The Motivating-Uncertainty Effect:
Do uncertain rewards increase motivation?

Master Thesis

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ABSTRACT

Uncertainty and motivation, what do these two components have in common? This research paper looks into the motivation-uncertainty effect and how this paradigm is affected by people focusing on either the process or outcome towards a reward. Research has shown that uncertain rewards are preferred over certain rewards, because it shows that uncertainty stimulates arousal and positive experiences and thereby creates motivation. This study follows an online auction experiment in which the willingness to pay is elicited, and where a higher willingness to pay represents higher motivation. Two conditions are used as manipulation to see whether focus on the process towards a reward or the outcome of the reward influences willingness to pay. Lastly, the paper examines the effect of reiteration on willingness to pay in the certain and uncertain conditions. Contrary to the result of the previous study, this study finds a negative relation between uncertainty and willingness to pay. Moreover, no evidence was found for a relation between uncertainty and focusing on the process of reward pursuit. Repeating the experiment resulted in a reduction of the negative effect. Therefore, further research is needed to understand when uncertainty boosts motivation and is preferred to certain rewards.

Keywords: Motivating-uncertainty effect, motivation, willingness to pay, ANOVA.

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1. INTRODUCTION

"The only certainty is that nothing is certain" - Pliny the Elder

Suppose that on your way to work you buy a croissant on the go from a local barista. The following two situations can be considered. In the first *uncertain* situation, every time you buy a croissant on the go, you receive a €1 discount or a €2 discount, but you do not know which of the two discounts you will receive until you purchase the product. In the second *certain* situation, you receive a €1 discount every time you buy a croissant. In which situation would one buy more croissants from this barista?

Most of the time, people would predict that most people would keep buying from this barista in the certain discount situation. In general, consumers prefer certainty over uncertainty and therefore go for the second situation since this situation lets you enjoy the certain discount. How do individuals allocate their resources such as money, effort, and time towards uncertain and certain rewards? Do the process and the outcome towards an uncertain or certain reward influence this behavior, and how does this relate to motivation? This research paper looks towards the motivating-uncertainty effect, and specifically how uncertainty can influence motivation.

Economic research on decision theory has provided paradoxical answers to the question asked above. First of all, Expected Utility theory (von Neumann and Morgenstern, 1944) in essence tells us that when a consumer faces a decision between a set of mutually exclusive choices, this person will assign a probability and a utility measure to each of the choices and his choice will be by the maximum expected utility criterion (Halperin, R. A., 2017). The uncertainty part in this story is that the probabilities are unknown. While the Expected utility theory of von Neumann and Morgenstern, has been accepted overall as a normative model, the next theory is the descriptive theory of cumulative prospect theory (Kahneman and Tversky, 1979). This theory essentially tells us that people are risk-averse for gains and prefer a reward of a certain magnitude over a reward with an uncertain magnitude. Therefore, people might be more motivated by a reward of a certain magnitude compared to a reward of an uncertain magnitude (Shen et al., 2015).

On the other side, some studies predict the opposite. There are situations that people enjoy uncertainty and choose uncertainty over certainty. The paper by Wilson et al. (2005), studies the pleasure of uncertainty. They hypothesize that uncertainty prolongs pleasure that follows from a positive event. The authors state that people are often not aware uncertainty can have

this effect. They found evidence for the pleasure of uncertainty, and additionally, obtained results that indicate that participants would prefer to have their uncertainty resolved. Moreover, the study of Shen et al. (2015) research the motivating-uncertainty effect and find that people invest more resources in an uncertain reward compared to a certain reward. Furthermore, they find that the positive experience in the process of reward pursuit underlies the motivating-uncertainty effect and increases motivation. In order words, the authors predict that people will choose uncertain rewards over certain rewards. Marschak (1950), studies rational behavior and uncertain prospects when measuring utility. These studies on uncertainty show that people do enjoy uncertainty and hence, there is also a possibility that people are more motivated by an uncertain magnitude reward.

In addition to what these studies tell us about choosing uncertainty over certainty, there is literature focusing on the positive feelings behind this preference towards uncertain positive outcomes. Bar-Anan et al. (2009) hypothesize and found evidence that uncertainty during an emotional event makes pleasant events more pleasant. This would occur even if uncertainty is just described as the feeling of not knowing. Lee & Qiu (2009) start their study by stating that individuals generally prefer certainty over uncertainty. Their research shows the opposite, that is, that consumers facing uncertainty in a positive event experience greater positive feelings and excitement. Concluding, research has provided evidence that uncertainty about positive outcomes encourages positive feelings and experience.

To summarize, decision theory tells us that people prefer a reward of a certain magnitude over a reward with an uncertain magnitude and thus are risk-averse for gains. On the contrary to what these decision theories predict, there is a broad range of literature focusing on how uncertain rewards are preferred over certain rewards. It shows that it stimulates arousal and positive experiences. This research follows the paper of Shen et al. (2005) and proposes that a reward of an uncertain magnitude will increase motivation compared to a reward of a certain magnitude. Additionally, this assumption is based on the positive experience in the process of reward pursuit.

This paper sets out to understand how uncertainty generates arousal and positive experience and thereby explain why uncertain rewards are preferred to certain rewards. Accordingly, taking into account previous research, and the fact that there might be a new movement regarding uncertainty and motivation, this paper will study the motivating uncertainty paradigm. Specifically, this is formulated in the following research question:

Why is a reward of an uncertain magnitude more motivating than a reward of a certain magnitude and how is the process of reward pursuit related to the motivating-uncertainty effect?

The remainder of this paper is organized as follows: Chapter 2 will be a literature review discussing the effects of certainty and motivation. It will start discussing how individuals react towards uncertain and certain rewards and how this is related to motivation. Thereafter, it will describe the two focus groups, process, and outcome. Lastly, the effect of iteration on motivation is discussed. Chapter 3 will explain the method used. Chapter 4 will discuss the results and chapter 5 consists of the conclusion, limitations, and recommendations for further research. Chapters 6 and 7 include the references and Appendices.

2. LITERATURE REVIEW

This section discusses and outlines existing literature relating to relevant topics of the motivating-uncertainty effect and introduces the hypotheses of this study. First uncertainty and motivation will be discussed. Thereafter, the effect of process or outcome focus and lastly the effect of iteration on motivation will be discussed.

Uncertain rewards and motivation

Every person faces situations in which one knows things for certain, and situations in which one doubts and faces uncertainty. Whether the situation is certain or uncertain, one does devote time and resources in these situations to achieve certain goals, rewards, or items. Does the reward certainty influence the resources one would invest?

In social psychology, certainty is a main factor in constructing people's behaviors and attitudes (Tormala, 2016). People make different decisions and form different opinions, think differently, and behave in a different way when they feel certain compared to when they feel uncertain. To specify certainty, a certain reward has a fixed and known magnitude (Gross et al., 1995).

Uncertainty and synonyms of this word such as doubt and suspicion have a negative undertone (Wilson et al., 2005). Uncertainty can be defined as the lack of information about when, where, why, or how a certain situation will occur or will occur (Knight, 1921). Causation of it is due to people's anxieties, and therefore it is not surprising that the human mind tries to eliminate or reduce it (Hogg, 2000) Heuristics that are used when evaluating uncertainty can create biases with serious implications, such as illusion of control (Barnes Jr, 1984; Langer, 1975). Fortunately, humanity has gathered many facts to generate theories to make the unknown known and make the world more predictable. The cost of making the world more predictable and reducing uncertainty is that the world becomes less exciting and less intriguing (Wilson et al, 2005). Predictable events generate fewer emotions compared to unpredictable events, which entails that uncertainty reduction can reduce the pleasure that uncertainty strengthens.

An uncertain reward has at least two potential magnitudes with known or unknown probabilities (Shen et al., 2015). As mentioned, this paper will replicate the paper of Shen et al. (2015), and therefore I will compare motivation towards a certain reward to an uncertain reward. In this motivating-uncertainty paradigm, only positive values will be compared and the total expected value in the uncertain condition is strictly lower compared to the certain condition (b>c). This can be written as the following: L: (0.5: b, 0.5:c) vs. (1:b) (Shen et al., 2015).

In this situation, by monocity, receiving b is stochastically dominates the option of receiving b with a probability of 50% or receiving a smaller value than b with 50% probability. Accordingly, this paradigm serves as a powerful experiment for the influence of motivational uncertainty because this dominated-uncertainty paradigm compares certain rewards with uncertain rewards of a lower expected value.

As previously stated, results from several studies indicate that uncertainty is related to motivation. I predict that uncertainty increases motivation and investment resources. This paper will study events in which individuals choose the stochastically, by monocity, dominated uncertain reward over the certain rewards. Hence the first hypothesis:

H1: The motivating-uncertainty effect: a reward of an uncertain magnitude can be more motivating than a reward of a certain magnitude even if the uncertain reward has a lower expected value.

Process vs. Outcome

When striving for a reward, there are two focus distinctions that one can make. The process towards this reward, and the outcome itself: the reward. Mental simulation research has found that there are different effects for process vs. outcome focus (Escalas & Luce, 2004). Goal setting, thus deciding how much you are willing to invest in pursuing a certain goal is related to focusing on the outcome itself. For example, Bagozzi and Dholakia (1999) show that goal-setting plays a major role in the behavior of consumption of consumers, especially in a purposive setting. Moreover, if one has to motivates itself, one generally focuses on goal-setting procedures. Notably, the focus on instrumental aspects of an activity can affect the experience while pursuing a goal. Consequently, the focus on the outcome then evokes a mental state in which the mind centralizes affect-poor aspects to evaluate actions. (Fishbach and Choi, 2012; Gollwitzer, 2012). In order words, focusing on the outcome of the pursuit decreases motivation.

On the other hand, one can focus on the process towards the reward. Recent research has demonstrated that people who focused on the process towards a reward, rather than focusing on the outcome of the reward enjoyed a better achievement of their goals (Tormala, 2016; Taylor et al., 1998). As mentioned in the section above, research has shown that uncertainty can be exciting and increases motivation by causing arousal and positive feelings. Thus, people who face uncertainty may be more curious about what will happen, which increases the engagement with the event. When pursuing the reward, people intuitively focus on the process during the reward pursuit. Especially during this phase emotions increase motivation (Andrade

& Iyer 2009; Kivetz 2003). Therefore, focusing on pursuing the reward rather than the outcome increases motivation by generating positive experience during the pursuit of a reward of an uncertain magnitude. Following from this is the second hypothesis:

H2: The positive experience in the process of reward pursuit underlies the motivating-uncertainty effect.

