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Master Thesis Behavioural Economics

Do choices reveal stable preferences, as assumed in Economics? An improved experimental design to test for choice-induced preference change

Name student: Vera Smit

Student ID number: 451321

Supervisor: dr. Georg D. Granić

Second assessor: prof. dr. Aurelien Baillon

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Abstract

Choice-induced preference change (CIPC) has been a topic of interest in Psychology since the theory of Festinger (1957) about cognitive dissonance. The free-choice paradigm (Brehm, 1956) that is used extensively throughout literature to test and confirm CIPC was recently discovered to contain a methodological flaw questioning its existence (Chen, 2008). Many authors tried to improve the experimental design in their studies to eliminate the discovered bias. The overall finding of these studies is an effect smaller in magnitude but still significant (Enisman, Shpitzer & Kleiman, 2021). This observed effect of choice on preferences could be problematic for studies in Economics that assume choices to reveal stable preferences. This paper improves on the experimental design to test for CIPC in Economics by Alós-Ferrer & Granic (2021) by adding a clear trade-off in the choice and controls for memory. The results of an incentivized online experiment with 143 subjects about preferences on lotteries suggest no effect of choice-making on preferences about the lotteries. Controlling for memory does little to not affect these results. The findings of this paper suggest choices over economic goods like lotteries do not induce cognitive dissonance, presumably because of the lack of personal value attached to the decision. Limitations of this study are the number of observations, low monetary stakes of the incentivized decisions in the experiment and unclear results of the memory task.

Preference change, behavioural economics, cognitive dissonance, stable preferences

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1. Introduction

Choice-induced preference change (CIPC) has been a topic of interest in Psychology for a long period. It makes sense that you choose what you like. Or do you in fact like what you choose? Choosing makes you favour what you chose even more than before you made the choice, and it makes you favour what you rejected less. You want your actions and preferences to align, therefore you adjust your preferences according to the choice you made. This change in preferences after choice-making is caused by cognitive dissonance, a theory introduced by Festinger (1957). Cognitive dissonance is the uncomfortable feeling that arises when mental pieces of information, such as preference and behaviour, are not in line. This happens when you choose something (behaviour) which turns out not to be the option you favour the most (preference). To correct for the internal discomfort, people tend to like what they choose more and dislike what they rejected more than before they made their choice. The theory of cognitive dissonance is explained in more detail in the literature section of this paper.

Many papers have found evidence of the existence of CIPC (e.g., Sharot et al., 2010; Izuma et al., 2010; Alós-Ferrer et al., 2012; Salti et al., 2014; Chammat et al., 2017). However, this effect of choice-making on preferences could be very problematic for experiments conducted in Economics. In economic experiments, choices are assumed to reveal stable preferences (Samuelson, 1938;1948). If choices not only reveal, but also form preferences; measured preferences could be lagging from real preferences, and this could be problematic for earlier findings from studies using this procedure of preference revealing. The evidence from Psychology, that choices not only reflect but also alter preferences, is a serious concern for existing and future studies in Economics. It is relevant to find out if CIPC affects preferences in Economics to test whether earlier work using choice data to reflect preferences is biased. In case of the latter, other ways to elicit preferences must be implemented instead.

To test for CIPC in economics, we will first look at how to properly test for the effect. Over the last couple of years, the widely used Free Choice Paradigm (FCP) design to test for CIPC has been proven to be flawed. The paradigm measures preferences before and after choice-making by self-reported ratings of the subjects. The design did not control for pre-existing preferences on the goods from the choice that are inaccurately revealed by the noisy measure of self-reported ratings. This methodological flaw, discovered by Chen (2008), questioned all earlier evidence on the existence of CIPC. The design has since then been altered in several ways to control for the methodological flaw. In addition to testing for the effect of CIPC in Economics, this paper will continue the search for the best improvement of the design to test for CIPC. Using alternative forms of the FCP design and controlling for the methodological flaw, many psychological studies found results supporting the existence of CIPC over the last couple of years. Some of the relevant improved models and their results are discussed in more detail in the literature section of this paper. Although the magnitude of the effect is smaller than found when using the flawed FCP design, the effect of choice-making is still observed and significant and therefore a motivation to study the effect in Economics. Using several papers from existing literature, this study attempts to improve on existing experimental designs and structures an improved version to most properly test for CIPC.

Recently, a study is conducted on the effect of choice on preferences over lotteries in a controlled economic experiment to test for the existence of CIPC in Economics (Alós-Ferrer & Granic, 2021). Their "mere-choice" design tackles biases from the psychological research designs by following standards of economic experiments rather than psychological, such as the choices being incentivized instead of hypothetical. In addition, to improving the experimental design to test for CIPC, this study has started exploring the effect in Economics. Their results suggest no existence of CIPC in economic preferences since they found no significant results. However, their design to test for CIPC could still be improved on. Their choices do not display a clear trade-off, which is necessary for cognitive dissonance to arise. Moreover, Alós-Ferrer & Granic's experiment did not control for memory, which is found to be crucial for CIPC to occur (Izuma et al., 2010; Salti et al., 2014; Chammat et al., 2017). Therefore, this paper improves on the experimental design by Alós-Ferrer & Granic by altering the design into a more considerate design to test for CIPC. This leads to the following research question:

RQ: "Is choice-induced preference change a concern for the revealed preference measure used in Economics?"

We do not expect a large effect of choice on economic preferences, since the previous study found no significant results. However, the results of one experiment do not provide us with evidence convincing enough. The lack of trade-off and control for memory could be the reason for the absence of significant effects observed. The experimental design could be improved to create more externally valid results. To be careful with expectations we expect some effect of CIPC, but smaller in magnitude than in Psychology. This smaller expected effect is allocated to a decreased personal value and importance of choices over lotteries instead of other goods. This will induce less cognitive dissonance, which will be elaborated on in the literature section of this paper. We hope to observe no effect, since this will form a concern for studies in Economics.

2. Literature review

2.1 Choices in Economics

2.1.1 The Revealed Preference Theory

The use of choice data to analyse preferences of individuals and to forecast future preferences has gained exponential popularity over the decades (Hensher, Rose, Rose, & Greene, 2005). But choice data is assumed to reveal underlying preferences of the choice makers in Economics for a long time already. Observing choices to reveal true preferences started with the revealed preference theory by Samuelson (1938). His revealed preference theory assumes that true, stable, preferences of consumers are revealed by their purchase decisions. Until this day, choices are perceived as an accurate measure of preferences, whereas ratings, rankings or other self-reported preferences are perceived as more noisy measures.

The evidence from several fields in literature, on choices to alter preferences is concerning for the assumption of the revealed preference theory. If CIPC is true for choices and preferences in Economics, preferences change after the choice is made and observed preferences would lag from true ones. The evidence on CIPC from Psychology could be problematic because this shows that preferences can change without any new information, in minutes of time, only by the act of the choice. Predictions of future behaviour based on current preferences and choices could be biased if cognitive dissonance is involved in the choice. For the theory of revealed preferences to hold, stable preferences and therefore choices are assumed (Samuelson, 1938). If CIPC is true for economic preferences, this assumption does not hold. Therefore, it is of relevance to study the stability of preferences in correlation with choice-making in an economic experimental setting.

2.1.2 Recent Study on CIPC in Economics

Recently, a study started the research on the effect of CIPC on economic preferences, since this has not been tested yet. Alós-Ferrer and Granić (2021) applied the paradigm to test for CIPC from Psychology, which will be elaborated on in section 2.2.2, to an economic setting to test whether CIPC is an issue for stability of preferences, and they found no significant effect. They applied their previously used implicit choice design (Alós-Ferrer et al., 2012) to an economic instead of a psychological experiment by using simple lotteries instead of holiday destinations as options to choose from. By using lotteries, they not only test for CIPC in Economics instead of Psychology; they also omit biases occurring within the psychological alterations of the experimental design. See Table 1 for an overview of the experimental design. Their mere choice model has participants choose between lotteries, lottery *a* and *c*, where one out of the two is transparently superior to the other. Meaning, that one of the two lotteries is clearly the better option to choose. By doing so, the researchers can predict the decision of the subject in advance. After making the "mere-choice", participants must perform the "preference-choice" task between lottery *a* and the newly introduced lottery *b*. lottery *b* is not dominantly better or worse than *a*. If CIPC is true, the preference choice is expected to be affected by the mere choice. If the theory of cognitive dissonance holds, *a* is expected to be chosen over *b* if *a* is superior and chosen over *c*; and *b* is expected to be chosen over *a* if *a* is inferior to *c* and therefore rejected in the mere-choice task. This is to align their first choice (behaviour) with their second one (preference).

Table 1 *The Economic Mere Choice Design (Alós-Ferrer & Granić, 2021)*

	Stage 1	**Stage 2**
a* transparently superior to *c	Choice (*a, c*)	Choice (*a, b*)
a* transparently inferior to *c	Choice (*a, c*)	Choice (*a, b*)

The study by Alós-Ferrer and Granić aims to test if the subjects experience CIPC over their preferences regarding lottery *a*, which is involved in the mere choice before the preference eliciting choice in stage 2. Their results do not suggest the existence of CIPC, like other findings in literature do, due to lack of magnitude and significance, suggesting CIPC is not present for economic preferences with choices under risk. However, for future research, they suggest CIPC could only be present for choices with a clear trade-off because cognitive dissonance only arises with difficult choices and therefore a trade-off. The first-order stochastic dominance (FOSD) dominant mere-choice, where one out of the two options is clearly the better option, from their experiment could therefore not induce cognitive dissonance enough for CIPC to happen. A choice task with a clear trade-off will also make the results more comparable to the studies from Psychology on CIPC.

This paper will further explore the existence of CIPC in economics using lotteries and apply the suggestion by Alós-Ferrer and Granić (2021) about the clear trade-off within the choice task. Therefore, the following hypothesis is formed and tested:

H1: After choosing between lotteries with a clear trade-off between risk and reward, preferences over these lotteries will change with the direction of the choice.

2.2 CIPC in Psychology

2.2.1 Cognitive Dissonance Theory

The literature on CIPC has existed for over a long time and roots in the theory by Festinger (1957) about cognitive dissonance. To completely understand the concept of CIPC we will dive into the theory behind the psychological phenomenon before we explore the studies that tested for it. The theory of cognitive dissonance concludes on the perception of clashing information that an individual experiences on a certain topic. To clarify this statement, someone has pieces of information, mental cognitions, about a matter such as beliefs, actions, feelings, values, ideas, etcetera. You can for example buy an apple (action) and think an apple is good for your health (belief). People like these cognitions to be in line with each other. If mental cognitions clash, meaning they do not line up with each other, someone experiences psychological stress. For example, if you decide to buy a new dress, you favour to like the dress when you get home and often wear it, then for you to dislike the dress after the purchase and it being a bad bargain. In the case of the latter, your actions turn out to be not in line with your preferences, causing you to experience psychological stress. You chose to buy the dress (behaviour) but did not end up liking the dress (preferences). To eliminate this psychological stress, you will subconsciously try to line your cognitions back up again. To line up the contrary mental cognitions, you adjust one of the clashing pieces of information. In the case of the dress, you cannot undo the purchase, so you adjust your opinion about the dress. After buying the dress, you align your view on the dress accordingly to your purchasing decision. Where you first were not entirely certain about your opinion on the dress, you now adjust your preferences into liking it simply because you decided to buy it. Now your buying behaviour, and your preferences about the dress, are in line and therefore do not clash. Cognitive dissonance is the feeling of distress caused by mental cognitions that clash. Therefore, the theory of cognitive dissonance predicts preferences to change after choice-making to align preferences with your actions.

According to the theory, this adjustment of preferences also works the other way around, for rejected matters. The following example will clarify this. Suppose you are in doubt about moving to Rotterdam or Amsterdam. After making the difficult decision between the two cities and if you decide to move to Rotterdam, you think about the decision again and the uncertainty has faded. Suddenly you can mainly think of the negative aspects of living in Amsterdam, such as it being too crowded and touristic. You align your choice to move to Rotterdam and not to move to Amsterdam with your opinion and preferences about the cities. No additional information is involved, the likability increases or decreases just by the fact of the city being "chosen" or "unchosen". The greater the personal value of a mental cognition is to you, the greater the magnitude of the cognitive dissonance and therefore the urge to eliminate the dissonance. The choice to live in a certain city is more likely to be an important decision than buying a dress. Therefore, your opinion about the city you doubted moving to is more likely to change by the choice you made than your opinion about a dress you doubted buying.

