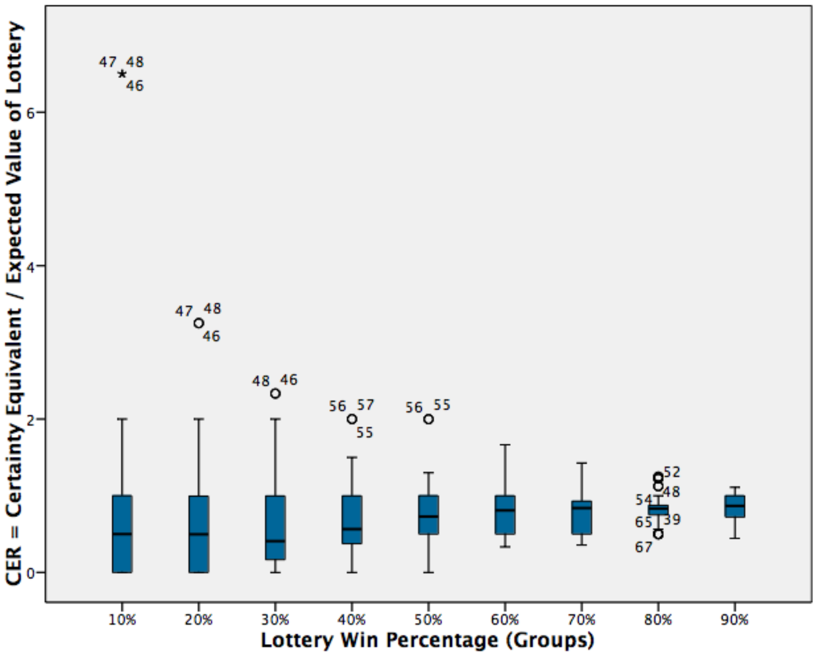


Fig. 10: Boxplot showing the outliers for the group

6.2.3 <u>Standard Deviation</u>

The CER dispersion is almost always smaller for groups than for individuals. However there is an exception at the 50% mark, where this is not the case. Another observation that can be made here is the size of standard deviation. It shrinks with higher percentages. This observation could already be monitored within the boxplots. The graphic below however displays it better. The development is not surprising. At the lower win percentages, the range for the rational decider is bigger. He/she will slowly move towards higher monetary values. The higher the percentage value, the less decision options are available, because every option below the previous value is (usually) ignored.

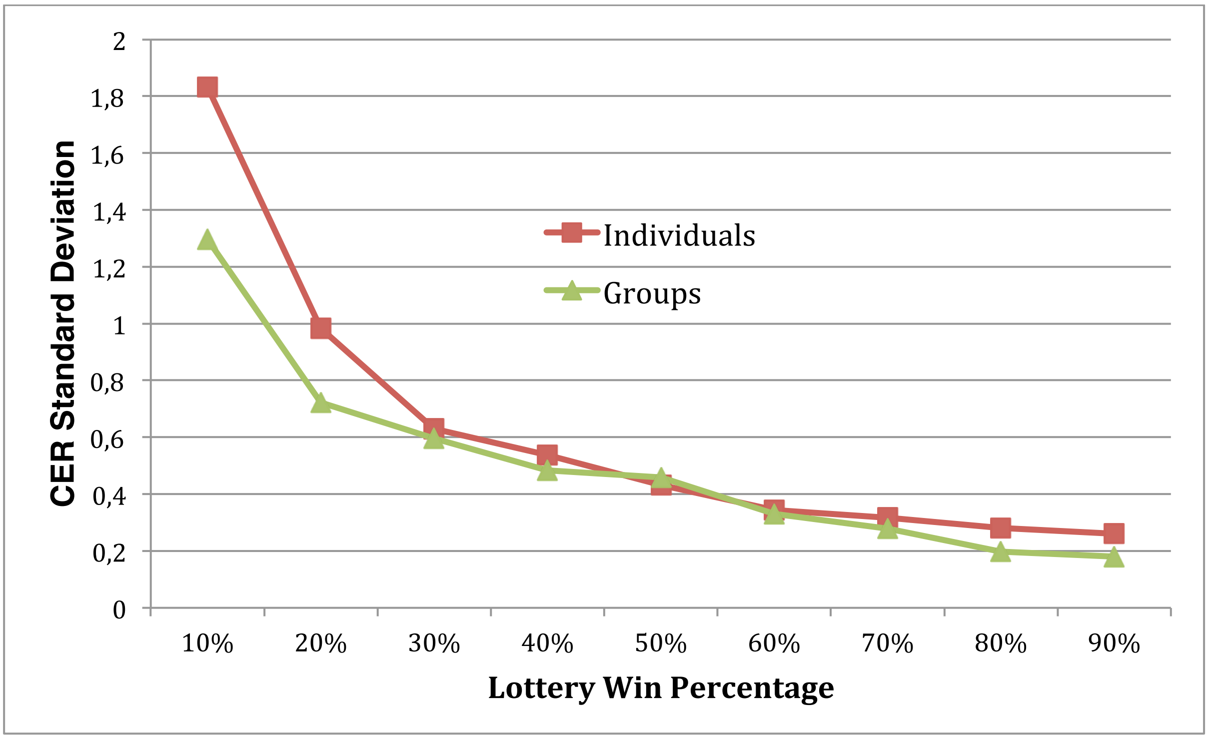


Fig. 11: The Standard Deviation for the Certainty Equivalent Ratio (CER)

6.3 Regression Analysis

To find out, if and when individuals actually underlie choice shift when it comes to making decisions that involve risk, a regression model is needed. For the analysis a total of 1404 observations could be made (2x9x78). As the dependent variable, the CERs of the different lotteries were used. The independent variables were the different configurations of the lotteries. This means that a dummy variable was created for each case. They, on the one side, showed which lottery was looked at, and, on the other side, if it was an individual or an individual in a group. LOTi marked the different win percentages, with i representing the win percentage (e.g. LOT20, LOT30…). The dummy variable GRP indicated if it concerned an individual (0) or a group (1). The individual lottery for 10% served as the constant (marked with CONSTANT), this is why LOT10 is not listed in the tables. The theory described in this thesis, as well as Fig. 6 indicates, that the group effect is different across the lotteries. This was solved by including LOTi x GRP as interaction terms.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	1.241	.080		15.550	.000
GRP	-.386	.113	-.271	-3.419	.001
LOT20	-.371	.113	-.164	-3.288	.001
LOT30	-.529	.113	-.233	-4.688	.000
LOT40	-.488	.113	-.215	-4.323	.000
LOT50	-.419	.113	-.185	-3.714	.000
LOT60	-.406	.113	-.179	-3.596	.000
LOT70	-.443	.113	-.195	-3.925	.000
LOT80	-.432	.113	-.191	-3.831	.000
LOT90	-.463	.113	-.204	-4.105	.000
GRPxLOT20	.126	.160	.040	.789	.430
GRPxLOT30	.266	.160	.085	1.667	.096
GRPxLOT40	.284	.160	.091	1.779	.075
GRPxLOT50	.258	.160	.083	1.615	.107
GRPxLOT60	.360	.160	.116	2.257	.024
GRPxLOT70	.391	.160	.126	2.449	.014
GRPxLOT80	.404	.160	.130	2.533	.011
GRPxLOT90	.444	.160	.143	2.782	.005

Table 2: Regression model with CER as the dependent variable

Table 2 displays the regression coefficients (B) as well as the standard errors and the Standardized Coefficients (Beta). The H0 that the coefficient is equal to 0 is rejected in almost every case, except for the interaction terms of the group lotteries between 20% and 50%. With an R^2 of 0,036 the analysis only explains a very small part of the model.

6.4 Distribution of the data

To get further insight into the results, it is important to know, if the data is normally distributed or not. Taking a look at the histograms of the distribution, it can already be anticipated, that it is not the case. Still, a tendency towards normal distribution can be seen in some cases. Due to the lack of space, only two histograms are shown here. For the fist one, the null-hypothesis of the data being not-normally distributed cannot be rejected. In the second example the null-hypothesis is rejected. All histograms are included in the appendix and in the excel files under “Test for Normality”.

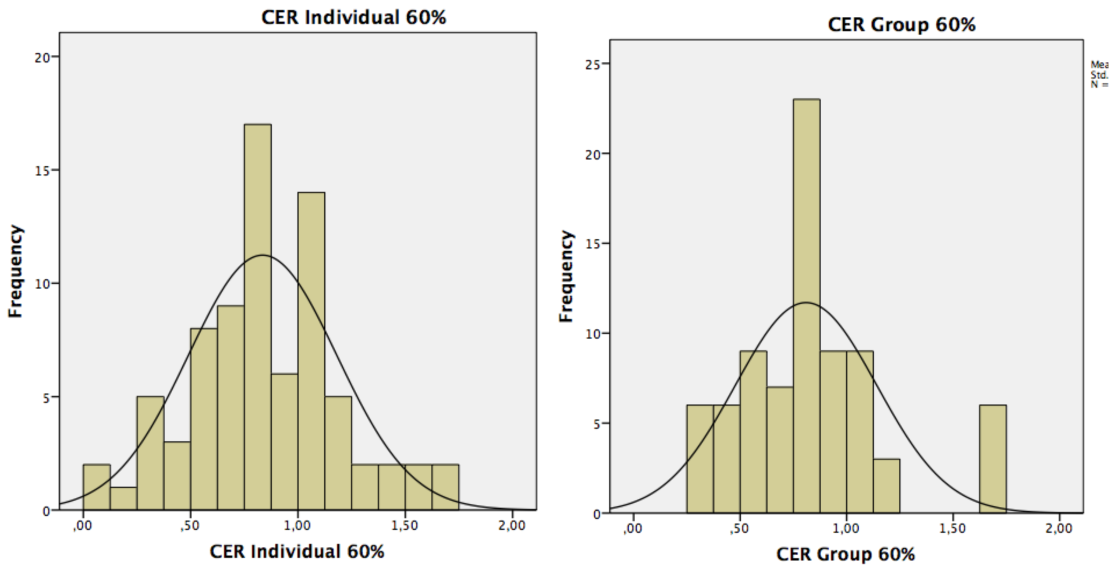


Fig. 12: Histograms of the 60% Individual CER and the 60% Group CER

Most of the histograms however look like the one on the right. On the other side there are exceptions, like the example on the left, that look more like a normal distribution. The significance was tested with a Kolmogorov-Smirnova as well as with a Shapiro-Wilk test for normality. What was already anticipated on a graphical level is proven on a statistical level as well. The table below shows that for most cases the null hypothesis of the distribution to be equal to a normal one can be rejected at most times. This goes for both, individuals and groups. The only exceptions were the CERs of the individual lotteries of 60% (see Fig. 12) and 70%, where the p-value was higher than 0,05.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CER Individual 10%	0,251	78	0	0,635	78	0
CER Individual 20%	0,197	78	0	0,763	78	0
CER Individual 30%	0,158	78	0	0,843	78	0
CER Individual 40%	0,132	78	0,002	0,919	78	0
CER Individual 50%	0,123	78	0,005	0,96	78	0,015
CER Individual 60%	0,099	78	0,057	0,983	78	0,395
CER Individual 70%	0,096	78	0,073	0,977	78	0,175
CER Individual 80%	0,121	78	0,006	0,961	78	0,017
CER Individual 90%	0,112	78	0,017	0,931	78	0
CER Group 10%	0,263	78	0	0,601	78	0
CER Group 20%	0,214	78	0	0,759	78	0
CER Group 30%	0,176	78	0	0,842	78	0
CER Group 40%	0,137	78	0,001	0,923	78	0
CER Group 50%	0,107	78	0,027	0,93	78	0
CER Group 60%	0,168	78	0	0,892	78	0
CER Group 70%	0,154	78	0	0,928	78	0
CER Group 80%	0,174	78	0	0,937	78	0,001
CER Group 90%	0,116	78	0,012	0,947	78	0,003

Table 3: Values for the Kolmogorov-Smirnov and the Shapiro-Wilk test

As almost all results deny the assumption of normally distributed data, a t-test will not be used. The analysis will be done with a Mann-Whitney U-Test that does not rely on normally distributed data. It is a nonparametric test to examine two independent samples. It tests the data via a ranking scheme. For the coding, a dummy was generated that differentiated the individuals from the groups. This format can be found in the Excel file under the point “Mann-Whitney Format” as well as in the SPSS files containing “Mann-Whitney U-Test”.

6.5 Analysis of the means

When it comes to the comparison of the means it makes sense to examine, if an overall tendency of certain behaviour can be monitored. The first question that has to be asked here is, if the observations of risk aversion are significant. All the examined means and medians (except the 10% individual mean) lie below the risk neural CER of 1. So the first test that was run was a Mann-Whitney U-test for the individuals and afterwards for the groups, stating that the there is no difference between the behaviour over the different lotteries and risk neutral behaviour. The results are clearly in favour of the observation. The null hypothesis, that the subjects' behaviours are risk neutral is rejected in every case, with a p-value of zero (except for the 10% individual lottery). The results are summarized in the table below.

Percentage	p-value for the individuals	p-value for the groups
CER 10%	0,004	0
CER 20%	0	0
CER 30%	0	0
CER 40%	0	0
CER 50%	0	0
CER 60%	0	0
CER 70%	0	0
CER 80%	0	0
CER 90%	0	0

Table 4: p-values of the one-sample t-test for individuals and groups

In this case the question to be asked is, if choice shift generates a more risk-seeking or risk-averse mind-set for the participants. Before going into detail with the different lotteries, the average CER of each participant in the individual round was compared to the average CER in the group round. This was done with a Mann-Whitney U-Test as well.

The average individual with a mean of 0,8462 has a higher tendency towards risk neutrality than the group, which is with 0,7418 more risk-averse (by 0,1044). Taking a look at the p-value of 0,095, the results turn out to be significant as $p < 0,10$. This means, the hypothesis, that there is no difference between individual and group CER can be rejected. The average group is more risk-averse than the average individual. The detailed results can be seen in the table below.

	Group or Individual	N	Mean Rank	Sum of Ranks
Average CER	Individual	78	84,54	6594
	Group	78	72,46	5652
	Total	156		

	Average CER
Mann-Whitney U	2571
Wilcoxon W	5652
Z	-1,67
Exact Sig. (2-tailed)	0,095
Exact Sig. (1-tailed)	0,048
Point Probability	0

Table 5: Mann-Whitney U-Test over the average difference in risk behaviour

As now it is proven, that there is an overall difference between groups and individuals, the data can be analysed further. This is why the procedure has been repeated for each of the different lotteries. In the table below, the results are shown and a graphic underlines the development.