Effects of iteration on motivation

Would an individual like to continue pursuing a reward once he already obtained a reward with the same procedure? In a variety of industries, marketers are bothered with the question of how they can influence consumers such that they drive consumers to repeated actions, such as purchases. In the case of uncertainty and process-focused, can these conditions drive repetition? One can argue that in a situation with an uncertain outcome, an individual wants to repeat the process to resolve the uncertainty. This uncertainty resolution provides a reward that can positively influence motivation (Shen et al., 2019).

On the other hand, many people might think that a repetitive task often turns out to be a boring one after accomplishing it the first time. Some theoretical viewpoints regarding the causation of boredom. First, Csikszentmihalyi (1975) describes the causation of boredom as the dissimilarity between the task difficulty and one's competence. A large difference can result in boredom, especially if the task is too easy. Second, Berlyne (1960) discusses the needs for tasks characteristics. e.g., complexity and uncertainty. Exposure to similar stimuli will generate boredom. Knowing that the task in this experiment is easy to perform, I expect that this might generate boredom if the participant will repeat the performance. Therefore, the third hypothesis is the following:

H3: The positive experience in the process of reward pursuit weakens when the reward pursuit is being repeated and thereby motivation weakens.

3. METHODOLOGY

The goal of this paper is to find out if and how uncertain rewards increase motivation. To study this research question, the three hypotheses introduced above will be tested. As discussed, the hypotheses are inspired by the leading paper of this thesis written by Shen et al. (2015). First, I examine the motivating uncertainty effect. I test whether a reward of an uncertain magnitude can be more motivating than a reward of a certain magnitude even if the uncertain reward is strictly worse than the certain reward. Second, I examine whether rewards with an uncertain magnitude cause the pursuit of the reward to be more exciting and create more curiosity and hence increase motivation. Third, I will research whether this positive experience in the process of reward pursuit weakens when the reward pursuit is repeated. Data is obtained via a survey distributed to young individual students. This data thereafter is analyzed with a set of statistical tests and regression analyses. The survey was fully anonymous, and the data was not published elsewhere.

Experimental design

In order to test whether uncertain rewards increase motivation, and to test whether positive experience in the process of reward pursuit underlies the motivating uncertainty effect I conduct an experiment with students from different universities in the Netherlands. Recruitment of subjects is done by distributing an online survey in Qualtrics through various social media platforms (LinkedIn, WhatsApp, Instagram), to reach an as large as possible sample. The social media message contains a short description of the experiment, a sentence mentioning a monetary reward as an incentive, and a link where students can sign up. The online survey was released on the 29th of June 2021 and was closed after 1 week on the 6th of July 2021. The experiment is based upon a 2 x 3 between-subjects design. This means for the reward possibility: certain vs. uncertain. The focus is divided into 3 groups: process vs. outcome vs. control. Figure 1 visualizes this research design.

The experiment simulates an auction similar to the one in Shen et al. (2015), in which participants bid on coin rewards in 3 auctions. At the beginning of the auction, the participant receives a budget of 30 fictional experiment coins and reads the instructions. After reading the instructions, the participants proceed and are randomly allocated to one of the two certainty reward situations. The participant can be in the certain reward condition, where the reward of 15 coins is won with a possibility of 100%, or can be in the uncertain reward condition, where the reward of 15 coins or 10 coins is won with a possibility of 50% / 50 %. Once located in one

of the treatments, the participant is directly randomly allocated again to one of the 3 focus treatments. This can be the process, control, or outcome focus. Thereby the 2x3 treatment design is completed (Figure 1). An overview of the division of the subjects into the treatments can be found in Table 8 in Appendix C

Figure 1: 2x3 design
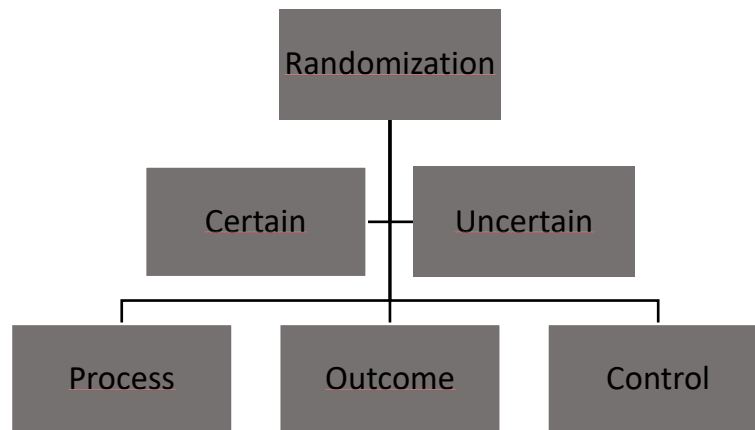
2*3 design	Certain	Uncertain
Process	Certain * Process	Uncertain * Process
Outcome	Certain * Outcome	Uncertain * Outcome
Control	Certain * Control	Uncertain * Control

In order to test whether uncertain rewards can be more motivating than certain rewards (H1), I will compare the willingness to pay (WTP) for lottery tickets between the two conditions: the certain reward and the uncertain reward condition. The uncertain reward will be determined in Qualtrics by the randomization algorithm Mersenne Twister.

The main dependent variable is WTP. A higher WTP in an auction indicates a greater incentive for investment in a reward, and thus reflects higher motivation. In order to make sure that participants reveal their true preferences, a Becker-DeGroot-Marschak (BDM) (Becker et al., 1964) like mechanism will be used. In a BDM mechanism, a participant states his WTP via bidding on the reward. A participant will purchase the reward if their true WTP is higher than the predetermined asking price. The asking price is randomly selected from a distribution of prices, in which the prices range from 10 to a price greater than the maximum WTP of a participant (Breidert et al., 2006). If the random asking price of the seller is greater than the bidder's WTP, the participant does not buy the reward. Therefore, the participant is price taker, and cannot influence the price and hence, truthfully revealing the WTP is a dominant strategy.

In order words, a higher WTP will reflect a greater motivation to get the reward in the auction. The total sum of WTP of all 3 auctions will be used as the measurement for motivation.

To test whether positive experience in the process of reward pursuit underlies the motivating-uncertainty effect (H2), I use the same variables as Sheng et al. (2015). I measure the reward attractiveness and the experience of the bidding process as independent variables. After completing the 3 auctions, participants are asked to answer a short questionnaire with 3 questions. To measure the experience of the process, they are asked how much they found the auction exciting and how much they found the auction interesting (both from a scale from 1 to 9, where 1 is not at all, and 9 is very). Additionally, to determine the attractiveness of the reward, participants were asked how attractive they found the reward of the auction (again from a scale from 1 to 9, where 1 is not at all, and 9 is very). These questions were asked after the three auctions.

At last, to test whether the positive experience in the process of reward pursuit weakens when the reward pursuit is being repeated (H3), I ask after completing the first 3 auctions, whether they would like to continue the bidding activity and participate in three more auctions. Participants would stay in the same treatment as they were before, and all conditions remain constant. I will measure this as a binary variable. Additionally, if a participant chooses to repeat the auction, their WTP will be compared as a within-subject variable to measure whether their WTP, and hence motivation will decrease or not.

The Experiment

As previously mentioned, the experiment was created in Qualtrics and distributed via various social media platforms. At the starting page, participants were shown an introduction message which stated that participation was voluntary, fully anonymous, showed a monetary reward as an incentive and that the instructions for the experiment could be read on the next page. Moreover, it asked the participants to answer as if the participant were in a real-life scenario. If the participants had read the information sheet and proceeded, the experiment was explained. The instruction page explained that the participants would be participating in an auction, and that they would adopt the role of the buyer. Subjects were asked to read them carefully to be sure that there is common knowledge. To be sure participants read the instructions well, two multiple-choice questions were asked regarding the instructions. The first question asked, "what is used to bid in the auctions", and the second question asked, "when do you win the auction". Participants could only continue after answering correctly. After reading

and answering, participants could proceed to the action and were randomly allocated into different treatments.

Participants in this experiment took approximately 8 minutes to finish the auction and the brief questionnaire. In the beginning, participants receive 30 fictional coins, which they could use for bidding on the auction rewards. Every coin they won or did not spend was transformed into a lottery ticket that counts as a ticket to win a reward in the form of a €30, - Bol.com card. In other words, 1 coin is worth 1 lottery ticket, and the lottery tickets were used in a lottery to win a €30, - Bol.com card. Participants were, therefore, incentives to obtain more coins, because this yields a higher chance of winning the monetary reward at the end using a Binary Lottery Incentive.

Besides the show-up fee of 30 coins, participants can choose to use those coins as a budget for bidding in the auction to increase their total amount of lottery tickets. For example, a participant's WTP is in all 3 auctions higher than the sellers asking price and the seller's total asking price is 8 coins in each auction. Then the participant's total budget is the remaining coins of his budget after bidding plus the coins won in de auction, depending on the certain and uncertain treatment. The example shown on the instruction page was the following:

>*"Your budget is 30 coins. If in auction 1, your bid is 11 coins and you win, and the reward of the first auction is 14 coins, your total budget increased to 33 coins. [30-11+14=33]"*

Once the instructions of the experiment were read, the auction started. In every auction, participants bid on a reward. The reward in every auction consisted of coins. The participant will purchase the coins only if their WTP is higher or equal than the predetermined, unknown, asking price. Both the seller and the buyer had the same information regarding the reward certainty. Moreover, since this is an online experiment, the buyers did not sit in front of a real-life seller, but were completing the study with a virtual seller. All participants completed three auctions and, in every auction, the buyer was told he could earn an amount of coins. In the original study, the buyer saw an opaque cup covering the reward. Since this experiment is a digitalized auction, the buyer could read or could not read the magnitude of the reward depending on the reward certainty randomization.

To elicit the WTP of the buyer, the BDM mechanism as described above was used. The seller will have a predetermined asking price, and the buyer had to determine the amount of coins he wanted to bid on the reward. The participant always bid their true WTP since they would only pay if the sellers' price was lower. A higher asking price did not influence their budget.

To manipulate the reward certainty, I show, in the certain-reward situation, the buyer the amount they can win. In each auction, they can win an amount of 15 coins. In the uncertain-reward situation, the buyers could either win 10 or 15 coins. Therefore, by monocity, the certain reward of 15 is preferred to the lottery of winning either 10 or 15 coins. The certain reward thereby, stochastically dominates the uncertain reward.

I manipulate the focus of a treatment based on the method of Shen et al. (2015) by introducing identical sentences as Shen et al. (2015). In the control condition, a participant will only receive the auction instructions shown in the introduction. The process condition, however, will read the following just before the start of the auction: *"Enjoy the auction!"*. The outcome condition participants will read before the auction starts: *The auctions are a good way to obtain a €30, - Bol.com card!"*. If a participant was assigned to one of the two treatments, they saw the sentences for a minimum of 5 seconds before they could proceed. This was done to raise awareness for the sentences.