Throughout literature, this phenomenon of altered preferences after choice-making is called Choice-Induced Preference Change (CIPC), with cognitive dissonance being the theorised reasoning behind it. CIPC is widely researched, tested for, and written about in literature which will be discussed in the rest of the literature section of this paper. In the current study, we are interested in the effect of cognitive dissonance on economic preferences. If CIPC is true, this could namely be a concern for economic experiments using choices as their measure of preferences. If choices are expected to display preferences but turn out to alter preferences, the measurement method could be too inaccurate. We will therefore first look at the evidence from existing literature on the concept of CIPC as well as how we should best test for its existence.

2.2.2 Flawed Free Choice Paradigm

Brehm (1956) was the first psychologist to propose an experiment to test for CIPC caused by cognitive dissonance with his Free Choice Paradigm (FCP) design. The design measures a participant's preferences before and after making a choice between two closely preferred household appliances, suggesting near to indifferent desirability between the two choice alternatives. Because the subject likes the two appliances almost the same, cognitive dissonance is expected to alter preferences about the household appliances after choice-making. According to the theory, to align behaviour and preferences, the post-choice likeability should increase for the chosen good and decrease for the unchosen good.

In more detail, the experiment consisted of the following three stages that can be seen in Table 2: The participant rates a list of goods, in this case, household appliances, in stage 1 according to desirability. The participant makes a choice between two closely rated goods in stage 2. A repetition of the rating task is performed in stage 3. To isolate the effect of choice-making on preferences, a control group performs the same rating stages 1 and 3, without making a choice in between, but receiving one of the goods as a gift instead. Brehm categorized types of dissonance in high, medium and low, where high dissonance holds closely desired goods for the choice in stage 2 and low dissonance holds goods rated further apart, being less close desired. The high dissonance group is closer to indifference between the two goods from the choice stage than the medium and low dissonance groups. To clarify, the appliances a subject must choose between in stage 2 for the high dissonance group differ 0.5 to 1.5 scale-points on an 8-point Likert scale for their ratings from stage 1, say 7 and 8. In the medium dissonance group, the appliances differ by about 2 scale points, say 5 and 7, and in the low dissonance group about 3 scale points, say 4.5 and 7.5. According to the cognitive dissonance theory, the high dissonance group is expected to alter preferences more after choice-making than the other groups, with the low dissonance group having the least alteration. Being indifferent between two goods and choosing one out of the two makes your mental cognitions less aligned than preferring one good over another and choosing the preferred good, the latter is more likely to occur in the lower dissonance groups. Preferences must change in a larger magnitude for the mental cognitions to be in line for a choice over indifferent options, like in the high dissonance group. If you clearly prefer one over the other, your cognitions are already in line with each other with making a choice.

Table 2 *The Free Choice Paradigm Design (Brehm, 1956)*

	Stage 1	**Stage 2**	**Stage 3**
Experimental Group “High Dissonance”	Rate	Difficult Choice	Rate
Experimental Group “Medium Dissonance”	Rate	Medium Choice	Rate
Experimental Group “Low Dissonance”	Rate	Easy Choice	Rate
Control Group	Rate	Gift	Rate

The results of Brehm’s experiment (1956) support the expectations based on the theory of cognitive dissonance. The subjects align their cognitions by liking the chosen appliance more after choice-making and liking the unchosen appliance less afterwards. The ratings for chosen goods significantly increased from stage 1 to stage 3 and significantly decreased for unchosen goods. The closer to indifference the subject was about the two goods in stage 2, the higher the dissonance of the experimental group, the larger the magnitude of the effect of CIPC. This is in line with expectations drawn from the theory. The spreading between the two different ratings of the same object (stage 1 to stage 3) is representing the CIPC caused by cognitive dissonance using the FCP design (Mann et al., 1969).

Throughout multiple disciplines in literature, an extensive number of studies used this 3-staged FCP design by Brehm (1956) to test for the effect of choice-making on preference change (see for example Gerard & White, 1983; Steele et al., 1993; Heine & Lehman, 1997; Lieberman et al., 2001; Egan et al., 2007; Ariely & Norton, 2008; Sharot et al., 2009; Leotti et al., 2010; Egan et al., 2010). Instead of the rating task in stages 1 and 3, some studies used a ranking task as a substitute which aims to measure the same, but which leads to fewer ties in preferences than using ratings which helps with analysing the data. The overall results show convincing evidence for the existence of CIPC. However, half a century after introducing the FCP, and many experiments using the design later, Chen (2008) discovered a methodological flaw in the design which questions all earlier evidence on the existence of cognitive dissonance driven CIPC.

Chen stated that ratings are too inaccurate in measuring preferences to conclude on preference change using this 3-staged FCP design. Even when two goods are rated indifferently in the first stage, the chosen good from stage 2 is more likely to have higher true desirability than the rejected good. Ratings are noisy measures and if someone chooses one over another good, this is more likely to display its true preference than rating does (Chen & Risen, 2010). In the flawed design, the control group does not make a choice. Therefore, we know less about their true preferences than we know from the experimental group. The spread in ratings from the experimental group is compared with the spread of the control group which is interpreted as measurement error. However, we do not know the direction of the measurement error because of the absence of the choice like we know for the treatment group. The spread is compared with a false baseline. In fact, a spread in the rating is expected without an effect of cognitive dissonance. For chosen goods, the true preference and therefore rating is more likely to be higher than stated in the first rating stage and vice versa for an unchosen good. This is due to learning effects; ratings are expected to improve as the subjects get acquainted with the rating scale. Therefore, a positive spread between two rating moments is expected for a good that is chosen, and a negative spread is expected for an unchosen good. However, for the control group, we cannot separate the spread caused by measurement error and the spread caused by improvement of the true rating. Therefore, we cannot separate the selection bias from the causal effect when comparing treatment and control group using Brehm's FCP design.

Several papers reviewed this accusation of biasedness and proved using mathematical simulations that the FCP can indeed falsely identify the existence of CIPC, even when there is none (Chen & Risen, 2010; Izuma & Murayama, 2013). To test for the existence of CIPC in Economics in this study, it is therefore important to improve on the experimental FCP design and control for the methodological flaw. It is of relevance to explain the FCP in detail to understand the origin of the experimental design to test for CIPC. We will now continue with ways to eliminate the bias in the design to properly test for CIPC.

2.2.3 Controlling for the Methodological Flaw

After Chen discovered the methodological flaw in the FCP design, many authors improved the experimental design in different ways to validly test for CIPC and see if it is even existing. Several solutions to eliminate the bias found by Chen (2008) are proposed such as the RCR/RRC design (Chen & Risen, 2010); the blind choice design (Sharot et al., 2010; Egan et al., 2010); the implicit choice design (Alós-Ferrer et al., 2012; Alós-Ferrer & Granic, 2021); the choice blindness design (Izuma et al., 2015); and the uniform choice design (Sela et al., 2017). Enisman, Shpitzer & Kleiman (2021) wrote a meta-analysis on 43 studies, all using an improved version of the FCP design to control for the methodological flaw. Overall, the results of this meta-analysis confirm the existence of preference change purely initiated by the act of choice-making. Although the effect is smaller in magnitude than anticipated using the flawed FCP design, the evidence of an effect of CIPC is still a concern for the results of economic experiments using choice as their metric of preferences. Therefore, we will review the improved experimental designs to set up the most proper design to test for CIPC in Economics. By doing so, we can discuss the validity of past and future experiments using choice as their measure of preferences.

Chen himself was the first to suggest a potential improvement; the modified FCP design. Shortly after his paper was published, Chen continued writing on this topic with Risen (2010) and he performed the proposed modified FCP design in an experiment. Within the modified FCP, next to the experimental and control group, a modified control group is added. The modified control group has choice stage 2 and rating stage 3 turned around, so the subjects first need to rate the good for the second time before making the choice; see Table 3. They implemented the Rank-Choose-Rank/Rank-Rank-Choose (RCR/RRC) design which is broadly used after publication in studies on the topic since it overcomes the found methodological issue of the original design by Brehm (1956) by just altering the control condition.

Table 3 *The Modified Free Choice Paradigm (Chen & Risen, 2010)*

	Stage 1	**Stage 2**	**Stage 3**
Experimental Group	Rank	Choice	Rank
Control Group "Standard"	Rank	Gift	Rank
Control Group "Modified"	Rank	Rank	Choice

This design eliminates the methodological flaw of the FCP because the selection bias is separated from the counterfactual. In other words, the spreading between the two ranking stages due to errors in preference measurement is separated from the actual effect of the choice task in between because the control group chooses as well, providing information on the direction of the measurement error. The control group now makes the same choice as the experimental group, but after the second rating stage so it will not affect their preferences as measured. In this way, you can compare the spread from the experimental and control group for chosen and unchosen goods separately. This is very important and was not possible with the original FCP design. The expected spread caused by the measurement error, observed in the control group, can be deducted from the observed spread in the experimental group to isolate the effect of choice-making. The findings of Chen & Risen's study are smaller in magnitude than the former results of FCP experiments using the flawed design and are little to not statistically significant, questioning all earlier evidence on CIPC.

However, the method of Chen and Risen (2010) received criticism later as well. Their experimental design is presumed to not filter out the entire measurement error since the experiment contains features that decrease the accuracy of the preference measurement. These features include too many options in the ranking stage, too many decisions in the choice task and not having the subject overthink their rankings enough (Kitayama, Tompson, & Chua, 2014). The search for the best design to validly test for CIPC did not end here inherently. Authors continued to publish improved versions of the FCP design that observed significant effects. The modified FCP design eliminates the bias from the original FCP design, but the critique, which could be the reason for the insignificant results, is relevant to consider structuring the experimental design to test for CIPC in Economics since the design by Chen & Risen (2010) is not optimal yet.

Following Chen & Risen, many authors proposed solutions to control for the methodological flaw of the FCP design. For example, some came up with a blind choice design to create a choice without selection bias (Sharot et al., 2010; Egan et al., 2010). Others eliminated the bias with an implicit choice, so the choice does not provide information about the preferences between the two goods of interest (Alós-Ferrer et al., 2012; Alós-Ferrer & Granic, 2021). Most of the studies observed an effect of choice-making on altered preferences. But the findings are divergent in direction of significant results, only for chosen (e.g., Sharot et al., 2010) or only for unchosen goods (Izuma et al., 2010). Therefore, this study will test for both directions separately to observe any effect, if existing.

2.2.4 Memory on CIPC

That same year, Izuma et al. (2010) found strong evidence for CIPC while controlling for the methodological flaw from the FCP and found the effect to be dependent on conscious memory of the choice. This finding is somewhat contrary to the blind choice design because Sharot et al. (2010) found evidence for CIPC from a blind choice which is unlikely to be actively remembered. Izuma et al. (2010) tested for preference change after choice-making using both self-reported preferences and brain activity measured preferences by looking at change in preference-related striatal activity in the brains with the use of functional MRI scans. In their experiment, they reminded the subjects in the experimental group in stage 3 whether they had chosen or rejected the piece of food in the choice task before they rated the item for the second time, as can be seen in Table 4. By doing so, they made sure the subject was aware of their choice to properly test if it changes preferences. They also created a conditional group where a computer made the choice for them. In stage 3 they were reminded whether the computer chose or rejected the piece of food, in line with the experimental group. This way of eliminating the methodological flaw is in line with the computer-made blind choice condition used by Sharot et al. (2010). Where a self-made choice is compared with a choice without personal value and behaviour connected to it. The control condition did not get a reminder about their choice since they made the choice after the second rating stage, like in Chen & Risen (2010). Izuma et al. (2010) found significant preference change for the unchosen goods in the experimental group for both self-reported as well as brain activity measured preferences and a strong effect of the reminder on CIPC. In line with Sharot et al. (2010), they found no effect for the computer-made choice condition. This can be explained by the theory of cognitive dissonance perfectly as discussed before. Where Sharot et al. (2010) only found significant CIPC for chosen goods, Izuma et al. (2010) only observe CIPC for unchosen goods.