	10%	20%	30%	40%	50%	60%	70%	80%	90%
Mann-Whitney U	2592	2503,5	2632,5	2697	2518,5	2730,5	2944,5	3019,5	2757
Asymp. Sig. (2-tailed)	0,105	0,054	0,144	0,22	0,062	0,268	0,729	0,936	0,31
Exact Sig. (2-tailed)	0,105	0,054	0,145	0,221	0,062	0,269	0,73	0,937	0,311
Exact Sig. (1-tailed)	0,053	0,027	0,072	0,11	0,031	0,135	0,365	0,469	0,155
Point Probability	0	0	0	0	0	0	0,001	0,001	0

Table 6: Results of the Mann-Whitney U-Test for the different lotteries

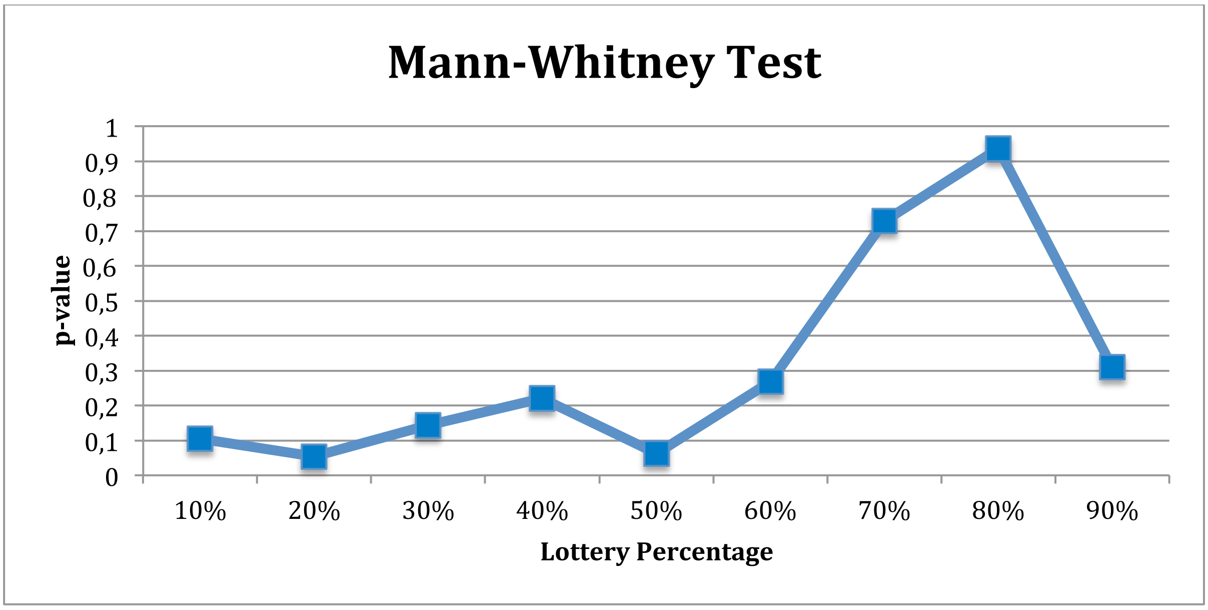


Fig. 13: Graphical depiction of the p-values of the different lottery

The graphic confirms once more, what was already anticipated with the comparison of the different means in Fig. 6. At the beginning, the p-values are comparatively low, however only in the case of the 20% and 50% lottery a significant difference between the group and the individuals can be observed. The overall observation lets assume, that there is a cautious shift, which getting smaller with the rise of the win percentage.

Starting at the 60% lotteries, the p-values get higher, reaching a climax at the 80% lottery before dropping again.

It is interesting to get an insight of how the results would change when certain values would be excluded from the test. This is why, for each of the analysis, the U-Tests have been repeated with different premises. The data can be found in the excel file under "Mann-Whitney Outliers xxx" and in the SPSS file "Mann-Whitney U-Test outliers xxx[13]" At first, subjects were excluded, who didn't act rational. This means, that everybody who reduced his/her WTP with the increase of the lotteries winning probability was not incorporated into the survey. This resulted in even less significant values. The same goes for the exclusion of very high WTPs (bidding at the 10% lottery already at €8 or more) and very low WTPs (a 90% lottery bid of €2 or lower). This effect reached its maximum when both premises were combined. The results are shown in the graphic and the table below.

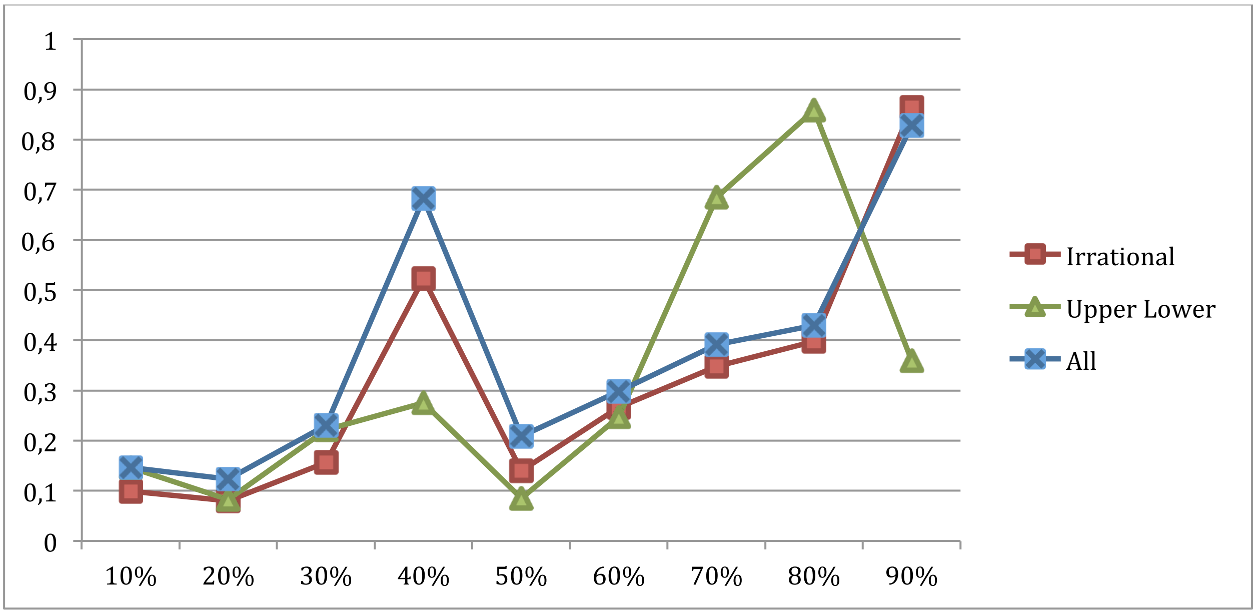


Fig. 14: Graphical Illustration: U-test p-value comparison excluding outliers

[13] In this case xxx is a placeholder fort he different kinds of outliers: irrational, upper lower and all.

Lottery	Irrational	Upper Lower	All
10%	0,099	0,146	0,146
20%	0,08	0,082	0,123
30%	0,156	0,222	0,231
40%	0,523	0,275	0,683
50%	0,14	0,085	0,209
60%	0,266	0,247	0,298
70%	0,348	0,685	0,391
80%	0,398	0,859	0,43
90%	0,864	0,36	0,828

Table 7: Tabular Illustration: U-test p-value comparison excluding outliers

As a conclusion it can be said, that the exclusion of the different outliers did not lead to a change in the data that would influence the findings of the original U-Test. The form of the graphs is still similar, expect for the 70% to 90% lotteries, where the irrational and all outliers were excluded.

6.6 Conclusions regarding lottery specific analysis

In the following I want to complete the lottery specific analysis with a summary of the conclusions that can be drawn from it.

Conclusion 1:

Prospect theory suggests, that subjects overestimate their chances of winning for very low lotteries and after that underestimate them. Even though a 10% lottery cannot really be ladled as very low tendencies for this effect can be seen here.

Conclusion 2:

There is an overall cautious shift from the individual to the individual interacting in a group. On this basis, the influences of SCT and PAT can be analysed.

Conclusion 3:

The informal observations of means and medians show a clear tendency. Beginning in low probability areas, individuals are more risk-seeking than groups. The differences approximate until the 70% mark, then a risky shift can be monitored. However at the 60% lottery, these differences become very small.

Conclusion 4:

Even though, the unofficial observations show a clear pattern, an official difference can only be proven for a few lotteries. Only in the 10% and 20%, 50% and 90% lotteries the results are significant for a U-Test. When the outliers are removed, mostly, only the 10% and 20% lotteries remain.

6.7 Testing the main hypothesis

The literature indicates, that from a meta-point of view (chapter 4.1) persuasive arguments theory has a stronger influence on tasks that are based on risky choices. The hypothesis tries to reinforce this statement with the help of the described experiment. In chapter 4.4.1 it was shown, that a person that is mostly influenced by the arguments would choose the group sheet, while a subject that changed its behaviour due to social comparison theory would select the single sheet. An influence by SeCaT can be ignored with this design, as there were no other groups, the subjects could compare themselves to. Participants were only allowed to discuss their behaviour with other members. They were not able to hear, what the other groups were talking about. With this lack of information, the possibility of an influence by SeCaT can be negated. Still, there remains the possible influence of the decision rules within the group. As no decision scheme in particular was prescribed in the test, this might state a problem. Even though the questionnaire was formulated to favour a system that is based on averaging, this cannot be proven. A plurality decision of some sort might also have been possible. Even if averaging were to be applied every time, the decision-makers might hide their true believes to generate an outcome that favours their own opinion. A person A might just claim to prefer a bid of €9.00, while the actual bid would be €7.00. When the other participants said they both prefer €6.00 the end result would be €7.00. Hiding the original intends this would lead to a distortion of the results. However, it has to be kept in mind that this is, just like SCT, only an influence in the outcome not in the mind-set of the person. A participant whose opinion on a topic was overruled would always prefer the individual to the group questionnaire. The hypothesis states that “persuasive arguments theory has a higher influence on choice shift, than social comparison theory”. However, if SDT had a significant influence, it would strengthen the person’s urge to choose the individual sheet. In case the hypothesis can be accepted, this would mean that SCT and SDT combined weren’t as influential as PAT alone. This would lead to the conclusion, that SCT alone must have less influence than PAT. The reason, why this wasn’t mentioned in the hypothesis is simple. SDT allows calculating the influence on choice shift and predicting certain outcomes. This means even though it influences the outcome of a decision, its approach is another one than SCT and PAT. This is, why it was left out on purpose in the formulation of the hypothesis. Even though the introduction towards the results was quite extensive, the hypothesis itself can be clarified rather fast. For this, a binomial test was conducted. The influential proportion was set at 50%. This means, that the choice is not purely random, but in favour of this group sheet, by this stating, that PAT has a higher influence for more people, than SCT does.

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
Chosen Sheet	PAT	group	54	0,69	0,5	0,001
	SCT	individual	24	0,31		
	Total		78	1		

Table 8 Binomial test of the main hypothesis

With a p-value of 0,001 the null hypothesis can clearly be rejected. We can negate the statement that the influence of social comparison theory is as high or higher as the persuasive arguments theory. This means that the H1 can be accepted. The results of the meta-analysis stated in chapter 4.1 now have been verified by experiment and open up the way for new research.

6.8 Gender specific behaviour analysis

As a lot of data has been won with the experiment it is interesting to take a look at them from other perspectives. First, a chi-square test has been conducted to see, if there might be a significant difference between the two genders. With a chi-square test, it is possible to analyse the frequency of a certain feature. In this case the choice between the single and the group sheet. The results are shown in the table below.

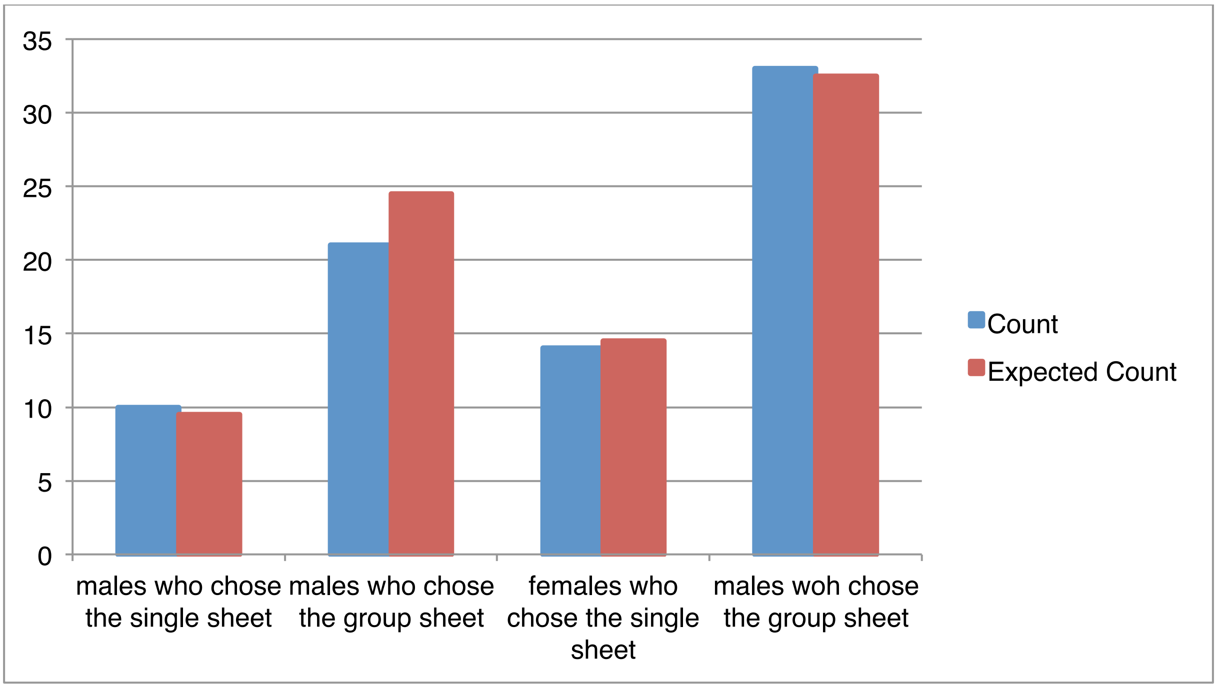


Fig. 15: Actual and expected distribution of a gender specific distribution

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,054	1	0,817		
Continuity Correction	0	1	1		
Likelihood Ratio	0,053	1	0,817		
N of Valid Cases	78				

Table 9 Results of the Chi Square test for gender specific distribution

As the difference between the expected observations and the actual observations are really low, a high p-value can be expected. The test has been done with a common Pearson Chi-Square test. A Fisher's exact test wasn't done, as the expected values didn't fall below 5. With p=0,817 and p=0,818, it is certain that there is no gender specific tendency to a certain behaviour. However it might be possible, that the influence of SCT and PAT is different for men than it is for women. Unfortunately this cannot be measured with the test design at hand.

6.9 Polarization specific analysis for individuals

As already mentioned in chapter 3.2, choice shift usually generates a sort of polarization where individuals, that tended to be risk-seeking become it even more during the discussion in a group. The same goes for risk-averse persons, only the other way around. In the following, a simple linear regression analysis is set up to find out if this can be confirmed. To do so, the individual data will be compared to the group data. A polarization effect will be expressed by the regression coefficient. When it is larger than 1, polarization can be monitored.

Usually the dependent variable would be the CER of the group and the CER of the individual will be the independent one. In this case it would mean that the higher/lower the CER of the individual, the higher/lower the CER of the individual in the group. The problem here is, that this does not indicate any statement about polarization. This can be solved by reducing all the CERs by 1, thus generating a risk neutral value of 0. This variable will be referred to as CEN (Certainty Equivalent Neutrality). Risk-averse behaviour will then be indicated by a negative value. In case of polarization, the negative value is even lower for the groups. The same holds for risk-seeking behaviour, only the other way around. Subjects that were already risk-seeking and became it even more show this by an increased CEN value. In both cases, the regression variable would have a value over 1. The results of this simple regression are summarized in the table below.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,417	0,174	0,163	0,412783724

Table 10: R^2 of the polarization regression for individuals

Model	Unstandardized Coefficients		Stand. Coefficients	t	Sig.	95,0% Confidence Interval for B
	B	Std. Error	Beta			Lower Bound
(Constant)	-0,2	0,049		-4,084	0	-0,297
Average CEN Individuals	0,35	0,088	0,417	3,995	0	0,175

Table 11: Coefficients for the Regression analysis for polarization for individuals

The R^2 states, that 17,4% (adjusted R^2 is 16,3%) can be explained by this model. The highly significant (p=0) regression coefficient is, with 0,350, far below 1. This means, that the subjects tend to undergo choice shift in general, but there is no tendency towards polarization.

6.10 Polarization specific analysis for groups

The analysis in the preceding chapter was a linear regression on each individual. Theory states, that SCT has a stronger influence on groups whose opinions already tend to go in a certain direction, before group discussion. This means, a group whose members were already very risk-averse tend to become it even more. For this linear regression, the average CEN of the persons before the discussion was calculated. This means it can be seen which group combination was already risk-seeking/ risk-averse before the discussion. The dependent variable will be the group CEN after discussion. The results are shown in the table below.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,546	0,299	0,268	0,398215009

Table 12: R^2 of the polarization regression for groups

Model	Unstandardized Coefficients		Stand. Coefficients	t	Sig.	95,0% Confidence Interval for B
	B	Std. Error	Beta			Lower Bound
(Constant)	-0,193	0,085		-2,279	0,032	-0,367
Average CEN Individuals	0,673	0,215	0,546	3,129	0,005	0,228

Table 13: Coefficients for the Regression analysis for polarization for groups

As it already can be seen at the R^2 value of 0,299, this model is able to explain almost twice as much as the one form chapter 6.9. The Constant almost stays the same. However, the regression coefficient stays below 1. Even though, with 0,673, it is way higher than before it still is too low to state, that there is a polarization effect that is depending on the groups position before discussion.