After completing the first three auctions, the participants were asked to whether they would like to continue the bidding activity and participate in three more auctions. Depending on their choice, they could either directly proceed to the questions on the bidding process and reward attractiveness or participate in three more auctions. The last page of the experiment contained questions about the demographics of the participant. Data on gender, age, level of education, and nationality were obtained. These questions were asked at the end of the survey, to turn down the likelihood of people quitting the survey beforehand. Moreover, answering demographic questions requires less attention compared to playing the auction, and it is, therefore, more likely that these questions have fewer exhaustion effects. Once finished, the participants were thanked for their time and participation. They were asked to fill in their email address to compete in the lottery, with the lottery tickets they had won during the experiment. To guarantee privacy, it stated that email addresses were deleted after 7 days and only used for the lottery. Additional information regarding the questions asked in the experiment can be found in Appendix A.

Sampling

The Qualtrics experiment was distributed through various social media platforms such as LinkedIn, WhatsApp, Instagram, and Facebook to recruit participants. Respondents were contacted via personal distribution channels such as WhatsApp groups, personal LinkedIn contacts, and personal Instagram followers. The majority of respondents were students, due to

personal outreach. To extent the sample size and increase variety in the sample, the survey was distributed on an online survey distribution platform called SurveySwap. SurveySwap connects people by putting them in contact with each other, so they could fill in each other's surveys. A total of 150 respondents participated in the experiment. Moreover, out of these 150 observations, 51 of the observations had to be dropped from the data sample, as the participants did not complete the experiment before it was finished. Unfortunately, some participants had an error in the experiment and the last question was not answered, causing 2 observations to be invalid. This results in a total of 97 observations left to analyze.

Data analysis

After collecting the data, the data obtained from distributing the experiment had to be cleaned in advance before it could be used for the analysis. This was done using Stata and Excel. After cleaning, 97 observations were left to generate the variables and their scores and indices. The main variables which are tested are WTP and WTP_Repeat.

To analyze the data obtained from the experiment, there are 11 models constructed. First of all, two OLS regressions are executed on WTP and certainty to see how these variables interact with each other. Second, since this research follows a 2x3 design, two models with WTP and interaction terms between certainty and focus will be executed. Next, to these two models, the level of excitement, interest, and reward attractiveness are added to these models. In these models, the level of excitement and interest are averaged into an index of process experience. Besides these 6 models, a logit model testing for selection bias and a regression model on the effect of repeating on positive experience are created. Moreover, to test the interaction between WTP and certainty and focus, a two-way ANOVA test will be executed. According to Gelman (2005), various assumptions of ANOVA analysis must be met in order to have a valid ANOVA analysis. If these assumptions do not hold, the results of the analysis are not credible. The first assumption regards the dependent variable and tells us that it should always be measured at the continuous level. This holds for willingness to pay. The second assumption regards the independent variables, and tells us that each should consist of two or more categorical independent groups. This holds for both certainty (0 or 1) and Focus (0, 1, or 2). The next assumption regards the independence of observations. This data set is not one of time-series, but one of cross-sectional, and therefore this assumption holds as well. The fourth assumption regards no significant outliers because this can harm the accuracy of the ANOVA results. To account for the few outliers the dataset has, the WTP is winsorized to remove significant outliers. The 1 and 99 percentile outliers have been replaced with the 5 and 95 percentiles

values. The fifth assumption regards the dependent variable and states that it should follow approximately a normal distribution for each group of the independent variable. The distributions are not perfectly normally distributed, by approximately, therefore it holds and can be seen in Appendix B, Figure 7. The last assumption regards homogeneity of variance. This must hold for every combination of groups of the two independent variables. To test this, Levene's test for homogeneity of variance is used. This can be found in Appendix E, Table 15.

Thereafter, to test the experience and attractiveness, a moderated-mediation model will be constructed. The moderated-mediation model by Hayes (2008, 2017) is used to find out whether process experience and reward attractiveness mediate the effects of reward certainty on willingness to pay, and to find out whether focus moderated this mediation. A mediator variable can be defined as a variable that is located between an independent variable and the dependent variable. Some of the effects that the independent variable has on the dependent variable passes through this mediator, known as the indirect effect. Next to the mediator, a moderator variable has its presence if two variables interact with each other such that the effect of one variable depends on the value of the moderator variable, i.e., depending on the value of the moderator, the other value of the other variable changes. Combining the moderator and the mediator results in the moderated-mediation model of Hayes, and occurs when a moderator variable interacts with a mediator variable, resulting in a conditional indirect effect. To compute this conditional indirect effect, bootstrapping is used to obtain standard errors and confidence intervals. Next to bootstrapping, two regression models are needed to compute obtain coefficients, first a model with the dependent variable as the response variable, and second a model with the mediator as the response variable (UCLA: Statistical consulting Group). This is obtained by an SEM model and is calculated by multiplying coefficients with the selected values of the moderator variable.

Lastly, to analyze whether repeating the experiment weakens the positive experience arousal and thereby lowers willingness to pay, a paired t-test will be executed. To compare the two same groups, a subgroup of WTP is taken. This subgroup consists out of all the participants who have chosen yes at the repeating question. Their WTP of the first three rounds is compared to their WTP_Repeat of their 3 rounds in the repeating auctions. For an overview of the histogram of this variable, see Figure 8 in Appendix B. For the t-test to be valid the variables need to be normally distributed, and extreme outliers have to be removed. To account for the few outliers WTP_Repeat and WTP have, they are winsorized to remove significant outliers. The 1 and 99 percentile outliers have been replaced with the 5 and 95 percentiles values. The t-test will compare the means of WTP and WTP_Repeat.

The models will include a different set of control variables, chosen from the set: *Age, Male, Education, and Dutch*. *Age* is a categorical variable (1-4). A value of 1 represents the age group 1-17, 2 the age group 18-24, 3 the age group 26-30, and 4 the age group 30-40. *Gender* is a dummy variable that takes the value 1 if a subject is a male, and 0 if a subject is a female. *Education* is a categorical variable 1-3 representing the highest level of education a subject has completed. Values of 1 represent secondary education, 2 a bachelor's degree, and 3 a master's degree. *Dutch* is a dummy variable that indicated the country, where 1 represents a Dutch nationality and 0 a non-Dutch nationality. The descriptive statistics of all variables and the results of the different models can be found in section 4. The spearman rank correlations can be found in Appendix D, Table 13 and 14.

4. RESULTS

Descriptive Statistics

The final sample size consists of 97 subjects, of which 57 are males, 40 are females, and 0 other/preferred not to say. The majority of the participants were in the age group between 18 and 25 (n = 77). The second largest group has an age between 26 and 30 (n = 17). Next to age, 94% of the participants have obtained at least a bachelor's degree. Besides age, gender, and education, subjects' nationality was asked, 84 participants were Dutch (87%), while the remaining 13 participants (13%) have different nationalities. The exact information regarding frequencies and the sample can be found in Appendix C, Table 7.

Next to the demographics, there are categorical and dummy variables generated to use in specific models. *Excitement*, *Interest,* and *Attractiveness* are variables indicating the process experience and reward attractiveness. This is done on a Likert scale ranging from 1-9 (Likert, R., 1932). Next to their individual statistics, excitement and interest are corresponding to the process experience and are therefore an averaged index of process experience is generated by adding the scores. The mean of this index is 5.79 with an SD of 0.64. *Repeat*, is a dummy variable indicating whether participants would like to participate again. If choosing yes (1), participants will complete the whole survey again, having a chance of obtaining more lottery tickets. In total, 69 people have chosen to repeat the experiment, which is about 71%. An overview of the descriptive statistics can be found below in Table 1. The description of all the variables that will be used in the different models can be found in Appendix C, Table 6.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Willingness to Pay	97	29.753	8.886	12	55
Repeat	97	.289	.455	0	1
Willingness to Pay_R	69	36.928	6.362	15	56
Bidding process 1	97	5.845	1.938	1	9
Bidding process 2	97	5.732	1.907	1	9
Reward attractive	97	5.897	1.907	1	9
Age	97	2.206	.477	1	4
Education	97	2.33	.572	1	3
Male	97	.588	.495	0	1
Dutch	97	.866	.342	0	1

Willingness to Pay and Willingness to Pay Repeat

For the first two hypotheses, the dependent variable willingness to pay was computed. WTP is a continuous dependent variable and was measured after each auction. The paper of Shen et al. (2015) uses the sum of WTP in all 3 auctions, which is based on the fact that participants were unable to find out the bidder's price in both the uncertain and certain conditions. Since this study is replicating the study of Shen et al. (2015), this study will also use the sum of the 3 auctions as a measure of motivation. The following formula is used: $WTP = WTP\ auction\ 1 + WTP\ auction\ 2 + WTP\ auction\ 3$. All 97 subjects reported their WTP for all three auctions, and thus the sum of all three auctions could be used for all subjects. The mean WTP is 29.753 (SD = 8.89) with a maximum sum of 55. The skewness, which is a measure of degree and direction of asymmetry, is 0.1127 ($P>0.05$), which indicates a normal distribution (see Table 12, Appendix C). Moreover, a Shapiro-Wilk test also indicates a normal distribution($P>0.05$). Figure 2 shows a histogram of the variable willingness to pay. The spearman rank correlations show that the variable of interest, WTP, is correlated with the variables certainty ($p<0.01$), focus($p<0.1$), bidding process ($p<0.01$) and reward attractiveness($p<0.05$) (See Table 13, Appendix D). These will therefore be added to Models 1 and 2. Furthermore, the spearman rank correlations indicate a significant correlation between biddingprocess_1 and 2 and between these variables and reward attractiveness. Bidding processes 1 and 2 are similar questions in the experiment and will be indexed, it is, therefore, plausible that those are correlated. With respect to the control variable gender, males have a slightly higher WTP compared to females (M = 29.9 vs M = 29.7). Plotting Willingness to pay against certainty, we observe that subjects in the certain condition, without considering the focus of the auction, are willing to pay more compared to the uncertain condition (M = 35.14 vs M = 24.25).

The participants who selected yes at the question regarding repeating the auction played the three auctions again. This resulted in the *Willingness_To_Pay_Repeat* (WTP_Repeat) variable, which is computed in the same way as the Willingness to pay variable. The mean WTP_Repeat is 36.93 (SD = 8.89) with a maximum sum of 56. The skewness for WTP_Repeat is 0.4819 ($P>0.05$), which again indicates a normal distribution (see Table 12, Appendix C). Figure 3 shows a histogram of the variable willingness to pay repeat. Looking at the spearman rank correlations for WTP_Repeat, shown in Table 14 in Appendix D, the certain and focus variables do not have a significant correlation with the variable of interest. This can be due to the fact that the subjects were already bored by the first round of auctions and fermented themselves

with the task. This will be further discussed in the next section. Furthermore, the spearman rank correlations indicate a significant correlation between biddingprocess_1 and 2 and between these variables and reward attractiveness. Again, bidding processes 1 and 2 are similar questions in the experiment and will be indexed, it is, therefore, plausible that those are correlated. With respect to gender, males have again a slightly higher WTP_Repeat compared to females (M = 36.32 vs M = 38.23). Plotting WTP _Repeat to certainty indicates that, excluding the focus condition, subjects in the certain condition are willing to pay less relative to subjects in the uncertain condition (M = 36.18 vs M = 37.66). The histograms on WTP and WTP_Repeat to gender and certainty can be found in Appendix B, Figures 5 and 6.