Table 4 *The Reminder Choice Design (Izuma et al., 2010)*

	Stage 1	**Stage 2**	**Stage 3**
Experiment "Self-made Choice"	Rate	Choice	Rate + Reminder
Experiment "Computer Choice"	Rate	Computer Choice	Rate + Reminder
Control	Rate	Rate	Choice

The experimental design by Izuma et al. (2010), however, displays asymmetry because the subjects in the experimental group get the reminder and the control group does not. Asymmetry in the experimental design can cause confounding factors to affect the outcome. Therefore, in their 2014 paper, Salti et al. replicated the experimental design by Izuma et al. (2010) with an added control condition for robustness of the results. Next to the RCR with reminder condition and the RRC control condition without reminder, they added another RCR without reminder condition with a memory task added in after the last stage, see Table 5. This memory task tests whether the participant remembers their choice from stage 2 correctly. Because this stage is after all other stages, it does not affect the symmetry of the design. This new condition can therefore be compared validly with the RRC control condition. Their results display a strong correlation between the effect of choice-making on altering preferences and conscious memory of the choice. They find significant evidence for CIPC controlling for memory. This suggests that subjects need to remember their choice for their preferences to change induced by cognitive dissonance. This finding makes sense according to the theory since personal value of the cognition enlarges cognitive dissonance. Personal value is more likely to attach to the mental cognition of behaviour when the choice is remembered.

Table 5 *The RCR/RRC with Reminder Design (Salti et al., 2014)*

	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
RCR + Reminder	Rate	Choice	Rate + Reminder	
RCRM (Comparable with RRC Control)	Rate	Choice	Rate	Memory
RRC Control	Rate	Rate	Choice	

Moreover, Salti et al. extended the use of the same design from their 2014 paper, in collaboration with other authors in a new study on the effect of episodic memory on cognitive dissonance (Chammat et al., 2017). They studied CIPC in correlation with episodic memory using multiple brain activity measurements. Their results provide strong evidence for the dependence of cognitive dissonance on the conscious memory of the choice. This means the participant needs to remember their chosen and unchosen goods from the choice task actively, for cognitive dissonance to cause their preferences to change about the goods afterwards.

This finding of CIPC being dependent on memory makes sense according to the theory. The mental cognitions only create cognitive dissonance if they are important enough according to personal value. However, the evidence on the effect of memory does not add up to the significant effect found using a blind choice (Sharot et al., 2010). A possible explanation is a vague subconscious memory of the choice, or the observed effect must be random. Moreover, the recent study on CIPC in Economics did not control for memory, which can be the reason for their insignificant results. The discovered dependence of cognitive dissonance on remembering the choice leads us to the second hypothesis statement of this paper:

H2: Memory of the choice enlarges the effect of CIPC for preferences over lotteries.

The exact method that will be used in this study to improve on the experimental design, structured from previous studies, to test for CIPC in economics will be elaborated on in the following chapter.

3. Methodology

After discussing the existing literature on CIPC, and the experimental designs proposed to properly test for its existence. This chapter will discuss the experimental design used in this paper, which overcomes the methodological flaw of the original FCP design and aims to test for CIPC in Economics in the most proper way. The design is inspired by the RCR/RRC design by Chen & Risen (2010), with an added stage 4 with memory task inspired by Salti et al. (2010). Lotteries are used inspired by and copied from Alós-Ferrer and Granić (2021). To study the effect of choice-making on economic preferences, quantitative data is conducted by performing an online experiment. The experimental design to isolate and observe this effect will be discussed in detail in this section of the paper.

3.1 Experimental design

The purpose of the experiment is to observe whether CIPC is existing for choices and preferences over economic goods. To replicate economic choice-making, subjects are presented with lotteries in line with the experiment by Alós-Ferrer and Granić (2021) in their most recent study. Lotteries are economically relevant and choosing over them simulates decision-making under risk. Since we are interested in whether observed preferences are stable in economic experiments, lotteries are the matter of choice since these are often used because they can be paid out for real very easily. To properly separate the effect of choice-making on preferences from selection bias, the RCR/RRC design by Chen & Risen (2010) is used, as can be seen in Table 6. With this design, we will observe the effect of two choices, between Lottery A and B and between Lottery C and D, on the desirability of the four lotteries.

Table 6 *Experimental Design*

	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Treatment	Real Choice Task (AB) & (CD)	WTA (ABCD)	Filler Choice Task (ZY) & (XW)	Memory Task (AB) & (CD)
Control	Filler Choice Task (ZY) & (XW)	WTA (ABCD)	Real Choice Task (AB) & (CD)	Memory Task (AB) & (CD)

Because lotteries are objective goods, and the expected values of the lotteries within each choice pair, AB and CD, are almost equal. The subjects, in both groups, are expected to be indifferent to both choice pairs, on average. Therefore, the first rating stage is skipped in the experimental design. The pre-choice desirability of the lotteries is assumed to be equal for both lotteries in each choice pair. In combination with the objectivity of the goods and random assignment to treatment and control groups, we can compare the ratings of chosen and unchosen lotteries just by looking at their stated willingness to accept (WTA) from stage 2. By doing so, the length and mental effort it takes to perform the tasks for the participants are decreased and this improves the reliability of the answers given (Kitayama, Tompson, & Chua, 2014).

The survey starts with an introduction and instructions followed by five demographic questions and two test questions for understanding of the lotteries. The subjects can only continue the survey if they answered the test questions correctly to eliminate noisy answers from subjects who do not understand the concept of the lotteries. After this general part of the survey, the subjects are randomly assigned to the treatment and control groups to eliminate the effect of selection bias. The treatment group begins with the choice task in stage 1 consisting of the two questions of choosing over choice pairs AB and CD, as can be seen in Table 7. Lottery A versus Lottery B and Lottery C versus Lottery D are both hard choices with a clear trade-off between risk and reward to induce cognitive dissonance. Stage 2 is a rating task where subjects need to state their WTA for selling the lottery presented. These are the same lotteries as in the choice task, A, B, C and D, to test whether the choice task affects their desirability and thus stated WTA. Stage 3 is a filler choice task with new lotteries for symmetry of the experiment for the treatment and control group, so general instructions apply. Lottery Z versus Lottery Y and Lottery X versus Lottery W display easy choices with clear superiority of one over the other lottery. Moreover, stage 4 is a memory task on the correct memory of the choice the subject made before in the choice task for choice pairs AB and CD. In the control group, the choice task and the filler choice task are switched to observe the effect of the choice task on the WTA of the lotteries. This is done by comparing the WTA from the treatment condition with the control condition where the choice task does not affect the ratings because it is afterwards. The memory task will reveal the effect observed for correctly remembered answers and incorrectly remembered answers to see if the observed CIPC differs controlling for this condition. A more extensive description of the tasks is provided in the following section.

Table 7 *Survey Flow*

Treatment	Control
Introduction and Instructions	
Demographic Questions	
Questions for Understanding of the Lotteries	
Choice Task (AB) & (CD)	Filler Choice Task (ZY) & (XW)
WTA Task (A, B, C, D)	WTA Task (A, B, C, D)
Filler Choice Task (ZY) & (XW)	Choice Task (AB) & (CD)
Memory Task (AB) & (CD)	Memory Task (AB) & (CD)
Email Address for Random Lottery Incentive (RLI)	

3.2 Controlled Economic Experiment

The experimental design implements all five precepts as proposed by Smith to achieve control (Smith, 1982). Because this experiment is incentivized by real money, non-satiation and salience are satisfied. Money is a rewarding system where people consistently prefer more over less and if you make a good call in the experiment, you earn more. To achieve dominance, the earnings from the lotteries must be high enough to matter to the participants so they do not choose randomly. The lotteries are copied from the existing study by Alós-Ferrer and Granić (2021), so they are assumed to hold high enough earnings for the subjects to make considerate decisions. Privacy is no concern since no participant will get to know the answers of the other participants and they are not correlated in any matter. Parallelism is assumed since general behaviour applies everywhere.

Similar to the experiment of Alós-Ferrer and Granić (2021), several methodological biases of the FCP design are eliminated because the experiment is conducted using the standards of Economics rather than the standards used in Psychology. The results are more valid than results from psychological experiments because the choices are incentivized by real money and therefore the hypothetical bias is not an issue. The subjects are not deceived and stating their actual WTA for lotteries will elicit preferences more accurately than hypothetically rating a good. Since it will be very timely, costly and inconvenient to pay out every decision throughout the experiment, the Random Lottery Incentive (RLI) system will be used to pay out randomly selected decisions (Cubitt et al., 1998). A random generator will decide for which five participants one of their decisions will be played out and paid out for real. All data retrieved is handled confidentially, only used for the study and is not shared with anybody else. The ethical review board of the Erasmus University Rotterdam approved the survey.

3.3 Stages in detail

3.3.1 Choice Task

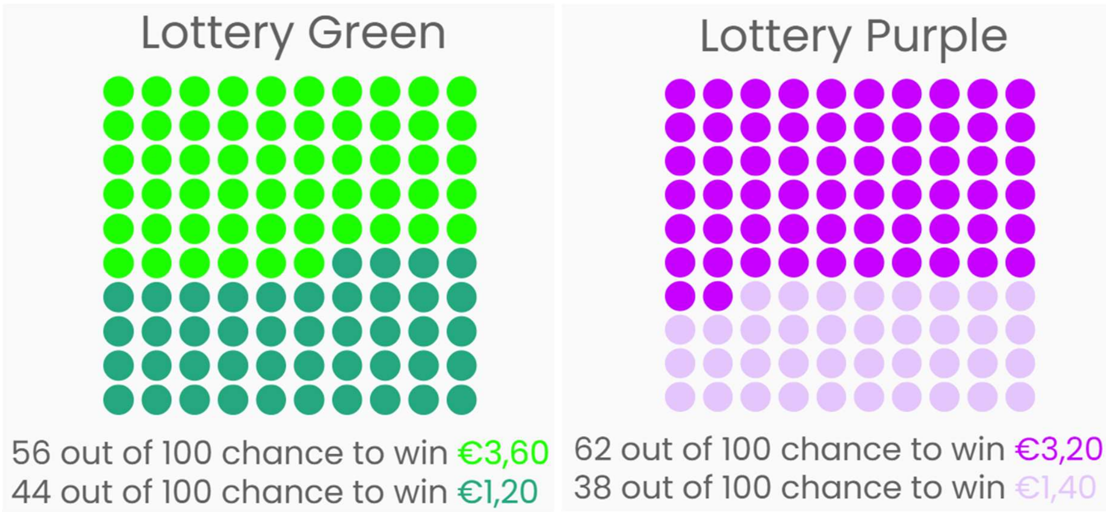
The choice task consists of two out of the four “difficult” choice pairs that Alós-Ferrer & Granić (2021) came up with and used in their most recent study on CIPC in economics. These choice pairs are used because they display a clear trade-off between risk and reward for the decision-maker which is necessary to induce cognitive dissonance. These choice pairs make up difficult decisions because their expected values are very close, and people are expected to be indifferent on average. In their paper, in line with expectations, they found choice distributions close to half-half confirming the indifference on average. 47% of the subjects chose Lottery A over Lottery B and 56.5% chose Lottery C over Lottery D (Alós-Ferrer & Granić, 2021). The lotteries and their probabilities with outcomes and expected values are presented in Table 8. Choice pair AB is therefore (0.56, €3.60; 0.44, €1.20) versus (0.62, €3.20; 0.38, €1.40) and choice pair CD is (0.70, €3.00; 0.30, €1.00) versus (0.78, €2.70; 0.22, €1.20). The clear trade-off between risk and reward, making it a hard decision, is expected to cause cognitive dissonance with the choice-making and therefore alter preferences afterwards.

Table 8 *Lotteries of Interest*

Lottery	**Probabilities and Outcomes**	**Expected Value**
Lottery A (Green/Purple)	(0.56, €3.60; 0.44, €1.20)	€2.54
Lottery B (Purple/Green)	(0.62, €3.20; 0.38, €1.40)	€2.52
Lottery C (Blue/Orange)	(0.70, €3.00; 0.30, €1.00)	€2.40
Lottery D (Orange/Blue)	(0.78, €2.70; 0.22, €1.20)	€2.37

Since multiple studies found that one must remember the chosen and unchosen goods actively for CIPC to happen (Izuma et al., 2010; Salti et al., 2014; Chammat et al., 2017), an element of memory is added into the experimental design. To help the subjects remember their chosen and unchosen lotteries more easily, the lotteries are named after and displayed in that same colour. The subject pool is randomised into four subgroups, two treatment and two control groups. The purpose of splitting into four instead of two groups is to eliminate any selection bias effect from pre-existing preferences over the colours. The colours are randomised for treatment groups 1 and 2 as well as control groups 1 and 2. To clarify: Lottery A is green for treatment and control groups 1 and purple for treatment and control groups 2. Vice versa Lottery B is purple and green respectively. If a subject for instance prefers green over purple in advance, the confounding effects of such existing preferences are eliminated as much as possible through randomization. Lottery Green (A) and Lottery Purple (B), presented in the survey for treatment and control groups 1, are displayed in Figure 1 below to provide some illustration of the survey. The complete survey is written out in the Appendix.