6.11 Choice shift dependent behaviour

Another very interesting point is the influence the kind of choice shift has on the choice of the sheets. This means if a subject experiences a risky shift in the group, is she/he more likely to go back to his individual choice or does he stick to the group sheet? This can also be asked for a person, that experiences a cautious shift. As already mentioned, most of the experiments on SCT come to the conclusion, that a risky shift is generated in most cases, whereas cautious shifts are not that common here. So maybe in cases where people experience this is mainly due to SCT and not PAT. With another chi-square test it is possible to test if a pattern can be monitored between the choice of the sheet and the change in riskiness. For this, the two average CERs of the subjects were calculated (individual and group). A person that became more risk-seeking was coded with 1 and a person that became more risk-averse was coded with 0.

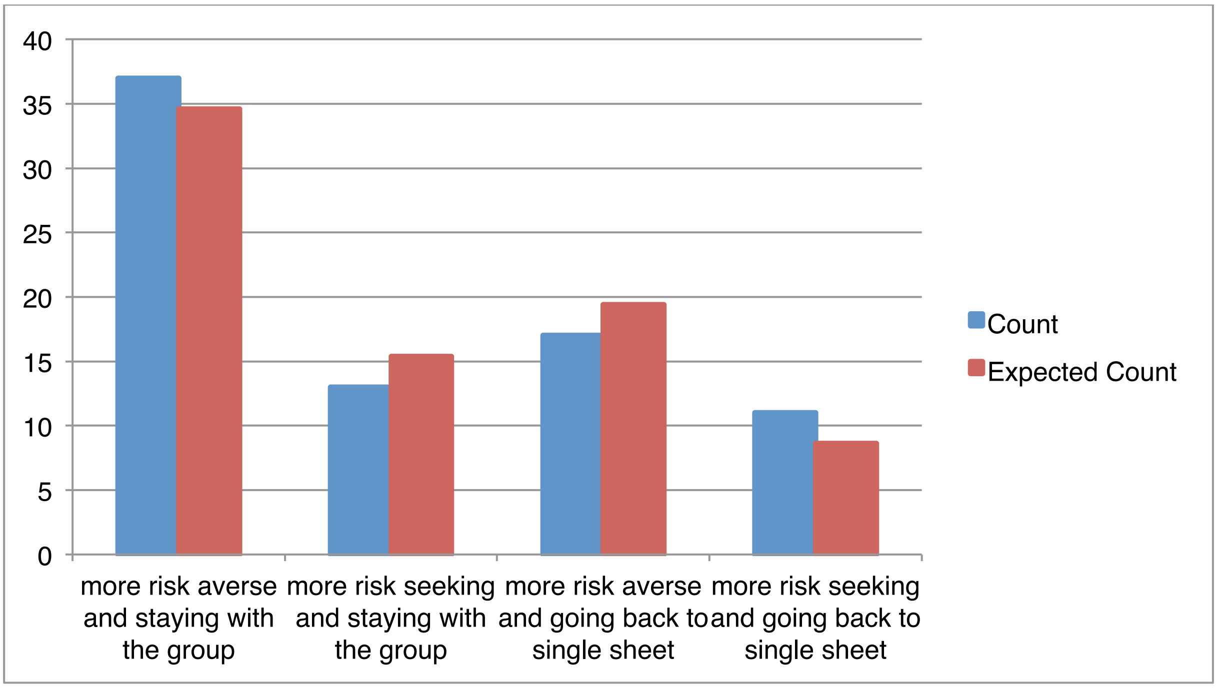


Fig. 16: Actual and expected distribution of the behaviour depending on the kind of choice shift

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1,487	1	0,223
Continuity Correction	0,929	1	0,335
Likelihood Ratio	1,464	1	0,226
N of Valid Cases	78		

Table 14 Results of the Chi-Square test for choice shift specific distribution

Even though the differences between the expected and the actual values are higher than in the chi-square gender-test, a p-value of 0,223 results in non-significance. Still the differences that can be monitored go into the expected way, where subjects who became more risk-averse tend to prefer the group more, than if there would be no influence. With subjects who became more risk-seeking, a higher preference of the single sheet could be monitored. This means, that people in general prefer the more riskless bets to the more risky ones. A possible conclusion would be that PAT has a higher impact on risk aversion and SCT on risk-seeking behaviour. The last argument goes conform to SCT, which usually evaluates risk-taking behaviour more than risk aversion. So even if the results are not significant, the tendencies confirm the theory.

6.12 Conclusions of the hypothesis testing and Chi-Square tests

Even though there is the possibility of additional tests, the ones performed in the previous chapters were the most important ones. In the following, the conclusions from these tests will be summarized.

Conclusion 1:
Even when it comes to argumentative poor decisions, PAT has a higher influence on choice shift, than SCT does.

Conclusion 2:

PAT has a higher influence on choice shift than SCT. This is a gender independent observation

Conclusion 3:

In argumentative poor decisions, there is no polarization effect.

Conclusion 4:

PAT has a higher influence on choice shift than SCT. This observation is not influenced by the kind of choice shift, the subject experiences in a group.

6.13 Comparison with the study of Shupp and Williams

In order to compare the experiment to the study of Shupp and Williams, the following chapter gives a short overview. The main focus will lie on the differences and the results, as the process of the experiment is quite similar to the one conducted in this thesis.

6.13.1 <u>The goal of the study</u>

As the title "Risk Preference Differentials of Small Groups and Individuals" already suggests, the main focus of this study lied on choice shift. The aim of the study was for the participants to truthfully reveal their willingness to pay - in the group and as individuals, over lotteries with different expected pay-outs. The theory states that the average group choice would be more risk neutral, than the average of the individual group members. For this experiment, the null conjecture stated, that there would be no systematic difference between the average of the group's and the average of the individuals WTP. The alternative conjecture was, that a difference could be observed. (Shupp, Williams, 2006, p. 5.). Another goal of the study was to identify the changes in risk behaviour over different risk distributions.

6.13.2 The structure of the experiment

For this design, Shupp and Williams recruited 100 participants from undergraduate economy classes at Indiana University, Bloomington. In contrast to this experiment, they were then separated into two groups, one for the experimental Design I and the other for Design II. For the first one, 16 of the 100 participants were used as individual decision-makers and 48 of them were put into 16 groups of 3. On the other side, for the second design, the remaining 36 participants took on the role of individual decision-makers first and then were put in a group of 3. This led to a total number of 12 groups and was used to investigate the change in risk aversion, when participants first made decisions alone and then in a group. In Design II, they were not told that the single phase would be followed by the group phase.

For the experiment the maximum demand price method was developed in order to avoid an endowment effect that appeared in the study of Kachelmeier and Shehata (1992, p. 1133.).

Even though the lotteries were the same as in the thesis's experiment, the endowment and the lottery price were $20.

The group round was similar to the singles round, as the lotteries and the pay-out processes stayed the same. In this round however, the monetary amounts were tripled. The participants had to decide as a group how they wanted to act in each lottery. The price (in case the chosen lottery paid) was divided by three afterwards.

Only one of the 9 lotteries was actually played in the process. The lottery played was decided by random as well (Shupp, Williams, 2008, pp. 261ff.)

6.13.3 The results of the study

For the analysis, the CER was taken as well. The results of the individual test of Design I (N= 16) and II (N=36) were compared to the group data of Design I (N=16). They came up with the following conclusions, which are illustrated in the graphics below:

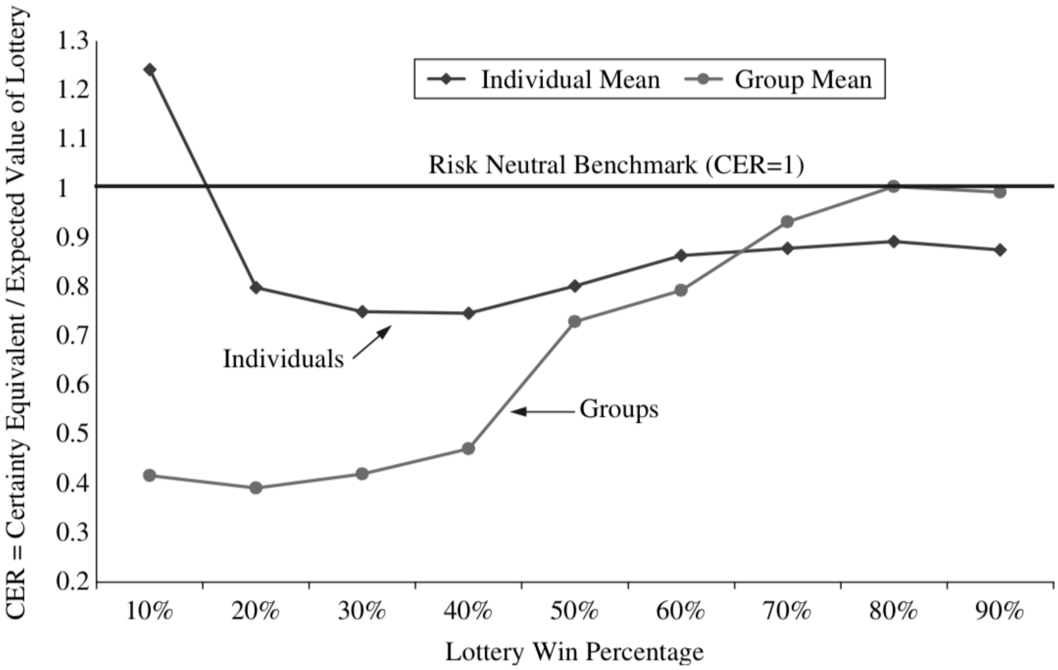


Fig. 17 Mean Certainty Equivalent-Ratio (CER) Comparison for the experiment of Shupp and Williams (Shupp, Williams, 2008, p.264.)

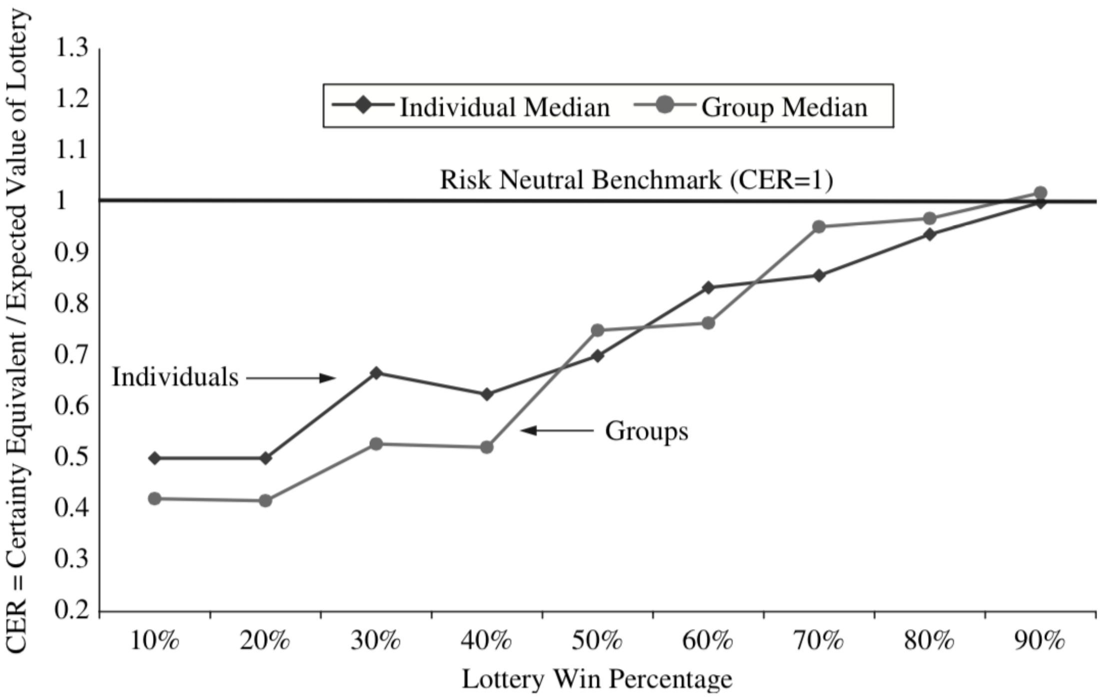


Fig. 18 Median Certainty Equivalent-Ratio Comparison for the experiment of Shupp and Williams (Shupp, Williams, 2008, p.264.)

Conclusion 1:

The CER vary significantly, depending on the win percentage of the lottery. This goes for both, individuals and groups. As the win percentage goes up, so does the CER from a risk-averse behaviour closer to a risk neutral one. The corresponding medians are fairly stable across the 10% to 60% lotteries. This changes beginning at the 70% probability, when they move to a more risk neutral benchmark (Shupp, Williams, p.272).

Conclusion 2:

For higher-risk lotteries with a win percentage of 40% or lower, the average group is significantly more risk-averse than the average individual. (Shupp, Williams, p.272.)

Conclusion 3:

For the lowest-risk lotteries with a win percentage of 80% and 90%, the average group is approximately risk neutral and significantly less risk-averse than the average individual. (Shupp, Williams, p.272.)

Conclusion 4:

For lotteries with a win percentage of 50%, 60% and 70%, the average group and the average individual are both risk-averse and are not significantly different. (Shupp, Williams, p.272.)

Conclusion 5:

The variance of CERs is lower for groups than for individuals in all lotteries. This difference is significant for all except the 40% and 50% lotteries. In general, CER variance tends to decrease as the lottery win-percentage increases. (Shupp, Williams, p.272.)

6.13.4 Criticism on the study

Even though, I don't see myself as experienced in this territory as the conductors of the mentioned experiment, I still want to give some food for thought here, how it can be made even better in my opinion. The "mistakes" mentioned in this part were, of course, tried to be prevented in my design. The first thing I want to point out here is the design of the explanation. The complications that might arise from such a design were counteracted with the video I did. This is only a minor problem, as there were usually only few questions, after the explanations were read (Shupp, Williams, 2006, p. 6). Second, I want to mention the test run without monetary rewards was stated (Shupp, Williams, 2006, p. 6). This could lead to a cognitive bias of the participants. They could be influenced by their own outcome and even more by the outcome of their colleagues. When they acted very risk-averse in the test run and did not participate in the lottery, while the other students were lucky to win with a little bit more risky attitude, this might change a person's risk behaviour in the real experiment. This is, why the test run was left out in my study.

The third and last critique I want to mention is the presentation of the group earnings. Even though the outcome of each lottery was the same for every individual ($60/3 = $20) the presentation of the earnings is different than in the group round. Due to a framing effect, participants might perceive the earnings as higher than they actually are (Kahneman, Tversky, 1984, pp. 342.f.). As shown in the work of Kachelmeier and Shehata (chapter 4.3.2), higher possible earnings also lead to a higher risk aversion (Kachelmeier, Shehata, 1992). This means, if the earnings were perceived to be higher, this would lead to more risk-averse decisions. With splitting the earnings into three in the group phase, this problem was prevented as well.

As mentioned before, my critique on the experiment is a minor one. Especially the first two points are more like a trade-off someone must accept, when you want the participants to understand the procedure of the experiment. The third point could have been prevented; still it is so small, that it doesn't endanger the credibility of the experiment.

6.13.5 Comparison of the two studies and the results

The main question remaining is if the two studies can be compared without any constraints. The answer depends on the view. The research questions were different. Shupp and Williams tried to find out more about lottery specific risk behaviour of individuals, compared to individuals in groups. The thesis was focusing more on the reasons for the occurring change. This is why the group design (Design I and II,) of the authors could not be used here, as it cannot be said, if and how strong a choice shift occurs when there has been no observation for the individuals like it was the case in design I. Other limitations were slight changes in the explanation process and the paid amount. The latter might be crucial as higher amounts promote risk aversion.