Figure 3: Distribution of Willingness to pay
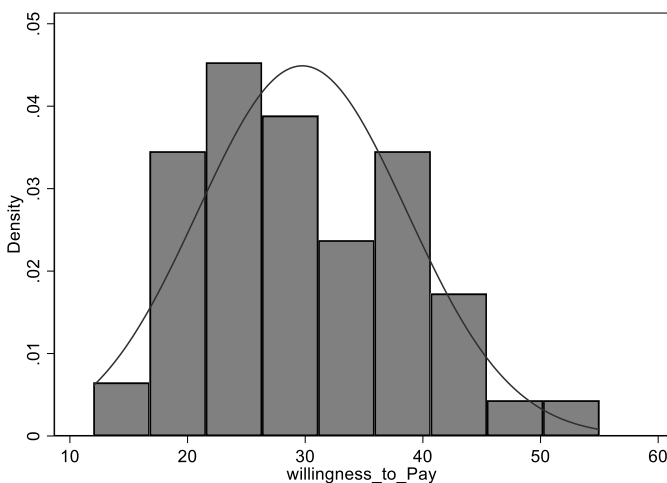
Figure 2: Distribution of Willingness to pay_Repeat
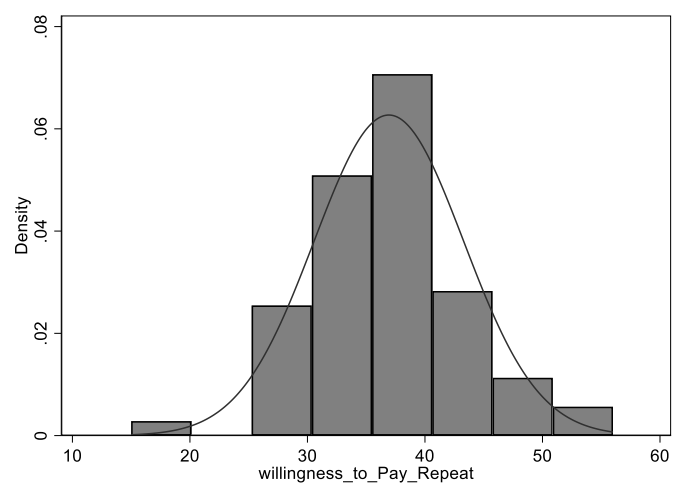
Hypothesis 1: Willingness to pay and Certainty

To visualize whether the people who faced the uncertain auctions had a higher willingness to pay and hence, a higher motivation, the mean and SD of this group was obtained, and similarly for the certain condition. In the certain condition, the mean was 35.143 (SD = 8.612) and for the uncertain condition, the mean was 24.25 (SD = 4.931). To further test in-depth whether a reward of an uncertain magnitude can be more motivating than a reward of a certain magnitude and to see if the difference is significant, two OLS models are created (Table 2). Model 1 shows the effect of certainty on WTP, and model 2 shows the effect of certainty on WTP controlling for age, education, gender, and nationality. Model 2 aims to be more precise with the estimation of the model by including control variables because they can affect certainty.

Model 1: Willingness to pay = Constant + β1*Certainty + error term

Model 2: Willingness to pay = Constant + β1*Certainty + β2*age + β3*education +
β4*male+ β5*Dutch + error term

Table 2: Regression results WTP and certainty

VARIABLES	Model 1 WTP	Model 2 WTP
certain	10.89***	11.18***
	(1.421)	(1.417)
age		-0.294
		(1.489)
education		1.265
		(1.396)
male		-1.162
		(1.413)
Dutch		-1.739
		(2.435)
Constant	35.14***	35.17***
	(1.230)	(4.259)
Observations	97	97
R-squared	0.380	0.396

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The spearman test indicated a correlation between certainty and WTP. Model 1 shows that an increase in certainty leads to an increase in WTP compared to uncertainty. In other words,

willingness to pay increases with 10.89 coins if a person is facing the certain condition compared to the uncertain condition ceteris paribus (P<0.01). Model 2 shows that when adding more control variables to obtain more accuracy, the coefficient becomes even more positive: 11.18 (P<0.01). The constant in model 1 is equal to 35.14 and in model 2 equal to 35.17 and both represent the predicted value when all variables equal 0 or are at their base case. Both are significant at a 1% level. Taking the findings to answer the first hypothesis, the results show that a certain reward does increase willingness to pay and hence motivation and an uncertain reward does decrease willingness to pay and motivation.

Hypothesis 2: positive experience as the underlying basis for the motivating-uncertainty effect

To further test whether and how uncertain rewards are more motivating compared to certain rewards, this study compared three focus groups. The statistical approach to this hypothesis is a combination of 4 OLS regression models that include interaction terms, and a two-way Analysis-of-Variance (ANOVA) test. First, the two-way ANOVA test is computed. A two-way ANOVA test is an extension of the one-way ANOVA test. The primary function of the two-way ANOVA test is to find out if there is an interaction between two independent variables on the dependent variable. In this study for hypothesis 2, the dependent variable is willingness to pay, and the two independent variables are certainty (certain or uncertain) and focus (process, outcome, or control). Before conducting the ANOVA, a test for homogeneity of variance was performed for certainty and focus. The results can be found in Appendix E, Tables 15. For the independent variable focus, the results are insignificant which means the null hypothesis, which states that the variances are equal, is not rejected. However, for the independent variable certainty, the results are significant. This means the null hypothesis, that of equal variances, is rejected. This violates the assumption of homogeneous variances. Stevens (1996) mentions that if the size of groups is fairly equal, the analysis of variance is still quite robust. This applies to both variables. Below, in Table 3 you can find the ANOVA results.

Table 3: Two-way ANOVA

willingness_to_Pay	Coef.	t.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Uncertain	-14.167	2.414	-5.87	0	-18.962	-9.371	***
Process focus	-3.447	2.469	-1.40	.166	-8.352	1.458	
Outcome focus	-4.79	2.365	-2.03	.046	-9.489	-.092	**
Uncertain* Process focus	5.256	3.509	1.50	.138	-1.714	12.227	
Uncertainty* Outcome focus	5.433	3.486	1.56	.123	-1.491	12.358	
Constant	37.524	1.527	24.58	0	34.491	40.557	***

Mean dependent var		29.753	SD dependent var		8.886
R-squared		0.412	Number of obs		97.000
F-test		12.768	Prob > F		0.000
Akaike crit. (AIC)		658.496	Bayesian crit. (BIC)		673.944

*** p<.01, ** p<.05, * p<.1*

The two-way ANOVA was run on a sample of 96 subjects to examine the effect of certainty and education on willingness to pay. There is no statistically significant interaction between the effects of certainty and focus on willingness to pay, *F(2, 91) = 1.58, p= 0.2108.* There is, however, one significant main effect in the outcome focus condition on willingness to pay at the 95% level. Moreover, there is a significant main effect in the uncertain conditions on willingness to pay at the 95% level. Although there is no statistically significant interaction between certainty and focus on willingness to pay, the choice is made to still carry on with studying the interaction in order to add the interaction to models 3 and 4, that regress the interaction to willingness to pay with the process experience and reward attractiveness in order to answer hypothesis two. Therefore, it from great importance to note that this test now may hold less statistical power.

The next step is to add the interaction effect to the 2 models that are generated to test whether the focus on the process compared to the outcome underlies the motivating-uncertainty effect. Table 4 shows an overview of the regression models with an interaction effect. Model 3 excludes the control variables, while model 4 includes them. The control variables are added to model 4 to check for robustness of the findings and are added to reduce omitted-variable bias.

Model 3: Willingness to pay = Constant + β1*Certainty + β2*Focus + β3*Certainty*Focus + error term

Model 4: Willingness to pay = Constant + β1*Certainty + β2*Focus + β3*Certainty*Focus + β4*Age+ β5*Education + β6*Male+ β7*Dutch + error term

Table 4: Regression results with interaction effects

VARIABLES	WTP model 3	WTP model 4
Uncertain	-14.17***	-14.24***
	(2.414)	(2.510)
Process focus	-3.447	-3.072
	(2.469)	(2.534)
Outcome focus	-4.790**	-4.749*
	(2.365)	(2.401)
Uncertainty * Process focus	5.256	4.571
	(3.509)	(3.768)
Uncertainty * Outcome focus	5.433	5.486
	(3.486)	(3.536)
age		0.0346
		(1.729)
education		0.936
		(1.403)
male		-1.180
		(1.553)
Dutch		-1.623
		(2.224)
Constant	37.52***	37.39***
	(1.527)	(4.961)
Observations	97	97
R-squared	0.412	0.426

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Model 3 shows statistically significant results for uncertainty and focus at 5%. For uncertainty, this implies that, if a person faces the uncertain condition, their willingness to pay decreases with 14.17 coins compared to facing the certain condition, ceteris paribus. The significant coefficient for focus implies that if a subject faces outcome process condition, their willingness to pay decreases with 4.79 coins compared to the control condition, ceteris paribus. In model 3, none of the interaction terms between the two independent variables yielded a significant result. Model 4 includes the control variables, and the same coefficients are significant as in model 3. The significant coefficient for the outcome focus is now significant at a 10% level.

This means that there is weak evidence that certainty increases willingness to pay, and there is a weak signal that being in the outcome group condition, decreases willingness to pay compared to the control condition, ceteris paribus. However, for both models, there is no evidence of a

crossover interaction. Before making conclusions regarding the second hypothesis, models 5 and 6 will include the index of process experience and the reward attractiveness to see their effect on willingness to pay.

To measure whether the positive experience in the process affects the reward certainty on WTP and whether the focus conditions affect this experience, the process experience, and reward attractiveness are added the models 3 and 4. Before adding, an index of process experience had to be created. The ratings of interest and excitement are averaged into the indexBP, which is the index of process experience (α=0.90). In Appendix C, the mean and standard deviations of both bidding processes can be found in Tables 9 and 10. The index created out of the two can be found in Table 11.