Figure 1 *Real Choice Task: Lottery A (Green) vs. Lottery B (Purple)*



Another element of memory in the choice task is a reminder of the memory task, inspired by the reminder used by Izuma et al. (2010) and Salti et al. (2014). With every choice question, the subjects are reminded to keep their decision in mind for the incentivized memory task at the end of the survey to earn €2.50 if answered correctly. This reminder is expected to improve the amount of correctly remembered choices and have the subjects consider their decision with more attention. The more they think about their choice actively, the more cognitive dissonance will arise according to expectations.

3.3.2 WTA Task

To truthfully reveal the participants' preferences in the rating stage, the Becker–DeGroot–Marschak (BDM) method is used (Becker, DeGroot & Marschak, 1964). With this method, participants state their Willingness to Accept (WTA) for lotteries A, B, C and D. The subjects are asked to state the amount of money they are willing to accept at a minimum, instead of playing out the lottery. After they state this amount in Euros, a random generator will release a price for the lottery. If this price is below the stated WTA, the participant will play out the lottery. If the price is above the declared WTA, the participant will receive the payment of the generated price and the lottery will not be played out. This method reveals the certainty equivalent of the subject for what fixed amount the subject indifferent is between receiving the amount of money answered and playing out the lottery. The subject is presented with a slider to give their answer, between €0 and €4, which can be seen in the survey in the Appendix.

The randomly generated price for the BDM method will only be generated if this decision is chosen to be played out and paid out for real by the RLI system afterwards. This method of WTA stating is a dominant strategy to reveal someone's preferences because the decision is incentivized by the actual possibility of being played out and receiving a fixed amount of money instead of playing out the lottery. Because every decision is incentivized by the RLI, the stated preferences will be as close to the actual preferences as possible. This will eliminate the hypothetical bias present in the psychological versions of the FCP experimental design.

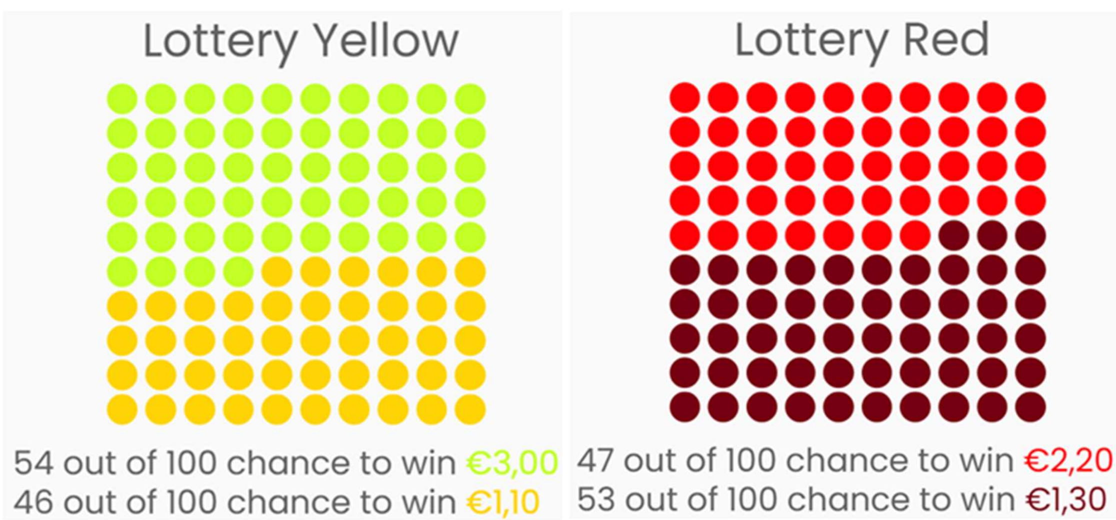
3.3.3 Filler Choice Task

In the filler choice task, the subjects are presented with similar lotteries in look and feel as presented within the real choice task. However, these choice pairs stand for the "easy" choice pairs from the paper by Alós-Ferrer and Granić (2021) and an overview of their probabilities, outcomes and expected value is stated in Table 9. One out of the two lotteries to choose from is superior to the other in a dominant sense, following FOSD. This ease in choice will limit any effect of dissonance after choice making for the control group to affect their WTA ratings in the following stage. The lotteries are called Lottery Grey, Pink, Yellow and Red, an example is displayed in Figure 2. As you can see Lottery Yellow is the better option to go for than Lottery Red in terms of probability, outcome and expected value. The task yields the same instructions as the real choice task for symmetry reasons.

Table 9 *Filler Choice Task Easy Lotteries*

Lottery	**Probabilities and Outcomes**	**Expected Value**
Lottery Z (Grey)	(0.72, €2.50; 0.28, €1.00)	€2.08
Lottery Y (Pink)	(0.63, €1.90; 0.37, €1.10)	€1.60
Lottery X (Yellow)	(0.54, €3.00; 0.46, €1.10)	€2.13
Lottery W (Red)	(0.47, €2.20; 0.53, €1.30)	€1.72

Figure 2 *Filler Choice Task: Lottery X (Yellow) vs. Lottery W (Red)*



3.3.4 Memory Task

After reminding the subjects about the memory task upfront, naming the lotteries and displaying the lotteries in the same colour throughout the experiment, a memory task is included in the end to test the effectiveness of these memory attempts inspired by the study of Salti et al. (2014). The memory task is included in both groups for symmetry reasons, similar to the experiment of Chammat et al. (2017), and because the reminder for the choice task during the experiment that is present for both groups to have the subjects overthink their choices. By doing so, we can observe the effect of actively remembering the choice on CIPC and therefore test the second hypothesis. In the memory task, the participants get to see choice pairs AB and CD and recall their previously made decisions, as can be seen in the survey in the Appendix. For every correct answer, €2.50 can be earned to incentivize the memory task.

4. Subjects and Procedures

4.1 Subjects

To determine the number of subjects needed for robust results, a power calculation is performed. Following the study by Alós-Ferrer and Granić (2021), we expect a small effect size and therefore use the same d of 0.2 for our power calculation. We set the α to 0.05 since this is the standard used significance level throughout literature. $1\text{-}\beta = 0.8$ following the former study as well since this study is very similar to theirs. Leaves us with an *a priori* required sample size of 650 subjects, evenly divided over the treatment and control conditions. This is the power calculation result for the one-sided Mann-Whitney U test using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007). However, due to budget and time limitations, a smaller sample is used in this paper. With the significance level α set to 0.1 we still need a bigger sample size, of 474 subjects in total, than is realised.

The experiment is performed by 143 subjects in total. Evenly distributed over the treatment and control groups. The subjects are recruited via social media channels such as WhatsApp, Instagram and Facebook as well as word of mouth by the researcher. Everyone was eligible to fill in the survey, no age or other demographic constrictions apply. Because all questions are mandatory, all participants who started the survey finished it as well, and therefore no observations are excluded from the sample. The characteristics of the subjects are discussed extensively in the results section of the paper.

4.2 Measures

4.2.1 WTA

Willingness to Pay (WTP) is a measure to elicit the amount of money a subject is willing to pay at maximum for a certain good (Varian, 1992). By using WTP, the certainty equivalent of each subject over the lotteries will be revealed. Kahneman, Knetsch, and Thaler (1990) found WTA and WTP to differ as stated by subjects for the same goods, which should not be the case if both methods truthfully elicit someone's certainty equivalent to that good. However, using the Becker–DeGroot–Marschak (BDM) method, Eisenberger and Weber (1995) found that for ambiguous and risky lotteries the stated ratios are practically the same. Therefore, this study will use WTA instead of WTP because we cannot ask to pay us for real, only the other way around. Wertenbroch and Skiera (2002) tested the validity of the preference measuring tool using lotteries and found the stated amounts to be lower than in hypothetical studies because of the incentive constraint. Since this study will use risky lotteries and pay out the lotteries and their stated prices for real using the RLI system, WTA can be assumed to elicit preferences reliably. For a better understanding of the subjects, we use Willingness to Sell (WTS) instead WTA in the survey, but WTA and WTS mean the same.

4.2.2 CIPC

CIPC is measured in two different ways in this study, both using the stated WTA over the lotteries. For every choice pair, AB and CD, the difference in ratings is calculated by subtracting the WTA for the unchosen lottery from the WTA for the chosen lottery. Because the lotteries are objective and the expected value of both lotteries in each choice pair are almost equal, this is expected to be close to zero for the control condition. For the treatment condition, this difference is expected to be larger than for the control condition since the WTA of the chosen lottery increases and for the unchosen lottery decreases according to the theory. Therefore, the first interpretation of CIPC is the difference in WTA for each choice pair, chosen minus unchosen.

Because of the general objectivity of the goods, we can also look at the WTA for every lottery, separately for chosen and unchosen. For every chosen Lottery *x*, the WTA is expected to be higher in the treatment than in the control group because of choosing the lottery over another closely preferred lottery before stating the WTA. For every unchosen Lottery *x*, the WTA is expected to be lower in the treatment than the control group, because rejecting the lottery over a closely preferred lottery in advance. If the WTA differ significantly for the treatment and control condition, this is interpreted as the effect of pure choice-making, without any additional information, and thus CIPC. Because the experiment is controlled and the only difference between the two groups is the choice task, we assume any effect measured comes from the choice-making.

4.3 Procedures

4.3.1 Qualtrics

The experiment is performed as an online survey, created using the Erasmus University website of Qualtrics. Qualtrics is an online platform specialised for students at universities to perform their experiments. An experimental survey is created via the website and afterwards shared with the subjects via an online link using multiple social media channels to distribute the link. The survey takes about 8 minutes to complete, and the subjects are compensated for their time by the RLI system, incentivizing every question of the survey. The complete survey is included and can be found in the Appendix.

4.3.2 Excel

The data retrieved using Qualtrics is transformed with Excel to create the extra variables needed in addition to the experimental output. Within Excel, variables are created such as the dummy variable *Achosen* which is 1 if A is chosen over B and 0 if B is chosen over A. The same goes for *Cchosen*, which is 1 when Lottery C is chosen and 0 if Lottery D is. Continuous variables are created such as *WTAAchosen*, which stands for the WTA of Lottery A if chosen. If the subject did not choose A over B, the observation is left blank. This variable is created for all lotteries A, B, C and D, chosen and unchosen separately, forming eight new variables. These variables are all used as dependent variables to test the hypotheses to see if treatment and memory affect them. The difference in WTA chosen minus WTA unchosen for each choice pair, per subject, is also created as a continuous variable creating two new variables, *DifferenceAB* and *DifferenceCD*. If a subject prefers Lottery A over Lottery B in the choice stage, you expect the WTA for A to be higher than for B in the rating stage. Therefore this "difference" in ratings per choice pair is created as a continuous variable to test for CIPC using statistical analysis as discussed in the following subsection. The created variables are used for the statistical analysis, as described in subsection 4.4, which is performed using StataMP 17.

4.4 Statistical Analysis

4.4.1 Mann-Whitney U tests

For the two hypotheses, we are interested in the effect of the choice task on the stated WTA of the lotteries. For the second hypothesis, we are interested in the effect of remembering the choice correctly on the WTA of the lotteries for subjects who had the choice task in the stage before the WTA stating. Since we are analysing data obtained from an experiment, the most appropriate way to analyse this data is using a non-parametric test. This is because it is unlikely that all the assumptions for using a parametric test can be true. For example, the assumption of a normal distribution of the error terms is very unlikely with a sample of this size, 143 observations, and we cannot assume the variance of the two groups to be the same.