Still, taking a look at the means, the development is similar. The differences in the assessment of risk were higher in the original study compared to the results in this thesis. This might also be a reason for the significant results for the lower and the higher lotteries. The different p-values cannot be compared, as there exists no exact data within the paper.

These observations lead to the conclusion that, even due to the same methods to be used, a real comparison is not possible from a scientific viewpoint. The group design is too different from the one in this thesis and the data is not sufficient to make further conclusions. Still, the development of the behaviour, concerning the lotteries is similar, although only significant for few lotteries.

7 Summary and Conclusion

The main purpose of this thesis was to find more about the influences that generate choice shift. For this, an overview was given, how people evaluate choices, especially choices under risk. It was shown, that the human behaviour is not easy to predict, but that prospect theory comes the closest when it comes to this topic. It takes into account, that we over- respectively underestimate our chances, are influenced by framing effects and that we are more risk-seeking when it comes to losses.

The different theories on choice shift explained, why our behaviour changes significantly, when we enter a group and how it does. The main drivers of these behavioural changes were social comparison theory and persuasive arguments theory. With the combination of the knowledge about decision making, as well as the theories that lead to choice shift, it was possible to construct an experiment that could approach an area that, so far, was only discussed on a theoretical level: Which of the two theories on choice shift has more influence, PAT or SCT?

In addition to that, the design made it possible to scrutinize other findings about choice shift, that have been made by other authors.

Comparing the different attitudes towards risk from Shupp and Williams with the results of my experiment, a graphical similarity can be found. The results however were significant on a more frequent level for the two authors, where in my thesis this was only seldom the case.

A mandatory statement from my side is hard to make, as for this, the findings were not significant enough. Still the main hypothesis that was tested could be accepted. Further comparisons gave more insight on the topic. In the following, I want to give some food for thought of how these insights can be used and what future research could look like.

7.1 Usage of the results of the thesis

First of all, it is good to know, that when it comes to decisions under risk, most people prefer arguments to influences by social comparison. Still, with a ratio of 54 to 24, it is certain that this is not true for all people. Other effects on the chosen sheet, like gender or the kind of choice shift could not be proven to have an influence. Even though, the main hypothesis turned out to be highly significant, the inconsistent p-values, especially for the testing in chapter 6.5, were not the results that were expected.

The main question here is, how these new insights can be used to nudge[14] people into the right direction to make value-maximizing decisions. An interesting idea would be to let people make riskier decisions alone, as they tend to be more risk-seeking here, than groups. However when the not as risky it should make more sense, to form a group and let PAT and SCT do its work. This however is only a proposal that might only be true in this specific scenario of the experiment.

7.2 Future research and thoughts on the topic

As mentioned, most of the research on choice shift is done via the scheme of an individual phase, a group phase and, sometimes, an additional individual phase. The general idea a third (respectively fourth) phase, where people have to choose between decisions they made earlier, is nothing new. But the idea of involving such a phase into an experiment concerning choices under risk hasn't been done before. As the method used here is not the only design to measure behaviour, it makes sense to combine the decision phase with other kinds of experiments on choice shift as well. This would make it possible to make statements over SCT and PAT from other points of view. Still the model is limited with its assertions.

[14] Nudging is the theory of influencing people to influence the behaviour of people without forcing them (Thaler & Sunsteen, 2008).

Now that it is clear, that PAT has the upper hand, it is necessary to find out more to what degree this happens. The problem of a direct comparison however doesn't lie in the theory, but the practical design of an experiment.
With the test design in mind, there might be an influence that has not been researched yet that might be similar to a framing effect. The experiment here evaluates behaviour under different percentages of risk. This might lead to an unintended effect, that participants orientate themselves on the choices they made in the earlier lotteries. If they for example started with the lower ones, they are tended to make higher and higher bets, as it is the rational thing to do. However if they reach the last lottery, the choices they can make are limited, because they will not go below the bid they filled out in the lottery before. This reduces their choice possibilities. It might be interesting, if a person would give out the same answer, when he/she is only presented with one lottery, compared to the person that has to do nine of them.

In the last decades, a lot of research was done on the topic of utility and how we make decisions under risk. Even today, it is one of the most debated topics and the thesis shows why. Human behaviour is not that easy to cast into a simple formula. It has been a long way until scientists stopped only focusing on the optimal decisions, but on the actual decisions of people. With utility and later prospect theory, there has been a continuous development of views, ideas and theories. One experiment alone might not always make a big difference, but will lead to new thought-provoking impulses. Even though the hypothesis could be confirmed with high significance, additional testing is necessary. Still, the gathered insights help to understand decisions under risk, choice shift, their influences and human behaviour in general a little bit more. There is still much work ahead to finally understand human decision making as a whole. Even though there will be some dead ends on this way, this is a risk that definitely should be taken.

Appendix

Appendix A: The original experimental Sheets for the participants

Anleitung für das Experiment:

Dieses Experiment fokussiert sich auf die individuelle Bewertung von Ereignissen mit unsicherem Ergebnis, hier Lotterie genannt. Du startest mit einem Geldbetrag von €10. Diese €10 kannst du nutzen um dir das Recht zur Teilnahme an einer Lotterie zu erkaufen. Da das Ergebnis der Lotterie unsicher ist, kannst du bei einer Teilnahme mehr Geld zu deinem Startkapital von €10 hinzugewinnen oder auch Geld verlieren, je nach Ausgang der Lotterie. Das Startkapital wird am Ende des Experiments zusammen mit dem finalen Gewinn bar ausgezahlt.

Bevor wir genauer auf das Experiment an sich eingehen, ist es wichtig, dass du genauer verstehst, was mit dem Begriff Lotterie gemeint ist.

1. Was ist eine Lotterie?

In diesem Experiment bietet dir die Lotterie die Möglichkeit ein Preisgeld von €10 zu gewinnen. Die Anzahl der verschiedenen Lotterien dieses Experiments beträgt neun. Diese neun Lotterien bieten euch die folgenden Chancen auf einen Gewinn: 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20% und 10%. Betrachten wir beispielsweise die 60% Lotterie. Wird diese Lotterie mehrere Male gespielt, so würden die Teilnehmer in 60% der Fälle €10 ausgezahlt bekommen bzw. die Lotterie in 40% der Fälle verlieren und leer ausgehen. Der Erwartungswert dieser Lotterie beträgt somit (0,6 x €10) + (0,4 x €0), also €6.

2. Wie wird die Auszahlung der Lotterie bestimmt?

Um zu bestimmen, ob eine Lotterie die €10 auszahlt oder nicht, wird aus einem Behältnis einer von zehn Pokerchips gezogen. Diese sind grün oder rot. Der prozentuale Anteil der grünen Pokerchips ist gleich der prozentualen Gewinnchance einer Lotterie. Bei der Lotterie Nr.6 (60%) sind somit 6 grüne und 4 rote Chips im Behälter. Wird ein grüner Pokerchip gezogen, so erhält der Teilnehmer €10 Gewinnauszahlung, sollte ein roter Chip gezogen werden, so ist die Auszahlung gleich €0.

3. Wie erkaufe ich mir das Recht an einer der Lotterien teilzunehmen?

Jetzt, da du weißt wie die Lotterien ablaufen wird es Zeit, dir zu erklären, wie du das Recht erwirbst, an einer der Lotterien teilzunehmen. Es gibt drei Phasen in diesem Experiment: Die Gebot-Phase, die Lotterie-Auswahl-Phase und die Kaufpreis-Bestimmungs-Phase.

3.1 Die **Gebot**-Phase

In der Gebot-Phase wirst du den **maximalen Betrag, welchen du zu zahlen bereit bist**, in die Kästchen des beiliegenden Experiment-Formular eintragen. Es handelt sich hierbei um dein **Gebot**. Dies machst du für **jede** der 9 angegebenen Lotterien. Bei den eingetragenen Preisen handelt es sich um deine Kaufgebote, welche deine **maximale Zahlungsbereitschaft** darstellen. Der Minimalbetrag den du eintragen kannst, liegt bei €0 und der Maximalbetrag bei €9,99. Wenn jeder von euch fertig ist, wird **eine der neun Lotterien gezogen**. Die anderen acht Lotterien werden eliminiert und nicht gespielt.

3.2 Die Lotterie-Auswahlphase

Welche der Lotterien gespielt wird hängt ebenfalls vom Zufall ab. Zur Bestimmung der Lotterie werden Pokerchips, welche mit den Nummern 1 bis 9 beschriftet sind auf einem Behälter gezogen. Wird Chip 1 gezogen, so wird die Lotterie 1 gespielt, bei Chip 2 die Lotterie 2 und so weiter.

3.3 Die **Kaufpreis**-Bestimmungsphase

Nachdem nun **eine** der 9 Lotterien bestimmt wurde wird ein **zufälliger Kaufpreis** für diese bestimmt. Der Kaufpreis der Lotterie wird sich zwischen €0 und €9,99 befinden. Zur Bestimmung werden wieder Chips und ein Behälter genutzt. Die Nummern befinden sich zwischen 0 und 9. Es wird drei Runden geben, in denen gezogen wird. Jede Runde bestimmt eine der drei Ziffernstelle. Die erste den Euro , die zweite den 10 Cent und die dritte den Cent Betrag. Werden zum Beispiel nacheinander die Zahlen 3, 5 und 1 gezogen beläuft sich der Kaufpreis der Lotterie auf € 3,51.

Sollte dein **Gebot** (maximale Zahlungsbereitschaft) größer der gleich dem **Kaufpreis** sein, so zahlst du den gezogenen Kaufpreis und nimmst an der Lotterie teil. Sollte dein Gebot unter dem Kaufpreis liegen, so spielst du die Lotterie nicht mit.

Es ist wichtig zu verstehen, dass wenn du die Lotterie spielen solltest, du den zufällig generierten Kaufpreis zahlst und nicht das von dir abgegebene Gebot (es sei denn, dein Gebot entspricht dem Kaufpreis). Das ist auch der Grund warum du am besten fährst wenn dein abgegebenes Gebot deiner maximalen Zahlungsbereitschaft entspricht.

Nachdem der Kaufpreis bestimmt ist wird, wie unter Punkt 1 beschrieben, bestimmt ob die Lotterie die €10 auszahlt oder nicht.

4. Wie hoch ist meine endgültige Barauszahlung?

Es gibt drei Szenerien für deine endgültige Auszahlung.

1. Du nimmst nicht an der Lotterie teil, weil sich der Kaufpreis über deinem Gebot befindet. Das bedeutet, dass du das Experiment mit den €10 Startkapital abschließt.
2. Du nimmst an der Lotterie teil, weil dein Gebot über dem Kaufpreis liegt. Die Lotterie wird gespielt und du gewinnst die zusätzlichen €10. Dein Gewinn beträgt somit dein Startkapital von €10 von denen der Kaufpreis der Lotterie abgezogen wird. Hierzu wird nun der Lotteriegewinn von €10 addiert.
3. Du nimmst an der Lotterie Teil, weil dein Gebot über dem Kaufpreis liegt. Die

Lotterie zahlt €0. Somit liegt dein Gesamtgewinn bei €10 Startkapital abzüglich dem Kaufpreis.

5. Wie hoch ist der größtmögliche gewinnbare Betrag?

Der höchste gewinnbare Betrag beläuft sich auf €20. Dies ist nur dann möglich, wenn der gewählte Kaufpreis €0 beträgt und sich dein gewähltes Gebot ebenfalls auf €0 beläuft. Bitte beachte, dass sich die Chancen, einen spezifischen Kaufpreis zu ziehen sich auf 1 zu 1000 (0,05%) belaufen.

6. Wie hoch ist der kleinstmögliche gewinnbare Betrag?

Die kleinste Auszahlung beläuft sich auf €0,01. Dies ist nur dann möglich, wenn du ein Gebot von €9,99 abgibst und genau dieser Betrag als Kaufpreis gezogen wird. Zusätzlich musst du noch die Lotterie verlieren.

7. Was ist der genaue Ablauf des Experiments?

1. Jeder trägt seine neun Gebote in die dafür vorgesehenen Bereiche ein. Bitte vergiss nicht, dass dein Gebot deine maximale Zahlungsbereitschaft darstellt. Es ist der maximale Preis den du bereit für die Teilnahme an der jeweiligen Lotterie zu zahlen. Vergiss nicht, du zahlst nicht genau das Gebot, welches du einträgst, sondern den Kaufpreis, der gezogen wird.
2. Wenn jeder mit dem Ausfüllen fertig ist, werden die Fragebögen eingesammelt. Der Leiter des Experiments wird anschließend mit Hilfe der Pokerchips auswählen, welche Lotterie gespielt wird.
3. Nachdem die Lotterie ausgewählt wurde wird ihr Kaufpreis bestimmt. Dies geschieht mit dem in Punkt 2 beschriebenen Verfahren. Der Preis beträgt zwischen €0 und €9,99.
4. Jeder kann anhand seines Blattes feststellen, ob er an der Lotterie teilnimmt

oder nicht. Ist dein Gebot niedriger als der Kaufpreis spielst du nicht mit. Ist er hier oder gleich, spielst du mit.

5. Es wird über das in Punkt 2 erklärte Verfahren (rote und grüne Chips) bestimmt, ob die Lotterie die €10 oder €0 zahlt.
6. Jeder der bei der Lotterie mitspielen durfte, weiß nun, wie viel er beim Experiment gewonnen hat.
7. Am Ende des Experiments gibt jeder das ausgefüllte Blatt ab. Der Leitung des Experiments wird für jede Person den finalen Geldbetrag bar auszahlen. Du erhältst das erspielte Geld und musst noch ein Dokument unterschreiben, dass du das erspielte Geld erhalten hast.

Das ist das Ende der Anleitung. Wenn du noch Fragen hast, kannst du diese jetzt stellen. Wenn nicht, kann das eigentliche Experiment beginnen.

Viel Glück!

Experiment Teilnahmeblatt

Teilnehmernummer: ___

Bitte trage in **jedes** Feld der neun Lotterien dein Gebot ein. Bei jeder der neun Lotterien kannst du **€10** gewinnen. Die Chancen hierfür sind 10%-90%, je nach Lotterie.

Teil 1:

	Lotterie	Dein Gebot um an der jeweiligen Lotterie teilzunehmen (€0 - €9,99)
1)	10% Chance auf den Gewinn von € 10	€________________
2)	20% Chance auf den Gewinn von € 10	€________________
3)	30% Chance auf den Gewinn von € 10	€________________
4)	40% Chance auf den Gewinn von € 10	€________________
5)	50% Chance auf den Gewinn von € 10	€________________
6)	60% Chance auf den Gewinn von € 10	€________________
7)	70% Chance auf den Gewinn von € 10	€________________
8)	80% Chance auf den Gewinn von € 10	€________________
9)	90% Chance auf den Gewinn von € 10	€________________

Experiment Teilnahmeblatt 2

Teilnehmernummer: ___ Gruppennummer: ___

Unterschiede zur Einzelrunde:

- Du darfst dich mit deinen zwei anderen Gruppenmitgliedern unterhalten
- Deine eingetragenen Werte müssen mit denen deiner Gruppenmitglieder **ÜBEREINSTIMMEN**
- Du darfst dein Blatt aus der Einzelrunde als Referenz verwenden
- Deine Gruppenmitglieder dürfen dein Blatt aus der Einzelrunde **NICHT** sehen!
- Solltet ihr zu keiner Übereinstimmung kommen trägt jeder seine Werte in die Fächer ein. Aus diesen wird anschließend der Durchschnittswert gebildet.