Model 5: Willingness to pay = Constant + β1*Certainty*Focus + β2*Certainty + β3*Focus + β4*IndexBP + β5*RewardAttractiveness+ error term

Model 6: Willingness to pay = Constant + β1*Certainty*Focus + β2*Certainty + β3*Focus + β4*IndexBP + β5*RewardAttractiveness + β6*Age+ β7*Education + β8*Male+ β9*Dutch + error term

The two models are created to test whether positive experiences underlie the motivating uncertainty effect in each focus condition. The hypothesis is that a reward of an uncertain magnitude yields more motivation than a reward of a certain magnitude in the process of reward pursuit. The results of models 5 and 6 can be found in Table 5. Model 5 shows statistically significant results for uncertainty at 1%. For uncertainty, this implies that, if a person faces the uncertain condition, their willingness to pay decreases with 9.98 coins compared to facing the certain condition, ceteris paribus. In both models 5 and 6, none of the interaction terms between the two independent variables yielded a significant result. Model 6 includes the control variables, but none are significant. The coefficient of the control variables in model 6 can be found in Table 17 in appendix E. Looking at the results of process experience index and reward attractiveness, one can conclude that only in model 6 reward attractiveness positively affects WTP at a 10% level with 0.78 coins ceteris paribus.

Table 5: Results with interaction effects, process experience and reward attractiveness

VARIABLES	WTP Model 5	WTP model 6
Uncertain	-9.980***	-10.25***
	(2.025)	(2.077)
Process focus	0.277	0.625
	(3.003)	(3.038)
Outcome focus	0.578	0.652
	(3.134)	(3.172)
Uncertainty * Process focus	1.354	0.963
	(3.125)	(3.328)
indexBP	2.474	2.369
	(2.251)	(2.264)
reward_attractivenes_1	0.621	0.779*
Constant	16.18	13.86
	(14.52)	(15.60)
Observations	97	97
R-squared	0.428	0.448

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To further analyze the effect of process experience and reward attractiveness on reward certainty and focus on WTP, a moderated-mediation model by Hayes (2008, 2017) was performed. First, a structural equation modeling (SEM) is carried out to measure latent variables and their connection with each other. The results can be found in Appendix E Tables 16 and 19. Using this output, the effect both of certainty and focus on indexBP are statistically significant (P<0.01) and are negatively related. Moreover, the output provides data describing the pathway from process experience, certainty, focus and the interaction term on WTP. These results are insignificant. Thereafter, the indirect effect and bootstrap estimates of standard errors and confidence intervals are generated to test for statistical significance. The results can be found in Appendix E, Tables 18 and 20. In this model, the path between the certainty and the mediator indexBP is moderated by focus, see Figure 9 in Appendix E for a visualization of the model. The conditional indirect effect of certainty on WTP through the index of process experience was insignificant. (Bs_1 conditional indirect = -6.48, SE = 17.21; 95% C.I = [-40.20, 27.24]; based on 1000 bootstrap samples). The conditional indirect effect of certainty and focus on WTP through the index of process experience was insignificant as well. (Bs_3 conditional indirect = -1.48, SE = 3.88; 95% C.I = [-6.12, 9.07]; based on 1000 bootstrap samples). The conditional indirect effects increase, as the value of the moderator variable increases. The result illustrates

that increasing process experiences does not mediate the effect of reward certainty on WTP. Besides the index of process experience, the experiment measured the level of reward attractiveness. To test for attractiveness in a similar moderated-mediation model, first, an SEM model was carried out. Bootstrapping the estimates of the standard errors and confidence intervals resulted in insignificant indirect effects of certainty and focus on WTP through reward attractiveness. ($Bs\_1_{conditional\ indirect}$ = -0.87, SE = 0.73; 95% C.I = -2.29, 0.55]; based on 1000 bootstrap samples). Therefore, the results indicate that process experience and reward attractiveness do not mediate the effect of reward certainty on WTP. The conditional indirect effect of certainty and focus on WTP through the reward attractiveness was insignificant as well. ($Bs\_3_{conditional\ indirect}$ = -0.44, SE = 0.50; 95% C.I = -0.54, 1.42]; based on 1000 bootstrap samples). For reward attractiveness, the conditional indirect effects increase as well. The results, however, indicate no significant moderated mediation effect for reward attractiveness. Therefore, no significant results are found that the positive experience is the underlying basis for the motivating-uncertainty effect.

Hypothesis 3: The positive experience weakens when the reward pursuit is being repeated and thereby motivation weakens.

The literature suggested that positive experience in the process of reward pursuit awakens motivation and leads to a higher willingness to pay. To execute tests on willingness to pay and repeating, the experiment contained a question of whether participants wanted to participate in the auctions again. As mentioned, the same rules applied and subjects remained in their original condition: certain vs uncertain; process; outcome; control. First, the repeat variable was coded as a binary variable. 69 subjects selected yes, and repeated the auction.

Notably, although not significant, the magnitude of the uncertainty coefficient is positive when regressed to WTP_Repeat (1.48, p = 0.338). Given the different treatments and the option to repeat, it may be the case that there is a selection effect. As a result of selection bias, the data might be considered distorted and false (Heckman, 1979). To check for selection bias between the different treatments and saying yes, an ordered logit model is computed (Table 21, Appendix E). No significant results in models 7a and 7b are found, and therefore show that the treatment does not drive the differences in yes to the repeated round. Therefore, there is no significant proof that there is selection bias.

To answer whether the positive experience in the process of reward pursuit weakens when the reward pursuit is repeated, one can look at model 8a (Appendix E table 22). First, the

insignificant results of the regression on positive experience in the process of reward pursuit if the experiment is repeated show us that repeating increases the positive experience by 0.049. Thereby, positive experience in the process of reward pursuit does not weaken when the pursuit is being repeated as the results are insignificant. Second, in model 8b, increasing positive experience by 1 unit increases WTP by 5.114 (p<0.001) in the first 3 auctions and decreases WTP in the repeating 3 auctions by 1.343 although this last result is insignificant. Nonetheless, positive experience has a significant positive influence on WTP, whereas it has a negative insignificant effect on WTP_Repeat. The results of models 8b and 8c can also be found in appendix E, table 22.

To further see whether motivation decreases, WTP and WTP_R are compared. To compare the WTP with WTP_R by certainty and focus, a series of t-test models are executed. First, a paired-samples t-test was conducted to compare the willingness to pay in WTP_Repeat and WTP. There is a significant difference in the scores of willingness to pay for WTP_Repeat (M = 36.96, SD = 0.77) and WTP (M = 29.28, SD = 1.03); with T(68) = 7.71 and two-side P <0.000. These results imply that repeating the auction does affect WTP. More specifically, the results suggest that when a subject repeats the auction, their total WTP increases. Next, multiple conditional t-tests are executed to compare the treatments conditions to each other in the repeat situation and the original situation. The results are indicating different WTPs in the control, process, and outcome conditions. Figure 4 visualizes the results. The conditional paired t-test comparing WTP_Repeat and WTP if in the certain control condition, resulted in a nonsignificant difference between the two with T(12) = -0.28 and two-side P > 0.61. In the condition of certainty and process, the t-test provided significant results with T(10) = 1.419 and two-side P < 0.09. The t-test comparing the condition of certainty and outcome resulted in a significant difference with T(9) = 1.58 and two-side P < 0.07. Changing the certainty condition to uncertain, the uncertain control condition t-test resulted in a significant difference between WTP_Repeat and WTP with T(9) = 7.02 and two-side P < 0.000. The uncertain process condition t-test showed a significant difference between WTP_Repeat and WTP with T(11) = 10.52 and two-side P < 0.000. Lastly, the uncertain outcome condition t-test resulted in a significant difference with T(12) = 17.64 two-side P < 0.000. For all conditions, but the Certainty Control condition, the subjects had a higher WTP_Repeat in the repetitive round of auctions compared to the original WTP. This contradicts the predictions of hypothesis three, which stated that the motivation, and thus WTP, would decrease after repeating the experiment. On top of this, due to the insignificant result on the positive experience in the process, one cannot conclude that the positive experience in the

process of reward pursuit weakens if the pursuit is being repeated. Therefore, hypothesis three is rejected.

Figure 4: Mean comparison between subsample WTP and WTY_Repeat
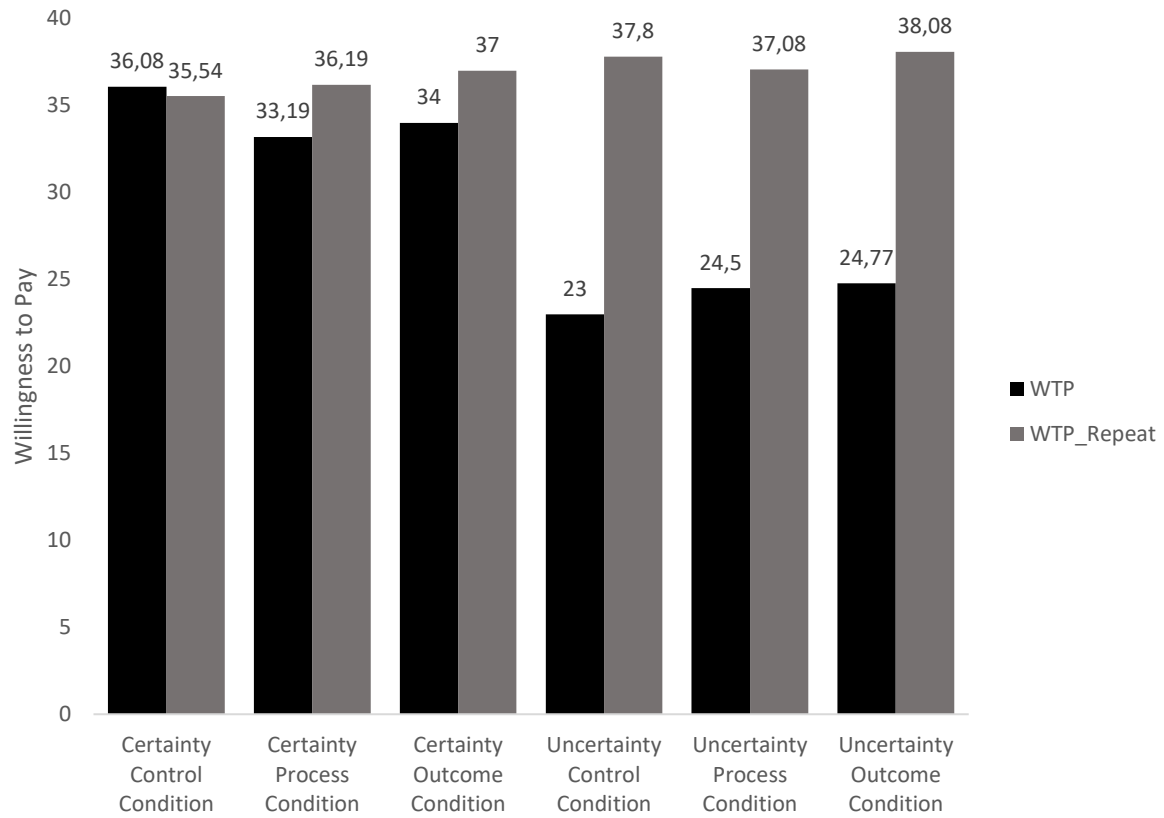
5. DISCUSSION AND CONCLUSION

Discussion

The paper tries to address the question of why a reward of an uncertain magnitude might be more motivating than a reward of a certain magnitude and how the process of reward pursuit is related to the motivating-uncertainty effect. In order to answer this research question, the question was split up into three hypotheses. Those addressed the motivating-uncertainty effect itself, the underlying effect of the motivating-uncertainty effect, and the effect of repeating on the positive experience. The results of this research indicate several things depending on which hypothesis was tested.