4.4.1.1 Hypothesis 1. We want to observe the causal effect of the choice on preferences. For our data, this means the effect of being in the treatment group on the stated WTA of the lotteries. We want to observe the effect for every lottery separately; chosen and unchosen separately, because of divergent results in literature on either a significant effect for chosen or unchosen goods. We also test for the effect of treatment on, for every choice pair, the difference in stated WTA for the chosen minus the unchosen lottery. Because we are using a monetary amount (EUR) for our dependent variable, the WTA of a lottery or the difference in WTA, the data is measured on a ratio scale. The treatment and control groups will be compared, which are two non-paired samples from the same population. The data is therefore compared between subjects, so the most appropriate test to use is the Mann-Whitney U (MWU) test to analyse whether the distributions differ significantly for the treatment and control conditions. The test is one-tailed because we know the direction of the difference. This direction is different for chosen and unchosen lotteries and is discussed for each variable.

The MWU ranks all combined observations and counts them separately per group afterwards. Then it tests the probability that one out of the two groups has a higher sum of ranks. If the sum of ranks has a significantly higher probability to be greater in one group over the other, the null hypothesis can be rejected. Therefore, the test is first run with the difference in WTA per choice pair, chosen minus unchosen, where *x* denotes choice pair AB or CD, as the dependent variable. The MWU will test whether the probability that the sum of ranks is higher in the treatment than in the control group, is larger than 50%. The null hypothesis and the alternative hypothesis of H1 are, therefore:

$H0\text{: Probability [Difference-Choice Pair-}x_{treatment} > \text{Difference-Choice Pair-}x_{control}] \leq 0.5$

$Ha\text{: Probability [Difference-Choice Pair-}x_{treatment} > \text{Difference-Choice Pair-}x_{control}] > 0.5$

Some studies only found evidence for CIPC for chosen goods (e.g., Sharot et al., 2010). If this is true for our data, the difference as considered above could not observe the entire effect. Therefore, the following hypothesis will be tested, for every chosen Lottery *x* which denotes A, B, C or D:

$H0\text{: Probability [WTA-Chosen-}x_{treatment} > \text{WTA-Chosen-}x_{control}] \leq 0.5$

$Ha\text{: Probability [WTA-Chosen-}x_{treatment} > \text{WTA-Chosen-}x_{control}] > 0.5$

Other studies only found an effect for unchosen goods (e.g., Izuma et al., 2010). Therefore, the same test is performed for the unchosen lotteries, wherefore the effect is expected the other way around which leads to the following hypothesis:

$H0\text{: Probability [WTA-Unchosen-}x_{treatment} < \text{WTA-Unchosen-}x_{control}] \leq 0.5$

$Ha\text{: Probability [WTA-Unchosen-}x_{treatment} < \text{WTA-Unchosen-}x_{control}] > 0.5$

4.4.1.2 Hypothesis 2. The second hypothesis, on the effect of memory, predicts remembering a choice correctly enlarges the effect of CIPC. Therefore, H2 is tested by performing the same tests, comparing observations where the choice is remembered correctly and not remembered correctly. Because we are interested in the effect of CIPC, we only look at the observations in the treatment group where the choice is before the WTA stating. If memory indeed enlarges the effect of CIPC, the probability that the observed CIPC, measured as the difference in stated WTA for the chosen minus the unchosen lottery for each choice pair, is larger for correctly remembered observations should be higher than for incorrectly remembered observations. Therefore, the following null hypothesis and alternative hypothesis are tested with MWU.

H0: Probability [Difference-Choice Pair-$x_{remembered}$ > Difference-Choice Pair-$x_{forgotten}$] ≤ 0.5
Ha: Probability [Difference-Choice Pair-$x_{remembered}$ > Difference-Choice Pair-$x_{forgotten}$] > 0.5

H2 is also tested on the WTA for every chosen Lottery *x* separately, leading to the following hypotheses tested:

H0: Probability [WTA-Chosen-$x_{remembered}$ > WTA-Chosen-$x_{forgotten}$] ≤ 0.5
Ha: Probability [WTA-Chosen-$x_{remembered}$ > WTA-Chosen-$x_{forgotten}$] > 0.5

And in accordance, for every unchosen Lottery *x* separately and in the other direction as well:

H0: Probability [WTA-Unchosen-$x_{remembered}$ < WTA-Unchosen-$x_{forgotten}$] ≤ 0.5
Ha: Probability [WTA-Unchosen-$x_{remembered}$ < WTA-Unchosen-$x_{forgotten}$] > 0.5

4.4.2 OLS Regressions

For robustness of the results and to incorporate possible confounding effects of subject characteristics like age or gender, Ordinary Least Squares (OLS) regressions are run on the same dependent variables as with the MWU tests. Every demographic categorical variable is added to the models to control for confounding effects. After running regressions with *Treatment* as the explanatory variable, and the demographics included, for robustness of the results for H1. All regressions are run with a memory dummy added and an extra interaction term between *Treatment* and the memory dummy for robustness of the results for H2. The formula of the OLS regression is the following:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \cdots \beta_n X_{in} + \varepsilon_i$$

Where Y_i denotes the dependent variable tested, in this case, the same dependent variables as used for the MWU tests that represent the measured CIPC: the chosen minus unchosen difference in WTA for both choice pairs, *DifferenceAB* and *DifferenceCD*; the WTA for every chosen Lottery *x*; and the WTA for every unchosen Lottery *x*. To test H1, X_{i1} to X_{in} denote the explanatory categorical variables for *Treatment, Male, Employment, Dutch, Age* and *Education*. For H2, a dummy variable whether someone correctly answered the memory task is added as well as an interaction term of *Treatment* and this memory dummy, in addition to the same categorical variables used for H1.

5. Results

5.1 Descriptive statistics

5.1.1 Participants

The experiment is conducted using 143 subjects in total, 74 of them were assigned to the treatment group and 69 to the control group yielding a 52/48 distribution, as can be seen in Table 10. Two-thirds of all subjects are female, and one-third are male. Most of the subjects are students with 57%, followed by working full-time with 23%, part-time covers 16% of the subjects, 3% is unemployed and only one participant is retired covering less than 1%. The subject pool is mostly Dutch with 89% coverage. The majority of the participants are between 18 and 24 years old with 83 out of 143 observations. 33 observations recall participants between 25 and 34 years old, followed by 9 between 45 and 54, 7 from 35-44, 6 from 55-64, 5 under 18 and one between 75 and 84. For completed education, the subject pool is divided somewhat more equally with high school, HBO and WO-Master covering about a fifth of the group each. WO-Bachelor is the largest category with 31% of the total and less than high school, MBO and prefer not to say cover a few observations and percentages each.

Table 10 *Demographics*

Variable	**Category**	**Frequency**	**%**
Treatment	Treatment	74	51.7
	Control	69	48.3
Gender	Female	95	66.4
	Male	48	33.6
Employment	Full-time	33	23.1
	Part-time	23	16.1
	Unemployed	4	2.8
	Retired	1	0.7
	Student	82	57.3
Nationality	Dutch	127	88.8
	Other	16	11.2
Age	Under 18	5	3.5
	18-24	82	57.3
	25-34	33	23.1
	35- 44	7	4.9
	45-54	9	6.3
	55-64	6	4.2
	65-74	0	-
	75-84	1	0.7
	85 or Older	0	-
Education	< High School	4	2.8
	High School	30	21.0
	MBO	4	2.8
	HBO	27	18.9
	WO-Bachelor	44	30.8
	WO-Master	32	22.4
	Prefer not to say	2	1.4

5.1.2 Choices

Of all participants, 68 chose Lottery A over Lottery B in the choice task and 84 subjects chose Lottery C over Lottery D. This is in line with the results of the paper they originate from, by Alós-Ferrer and Granić (2021). In their paper, these same choice pairs yield 47% and 57% respectively. In the current study, almost the same results are obtained with 48% and 59%, as can be seen in Table 11. This confirms the difficulty of the choice pairs and the clear trade-off between risk and reward, which leads to indifference on average. The trade-off is expected to induce cognitive dissonance and therefore alter preferences after choice-making, which will be tested throughout the rest of this chapter. For the filler choice pairs, ZY and XW, the participants are expected to prefer one over the other due to clear FOSD dominance of one over the other lottery. This is confirmed by the observations with 90% of the subjects choosing Z over Y and 93% choosing X over W. Both memory tasks on choice pairs AB and CD were correctly answered by 81% of the subjects.

Table 11 *Choices*

Variable	Category	Frequency	%
Choice AB	A chosen over B	68	47.6
	B chosen over A	75	52.4
Choice CD	C chosen over D	84	58.7
	D chosen over C	59	41.3
Filler Choice ZY	Z chosen over Y	128	89.5
	Y chosen over Z	15	10.5
Filler Choice XW	X chosen over W	133	93.0
	W chosen over X	10	7.0
Memory Task	A vs. B Correct	116	81.1
	Incorrect	27	18.9
	C vs. D Correct	116	81.1
	Incorrect	27	18.9

5.2 Hypothesis 1

The first hypothesis, whether choosing between lotteries with a clear trade-off between risk and reward induces CIPC, is tested with the MWU test on several dependent variables which capture preferences by stated WTA as explained in section 4 of this paper. The results of all MWU tests for H1 are presented in Table 13 and will be elaborated on after discussing the descriptive statistics of the dependent variables as described in Table 12.

5.2.1 Descriptive Statistics CIPC Variables

When looking at the descriptive statistics of the WTA of chosen minus unchosen variables for the choice pairs, in Table 12, we see that the mean difference for both choice pairs AB and CD is €0.012, thus a little over one euro cent. The standard deviation for AB is 0.395 which is 33 times the size of the mean. The difference for choice pair CD fluctuates even more with a standard deviation of 0.487. When looking at only observations in the treatment group, where the choice is before the WTA stating, the differences increase by 100% to €0.024. This enlarged difference in stated WTA for chosen minus unchosen lotteries for a choice pair is in line with expectations. However, the difference for each choice pair is not only observed as a positive number but also has negative observations, as can be seen from the minimum differences of -€1.45 and -€1.99 respectively for AB and CD. A negative difference is not in line with the expectations that confirm the first hypothesis. However, the maximum amounts are greater in magnitude than the negative amounts, maximising to €2.49 and €3.33 respectively.

Moreover, the effect could only be observed for chosen or unchosen lotteries which cannot be observed from the variables on the difference. Therefore, when looking at the descriptive statistics of the WTA for the lotteries using all observations, we observe the following. The means of all lotteries are very close to each other ranging from €2.265 for Lottery D to €2.422 for Lottery B with standard deviations from around 0.75. For Lottery A and Lottery D, we see a higher mean for the chosen observations than for the unchosen ones, in line with expectations. However, for Lottery B and C this is not the case, where the mean of the unchosen observations is higher.

Table 12 *Descriptive Statistics Dependent Variables*

Variable		**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
WTA Chosen Minus WTA Unchosen for A vs. B		143	0.012	0.395	-1.45	2.49
	Treatment	74	0.024	0.416	-1.07	2.49
	Correct Memory	102	0.038	0.409	-1.07	2.49
WTA Chosen Minus WTA Unchosen for C vs. D		143	0.012	0.487	-1.99	3.33
	Treatment	74	0.024	0.561	-1.99	3.33
	Correct Memory	106	0.092	0.473	-1.01	3.33
WTA Lottery A		143	2.377	0.771	0.43	4
	Chosen	68	2.399	0.742	0.43	4
	Chosen (T)	37	2.458	0.672	1.2	4
	Unchosen	75	2.358	0.800	0.98	4
	Unchosen (T)	37	2.158	0.759	0.98	4
WTA Lottery B		143	2.422	0.703	0.35	4
	Chosen	75	2.412	0.791	0.35	4
	Chosen (T)	37	2.187	0.799	0.35	4
	Unchosen	68	2.433	0.597	1	4
	Unchosen (T)	37	2.440	0.593	1.4	4
WTA Lottery C		143	2.322	0.738	0.47	4
	Chosen	84	2.275	0.701	0.74	4
	Chosen (T)	48	2.258	0.704	0.94	4
	Unchosen	59	2.389	0.789	0.47	4
	Unchosen (T)	26	2.239	0.842	0.47	3.76
WTA Lottery D		143	2.265	0.665	0.5	4
	Chosen	59	2.335	0.696	0.84	4
	Chosen (T)	26	2.328	0.756	0.84	4
	Unchosen	84	2.216	0.642	0.5	4
	Unchosen (T)	48	2.269	0.664	1.03	4

T = observations from the treatment group only

5.2.2 MWU Results for CIPC

The results of the MWU test with the differences in WTA for the choice pairs are presented in Table 13. For choice pair AB, the probability is exactly 0.5 and the p-value is insignificant with 0.500. The sum of the ranks, weight to the number of observations, is the same for both the treatment and control group, meaning the treatment has zero effect on the difference in stated WTA for the lotteries, chosen minus unchosen, of choice pair AB. In other words, the probability of the sum of ranks of the WTA chosen minus WTA unchosen difference for choice pair AB, being greater for the treatment group than the control group is 0.5. This means the probability of the sum of ranks being greater for the control group is the same, yielding no effect of choice-making. For choice pair CD, the probability of the sum of ranks being greater for the treatment than for the control group is 0.501 with another insignificant p-value of 0.491. For both choice pairs, the null hypothesis of the probability that the sum of ranks in the treatment group is equal to or smaller than the control group, cannot be rejected.