<u>Teil 2:</u>

	Lotterie	Dein Gebot um an der jeweiligen Lotterie teilzunehmen (€0 - €9,99)
1)	10% Chance auf den Gewinn von € 10	€________________
2)	20% Chance auf den Gewinn von € 10	€________________
3)	30% Chance auf den Gewinn von € 10	€________________
4)	40% Chance auf den Gewinn von € 10	€________________
5)	50% Chance auf den Gewinn von € 10	€________________
6)	60% Chance auf den Gewinn von € 10	€________________
7)	70% Chance auf den Gewinn von € 10	€________________
8)	80% Chance auf den Gewinn von € 10	€________________
9)	90% Chance auf den Gewinn von € 10	€________________

Experiment Teilnahmeblatt 3

Teilnehmer Nummer: ___ Gruppennummer: ___

Für welches Blatt hast du dich entschieden?

☐ Das Blatt aus der Einzelrunde

☐ Das Blatt aus der Gruppenrunde

Gezogene Lotterie : Nr. ____

Gezogener Kaufpreis für die Lotterie: ____

Dein Gebot für diese Lotterie: ____

Ist der Kaufpreis niedriger als das von dir abgegebene Gebot?

☐ JA (Teilnahme an der Lotterie) ☐ NEIN (Auszahlung der 10€)

Ergebnis der Lotterie: ***(nur ausfüllen wenn du an der Lotterie teilgenommen hast)***

Gezogene Farbe (rot oder grün): ____ 10€ gewonnen? ☐ JA ☐ NEIN

Finale Auszahlung: €10 Startkapital + € ____ Lotteriegewinn - € ____ Kaufpreis = € _______

Dein Alter: ____

Deine Studienrichtung: ____________________________

Dein Geschlecht: ☐ männlich

☐ weiblich

Appendix B: Video-Questionnaire for the participants of the Konversatorium and evaluation

Fragebogen zur Verständnis des Videos

Bitte fülle den Fragebogen komplett aus. Bitte kreuze bei den 8 Aussagen an, ob du ihnen eher zustimmst, oder sie ablehnst.

1. Meiner Meinung nach trägt ein Erklärungsvideo zur besseren Verständnis eines Experiments bei.

Lehne Stark ab	Lehne ab	Weder noch	Stimme zu	Stimme stark zu	Keine Antwort

2. Die Stimme des Sprechers war stets verständlich.

Lehne Stark ab	Lehne ab	Weder noch	Stimme zu	Stimme stark zu	Keine Antwort

3. Die im Video verwendeten Grafiken und Animationen haben den Inhalt gut verdeutlicht.

Lehne Stark ab	Lehne ab	Weder noch	Stimme zu	Stimme stark zu	Keine Antwort

4. Der Aufbau des Videos ist sinnvoll.

Lehne Stark ab	Lehne ab	Weder noch	Stimme zu	Stimme stark zu	Keine Antwort

5. Die gewählten Beispiele haben zur Verständnis beigetragen.

Lehne Stark ab	Lehne ab	Weder noch	Stimme zu	Stimme stark zu	Keine Antwort

6. Durch das Video habe ich den Ablauf des Experiments verstanden.

Lehne Stark ab	Lehne ab	Weder noch	Stimme zu	Stimme stark zu	Keine Antwort

7. Aufgrund des Videos benötige keine weitere Erklärung durch die Leitung des Experiments oder durch eine schriftliche Anleitung des Experiments.

Lehne Stark ab	Lehne ab	Weder noch	Stimme zu	Stimme stark zu	Keine Antwort

8. Das Video hat mich verwirrt.

Lehne Stark ab	Lehne ab	Weder noch	Stimme zu	Stimme stark zu	Keine Antwort

Studienrichtung: □ BWL □ IBWL □ Sonstiges

Alter:____

Geschlecht:____

Vielen Dank

Evaluation of the data

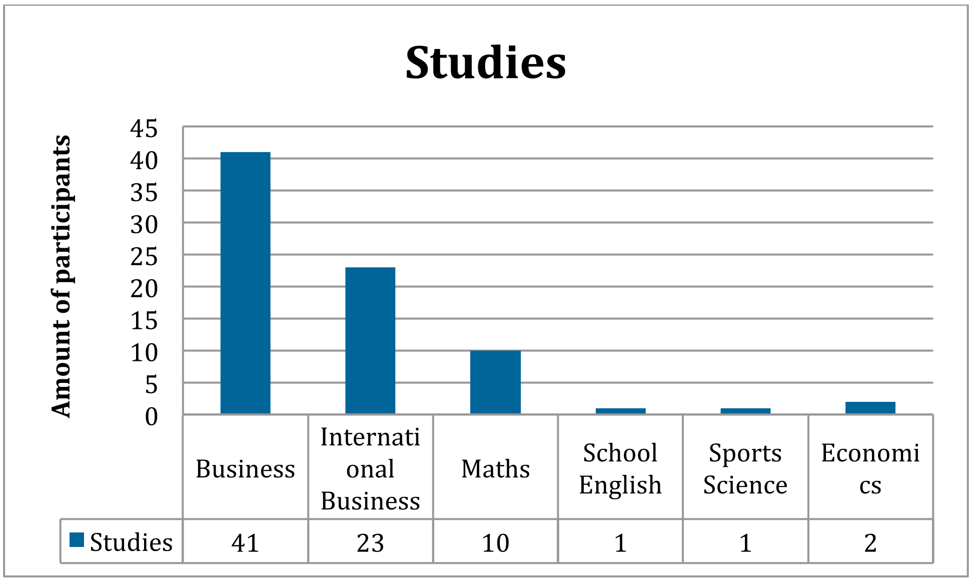
QUESTION:	Strongly agree	Agree	neither nor	reject	strongly reject	MEDIAN
In my opinion, a explanation video adds value to understanding an experiment	45 %	45%	10%	0%	0%	4,00
The Voice of the narrator was comprehensible at all times	75%	25%	0%	0%	0%	5,00
The graphics and animations used in the video helped to clarify the content	60%	35%	5%	0%	0%	5,00
The structure of the video makes sense	65%	35%	0%	0%	0%	5,00
The provided examples helped to understand the experiment	80%	15%	5%	0%	0%	5,00
The video made me understand the procedure of the experiment	50%	40%	10%	0%	0%	4,50
Due to the video I need no more explanation by the examiner or a written instruction	50%	25%	10%	15%	0%	4,50
The Video confused me	0%	0%	10%	40%	50%	1,50

The total number of participants was N=20. No question was left unanswered by the participants.

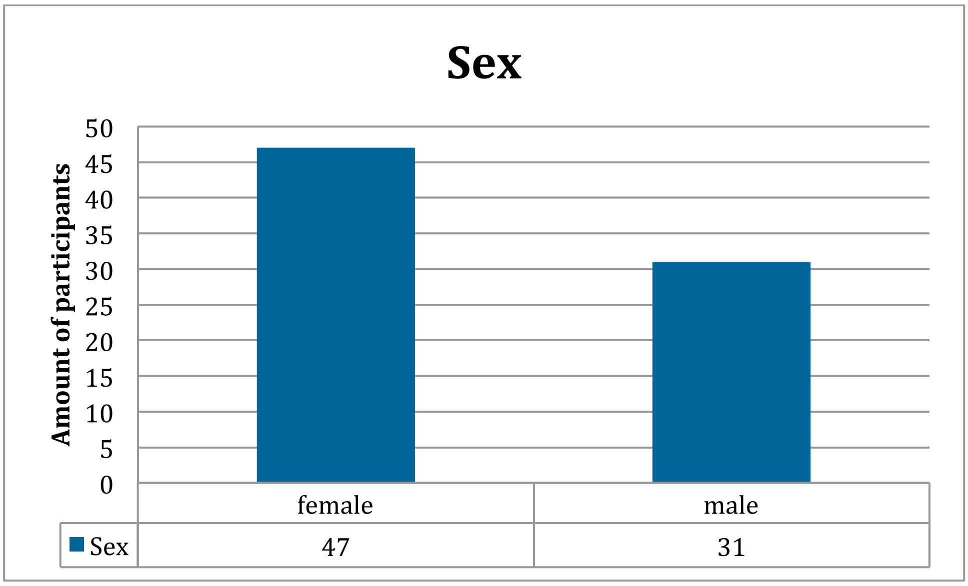
Appendix D: Informative Statistics

Number of total Participants	80,00
Number of valid Participants	78,00
Average Age	23,47
Median Age	23,00
Number of Groups	26,00
Number of Sessions	19,00
Average Session Size	4,11
Average Lottery Prize	5,52 €
Median Lottery Price	5,38 €
Total Money paid	935,09 €
Average earnings of the participant	11,99 €

Studies	
Major	Count
Business	41
International Business	23
Maths	10
School English	1
Sports Science	1
Economics	2
Total	78



Sex distribution	
	Total
Female	47
Male	31
Gesamtergebnis	**78**

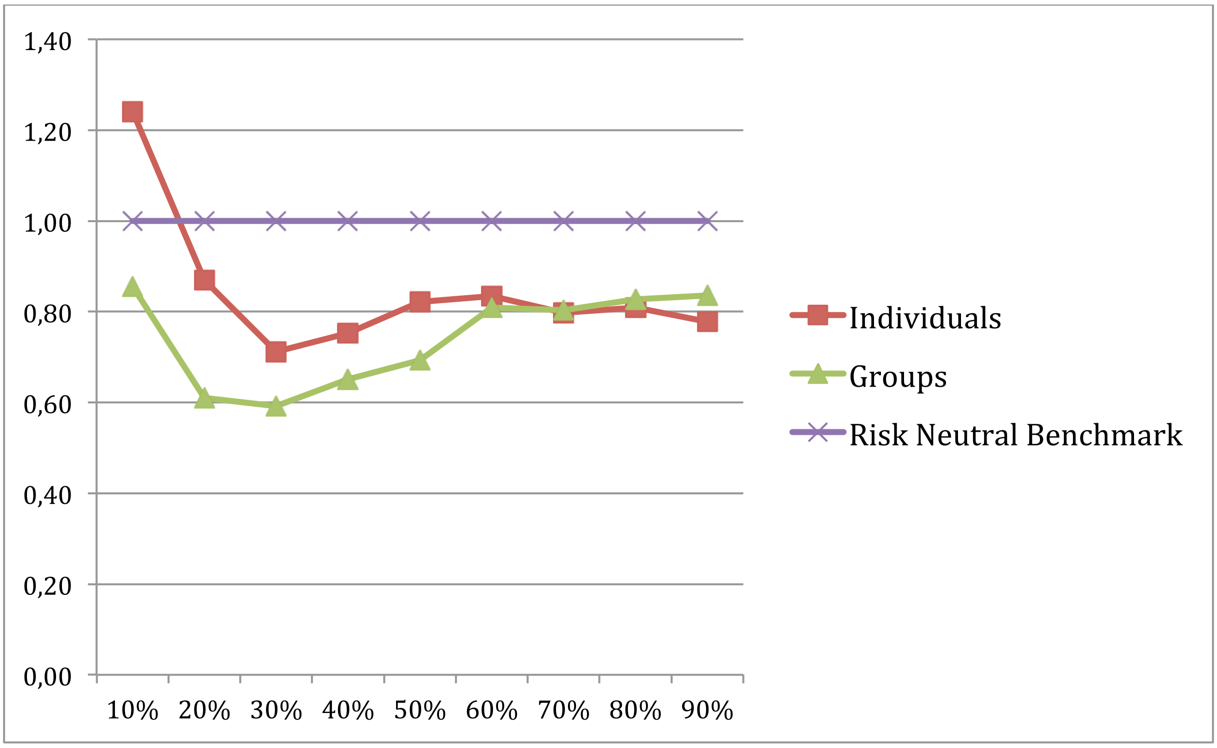


Participation in the Lottery?	Did the Lottery pay? No	Nes	Total
No	27	18	45
yes	6	27	33
Total	33	45	78

Appendix E: Analysis of the mean, median and standard deviation

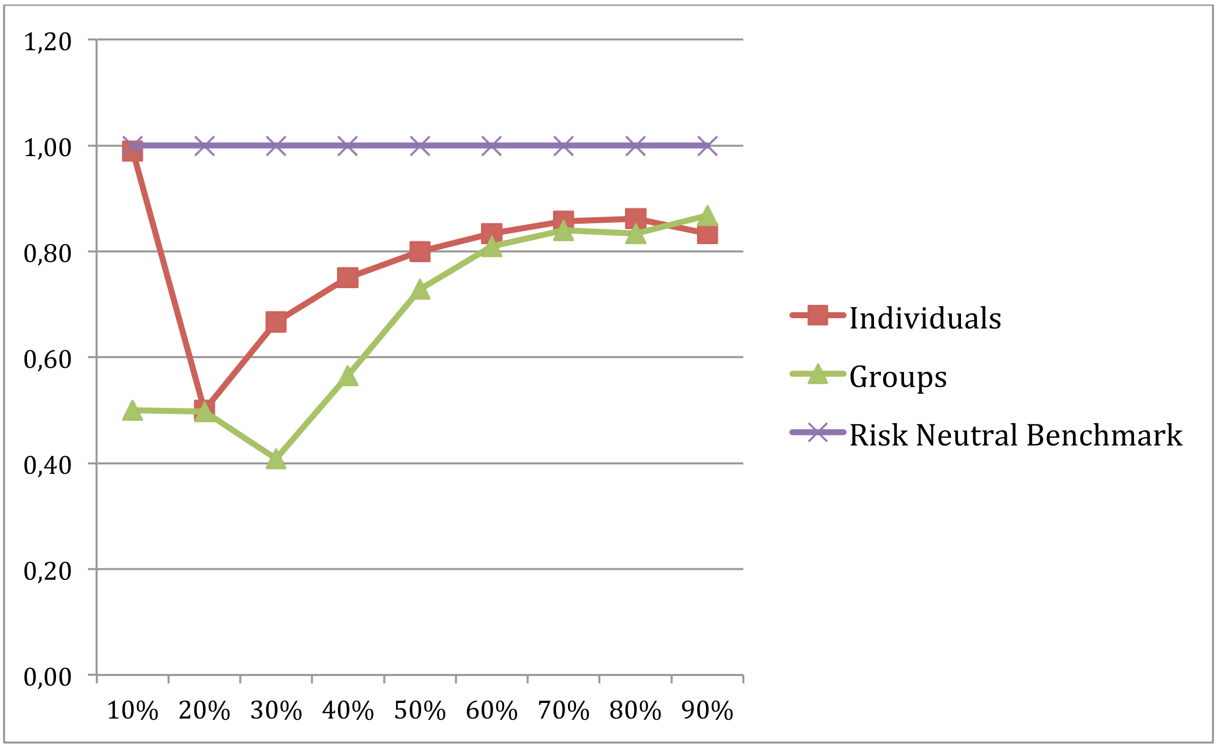
Mean:

Lottery Percentage	Absolut Single	Group	CER Single	Group
10%	1,24 €	0,86 €	1,24	0,86
20%	1,74 €	1,22 €	0,87	0,61
30%	2,14 €	1,78 €	0,71	0,59
40%	3,01 €	2,60 €	0,75	0,65
50%	4,11 €	3,47 €	0,82	0,69
60%	5,01 €	4,86 €	0,84	0,81
70%	5,59 €	5,62 €	0,80	0,80
80%	6,47 €	6,61 €	0,81	0,83
90%	7,00 €	7,52 €	0,78	0,84