The first hypothesis states that a reward of an uncertain magnitude can be more motivating than a reward of a certain magnitude. The literature suggested that people are willing to reduce or eliminate uncertainty (Hogg, 2000). Moreover, it showed that uncertainty is related to motivation (Wilson et al, 2005) and that foreseeable events generate fewer emotions. Therefore, I predicted that uncertainty increases motivation and investment resources. The results of the first models that tested hypothesis one implicates something different than the literature. First of all, model 1 showed a significant negative relation between WTP and uncertainty. Second, model 2 showed an even stronger negative relation between WTP and uncertainty. This thus suggests that there is a negative relationship between WTP and uncertainty, which is not in line with this study's expectations.

The second hypothesis investigates positive experience as the underlying basis of the motivating-uncertainty effect. The ANOVA results of the study on hypothesis 2 show that there is no statistically significant interaction between the effects of certainty and focus on willingness to pay. The ANOVA test showed two significant main effects. The first significant main effect showed that being in the outcome focus condition compared to being in the control focus condition has a negative effect on WTP. Moreover, it showed that being in the uncertain condition, compared to being in the certain condition has a negative effect on WTP. The interaction effect was thereafter added to models 1 and 2 from hypothesis 1. The results of that regression analysis provided no significant results for the interaction terms, and hence no significant result for a positive relation between WTP and the process and uncertain nor the process and certain conditions.

The insignificant results of the moderated-mediation effect indicate that process experience and reward attractiveness do not mediate the effect of reward certainty on WTP. This applies to the indirect effect of certainty and focus as well. The literature suggested that people who focus on the process towards a reward, compared to focusing on the outcome of the reward appreciate a better achievement of their goals (Tormala, 2016; Taylor et al., 1998). Research has shown that uncertainty leads to curiosity, and curiosity is generated by focusing on the process of reward pursuit. This implicates that our results contradict the expectations and the literature. This might be due to people who focused on the process towards a reward, rather than focusing on the outcome of the reward enjoyed a better achievement of their goals (Tormala, 2016; Taylor et al., 1998). This implicates that the results contradict the expectations and the literature. This might be due to the fact that it was an online auction. Making people aware of process and outcome focus via a text file might not be as convincing as explaining and emphasizing the focus in a real-life auction. Therefore, due to insignificant results, and significant results that are contradicting the predictions, one has to conclude that in this experiment, the process experience does not underlie the motivating-uncertainty effect.

The results of the study on hypothesis 3 show that subjects had a higher WTP if they repeated the auctions, compared to their first auctions. The literature suggested that boredom in simple tasks, such as an online auction of three rounds may evoke. However, the results are contradicting these predictions. The t-test comparing WTP_Repeat and WTP resulted in a significant difference between the two, implying that repeating the 3 auction rounds does have a positive effect on a subject's WTP. Additionally, the conditional t-tests on the reward certainty and focus resulted in a significant difference between WTP_Repeat and WTP. This implies that repeating the 3 auction rounds does have a positive effect on a subject's WTP for every combination of conditions, except the certain control condition. It, however, contradicts the prediction of hypothesis 3. This might be the result of learning effects. Although prices differed, people might have learned that they just had to bid a bit more to win and make a small profit.

Conclusion and Limitations

Previous decision studies, overall, conclude that uncertainty negatively affects decision-making. The theories of von Neumann and Morgenstern (1944) and Kahneman and Tversky (1979) tells us that people are risk-averse for gains and prefer a reward of a certain magnitude over a reward with an uncertain magnitude. This paper followed a study of Shen et al. (2015), who showed the opposite in a range of conditions. This paper tried to replicate that study into an online experiment aimed at students mainly in the Netherlands. As mentioned, literature

shows us that people can be risk-averse for gains and prefer a certain reward over an uncertain reward. There is, however, new literature showing that people's decisions with a focus on outcome and a focus on process lead to uncertain rewards preferred over certain rewards.

This study finds contradicting results compared to the study of Shen et al. (2015). The authors do find significant results with their auction experiment. Thereby, answering the research question of "why is a reward of uncertain magnitude more motivating than a reward of certain magnitude and how is the process of reward pursuit related to the motivating-uncertainty effect", this paper one cannot conclude that a reward of an uncertain magnitude is more motivating compared to a reward of a certain magnitude and cannot conclude that the process experience does not underlie the motivating-uncertainty effect.

As discussed above, the three hypotheses are not accepted due to insignificant and contradicting results, which could be explained by the limitations stated afterward. Additionally, some limitations of this study have not yet been discussed. The first limitation in this research is that the distributions of WTP and WTP_Repeat are not perfectly normally distributed. Although they are approximately normally distributed, more accurate results could have been obtained if both variables were perfectly normally distributed. A second limitation of this study has been the young sample. In the sample, almost 80% of people are between 18 and 25 years old and are not representative of the general population. Therefore, the results and findings almost only apply to this group, and it was hardly possible to compare between age groups. It could be that there is a difference in WTP for the different conditions between ages which could potentially lead to different, significant, results. Third, the fact that it was an online auction experiment and not a physical experiment could have influenced the results. The rules were clearly explained, but people could choose to skip the reading, click proceed and quickly fill some numbers in. Boredom is often experienced in online surveys and therefore it might be the case that after 1-minute people just filled in some random numbers to end the survey as soon as possible, which results in non-usable data (Jun et al., 2017). To prevent this from happening, there was a robustness check in the last demographics question, and everyone answered that question correctly. However, it does not prevent people from just answering with random numbers.

Despite the limitations, I still think that the experiment and the findings of Shen et al. are still a foundation for an interesting topic. The uncertainty for achieving a reward can be challenging and motivating. The study by Goldsmith and Amir (2010) found no difference between reward conditions, whereas this research found a negative relationship between uncertain compared to

certain reward conditions. Shen et al., found only a positive effect when focusing on the process. Therefore, further research is needed to find out when uncertainty boosts motivation and is preferred to certain rewards. Moreover, the findings of figure 4 show that uncertainty does not increase WTP. What one also can see is that in the repeating situation, uncertainty does increase WTP_Repeat. Based on the results of the series of t-tests in hypothesis 3, one can see almost all of them are significant. Further research into this field might result in interesting results. New research on models that incorporate different conditions on uncertainty and motivation can muster interesting findings.

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7. APPENDIX A – THE EXPERIMENT

Introduction

Dear participant,

Welcome to this experiment, and thank you for your participation.

This is a voluntary survey and the experiment is fully anonymous. Moreover, you can win a bol.com gift card of €30! If you would like to participate in the lottery, you can leave your email address at the end of the survey. This will not be linked to the questions, so participating in the experiment is anonymous.

On the next page, the instructions for this experiment can be read. Please read these instructions carefully. Please answer each question if you are in a real-life scenario

By ticking the box, you agree you have read the information and you agree to participate in this experiment.

P.S.: This survey contains a completion code for SurveySwap.io

Thank you.

Instructions

Dear Participant,

You will be participating in an auction, and you will adopt the role of the buyer. Your starting budget consists of 30 coins by which you can bid in the auctions. In every auction, you can win coins that will be transformed into lottery tickets at the end of the experiment. 1 coin = 1 lottery ticket. The lottery tickets will then be used in the lottery with the potential to win a €30, - Bol.com card. The more coins --> the more tickets --> the higher the possibility to win the bol.com card.

You will complete 3 auctions. There are auctions where you can win a certain reward of 15 coins and there are auctions where you can win an uncertain reward, of either 10 coins or 15 coins. In the uncertain case, both have an equal probability.

The auction works as follows:

Your budget is 30 coins. If in auction 1, your bid is 11 coins and you win, and the reward of the first auction is 14 coins, your total budget increased to 33 coins. [30-11+14=33]

Your budget is now 33 coins. If in auction 2, your bid is 18 coins and you win, and the reward of the second auction is 12 coins, your total budget decreased to 27 coins. [33-18+12=27]

The seller has decided on a minimum purchasing price. If you bid equal or higher than this price, you win the reward of coins. If your bid is lower than the seller's price, you won't pay anything. The minimum purchasing price will not be revealed throughout the auction. Every auction round will have a different asking price.

In summary: your total budget will remain constant if you lost the auction, or increase/decrease if you outbid the seller.

Good luck.

Observing understanding of the experiment

What is used to bid in the auction

- Fictional experiment coins
- Lottery tickets
- Real money

When do you win the auction?

- If my bid is greater than the seller's asking price
- If my bid is lower than the seller's asking price
- If my bid is equal or greater than the seller's asking price

Uncertain auctions

Auction 1

In this first auction, you can bid on an uncertain reward of either 10 coins or 15 coins.
Your Total Budget is currently 30 coins.

How many coins do you want to bid? 0

Auction 2

Congratulations, you won the first auction!
In this second auction, you can bid on an uncertain reward of either 10 coins or 15 coins.

How many coins do you want to bid? 0

Auction 3

To bad! The seller's price was higher than your bid, so you lost!
In this third auction, you can bid on an uncertain reward of either 10 coins or 15 coins.

How many coins do you want to bid? 0

Congratulations! The seller's price was equal or lower than your bid, so you won!
Your total budget is now: 26 coins.
These will be transformed into lottery tickets that count in the final for the Bol.com Card.

Certain auctions

Auction 1

In this first auction, you can bid on a reward of 15 coins.
Your total budget is currently 30 coins.

How many coins do you want to bid? 0

Auction 2

Congratulations! The seller's price was equal or lower than your bid, so you won!
Your total budget is now: 30 coins.

In this second auction, you can bid on a reward of 15 coins.

How many coins do you want to bid? 0

Auction 3

To bad! The seller's price was higher than your bid, so you lost!
In this third auction, you can bid on an uncertain reward of either 10 coins or 15 coins.

How many coins do you want to bid? 0

To bad! The seller's price was higher than your bid, so you lost!
Your total budget is now: 33 coins.
These will be transformed into lottery tickets that count in the final for the Bol.com Card.