Table 13 *MWU Chosen Minus Unchosen*

Variable	**Probability T > C**	**P-value**	**Obs**
WTA Chosen Minus WTA Unchosen for A vs. B	0.500	0.500	143
WTA Chosen Minus WTA Unchosen for C vs. D	0.501	0.491	143

We did not observe a significant effect of the treatment on the WTA chosen minus WTA unchosen lotteries for a choice pair. We will now look at the results of the MWU tests on the WTA for every chosen lottery *x* and every unchosen lottery *x*, which are stated in Table 14. When looking at the p-values of the tests, we see that only two of all probabilities differ significantly from 0.5. These are the WTA for unchosen Lottery A and chosen Lottery B, which are the stated WTA answers from the same 75 observations since every subject that chose B unchose A. What we can infer from these results is the following. The probability that the WTA for unchosen Lottery A is smaller in the treatment than in the control group is 0.638 and this effect is significant at a 5% significance level with a p-value of 0.02. The probability that the WTA for chosen Lottery B is larger in the treatment than in the control group is 0.338 and this effect is significant at a 1% significance level with a p-value of 0.008. For unchosen Lottery A, we thus find a significant result in line with expectations. However, for chosen Lottery B we find the expected effect the other way around. In other words, the treatment significantly decreases the rating of Lottery A after being rejected but the treatment also significantly decreases the rating of Lottery B after being chosen which is the opposite of what is expected. All other probabilities are around 0.5 and insignificant. For unchosen Lottery A, we can therefore reject the null hypothesis of the probability that the sum of ranks is smaller in the treatment than in the control group, is smaller than or equal to 0.5.

From all MWU tests for H1, one null hypothesis can be rejected confirming H1 and for one lottery the effect is observed the other way around. These results overall suggest no effect of choice-making on the WTA for these lotteries.

Table 14 *MWU Separate Lotteries*

Variable		Probability T > C	Probability T < C	P-value	Obs
WTA Lottery A	Chosen	0.531		0.333	68
	Unchosen		0.638	0.020	75
WTA Lottery B	Chosen	0.338		0.008	75
	Unchosen		0.548	0.251	68
WTA Lottery C	Chosen	0.446		0.202	84
	Unchosen		0.561	0.214	59
WTA Lottery D	Chosen	0.477		0.383	59
	Unchosen		0.470	0.319	84

5.2.3 OLS Regressions on CIPC

For robustness of the MWU results, OLS regressions are run on the same relationships between treatment and the dependent variables for CIPC. In addition, the categorical demographics are added to the models to control for any effects of these characteristics. When looking at the regressions on the WTA chosen minus WTA unchosen variables for the choice pairs in Table 15, we see that for both the models the effect of treatment is small in magnitude and insignificant. This is in line with the MWU results. Both models are very little explanatory with a coverage of 13.8% and 6.4%, respectively for choice pair AB and CD, of the variation in the dependent variable. These results support the finding of no effect of choice-making on the difference in stated WTA for chosen minus unchosen lotteries for choice pairs AB and CD.

The regression models for the WTA of chosen lotteries are presented in Table 16. In line with the MWU results, treatment is only significant on the WTA of chosen Lottery B. The effect of the choice before the WTA stating significantly decreases the stated WTA for chosen Lottery B with 0.711, ceteris paribus. This effect is significant at a 1% significance level. This effect is in the opposite direction as expected by the cognitive dissonance theory. The coefficients of treatment are negative in magnitude, for all four models, against expectations, but insignificant for chosen lotteries A, C and D. The constants of all four models are large in magnitude and extremely significant. In line with the descriptive statistics, this shows that the stated WTA for the lotteries do not vary much between subjects. This makes sense because of the objectivity of lotteries.

Looking at the regression models for the WTA of unchosen lotteries in Table 17 we observe the following. In line with the MWU results, the coefficient of treatment is negative for the WTA of unchosen Lottery A. Choosing over the lotteries before stating the WTA for the lottery significantly decreases the stated WTA for unchosen Lottery A with 0.694, ceteris paribus. This effect is significant at a 1% significance level. The coefficient for treatment is also negative and significant, at a 5% level, for unchosen Lottery C. This effect was not observed by the MWU test which could be because of confounding factors that are controlled for in this OLS regression. In line with the models from the chosen lotteries, all constants are large in magnitude and extremely significant at a 1% significance level. This implies little variance in the answers given and is in line with the descriptive statistics from table 12.

Table 15 *OLS Regressions for the WTA Chosen Minus WTA Unchosen Difference of Choice Pairs AB & CD*

Dependent variable	**WTA chosen minus WTA unchosen for A vs. B**	**WTA chosen minus WTA unchosen for C vs. D**
Treatment	0.020	-0.004
	(0.070)	(0.089)
Male	0.075	0.018
	(0.064)	(0.087)
Employment (baseline full-time)		
Part-time	-0.090	0.024
	(0.100)	(0.157)
Unemployed	0.274	0.340***
	(0.174)	(0.124)
Retired	-0.017	0.218
	(0.484)	(0.447)
Student	0.091	0.110
	(0.112)	(0.157)
Dutch	0.057	0.069
	(0.075)	(0.140)
Age (baseline < 18)		
18-24	0.276	0.516
	(0.438)	(0.323)
25-34	0.284	0.449
	(0.448)	(0.342)
35- 44	0.417	0.756**
	(0.460)	(0.356)
45-54	0.024	0.628
	(0.479)	(0.398)
55-64	0.116	0.597
	(0.488)	(0.407)
75-84	0 (omitted)	0 (omitted)
Education (baseline < high school)		
High school	-0.669*	-0.420
	(0.389)	(0.319)
MBO	-0.630	-0.510
	(0.415)	(0.410)
HBO	-0.428	-0.315
	(0.445)	(0.475)
WO-Bachelor	-0.600	-0.430
	(0.381)	(0.315)
WO-Master	-0.515	-0.391
	(0.397)	(0.356)
Prefer not to say	-0.640	-0.087
	(0.393)	(0.518)
Constant	0.178	-0.250
	(0.296)	(0.356)
R-squared	0.138	0.064
Obs	143	143

* Indicates p < 0.1, ** indicates p < 0.05, *** indicates p < 0.01

Overall, these regressions for robustness of the H1 MWU results support the finding of no significant effect of CIPC over the lotteries with a clear trade-off. We observe a weak effect of CIPC for two of the four unchosen lotteries, which is somewhat in line with Izuma et al. (2010) who found evidence for decreased desirability of rejected goods.

Table 16 *OLS Regressions for the WTA of Chosen Lotteries*

Dependent variable	**WTA Lottery A**	**WTA Lottery B**	**WTA Lottery C**	**WTA Lottery D**
Treatment	-0.037	-0.711***	-0.185	-0.252
	(0.252)	(0.218)	(0.178)	(0.265)
Male	0.801***	0.069	0.656***	-0.027
	(0.239)	(0.219)	(0.195)	(0.253)
Employment (baseline full-time)				
Part-time	-0.293	-0.165	-0.188	0.163
	(0.368)	(0.344)	(0.298)	(0.383)
Unemployed	0.246	0.533*	1.039***	-0.711**
	(0.438)	(0.295)	(0.309)	(0.347)
Retired	-0.418			-0.585
	(0.738)			(0.491)
Student	-0.036	-0.445	0.191	0.072
	(0.339)	(0.320)	(0.260)	(0.352)
Dutch	0.367	0.188	0.278	-0.196
	(0.290)	(0.322)	(0.261)	(0.275)
Age (baseline < 18)				
18-24	0.042	-0.411	0.199	0.090***
	(0.665)	(0.305)	(0.527)	(0.000)
25-34	-0.378	-0.805*	-0.148	-0.415
	(0.696)	(0.402)	(0.588)	(0.276)
35- 44	1.047	0.490	1.160**	1.216***
	(0.691)	(0.601)	(0.546)	(0.443)
45-54	-0.288	-1.367***	0.121	-0.340
	(0.746)	(0.448)	(0.578)	(0.428)
55-64	0.270	-0.049	0.739	0.702
	(0.792)	(0.632)	(0.602)	(0.473)
75-84	0 (omitted)			0 (omitted)
Education (baseline < high school)				
High school	-0.523	-0.394**	-0.259	-0.197
	(0.630)	(0.187)	(0.499)	(0.219)
MBO	-0.754	-1.792***	-0.366	-1.417***
	(0.758)	(0.490)	(0.642)	(0.496)
HBO	-0.261	-0.744*	-0.263	-0.201
	(0.712)	(0.408)	(0.588)	(0.502)
WO-Bachelor	-0.087	0.022	0.158	-0.179
	(0.668)	(0.252)	(0.551)	(0.198)
WO-Master	-0.364	-0.130	-0.028	0.073
	(0.767)	(0.332)	(0.590)	(0.496)
Prefer not to say	-0.554	1.561***	0.239	0.692**
	(0.835)	(0.218)	(0.723)	(0.265)
Constant	2.168***	3.617***	1.669***	2.744***
	(0.541)	(0.554)	(0.416)	(0.471)
R-squared	0.339	0.390	0.309	0.308
Obs	68	75	84	59

* Indicates p < 0.1, ** indicates p < 0.05, *** indicates p < 0.01

Table 17 *OLS Regressions for the WTA of Unchosen Lotteries*

Dependent variable	**WTA Lottery A**	**WTA Lottery B**	**WTA Lottery C**	**WTA Lottery D**
Treatment	-0.694***	-0.089	-0.659**	0.074
	(0.219)	(0.197)	(0.274)	(0.155)
Male	0.048	0.644***	0.099	0.478***
	(0.227)	(0.200)	(0.292)	(0.176)
Employment (baseline full-time)				
Part-time	-0.261	-0.105	0.228	-0.413*
	(0.336)	(0.278)	(0.400)	(0.237)
Unemployed	0.511*	-0.224	0.919**	0.548**
	(0.269)	(0.355)	(0.379)	(0.269)
Retired		-0.485	-0.742	
		(0.405)	(0.488)	
Student	-0.675**	0.004	-0.185	0.086
	(0.252)	(0.245)	(0.406)	(0.267)
Dutch	0.297	0.242	-0.462	0.305
	(0.319)	(0.241)	(0.354)	(0.262)
Age (baseline < 18)				
18-24	-0.102	-0.306	-0.840***	-0.448
	(0.612)	(0.324)	(0.000)	(0.388)
25-34	-0.543	-0.683*	-1.329***	-0.758*
	(0.674)	(0.369)	(0.319)	(0.447)
35- 44	0.855	0.476	0.014	0.273
	(0.816)	(0.334)	(0.498)	(0.442)
45-54	-0.724	-0.401	-1.270**	-0.678
	(0.731)	(0.411)	(0.490)	(0.439)
55-64	0.483	0.050	0.117	-0.130
	(0.765)	(0.516)	(0.506)	(0.400)
75-84		0 (omitted)	0 (omitted)	
Education (baseline < high school)				
High school	-0.103	0.104	0.575**	0.335
	(0.203)	(0.253)	(0.248)	(0.525)
MBO	-1.747***	-0.103	-0.686	0.440
	(0.554)	(0.451)	(0.560)	(0.717)
HBO	-0.790***	0.187	0.146	0.350
	(0.259)	(0.395)	(0.380)	(0.733)
WO-Bachelor	0.338	0.395	0.737***	0.600
	(0.286)	(0.338)	(0.252)	(0.585)
WO-Master	-0.021	0.152	0.714	0.540
	(0.337)	(0.428)	(0.560)	(0.645)
Prefer not to say	1.944***	-0.027	1.939***	0.079
	(0.219)	(0.512)	(0.274)	(0.791)
Constant	3.129***	2.154***	3.507***	1.727***
	(0.756)	(0.412)	(0.622)	(0.611)
R-squared	0.425	0.316	0.389	0.238
Obs	75	68	59	84

* Indicates $p < 0.1$, ** indicates $p < 0.05$, *** indicates $p < 0.01$

5.3 Hypothesis 2

Since some studies found that remembering the choice is necessary for CIPC to occur from that choice (Izuma et al., 2010; Salti et al., 2014; Chammat et al., 2017), a memory task is added to control for correct memory of the relevant choice task. The second hypothesis, that memory enlarges the effect of

CIPC is therefore tested using the MWU test. The results are discussed in this section as well as the results of OLS regressions on the same relationships with control variables for robustness.