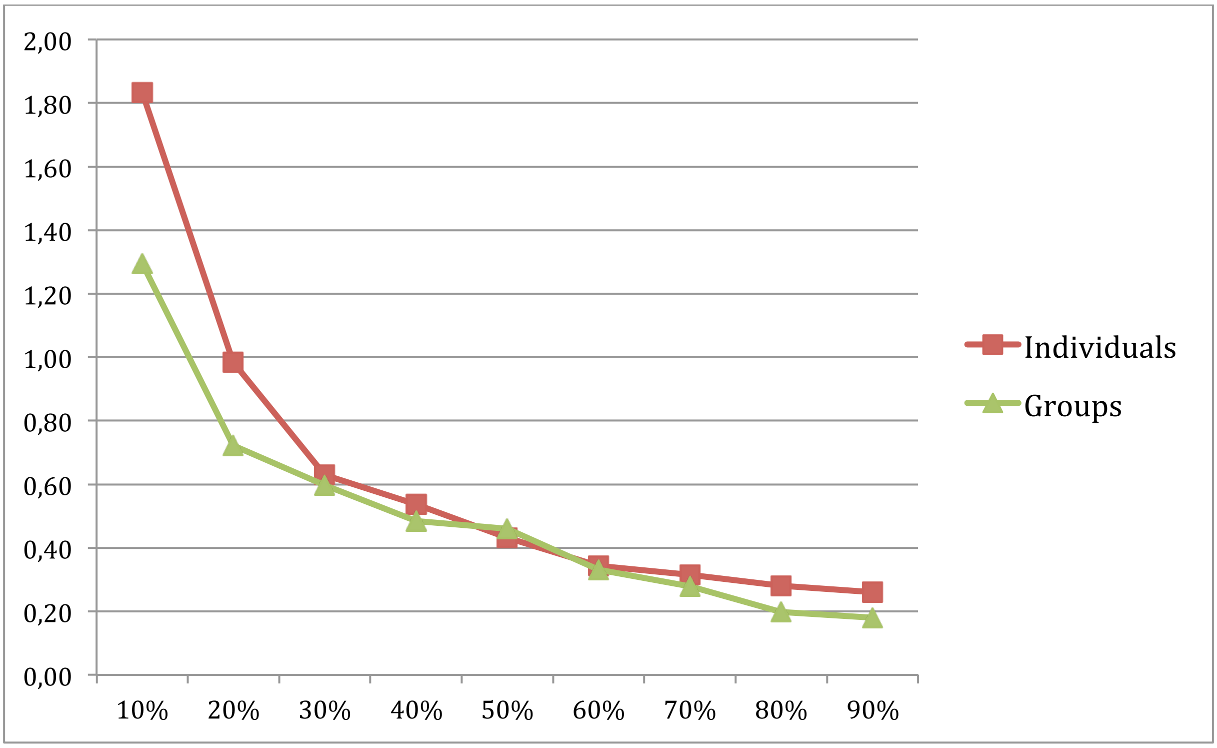
Median:

Lottery Percentage	Absolut Single	Group	CER Single	Group
10%	0,99 €	0,50 €	0,99	0,50
20%	1,00 €	1,00 €	0,50	0,50
30%	2,00 €	1,23 €	0,67	0,41
40%	3,00 €	2,26 €	0,75	0,57
50%	4,00 €	3,65 €	0,80	0,73
60%	5,00 €	4,86 €	0,83	0,81
70%	6,00 €	5,88 €	0,86	0,84
80%	6,90 €	6,67 €	0,86	0,83
90%	7,50 €	7,81 €	0,83	0,87



Standard Deviation:

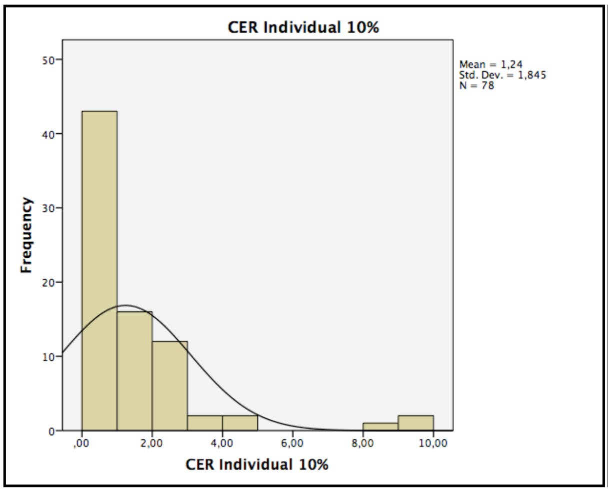
Lottery percentage	Absolut Single	Group	CER Single	Group
10%	1,83 €	1,30 €	1,83	1,30
20%	1,97 €	1,44 €	0,98	0,72
30%	1,89 €	1,79 €	0,63	0,60
40%	2,15 €	1,94 €	0,54	0,48
50%	2,16 €	2,30 €	0,43	0,46
60%	2,06 €	1,98 €	0,34	0,33
70%	2,21 €	1,96 €	0,32	0,28
80%	2,25 €	1,58 €	0,28	0,20
90%	2,34 €	1,62 €	0,26	0,18

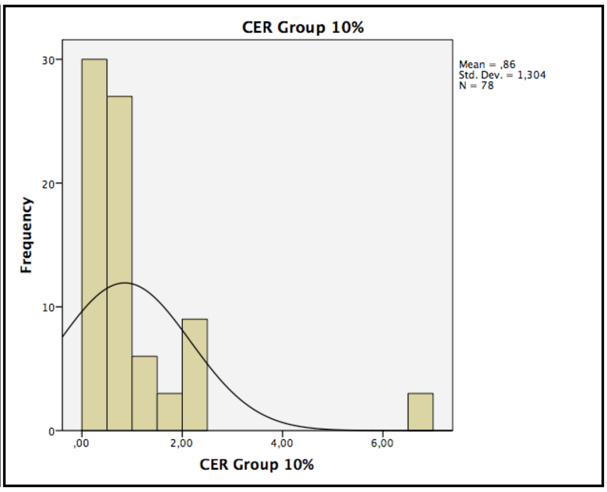


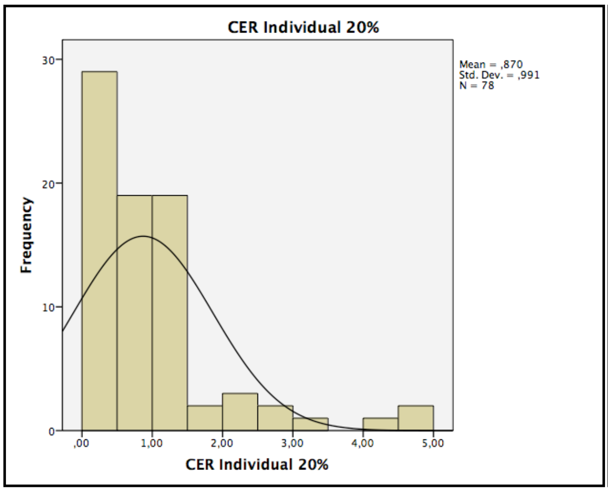
Appendix F: Tests of Normality

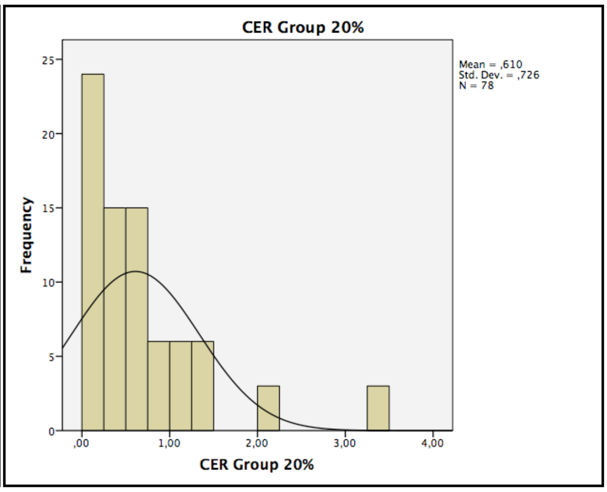
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CER Individual 10%	0,251	78	0	0,635	78	0
CER Individual 20%	0,197	78	0	0,763	78	0
CER Individual 30%	0,158	78	0	0,843	78	0
CER Individual 40%	0,132	78	0,002	0,919	78	0
CER Individual 50%	0,123	78	0,005	0,96	78	0,015
CER Individual 60%	0,099	78	0,057	0,983	78	0,395
CER Individual 70%	0,096	78	0,073	0,977	78	0,175
CER Individual 80%	0,121	78	0,006	0,961	78	0,017
CER Individual 90%	0,112	78	0,017	0,931	78	0
CER Group 10%	0,263	78	0	0,601	78	0
CER Group 20%	0,214	78	0	0,759	78	0
CER Group 30%	0,176	78	0	0,842	78	0
CER Group 40%	0,137	78	0,001	0,923	78	0
CER Group 50%	0,107	78	0,027	0,93	78	0
CER Group 60%	0,168	78	0	0,892	78	0
CER Group 70%	0,154	78	0	0,928	78	0
CER Group 80%	0,174	78	0	0,937	78	0,001
CER Group 90%	0,116	78	0,012	0,947	78	0,003

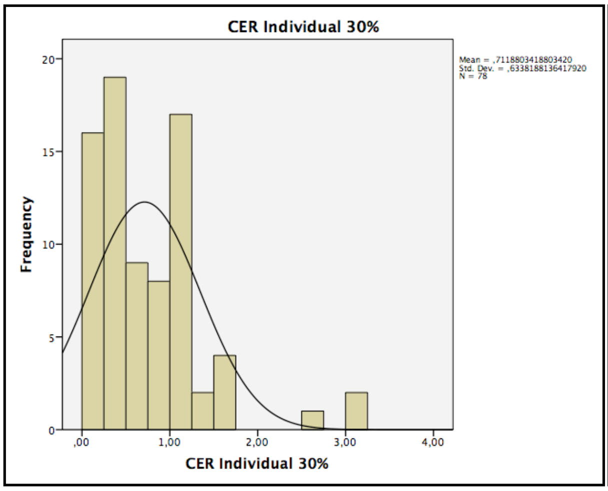
Histograms of the different lotteries

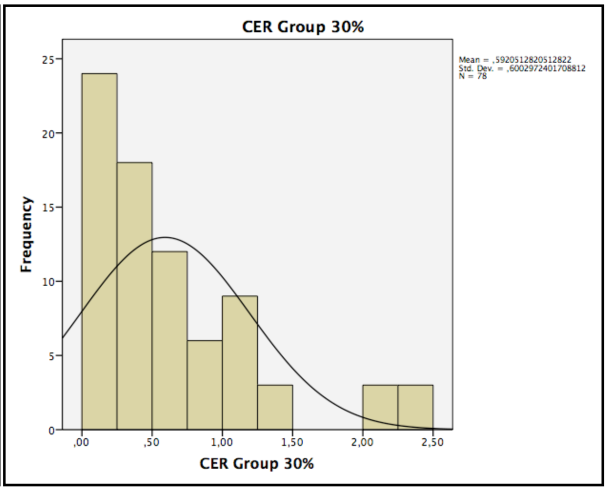


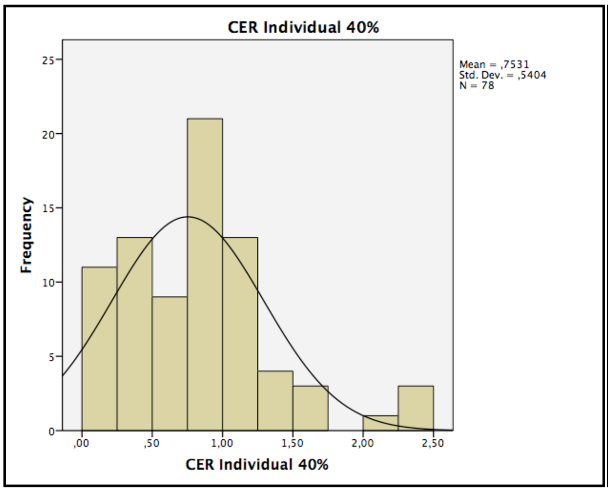


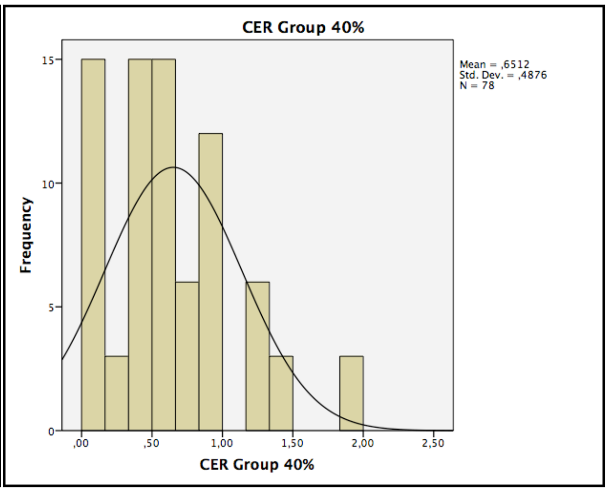

CER Individual 20%
Mean = ,870
Std. Dev. = ,991
N = 78
Frequency
0
10
20
30
,00
1,00
2,00
3,00
4,00
5,00
CER Individual 20%

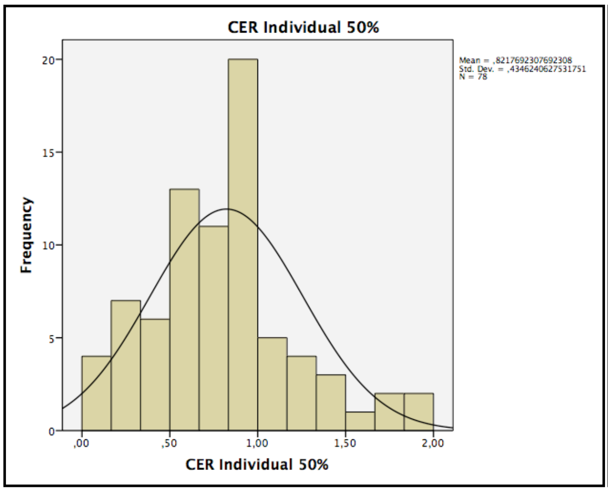

CER Group 20%
Mean = ,610
Std. Dev. = ,726
N = 78
Frequency
0
5
10
15
20
25
,00
1,00
2,00
3,00
4,00
CER Group 20%

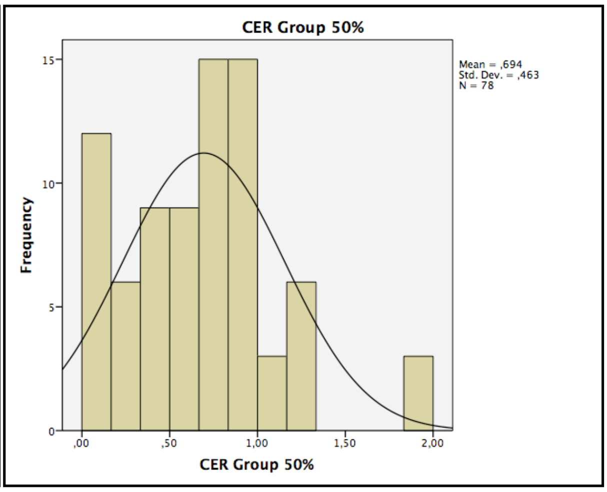

CER Individual 30%
Mean = ,7118803418803420
Std. Dev. = ,6338188136417920
N = 78
Frequency
0
5
10
15
20
,00
1,00
2,00
3,00
4,00
CER Individual 30%

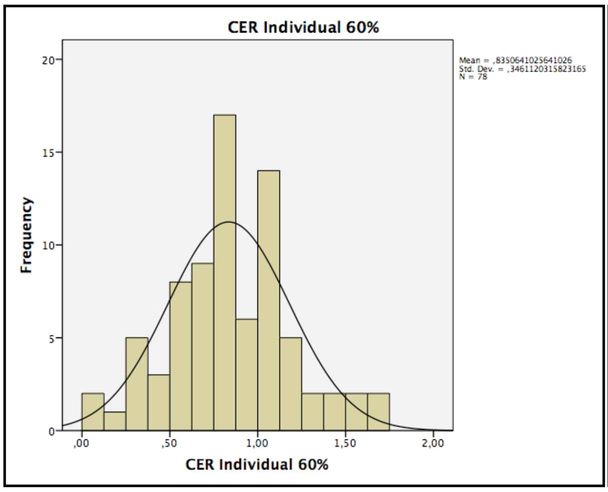

CER Group 30%
Mean = ,5920512820512822
Std. Dev. = ,6002972401708812
N = 78
Frequency
0
5
10
15
20
25
,00
,50
1,00
1,50
2,00
2,50
CER Group 30%