Experience of the bidding process

To assess the experience of the bidding process, please rate the following statements. (1 = not at all, 7 = very much)

How interesting did you find the auctions?	1	2	3	4	5	6	7
How exciting did you find the auctions?	1	2	3	4	5	6	7

Attractiveness of the reward

To assess the attractiveness of the reward, please rate the following statement. (1 = not at all, 7 = very much)

How attractive did you find the rewards?	1	2	3	4	5	6	7

The reward for each auction was an amount of coins that transformed into lottery tickets used to win a 30 euro Bol.com card.

Repeat

Would you like to continue the bidding activity and participate in three more auctions and potentially increase your coin budget to increase the chance of winning the Bol.com card? The auctions will have the same rules as the first three.

- Yes
- No

Demographics

What is your gender?

- Male
- Female
- Non-binary

What is your age?

- 0-17
- 18-25
- 26-30
- 31-40
- 41-55
- 56-60
- Above 60

In which country do you currently reside?

- Dropdown menu

What is your highest level of education obtained?

- Primary education
- Secondary education
- Bachelor's degree
- Master's degree
- Doctorate
- Prefer not to say

If you want to use your lottery tickets in the lottery to win a Bol.com card of €30, - please fill in your email address.

- Textbox

8. APPENDIX B – HISTOGRAMS

Figure 6: Distribution of WTP_Repeat by gender and certainty
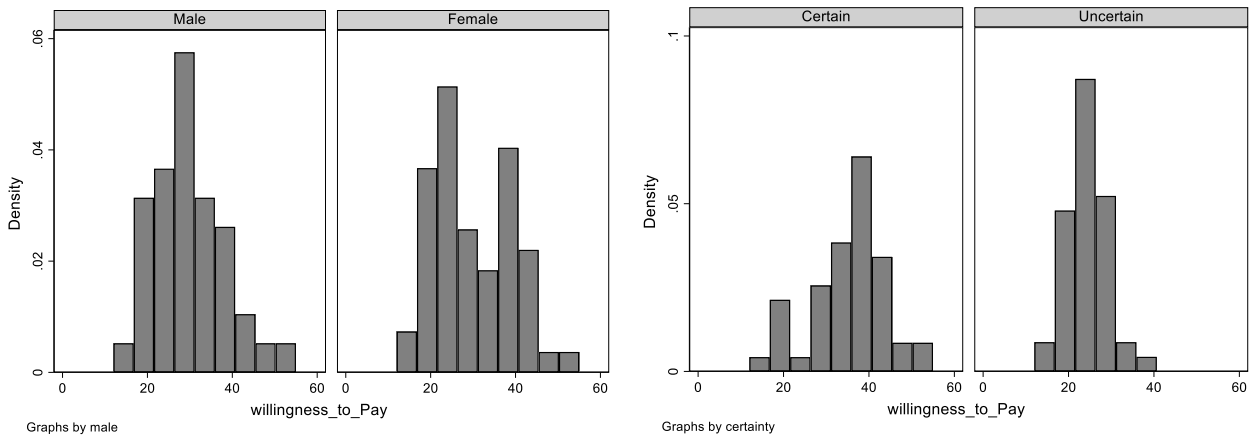
Figure 5: Distribution of WTP by gender and certainty
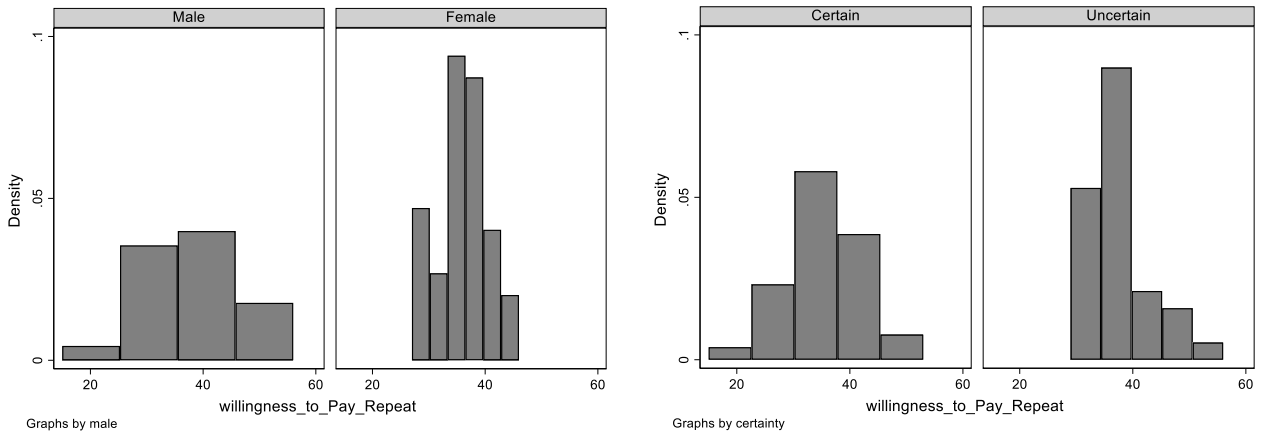
*Figure 7: Histograms of each combination certainty * focus*
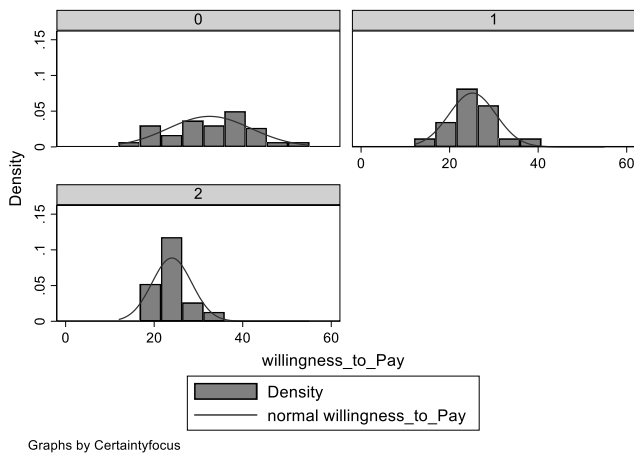
Figure 8: Distribution of subgroup WTP
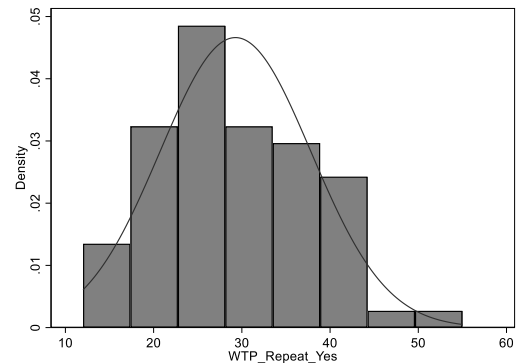
9. APPENDIX C – DESCRIPTIVE STATISTICS

Table 6: List of variables

Variable	Description
Willingness_To_Pay (WTP)	The participants' WTP as a measurement of motivation. Where a higher WTP reflects a higher motivation
Willingness_To_Pay_Repeat (WTP_R)	The participants' WTP as a measurement of motivation after repeating the auction. Where a higher WTP reflects a higher motivation
Focus	Categorical variable that indicates if you are in a treatment or control group. 2= outcome, 1 = process, 0 = control group.
Certainty	Dummy that indicates if you are in the Uncertain or Certain group. 1 = Uncertain group / 0 = Certain group.
Excitement	Participants' excitement score. Where 1 is not excited at all and 9 is very excited.
Interest	Participants' interest score. Where 1 is not interested at all and 9 is very interested.
Attractiveness	Participants' attractiveness rating of the reward. Where 1 is not interested at all and 9 is very attractive.
Repeat	Dummy that indicates if the respondents want to repeat. 1 = respondent wants resit / 0 = respondent does not want resit.
Age	Categorical variable that indicates your age group. 1 = 1-17, 2 = 18-24, 3 = 26-30, 4 = 30-40.
Male	Dummy variable that indicates your gender. 1 = male / 0= female.
Education	Categorical variable that indicates your level of education. 1 = secondary education, 2 = bachelor's degree, 3 = master's degree
Dutch	Dummy variable that indicates your country. 1 = Dutch / 0 = non-Dutch.

Table 7: Frequency Table of demographics of the sample

Variable	Value	Label	Frequency	Percentage
Age	1	0-17	1	1.03
	2	18-25	77	79.38
	3	26-30	17	17.53
	4	31-40	2	2.06
Male	1	Male	57	58.76
	0	Female	40	41.24
Education	1	Secondary	5	5.15
	2	Bachelor's	55	56.70
	3	Master's	37	38.14
Dutch	1	Dutch	84	86.60
	0	Non-Dutch	13	13.40

Table 8: Tabulation of subjects per treatment

focus	certainty		
	Certain	Uncertain	Total
Control	21	14	35
Process	13	18	31
Outcome	15	16	31
Total	49	48	97

Table 7: Frequency Table of demographics of the sample

Table 9: Rating results for Process Experience for BP1

Focus	Certainty	Mean	SD
0	0	7.095	1.091
0	1	5.714	1.816
1	0	5.769	2.048
1	1	5.722	2.052
2	0	5.333	2.059
2	1	5	2.066

Table 10: Rating results for Process Experience for BP2

Focus	Certainty	Mean	SD
0	0	6.762	1.411
0	1	5.643	2.061
1	0	5.769	1.787
1	1	5.389	2.062
2	0	4.733	1.870
2	1	5.750	1.915

Table 11: Index bidding process

	Index	Freq.	Percent	Cum.
Certain - Outcome	5.033333	15	15.46	15.46
Uncertain – Outcome	5.375	16	16.49	31.96
Uncertain – Process	5.555555	18	18.56	50.52
Uncertain – Control	5.678572	14	14.43	64.95
Certain – Process	5.769231	13	13.40	78.35
Certain – Control	6.928572	21	21.65	100.00
	Total	97	100.00	

Table 12: Skewness and kurtosis tests for normality

Variable	Obs	Pr(skewness)	Pr(kurosis)	---- Joint test ----	
				Adj chi2(2)	Prob>chi2
Willingness to pay	97	0.1127	0.659	2.790	0.248
Willingness to pay_R	69	0.482	0.009	6.640	0.036

10. APPENDIX D – SPEARMAN CORRELATIONS

Table 13: Spearman rank correlations (WTP)