5.3.1 Descriptive Statistics CIPC with Memory Effect

When looking at the descriptive statistics in Table 12 we see that the mean of the WTA chosen minus WTA unchosen difference goes from 0.012 to 0.038 for choice pair AB and from 0.012 to 0.092 for choice pair CD when excluding incorrectly remembered answers. This increase in the mean is in line with expectations for H2.

5.3.2 MWU Results for Memory Effect

To test the second hypothesis, we are interested in the causal effect of correctly remembering a choice on observed CIPC. Therefore, observations from the control group are excluded from the sample since they do not capture CIPC with the choice being after the WTA stating. The results for all the MWU tests are presented in Table 18. Looking at the p-values we see that five out of ten null hypotheses can be rejected. The probability of the sum of ranks being larger for correctly remembered observations than for incorrectly remembered ones is 0.748 for the WTA chosen minus WTA unchosen difference for choice pair CD. This effect is significant at a 1% significance level. In other words, correct memory of the choice significantly increases the observed CIPC for the choice between Lottery C versus Lottery D, ceteris paribus. This observed effect is in line with our second hypothesis and suggests an enlarged effect of CIPC for correctly remembered answers. For choice pair AB, the probability is below 0.5, not in line with expectations but the probability is insignificant.

Table 18 *MWU on Memory Effect (excl. Control Group Observations)*

Variable		**Probability C > I**	**Probability C < I**	**P-value**	**Obs**
Chosen - Unchosen	AB	0.419		0.189	74
	CD	0.748		0.003	74
WTA Lottery A	Chosen	0.882		0.015	37
	Unchosen		0.333	0.068	37
WTA Lottery B	Chosen	0.633		0.118	37
	Unchosen		0.225	0.059	37
WTA Lottery C	Chosen	0.708		0.027	48
	Unchosen		0.460	0.402	26
WTA Lottery D	Chosen	0.676		0.135	26
	Unchosen		0.581	0.226	48

For the separate WTA of the lotteries, the following results are obtained. The probabilities of 0.882 for chosen Lottery A and 0.708 for chosen Lottery C, to be larger for correctly remembered observations, are both significant at a 5% significance level and support the second hypothesis. A correct memory of the relevant choice increases the WTA for these chosen lotteries which is expected according to the cognitive dissonance theory. However, for unchosen lotteries A and B the effect is significantly observed contrary to the expected direction. The WTA is expected to be lower for correctly remembered answers for unchosen lotteries according to the theory, meaning higher for incorrectly remembered answers. The probability that the WTA for unchosen Lottery B is higher for incorrectly remembered answers than for correctly remembered answers is 0.333 which is below 0.5. This effect is significant at a 10% significance level. For unchosen Lottery B, this probability is 0.225 with the same significance level. These results suggest a correct memory of the choice increases the WTA of unchosen lotteries A and B, which is contrary to H2. The desirability of unchosen goods should decrease to align with the behaviour of rejection. The other MWU results are not statistically significant, implying no effect of memory.

These results overall suggest no enlarged effect of CIPC controlling for memory. Some tests support the second hypothesis, but most display no significant effect, and some even suggest a reversed effect. These results are somewhat in line with Sharot et al. (2010) who only found an effect for chosen and not for unchosen goods since the support we observed is attributed to chosen lotteries A and C. The significant effect observed the other way around for unchosen lotteries A and B cannot be explained by the cognitive dissonance theory.

5.3.3 OLS Regressions with Memory Effect

For robustness of the results of the MWU tests on memory effects, more OLS regressions are run. A dummy variable for correct memory as well as an interaction term between treatment and memory is included. The dummy variable captures the effect of correct memory on the WTA for the control group. The choice task is after the WTA stage for this group, so no effect of memory is expected. The interaction term captures the effect of correct memory of the choice for observations in the treatment group, the effect of interest for H2.

The regressions on the WTA chosen minus WTA unchosen difference for the choice pairs are presented in Table 19. Both the coefficients of memory are significant, which means correctly remembered choices in the control group are correlated with CIPC. The effect cannot come from the choice since the choice is after the WTA stating. This result could imply a better overthinking of answers given since their stated WTA and choices are more in line than incorrectly remembered answers. This observation makes sense because more thoughtful thinking about your answers will elicit true desirability better and is in line with correct memory of previous choices. Looking at the interaction terms for both models we observe no significant effect of correct memory on observed CIPC. The significant effect observed by the MWU for choice pair CD is not supported by this regression and is probably captured in the effects of demographics controlled for.

Table 19 *OLS Regressions for the WTA Chosen Minus WTA Unchosen Difference of Choice Pairs AB & CD with Memory Effects*

Dependent variable	**WTA chosen minus WTA unchosen for A vs. B**	**WTA chosen minus WTA unchosen for C vs. D**
Treatment	0.175	-0.263
	(0.154)	(0.242)
Remembered correctly	0.201*	0.271**
	(0.113)	(0.129)
Treatment x memory	-0.205	0.296
	(0.178)	(0.272)
Male	0.070	0.037
	(0.066)	(0.083)
Employment (baseline full-time)		
Part-time	-0.113	0.052
	(0.099)	(0.144)
Unemployed	0.297	0.306**
	(0.198)	(0.118)
Retired	-0.146	0.446
	(0.475)	(0.465)
Student	0.074	0.170
	(0.114)	(0.151)
Dutch	0.032	0.062
	(0.073)	(0.141)
Age (baseline < 18)		
18-24	0.162	0.353
	(0.429)	(0.351)
25-34	0.155	0.235
	(0.436)	(0.375)
35- 44	0.261	0.532
	(0.447)	(0.375)
45-54	-0.092	0.378
	(0.469)	(0.419)
55-64	-0.013	0.331
	(0.475)	(0.427)
75-84	0 (omitted)	0 (omitted)
Education (baseline < high school)		
High school	-0.540	-0.216
	(0.370)	(0.366)
MBO	-0.526	-0.212
	(0.397)	(0.442)
HBO	-0.307	0.017
	(0.428)	(0.509)
WO-Bachelor	-0.482	-0.238
	(0.359)	(0.365)
WO-Master	-0.399	-0.183
	(0.377)	(0.398)
Prefer not to say	-0.528	0.049
	(0.371)	(0.574)
Constant	0.061	-0.542
	(0.302)	(0.394)
R-squared	0.156	0.167
Obs	143	143

* Indicates p < 0.1, ** indicates p < 0.05, *** indicates p < 0.01

In Table 20, the OLS regressions for the chosen lotteries are presented with memory effects for robustness of the MWU results of H2. We observe no significant effect of correct memory on CIPC looking at the interaction terms of all four models. With the MWU results, we found significant results for chosen lotteries A and C, these findings are not supported by the regressions controlling for the demographics. For lotteries A and C, we observe an extremely significant gender effect looking at the coefficients of *Male*. For example, being male compared to being female increases the WTA for chosen Lottery A with 0.784 ceteris paribus. This effect is significant at a 1% significance level. The observed effect of the MWU could therefore include a confounding effect from another factor such as gender if being male and correctly remembering the choice are correlated for our sample.

Looking at the regressions for the memory effects on the WTA for unchosen lotteries in Table 21, we observe the following results. None of the interaction terms that capture the effect of memory on CIPC is significant and thus support H2. The observed contradictory effects for unchosen lotteries A and B, observed in the MWU results, are not supported by these regressions. A strong gender effect is observed for unchosen lotteries B and D. Overall, the OLS regressions for robustness of the results from the MWU tests on H2 support the finding of no significant effect of memory on CIPC for this sample. H2 can therefore not be confirmed by the data of this paper.

What stands out from the regressions in Tables 16, 17, 20 and 21 is the significant effect of gender for chosen lotteries A and C, and unchosen lotteries B and D. Chosen Lottery A is linked with unchosen Lottery B in observations and the same goes for chosen C and unchosen D. Every subject that chose Lottery A, rejected Lottery B and every subject that chose C, rejected D. All four coefficients are generally large in magnitude, ranging from 0.478 to 0.801, and are significant at a 1% significance level. Implying that male participants state a significantly higher WTA for these lotteries than females do, ceteris paribus. In other words, their certainty equivalent for playing out the lottery is higher than for females, suggesting they prefer a gamble over a fixed amount of money more than females do.

Table 20 *OLS Regressions for the WTA of Chosen Lotteries with Memory Effects*

Dependent variable	**WTA Lottery A**	**WTA Lottery B**	**WTA Lottery C**	**WTA Lottery D**
Treatment	-0.804	-0.582*	-0.077	-0.160
	(0.919)	(0.334)	(0.402)	(0.470)
Remembered correctly	-0.163	0.315	0.210	0.688**
	(0.931)	(0.288)	(0.322)	(0.302)
Treatment x memory	0.889	-0.177	-0.100	-0.301
	(0.951)	(0.413)	(0.438)	(0.477)
Male	0.784***	0.054	0.651***	0.091
	(0.229)	(0.223)	(0.199)	(0.235)
Employment (baseline full-time)				
Part-time	-0.279	-0.222	-0.179	0.306
	(0.363)	(0.347)	(0.299)	(0.354)
Unemployed	0.180	0.652*	1.037***	-1.015***
	(0.723)	(0.364)	(0.311)	(0.368)
Retired	-0.438			-0.313
	(1.059)			(0.557)
Student	0.019	-0.453	0.210	0.201
	(0.334)	(0.340)	(0.269)	(0.304)
Dutch	0.507*	0.157	0.287	-0.254
	(0.254)	(0.329)	(0.279)	(0.277)
Age (baseline < 18)				
18-24	0.159	-0.434	0.008	0.090***
	(1.101)	(0.337)	(0.574)	(0.000)
25-34	-0.188	-0.821*	-0.348	-0.639*
	(1.084)	(0.437)	(0.651)	(0.317)
35- 44	1.230	0.467	0.977	0.769*
	(1.160)	(0.637)	(0.602)	(0.400)
45-54	-0.249	-1.266**	-0.067	-0.094
	(1.156)	(0.524)	(0.608)	(0.364)
55-64	0.364	-0.046	0.526	0.478
	(1.194)	(0.644)	(0.678)	(0.459)
75-84	0 (omitted)			0 (omitted)
Education (baseline < high school)				
High school	-0.644	-0.289	-0.035	0.029
	(1.107)	(0.207)	(0.572)	(0.259)
MBO	-0.884	-1.774***	-0.087	-0.984**
	(1.187)	(0.482)	(0.725)	(0.465)
HBO	-0.308	-0.673	-0.024	0.252
	(1.180)	(0.412)	(0.660)	(0.562)
WO-Bachelor	-0.268	0.105	0.366	0.035
	(1.089)	(0.239)	(0.611)	(0.261)
WO-Master	-0.458	-0.083	0.190	0.506
	(1.253)	(0.333)	(0.669)	(0.465)
Prefer not to say	-0.654	1.609***	0.566	0.902***
	(1.219)	(0.266)	(0.812	(0.291)
Constant	2.136*	3.365***	1.427**	1.986***
	(1.108)	(0.582)	(0.549)	(0.567)
R-squared	0.375	0.405	0.314	0.394
Obs	68	75	84	59