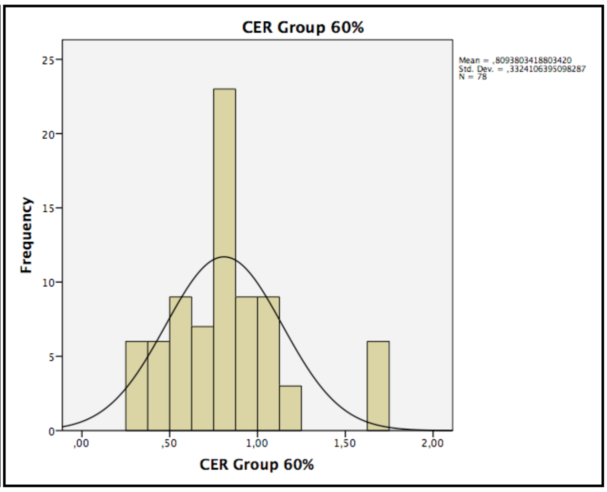

CER Individual 40%
Mean = ,7531
Std. Dev. = ,5404
N = 78
Frequency
0
5
10
15
20
25
,00
,50
1,00
1,50
2,00
2,50
CER Individual 40%

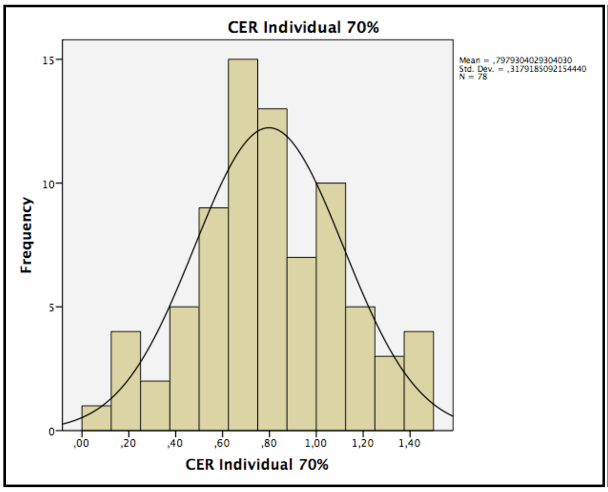

CER Group 40%
Mean = ,6512
Std. Dev. = ,4876
N = 78
Frequency
0
5
10
15
,00
,50
1,00
1,50
2,00
2,50
CER Group 40%

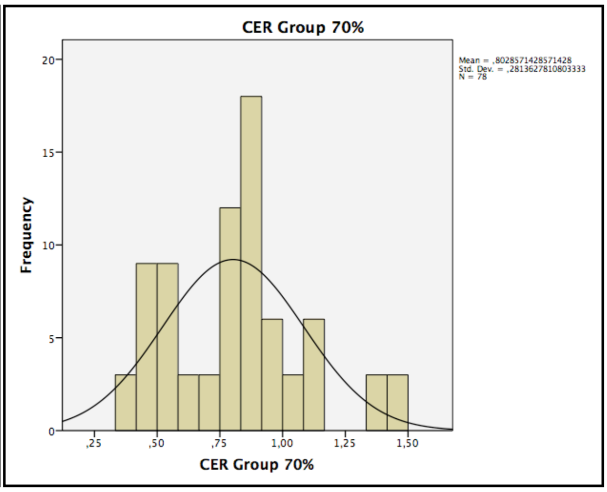

CER Individual 50%
Mean = ,8217692307692308
Std. Dev. = ,4346240627531751
N = 78
Frequency
0
5
10
15
20
,00
,50
1,00
1,50
2,00
CER Individual 50%


CER Group 50%
Mean = ,694
Std. Dev. = ,463
N = 78
Frequency
0
5
10
15
,00
,50
1,00
1,50
2,00
CER Group 50%

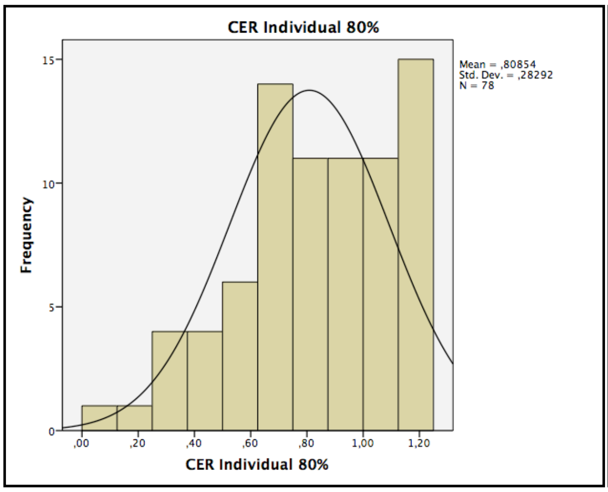

CER Individual 60%
Mean = ,8350641025641026
Std. Dev. = ,3461120315823165
N = 78
Frequency
0
5
10
15
20
,00
,50
1,00
1,50
2,00
CER Individual 60%

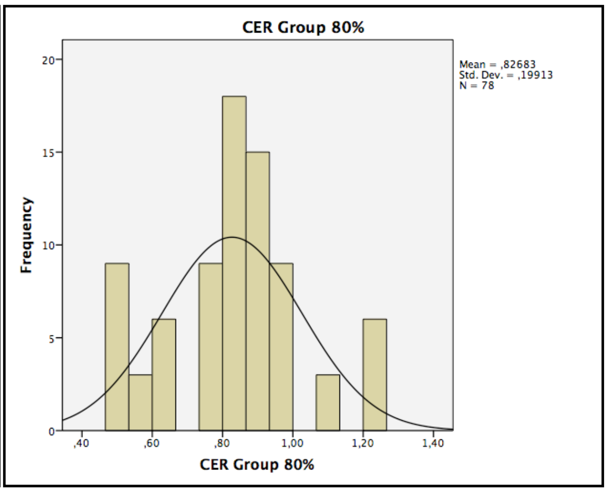

CER Group 60%
Mean = ,8093803418803420
Std. Dev. = ,3324106395098287
N = 78
Frequency
0
5
10
15
20
25
,00
,50
1,00
1,50
2,00
CER Group 60%

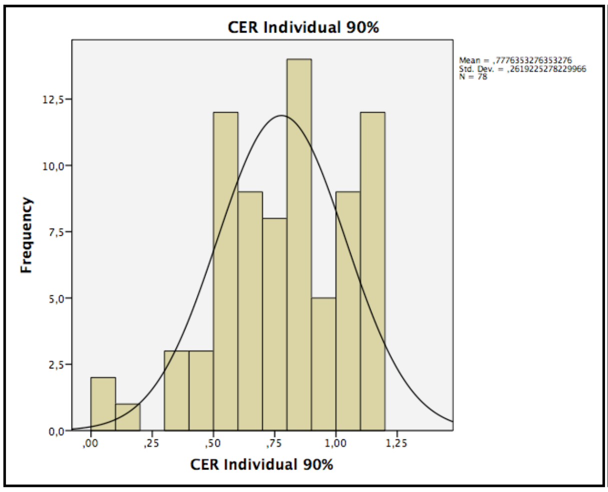

CER Individual 70%
Mean = ,7979304029304030
Std. Dev. = ,3179185092154440
N = 78
Frequency
0
5
10
15
,00
,20
,40
,60
,80
1,00
1,20
1,40
CER Individual 70%

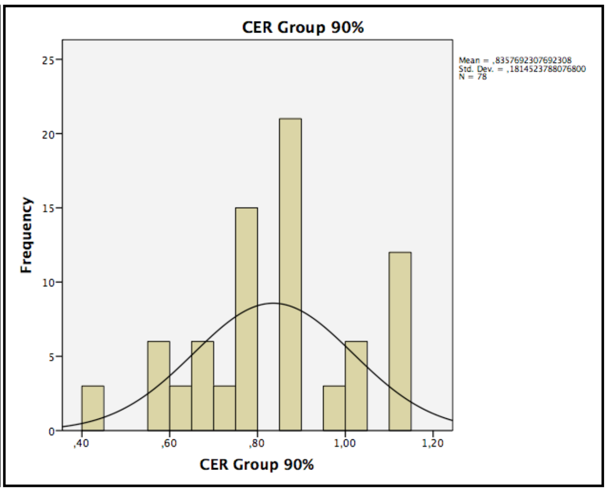

CER Group 70%
Mean = ,8028571428571428
Std. Dev. = ,2813627810803333
N = 78
Frequency
0
5
10
15
20
,25
,50
,75
1,00
1,25
1,50
CER Group 70%

Appendix


CER Individual 80%
Mean = ,80854
Std. Dev. = ,28292
N = 78
Frequency
CER Individual 80%


CER Group 80%
Mean = ,82683
Std. Dev. = ,19913
N = 78
Frequency
CER Group 80%


CER Individual 90%
Frequency
CER Individual 90%


CER Group 90%
Frequency
CER Group 90%

Appendix G: Mann-Whitney U-Test comparing the different lottery data to CER neutrality

Individuals:

	CER 10%	CER 20%	CER 30%	CER 40%	CER 50%	CER 60%
Mann-Whitney U	2301,000	2028,000	1521,000	1521,000	1872,000	1716,000
Wilcoxon W	5382,000	5109,000	4602,000	4602,000	4953,000	4797,000
Z	-2,916	-3,943	-6,026	-5,932	-4,653	-5,190
Asymp. Sig. (2-tailed)	,004	,000	,000	,000	,000	,000
Exact Sig. (2-tailed)	,003	,000	,000	,000	,000	,000
Exact Sig. (1-tailed)	,002	,000	,000	,000	,000	,000
Point Probability	,000	,000	,000	,000	,000	,000

	CER 70%	CER 80%	CER 90%
Mann-Whitney U	1365,000	1716,000	1365,000
Wilcoxon W	4446,000	4797,000	4446,000
Z	-6,541	-5,153	-6,496
Asymp. Sig. (2-tailed)	,000	,000	,000
Exact Sig. (2-tailed)	,000	,000	,000
Exact Sig. (1-tailed)	,000	,000	,000
Point Probability	,000	,000	,000

Groups:

	CER 10%	CER 20%	CER 30%	CER 40%	CER 50%	CER 60%
Mann-Whitney U	1404,000	1170,000	1170,000	1170,000	1287,000	1053,000
Wilcoxon W	4485,000	4251,000	4251,000	4251,000	4368,000	4134,000
Z	-6,341	-7,236	-7,231	-7,228	-6,846	-7,758
Asymp. Sig. (2-tailed)	,000	,000	,000	,000	,000	,000
Exact Sig. (2-tailed)	,000	,000	,000	,000	,000	,000
Exact Sig. (1-tailed)	,000	,000	,000	,000	,000	,000

Point Probability	,000	,000	,000	,000	,000	,000

	CER 70%	CER 80%	CER 90%
Mann-Whitney U	1053,000	936,000	1170,000
Wilcoxon W	4134,000	4017,000	4251,000
Z	-7,609	-8,134	-7,233
Asymp. Sig. (2-tailed)	,000	,000	,000
Exact Sig. (2-tailed)	,000	,000	,000
Exact Sig. (1-tailed)	,000	,000	,000
Point Probability	,000	,000	,000

Appendix H: Mann-Whitney U-Test of the average CER

Ranks

	Group or Individual	N	Mean Rank	Sum of Ranks
Average CER	Individual	78	84,54	6594,00
	Group	78	72,46	5652,00
	Total	156		

Test Statistics[a]

	Average CER
Mann-Whitney U	2571,000
Wilcoxon W	5652,000
Z	-1,670
Asymp. Sig. (2-tailed)	,095
Exact Sig. (2-tailed)	,095
Exact Sig. (1-tailed)	,048
Point Probability	,000

Appendix I: Mann-Whitney U-Test of the CER of the different lotteries

Ranks

	Group or Individual	N	Mean Rank	Sum of Ranks
CER 10%	Individual	78	84,27	6573,00
	Group	78	72,73	5673,00
	Total	156		
CER 20%	Individual	78	85,40	6661,50
	Group	78	71,60	5584,50
	Total	156		
CER 30%	Individual	78	83,75	6532,50
	Group	78	73,25	5713,50
	Total	156		
CER 40%	Individual	78	82,92	6468,00
	Group	78	74,08	5778,00
	Total	156		
CER 50%	Individual	78	85,21	6646,50
	Group	78	71,79	5599,50
	Total	156		
CER 60%	Individual	78	82,49	6434,50
	Group	78	74,51	5811,50
	Total	156		
CER 70%	Individual	78	79,75	6220,50
	Group	78	77,25	6025,50
	Total	156		
CER 80%	Individual	78	78,79	6145,50
	Group	78	78,21	6100,50
	Total	156		
CER 90%	Individual	78	74,85	5838,00
	Group	78	82,15	6408,00
	Total	156		

Test Statistics

	CER 10%	CER 20%	CER 30%	CER 40%	CER 50%
Mann-Whitney U	2592,000	2503,500	2632,500	2697,000	2518,500
Wilcoxon W	5673,000	5584,500	5713,500	5778,000	5599,500
Z	-1,622	-1,927	-1,461	-1,227	-1,863
Asymp. Sig. (2-tailed)	,105	,054	,144	,220	,062
Exact Sig. (2-tailed)	,105	,054	,145	,221	,062
Exact Sig. (1-tailed)	,053	,027	,072	,110	,031
Point Probability	,000	,000	,000	,000	,000

	CER 60%	CER 70%	CER 80%	CER 90%
Mann-Whitney U	2592,000	2503,500	2632,500	2697,000
Wilcoxon W	5673,000	5584,500	5713,500	5778,000
Z	-1,622	-1,927	-1,461	-1,227
Asymp. Sig. (2-tailed)	,105	,054	,144	,220
Exact Sig. (2-tailed)	,105	,054	,145	,221
Exact Sig. (1-tailed)	,053	,027	,072	,110
Point Probability	,000	,000	,000	,000

Appendix J: Mann-Whitney U-Test of the CER of the different lotteries without irrational outliers

Ranks

	Group or Individual	N	Mean Rank	Sum of Ranks
CER 10%	Individual	69	74,99	5174,50
	Group	69	64,01	4416,50
	Total	138		
CER 20%	Individual	69	75,39	5202,00
	Group	69	63,61	4389,00
	Total	138		
CER 30%	Individual	69	74,30	5127,00
	Group	69	64,70	4464,00
	Total	138		
CER 40%	Individual	69	71,67	4945,50
	Group	69	67,33	4645,50
	Total	138		
CER 50%	Individual	69	74,51	5141,00
	Group	69	64,49	4450,00
	Total	138		
CER 60%	Individual	69	73,28	5056,50
	Group	69	65,72	4534,50
	Total	138		
CER 70%	Individual	69	72,69	5015,50
	Group	69	66,31	4575,50
	Total	138		
CER 80%	Individual	69	72,38	4994,00
	Group	69	66,62	4597,00
	Total	138		
CER 90%	Individual	69	68,91	4755,00
	Group	69	70,09	4836,00
	Total	138		

Test Statistics

	CER 10%	CER 20%	CER 30%	CER 40%	CER 50%
Mann-Whitney U	2001,500	1974,000	2049,000	2230,500	2035,000
Wilcoxon W	4416,500	4389,000	4464,000	4645,500	4450,000
Z	-1,649	-1,752	-1,423	-,641	-1,477
Asymp. Sig. (2-tailed)	,099	,080	,155	,521	,140
Exact Sig. (2-tailed)	,099	,080	,156	,523	,140
Exact Sig. (1-tailed)	,050	,040	,078	,262	,070
Point Probability	,000	,000	,000	,001	,000

	CER 60%	CER 70%	CER 80%	CER 90%
Mann-Whitney U	2119,500	2160,500	2182,000	2340,000
Wilcoxon W	4534,500	4575,500	4597,000	4755,000
Z	-1,115	-,941	-,848	-,173
Asymp. Sig. (2-tailed)	,265	,347	,396	,862
Exact Sig. (2-tailed)	,266	,348	,398	,864
Exact Sig. (1-tailed)	,133	,174	,199	,432
Point Probability	,000	,001	,001	,001

Appendix K: Mann-Whitney U-Test of the CER of the different lotteries without upper and lower outliers