Variables	WTP	Certainty	Focus	BP1	BP2	RA	Age	Educ	Dutch	Male
WTP	1.000									
Certainty	-0.626*** [0.000]	1.000								
Focus	-0.198* [0.0521]	0.102 [0.3221]	1.000							
Bidding_proces~1	0.288*** [0.0042]	-0.199* [0.0505]	-0.275*** [0.0063]	1.000						
Bidding_proces~2	0.115 [0.2638]	-0.075 [0.4627]	-0.242** [0.0168]	0.700*** [0.000]	1.000					
Reward_attract~1	0.228** [0.0248]	-0.082 [0.4243]	-0.010 [0.9210]	0.449*** [0.000]	0.379*** [0.001]	1.000				
Age	-0.068 [0.5066]	0.107 [0.2953]	-0.079 [0.4391]	-0.130 [0.205]	-0.089 [0.3875]	-0.290*** [0.004]	1.000			
Education	0.023 [0.8227]	0.103 [0.3158]	-0.138 [0.1776]	0.092 [0.3705]	0.128 [0.2107]	-0.120 [0.4237]	0.300*** [0.0028]	1.000		
Dutch	-0.088 [0.3931]	-0.034 [0.7386]	0.017 [0.8672]	-0.181* [0.0754]	-0.109 [0.2901]	0.066 [0.5224]	-0.078 [0.4454]	-0.161 [0.1153]	1.000	
Male	-0.017 [0.8670]	-0.092 [0.3680]	-0.092 [0.3697]	0.076 [0.462]	0.076 [0.4602]	0.051 [0.6183]	0.164 [0.1077]	0.113 [0.2701]	0.224** [0.0276]	1.000

Spearman rho = 0.224
P-values in brackets *** p<0.01; **P<0.05; *p<0.1

Table 14: Spearman rank correlations (WTP_Repeat)

Variables	WTP	Certainty	Focus	BP1	BP2	RA	Age	Educ	Dutch	Male
WTP_Repeat	1.000									
Certainty	0.061	1.000								
	[0.6208]									
Focus	0.096	0.107	1.000							
	[0.4320]	[0.3221]								
Bidding_proces~1	0.103	-0.147*	-0.254***	1.000						
	[0.4019]	[0.0505]	[0.0063]							
Bidding_proces~2	0.012	0.054	-0.175**	0.601***	1.000					
	[0.9222]	[0.4627]	[0.0168]	[0.000]						
Reward_attract~1	0.292**	-0.020	0.111	0.348***	0.275***	1.000				
	[0.0149]	[0.4243]	[0.9210]	[0.000]	[0.001]					
Age	0.018	0.026	-0.092	-0.043	0.036	-0.229***	1.000			
	[0.8838]	[0.2953]	[0.4391]	[0.2050]	[0.3875]	[0.004]				
Education	-0.065	0.106	-0.132	0.106	0.132	-0.136	0.316**	1.000		
	[0.5983]	[0.3158]	[0.1776]	[0.3705]	[0.2107]	[0.2437]	[0.028]			
Dutch	0.027	0.149	-0.059	-0.200*	-0.074	0.107	-0.003	0.011	1.000	
	[0.8282]	[0.7386]	[0.8672]	[0.0754]	[0.2901]	[0.5224]	[0.4454]	[0.1153]		
Male	-0.074	0.072	-0.152	-0.037	0.032	-0.112	0.298	0.157	0.079**	1.000
	[0.5476]	[0.3680]	[0.3697]	[0.4620]	[0.4602]	[0.6183]	[0.1077]	[0.2701]	[0.0276]	

Spearman rho = 0.079
P-values in brackets *** p<0.01; **P<0.05; *p<0.1

11. APPENDIX E – ANOVA, INTERACTION TABLES & SEM

Table 15: Levene's test for Certainty and Focus

Certainty	Summary Willingness to pay		
	Mean	Std. dev.	Freq.
Certain	35.142	8.612	49
Uncertain	24.25	4.931	48
Total	29.753	8.886	97
W0 = 8.3188421	df(2, 94)	Pr > F = 0.00485411	
W50 = 7.6316812	df(2, 94)	Pr > F = 0.00688647	
W10 = 8.3290859	df(2, 94)	Pr > F = 0.00482904	

Focus	Summary Willingness to pay		
	Mean	Std. dev.	Freq.
Control	31.857	8.715	35
Process	28.903	9.148	31
Outcome	28.226	8.636	31
Total	29.753	8.886	97
W0 = 0.03445023	df(2, 94)	Pr > F = 0.96614861	
W50 = 0.03626392	df(2, 94)	Pr > F = 0.96439923	
W10 = 0.03040242	df(2, 94)	Pr > F = 0.97006462	

Table 16: Structural Equation Modeling process experience (SEM)

Log likelihood = -438.31497							n = 97
			OIM				
		Coefficient	Std. err.	Z	P>|z|	[95% conf. interval]	
Structural IndexBP							
	Certainty	-1.191	0.021	-56.46	0.000	-1.232	-1.149
	Focus	-.957	0.011	-84.96	0.000	-0.9792	-0.935
	Certainty*Focus	0.805	0.017	48.39	0.000	0.772	0.837
	_cons	6.881	0.014	500.36	0.000	6.854	6.908
WTP	IndexBP	5.968	10.307	0.580	0.563	-14.234	26.170
	Certainty	-6.226	12.458	-0.500	0.617	-30.644	18.191
	Focus	3.270	9.932	0.330	0.742	-16.197	22.736
	Certainty*Focus	-2.076	8.464	-0.250	0.806	-18.665	14.514
	_cons	-3.779	70.936	-0.050	0.958	-142.812	135.25
	Var(e.IndexBP)	0.004	0.001			0.003	0.006
	Var*e.WTP)	6.624	46.131			34.815	61.125
LR test of model vs. saturated: chi2(0) = 0.00						Prob > chi2 = .	
Endogenous variables:				Fitting target model:			
Observed: indexBP; willingness_to_Pay				Iteration 0: log likelihood = -438.31497			
Exogenous variables				Iteration 1: log likelihood = -438.31497			
Observed: certainty focus focus*certainty				Structural equation model			

Table 17: Coefficients of control variables model 6

VARIABLES	WTP Model 5	WTP model 6
Uncertainty	-9.980***	-10.25***
	(2.025)	(2.077)
Process focus	0.277	0.625
	(3.003)	(3.038)
Outcome focus	0.578	0.652
	(3.134)	(3.172)
Uncertainty * Process focus	1.354	0.963
	(3.125)	(3.328)
Uncertainty * Outcome focus	Omitted	Omitted
	(0)	(0)
indexBP	2.474	2.369
	(2.251)	(2.264)
reward_attractivenes_1	0.621	0.779*
	(0.391)	(0.415)
age		1.014
		(1.782)
education		0.934
		(1.383)
male		-1.385
		(1.535)
dutch		-1.760
		(2.194)
Constant	16.18	13.86
	(14.52)	(15.60)
Observations	97	97
R-squared	0.428	0.448

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 18: Bootstrap results process experience

	Observed coefficient	Bootstrap std. err.	z	p>|z|	Normal-based [95% conf. interval]	
_bs_1	-6.47873	17.20514	-0.38	0.707	-40.20019	27.24273
_bs_2	-2.501782	6.676074	-0.37	0.708	-15.58665	10.58308
_bs_3	1.475166	3.877228	0.38	0.704	-6.124061	9.074392

Bootstrap results
_bs_1: r(indirect effect)
_bs_2: r(direct effect)
_bs_3: r(total effect)

Number of observations = 97
Replications = 1000

Table 19: Structural Equation Modeling reward attractiveness(SEM)

Log likelihood = -438.31497						n = 97
		OIM				
		Coefficient	Std. err.	Z	P>|z|	[95% conf. interval]
Structural Rew_attrvns						
	Certainty	-1.526	0.574	-2.660	0.008	-2.651	-0.401
	Focus	-0.585	0.307	-1.910	0.056	-1.186	0.016
	Certainty*Focus	1.238	0.452	2.740	0.006	0.351	2.125
	_cons	6.575	0.374	17.570	0.000	5.841	7.308
WTP	IndexBP	0.640	0.374	1.710	0.087	-0.092	1.373
	Certainty	-12.355	2.188	-5.650	0.000	-16.644	-8.066
	Focus	-2.068	1.150	-1.800	0.072	-4.321	0.185
	Certainty*Focus	1.934	1.729	1.120	0.263	-1.455	5.323
	_cons	33.076	2.818	11.740	0.000	27.553	38.599
	Var(e.IndexBP)	3.314	0.476			2.501	4.391
	Var*e.WTP)	44.931	6.452			33.910	59.535

LR test of model vs. saturated: chi2(0) = 0.00   Prob > chi2 = .

Endogenous variables:
    Observed: Reward attractiveness; willingness to Pay
Exogenous variables
    Observed: certainty focus focus*certainty

Fitting target model:
    Iteration 0: log likelihood = -757.48119
    Iteration 1: log likelihood = -757.48119
Structural equation model

Table 20: Bootstrap results reward attractiveness

	Observed coefficient	Bootstrap std. err.	z	p>|z|	Normal-based [95% conf. interval]	
_bs_1	-0.874	0.725	-1.21	0.228	-2.294	0.547
_bs_2	-0.217	0.328	-0.66	0.508	-0.860	0.425
_bs_3	0.440	0.498	0.88	0.377	-0.536	1.416

Bootstrap results
_bs_1: r(indirect effect)
_bs_2: r(direct effect)
_bs_3: r(total effect)

Number of observations = 97
Replications = 1000

Figure 9: Visualization of the moderated - mediation model
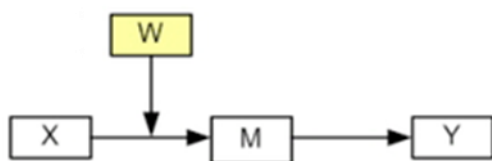
Note. X is the independent variable, M the mediator which is moderated by W. Y is the dependent variable. From UCLA: Statistical Consulting Group.
https://stats.idre.ucla.edu/stata/faq/how-can-i-do-moderated-mediation-in-stata/

Table 21: Results Ordered Logit model - Selection effect

VARIABLES	Model 7a Ordered logit on Repeat	Model 7b Marginal effects
1.certainty	-0.303	-0.055
	(0.455)	(0.084)
1.focus	-0.380	-0.072
	(0.557)	(0.105)
2.focus	-0.554	-0.102
	(0.630)	(0.113)
age	0.188	0.034
	(0.477)	(0.086)
education	-0.0297	-0.005
	(0.463)	(0.084)
male	-1.396***	-0.254***
	(0.497)	(0.078)
dutch	-0.488	-0.089
	(0.599)	(0.078)
Constant	0.329	0.329
	(1.548)	(1.548)
Observations	97	97

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 22: Repeating and positive experience

VARIABLES	IndexBP model 8a	WTP model 8b	WTP_R model 8c
indexBP		5.114***	-1.343
		(1.316)	(1.211)
repeat	0.0488		
	(0.0438)		
Constant	5.658***	-3.804	38.51***
	(0.0223)	(7.610)	(7.229)
Observations	31	97	69
R-squared	0.041	0.178	0.107

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1