Ranks

	Group or Individual	N	Mean Rank	Sum of Ranks
CER 10%	Individual	75	80,58	6043,50
	Group	75	70,42	5281,50
	Total	150		
CER 20%	Individual	75	81,63	6122,00
	Group	75	69,37	5203,00
	Total	150		
CER 30%	Individual	75	79,81	5986,00
	Group	75	71,19	5339,00
	Total	150		
CER 40%	Individual	75	79,37	5952,50
	Group	75	71,63	5372,50
	Total	150		
CER 50%	Individual	75	81,59	6119,00
	Group	75	69,41	5206,00
	Total	150		
CER 60%	Individual	75	79,61	5970,50
	Group	75	71,39	5354,50
	Total	150		
CER 70%	Individual	75	76,94	5770,50
	Group	75	74,06	5554,50
	Total	150		
CER 80%	Individual	75	76,13	5710,00
	Group	75	74,87	5615,00
	Total	150		
CER 90%	Individual	75	72,26	5419,50
	Group	75	78,74	5905,50
	Total	150		

Test Statistics

	CER 10%	CER 20%	CER 30%	CER 40%	CER 50%
Mann-Whitney U	2431,500	2353,000	2489,000	2522,500	2356,000
Wilcoxon W	5281,500	5203,000	5339,000	5372,500	5206,000
Z	-1,456	-1,743	-1,224	-1,094	-1,723
Asymp. Sig. (2-tailed)	,145	,081	,221	,274	,085
Exact Sig. (2-tailed)	,146	,082	,222	,275	,085
Exact Sig. (1-tailed)	,073	,041	,111	,138	,043
Point Probability	,000	,000	,000	,000	,000

	CER 60%	CER 70%	CER 80%	CER 90%
Mann-Whitney U	2504,500	2704,500	2765,000	2569,500
Wilcoxon W	5354,500	5554,500	5615,000	5419,500
Z	-1,162	-,407	-,179	-,919
Asymp. Sig. (2-tailed)	,245	,684	,858	,358
Exact Sig. (2-tailed)	,247	,685	,859	,360
Exact Sig. (1-tailed)	,123	,343	,429	,180
Point Probability	,000	,001	,001	,000

Appendix L: Appendix K: Mann-Whitney U-Test of the CER of the different lotteries without upper and lower outliers

Ranks

	Group or Individual	N	Mean Rank	Sum of Ranks
CER 10%	Individual	67	72,28	4843,00
	Group	67	62,72	4202,00
	Total	134		
CER 20%	Individual	67	72,63	4866,00
	Group	67	62,37	4179,00
	Total	134		
CER 30%	Individual	67	71,50	4790,50
	Group	67	63,50	4254,50
	Total	134		
CER 40%	Individual	67	68,87	4614,50
	Group	67	66,13	4430,50
	Total	134		
CER 50%	Individual	67	71,71	4804,50
	Group	67	63,29	4240,50
	Total	134		
CER 60%	Individual	67	70,99	4756,50
	Group	67	64,01	4288,50
	Total	134		
CER 70%	Individual	67	70,37	4715,00
	Group	67	64,63	4330,00
	Total	134		
CER 80%	Individual	67	70,15	4700,00
	Group	67	64,85	4345,00
	Total	134		
CER 90%	Individual	67	66,77	4473,50
	Group	67	68,23	4571,50
	Total	134		

Test Statistics

	CER 10%	CER 20%	CER 30%	CER 40%	CER 50%
Mann-Whitney U	1924,000	1901,000	1976,500	2152,500	1962,500
Wilcoxon W	4202,000	4179,000	4254,500	4430,500	4240,500
Z	-1,455	-1,545	-1,201	-,411	-1,260
Asymp. Sig. (2-tailed)	,146	,122	,230	,681	,208
Exact Sig. (2-tailed)	,146	,123	,231	,683	,209
Exact Sig. (1-tailed)	,073	,061	,115	,341	,104
Point Probability	,000	,000	,000	,001	,000

	CER 60%	CER 70%	CER 80%	CER 90%
Mann-Whitney U	2010,500	2052,000	2067,000	2195,500
Wilcoxon W	4288,500	4330,000	4345,000	4473,500
Z	-1,045	-,861	-,793	-,219
Asymp. Sig. (2-tailed)	,296	,389	,428	,826
Exact Sig. (2-tailed)	,298	,391	,430	,828
Exact Sig. (1-tailed)	,149	,196	,215	,414
Point Probability	,001	,001	,001	,001

Appendix M: Binominal Test comparing the influence of SCT and PAT

Binomial Test

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
Chosen Sheet	Group 1	group	54	,69	,50	,001
	Group 2	individual	24	,31		
	Total		78	1,00		

Appendix N: Chi-Square Test of difference in Male/Female distribution of SCT and PAT

Gender * Chosen Sheet (single/group) Crosstabulation

			Chosen Sheet (single/group)		Total
			single	Group Sheet	
Gender	male	Count	10	21	31
		Expected Count	9,5	21,5	31,0
	felmale	Count	14	33	47
		Expected Count	14,5	32,5	47,0
Total		Count	24	54	78
		Expected Count	24,0	54,0	78,0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,054[a]	1	,817		
Continuity Correction[b]	,000	1	1,000		
Likelihood Ratio	,053	1	,817		
Fisher's Exact Test				1,000	,505
Linear-by-Linear Association	,053	1	,818		
N of Valid Cases	78				

Appendix N: Chi-Square Test on choice shift dependent behaviour

Chosen Sheet (single/group) * DUMMY more risk-seeking 1 Crosstabulation

			more risk-averse	more risk-seeking	Total
Chosen Sheet (single/group)	group	Count	37	17	54
		Expected Count	34,6	19,4	54,0
	single	Count	13	11	24
		Expected Count	15,4	8,6	24,0
Total		Count	50	28	78
		Expected Count	50,0	28,0	78,0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1,487[a]	1	,223		
Continuity Correction[b]	,929	1	,335		
Likelihood Ratio	1,464	1	,226		
Fisher's Exact Test				,307	,167
N of Valid Cases	78				

Appendix O: Linear regression on polarization of the individual

Descriptive Statistics

	Mean	Std. Deviation	N
Average CEN Groups	-,258170906254240	,451102852983135	78
Average CEN Individuals	-,166531276850721	,537321511432055	78

Correlations

		Average CEN Groups	Average CEN Individuals
Pearson Correlation	Average CEN Groups	1,000	,417
	Average CEN Individuals	,417	1,000
Sig. (1-tailed)	Average CEN Groups	.	,000
	Average CEN Individuals	,000	.
N	Average CEN Groups	78	78
	Average CEN Individuals	78	78

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Average CEN Individuals[b]	.	Enter

a. Dependent Variable: Average CEN Groups
b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,417[a]	,174	,163	,412783724151013

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2,719	1	2,719	15,960	,000[b]
	Residual	12,950	76	,170		
	Total	15,669	77			

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B Lower Bound
1	(Constant)	-,200	,049		-4,084	,000	-,297
	Average CEN Individuals	,350	,088	,417	3,995	,000	,175

Coefficients

Model		95,0% Confidence Interval for B Upper Bound
1	(Constant)	-,102
	Average CEN Individuals	,524

Residual Statistic

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-,630679488182068	,439747512340546	-,258170906254240	,187926164812622	78
Residual	-1,1799371242523119	1,485163331031799	,000000000000000	,410094550742073	78
Std. Predicted Value	-1,982	3,714	,000	1,000	78
Std. Residual	-2,858	3,598	,000	,993	78

Appendix P: Linear regression model on polarization of the group

Descriptive Statistics

	Mean	Std. Deviation	N
Average CEN Groups	-,281010088183422	,465472049126055	25
Average CEN Individuals	-,131492233980012	,378158992750844	25

Correlations

		Average CEN Groups	Average CEN Individuals
Pearson Correlation	Average CEN Groups	1,000	,546
	Average CEN Individuals	,546	1,000
Sig. (1-tailed)	Average CEN Groups	.	,002
	Average CEN Individuals	,002	.
N	Average CEN Groups	25	25
	Average CEN Individuals	25	25

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Average CEN Individuals[b]	.	Enter

a. Dependent Variable: Average CEN Groups after discussion
b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,546[a]	,299	,268	,398215009017817

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,553	1	1,553	9,792	,005[b]
	Residual	3,647	23	,159		
	Total	5,200	24			

Model		95,0% Confidence Interval for B
		Upper Bound
1	(Constant)	-,018
	Average CEN Individuals	1,117

Appendix Q: Linear regression model

Descriptive Statistics

	Mean	Std. Deviation	N
CER	,7941	,71341	1404
GRP	,5000	,50018	1404
LOT20	,1111	,31438	1404
LOT30	,1111	,31438	1404
LOT40	,1111	,31438	1404
LOT50	,1111	,31438	1404
LOT60	,1111	,31438	1404
LOT70	,1111	,31438	1404
LOT80	,1111	,31438	1404
LOT90	,1111	,31438	1404
GRPxLOT20	,0556	,22914	1404
GRPxLOT30	,0556	,22914	1404
GRPxLOT40	,0556	,22914	1404
GRPxLOT50	,0556	,22914	1404
GRPxLOT60	,0556	,22914	1404
GRPxLOT70	,0556	,22914	1404
GRPxLOT80	,0556	,22914	1404
GRPxLOT90	,0556	,22914	1404

Correlations are left out here as they would take up too much space. They can be found in the Output SPSS file with the name “Linear regression”.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	GRPxLOT90, GRPxLOT80, GRPxLOT70, GRPxLOT60, GRPxLOT50, GRPxLOT40, GRPxLOT30, GRPxLOT20, LOT30, LOT20, LOT40, LOT90, LOT80, LOT50, LOT70, LOT60, GRP[b]	.	Enter

a. Dependent Variable: CER
b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,190[a]	,036	,024	,70476

a. Predictors: (Constant), GRPxLOT90, GRPxLOT80, GRPxLOT70, GRPxLOT60, GRPxLOT50, GRPxLOT40, GRPxLOT30, GRPxLOT20, LOT30, LOT20, LOT40, LOT90, LOT80, LOT50, LOT70, LOT60, GRP
b. Dependent Variable: CER

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25,653	17	1,509	3,038	,000[b]
	Residual	688,410	1386	,497		
	Total	714,063	1403			

a. Dependent Variable: CER
b. Predictors: (Constant), GRPxLOT90, GRPxLOT80, GRPxLOT70, GRPxLOT60, GRPxLOT50, GRPxLOT40, GRPxLOT30, GRPxLOT20, LOT30, LOT20, LOT40, LOT90, LOT80, LOT50, LOT70, LOT60, GRP

Coefficients

MODEL		UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS			95,0% CONFIDENCE INTERVAL FOR B
		B	STD. ERROR	BETA	T	SIG.	LOWER BOUND
1	(CONSTANT)	1,241	,080		15,550	,000	1,084
	GRP	-,386	,113	-,271	-3,419	,001	-,607
	LOT20	-,371	,113	-,164	-3,288	,001	-,592
	LOT30	-,529	,113	-,233	-4,688	,000	-,750
	LOT40	-,488	,113	-,215	-4,323	,000	-,709
	LOT50	-,419	,113	-,185	-3,714	,000	-,641
	LOT60	-,406	,113	-,179	-3,596	,000	-,627
	LOT70	-,443	,113	-,195	-3,925	,000	-,664
	LOT80	-,432	,113	-,191	-3,831	,000	-,654
	LOT90	-,463	,113	-,204	-4,105	,000	-,685
	GRPXLOT20	,126	,160	,040	,789	,430	-,187
	GRPXLOT30	,266	,160	,085	1,667	,096	-,047
	GRPXLOT40	,284	,160	,091	1,779	,075	-,029
	GRPXLOT50	,258	,160	,083	1,615	,107	-,055
	GRPXLOT60	,360	,160	,116	2,257	,024	,047
	GRPXLOT70	,391	,160	,126	2,449	,014	,078
	GRPXLOT80	,404	,160	,130	2,533	,011	,091
	GRPXLOT90	,444	,160	,143	2,782	,005	,131

Coefficients[a]

Model	95,0% Confidence Interval for B	Correlations			Collinearity Statistics	
	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	1,397					
GRP	-,165	-,073	-,091	-,090	,111	9,000
LOT20	-,150	-,027	-,088	-,087	,281	3,556
LOT30	-,308	-,070	-,125	-,124	,281	3,556
LOT40	-,266	-,046	-,115	-,114	,281	3,556
LOT50	-,198	-,018	-,099	-,098	,281	3,556
LOT60	-,184	,014	-,096	-,095	,281	3,556
LOT70	-,222	,003	-,105	-,104	,281	3,556
LOT80	-,211	,012	-,102	-,101	,281	3,556
LOT90	-,242	,006	-,110	-,108	,281	3,556
GRPxLOT20	,439	-,063	,021	,021	,265	3,778
GRPxLOT30	,579	-,069	,045	,044	,265	3,778
GRPxLOT40	,597	-,049	,048	,047	,265	3,778
GRPxLOT50	,571	-,034	,043	,043	,265	3,778
GRPxLOT60	,673	,005	,061	,060	,265	3,778
GRPxLOT70	,704	,003	,066	,065	,265	3,778
GRPxLOT80	,717	,011	,068	,067	,265	3,778
GRPxLOT90	,757	,014	,075	,073	,265	3,778

Collinearity Diagnostics are left out here as they would take up too much space. They can be found in the Output SPSS file with the name “Linear regression”.

Casewise Diagnostics[a]

Case Number	Std. Residual	CER	Predicted Value	Residual
127	11,010	9,00	1,2409	7,75910
128	5,151	4,50	,8698	3,63019
129	3,247	3,00	,7119	2,28812
776	3,023	3,00	,8698	2,13019
820	8,010	6,50	,8550	5,64500
821	3,746	3,25	,6098	2,64019
829	12,414	9,99	1,2409	8,74910
830	5,853	5,00	,8698	4,12519
831	3,247	3,00	,7119	2,28812
838	8,010	6,50	,8550	5,64500
839	3,746	3,25	,6098	2,64019
856	8,010	6,50	,8550	5,64500
857	3,746	3,25	,6098	2,64019
955	3,915	4,00	1,2409	2,75910
1009	3,915	4,00	1,2409	2,75910
1279	9,591	8,00	1,2409	6,75910
1280	4,512	4,05	,8698	3,18019

Casewise Diagnostics[a]

Case Number	Std. Residual	CER	Predicted Value	Residual
127	11,010	9,00	1,2409	7,75910
128	5,151	4,50	,8698	3,63019
129	3,247	3,00	,7119	2,28812
776	3,023	3,00	,8698	2,13019
820	8,010	6,50	,8550	5,64500
821	3,746	3,25	,6098	2,64019
829	12,414	9,99	1,2409	8,74910
830	5,853	5,00	,8698	4,12519
831	3,247	3,00	,7119	2,28812
838	8,010	6,50	,8550	5,64500
839	3,746	3,25	,6098	2,64019
856	8,010	6,50	,8550	5,64500
857	3,746	3,25	,6098	2,64019
955	3,915	4,00	1,2409	2,75910
1009	3,915	4,00	1,2409	2,75910
1279	9,591	8,00	1,2409	6,75910
1280	4,512	4,05	,8698	3,18019

a. Dependent Variable: CER

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	,5921	1,2409	,7941	,13522	1404
Std. Predicted Value	-1,494	3,305	,000	1,000	1404
Standard Error of Predicted Value	,080	,080	,080	,000	1404
Adjusted Predicted Value	,5694	1,2570	,7941	,13553	1404
Residual	-1,24090	8,74910	,00000	,70048	1404
Std. Residual	-1,761	12,414	,000	,994	1404
Stud. Residual	-1,772	12,495	,000	1,000	1404
Deleted Residual	-1,25701	8,86273	,00000	,70958	1404
Stud. Deleted Residual	-1,774	13,259	,002	1,018	1404
Mahal. Distance	16,988	16,988	16,988	,000	1404
Cook's Distance	,000	,113	,001	,005	1404
Centered Leverage Value	,012	,012	,012	,000	1404

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