* Indicates p < 0.1, ** indicates p < 0.05, *** indicates p < 0.01

Table 21 *OLS Regressions for the WTA of Unchosen Lotteries with Memory Effects*

Dependent variable	**WTA Lottery A**	**WTA Lottery B**	**WTA Lottery C**	**WTA Lottery D**
Treatment	-0.980**	-0.523	-0.440	0.327
	(0.417)	(0.620)	(0.636)	(0.381)
Remembered correctly	0.010	-0.098	0.486	-0.100
	(0.355)	(0.645)	(0.340)	(0.229)
Treatment x memory	0.394	0.503	-0.385	-0.323
	(0.434)	(0.665)	(0.655)	(0.399)
Male	0.024	0.635***	0.168	0.504***
	(0.241)	(0.197)	(0.281)	(0.177)
Employment (baseline full-time)				
Part-time	-0.233	-0.097	0.334	-0.413
	(0.352)	(0.280)	(0.381)	(0.250)
Unemployed	0.853**	-0.264	-1.137***	0.584**
	(0.348)	(0.519)	(0.373)	(0.267)
Retired		-0.490	-0.716	
		(0.657)	(0.738)	
Student	-0.607**	0.035	-0.104	0.043
	(0.256)	(0.251)	(0.364)	(0.255)
Dutch	0.237	0.321	-0.483	0.282
	(0.320)	(0.251)	(0.376)	(0.225)
Age (baseline < 18)				
18-24	-0.048	-0.235	-0.840***	-0.336
	(0.580)	(0.656)	(0.000)	(0.356)
25-34	-0.440	-0.571	-1.474***	-0.641
	(0.650)	(0.658)	(0.364)	(0.425)
35- 44	0.969	0.586	-0.310	0.410
	(0.813)	(0.731)	(0.424)	(0.396)
45-54	-0.486	-0.373	-1.094**	-0.475
	(0.754)	(0.718)	(0.468)	(0.382)
55-64	0.499	0.109	-0.023	0.068
	(0.758)	(0.809)	(0.465)	(0.341)
75-84		0 (omitted)	0 (omitted)	
Education (baseline < high school)				
High school	-0.062	0.029	0.732**	0.159
	(0.216)	(0.669)	(0.290)	(0.577)
MBO	-1.753***	-0.182	-0.388	0.191
	(0.577)	(0.764)	(0.488)	(0.715)
HBO	-0.791***	0.154	0.468	0.036
	(0.263)	(0.755)	(0.498)	(0.699)
WO-Bachelor	0.295	0.288	0.883***	0.438
	(0.257)	(0.662	(0.305)	(0.597)
WO-Master	-0.042	0.092	1.012**	0.360
	(0.347)	(0.807)	(0.488)	(0.649)
Prefer not to say	1.836***	-0.088	2.105***	-0.095
	(0.233)	(0.780)	(0.318)	(0.784)
Constant	3.057***	2.141***	2.962***	1.927***
	(0.746)	(0.760)	(0.653)	(0.629)
R-squared	0.441	0.334	0.418	0.269
Obs	75	68	59	84

* Indicates p < 0.1, ** indicates p < 0.05, *** indicates p < 0.01

6. Discussion

In this paper, we tested the effect of choice-making on preferences over lotteries, to test for CIPC in Economics. CIPC has been found to exist throughout Psychology (e.g., Sharot et al., 2010; Izuma et al.,2010). However, if this effect of choice-making is also true for economic preferences, this could be problematic; because in Economics, choices are assumed to reveal stable underlying preferences. If choices influence underlying preferences, this measure is not as accurate as it is assumed to be. To test for CIPC in Economics, experimental designs from literature are combined for the most proper way of doing so. The design is a combination of the RCR/RRC design by Chen & Risen (2010) and the design with reminder and memory task by Chammat et al. (2017). This paper is an improvement on the most recent study on CIPC in Economics, proposed by Alós-Ferrer & Granić (2021), by adding a clear trade-off to the choices (H1) and controlling for memory (H2). The experiment is conducted by performing an online survey where participants need to choose between and state their WTA for several lotteries incentivized by real money.

The first hypothesis that is tested was *"After choosing between lotteries with a clear trade-off between risk and reward, preferences over these lotteries will change with the direction of the choice."* We observed predominantly insignificant results from the non-parametric and parametric tests on the effect of choice-making on the WTA of the lotteries. The results suggest no significant effect of choice-making on preferences over the lotteries. The clear trade-off did not induce enough cognitive dissonance to arise from choice-making and preferences to change. The results do not support the first hypothesis and are in line with the results of Alós-Ferrer and Granić (2021). The results are contrary to findings on CIPC in Psychology where they observe a small in magnitude, but significant effect on hypothetical goods. Alós-Ferrer and Granić (2021) proposed their insignificant results could be due to the absence of a clear trade-off in their choice task. However, the results of this paper provide no support for their statement. The results suggest a choice between two objectively similar lotteries does not induce enough cognitive dissonance to arise to alter preferences.

Cognitive dissonance is dependent on the importance of the mental cognitions, in this case, the behaviour and preferences, that belong to the choice (Harmon-Jones & Mills, 2019). A possible explanation for the clear trade-off not affecting CIPC is the objectivity of the lotteries which induces not enough cognitive dissonance with the choice. In other words, the subject does not attach as much personal value to the choice over two objectively similar lotteries, as it does with other goods such as holiday destinations. This less perceived importance of the choice can also be caused by the monetary amounts assigned to the lotteries. Therefore, a suggestion for future research can be to perform the experiment with higher stakes to induce more personal value to the mental cognitions of the choice to trigger cognitive dissonance.

The second hypothesis tested in this paper is *"Memory of the choice enlarges the effect of CIPC for preferences over lotteries."* Following papers which found evidence of CIPC to be dependent on memory of the choice in Psychology (Izuma et al., 2010; Salti et al., 2014; Chammat et al., 2017). To enhance the effect of memory, the lotteries are named after and coloured in that colour for easier remembering, as can be seen in Figures 1 and 2. A memory task is added at the end of the survey to control for the effect of correct memory of the relevant choice. The results of the tests for H2 overall do not support find support for the hypothesis. These findings are not in line with earlier studies on the effect of memory, which observed a significant dependence of CIPC on memory. However, since we do not observe a significant effect of CIPC testing H1, the effect of memory on the observed CIPC is hard to find significant results for. An enlarged effect of CIPC is hard to observe if the effect of CIPC itself is minimal to non-existent. However, since the control observations are excluded for H2, we are only left with 74 observations. This number of observations is very small to draw conclusions from. A suggestion for future research could therefore be to perform an experiment on CIPC, controlling for memory with more subjects.

A result worth mentioning outside the scope of the hypotheses is the observed gender effect. Males consistently rated half of the lotteries higher, implying they prefer a gamble over a certain amount more than females do on average. This gender effect on risk in financial situations is supported in the literature (e.g., Yao & Hanna, 2005; Fehr-Duda, De Gennaro, & Schubert, 2006). Whereas a more recent study found this gender effect can be assigned to differences in individual determinants rather than purely gender (Fisher & Yao, 2017). Since the effect of gender is so strongly present for financial decisions under risk, a suggestion for future research could be to combine this gender effect with a study on CIPC.

6.1 Limitations

This study has its limitations which will be discussed in this paragraph. Both hypotheses cannot be confirmed by the results obtained in this paper. The results, therefore, provide support for CIPC to be non-existent for preferences and decisions under risk in Economics. Nevertheless, the lack of significant results could also be due to flaws in the experimental design. The lotteries used in this study, contain small amounts of money as copied from the design by Alós-Ferrer and Granić (2021). Yet, their study used the same amounts in GBP, which is somewhat more valuable than the same amount in EUR. Moreover, their subjects got paid out for every decision rather than using a random lottery incentive (RLI) like used in this paper. Therefore, the stakes of the current experimental design could be too low to have the participants overthink their decisions well enough to state their real preferences and attach enough personal value to the lotteries for cognitive dissonance to alter their preferences. Another limitation of the experimental design is in the memory task, which consisted of the choice pair graphic with the probabilities and monetary outcomes presented again, as can be seen in the survey in the Appendix. The display of the entire choice content could have subjects guess their previous decision, without them remembering it. Moreover, a non-parametric test such as the MWU is very little explanatory. Therefore, OLS regressions make the results more robust, but the assumptions of a parametric test are not very likely to hold with this number of observations. The number of observations is also a limitation of this study, as the power calculation required the use of 650 subjects.

6.2 Suggestions for Future Research

For future research, it might be of interest to perform an experiment using lotteries with a clear trade-off and using higher monetary amounts to induce more thoroughly thinking. The memory task could be less revealing than the choice task to control for the effect of memory even more precise. Moreover, people react differently to gains than to losses. Therefore, it could be relevant to study the effect of CIPC on lotteries with losses instead of gains to confirm the stability of choices and underlying preferences more thoroughly.

7. Conclusion

In Economics, choices are assumed to reveal stable preferences (Samuelson, 1938). This assumption does not add up with evidence from Psychology on the existence of CIPC caused by cognitive dissonance. If choices not only reflect but also alter preferences, the assumption of the revealed preferences theory about stable preferences does not hold. To test whether CIPC is a concern for evidence and predictions using choice data as their measure of preferences from Economics is the aim of this study, following the recent study by Alós-Ferrer and Granić (2021). This concern is studied by performing an online incentivized economic experiment, combining experimental designs from literature to most properly test for the existence of CIPC in Economics.

To answer the research question of this paper, *"Is choice-induced preference change a concern for the revealed preference measure used in Economics?"*, an experiment is conducted with 143 participants. The subjects made incentivized choices over lotteries and stated their WTA either before or after choice-making, following the design introduced by Chen and Risen (2010) to test for CIPC. To conclude on the effect of choice-making on preferences, the stated WTA of the subjects choosing before and the subjects choosing after stating their WTA are being compared. The study also controlled for correct memory of the choice according to the design by Chammat et al. (2017), since CIPC is found to be dependent on active memory of the choice (Izuma et al., 2010; Salti et al., 2014; Chammat et al., 2017). The results of this paper display no significant effect of the pure act of choice-making on preferences over the lotteries. This implies cognitive dissonance is no concern for studies and evidence from Economics that assume choices display stable underlying preferences.

However, there is still room for improvement in the experimental design, as discussed in the discussion section of this paper. The search for the best method to test for CIPC is not concluded yet.

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Appendix: The Experimental Survey

Survey Flow

Block: Introduction + instructions (2 Questions)
Standard: Demographics (5 Questions)
Standard: Test question (2 Questions)

Block Randomizer: 1 - Evenly Present Elements

Group: Experimental Group 1

- **Standard: Choice Task 1 (2 Questions)**
- **Standard: Rating Task 1 (5 Questions)**
- **Standard: Fake Choice Task (2 Questions)**
- **Block: Memory Task 1 (2 Questions)**

Group: Experimental Group 2

- **Block: Choice Task 2 (2 Questions)**
- **Block: Rating Task 2 (5 Questions)**
- **Standard: Fake Choice Task (2 Questions)**
- **Block: Memory Task 2 (2 Questions)**

Group: Control Group 1

- **Standard: Fake Choice Task (2 Questions)**
- **Standard: Rating Task 1 (5 Questions)**
- **Standard: Choice Task 1 (2 Questions)**
- **Block: Memory Task 1 (2 Questions)**

Group: Control Group 2

- **Standard: Fake Choice Task (2 Questions)**
- **Block: Rating Task 2 (5 Questions)**
- **Block: Choice Task 2 (2 Questions)**
- **Block: Memory Task 2 (2 Questions)**

Block: RLI (1 Question)

Introduction + instructions (2 Questions)

Introduction

Survey master thesis Vera Smit

Thank you for participating in this study on preferences and decision-making under risk. This survey is part of my master thesis in Behavioural Economics at the Erasmus University Rotterdam.

All data retrieved will be handled confidentially and is only used for the purpose of the research for the thesis and will not be shared with anybody else. The ethical review board approved this questionnaire.

After some questions on your demographics, in the first stage of the survey, you have to choose one out of two lotteries. In the second stage, you have to state prices for lotteries. In the third stage, you have to choose between lotteries again and in the final stage, a memory task on your decisions will conclude the survey. More detailed instructions will be provided throughout the survey.

This survey takes approximately 10 minutes to complete.

-- Page Break --

Instructions

You will choose between lotteries with different probabilities for monetary outcomes, amounts in EUR that you can earn ranging from €1 to €3,60 per question. After conducting all observations, five participants will be randomly selected and one of their decisions will randomly be chosen and played out and paid out for real. You will receive the amount in EUR for real if chosen.

Keep this in mind while making your decisions. Each decision could be one that is played out for real and you will receive that payment. It is therefore in your best interest to think about your decisions carefully and state your answers truthfully.

At the end of the survey, you will be asked about the decisions you made throughout the survey. Make sure to keep your decisions in mind for the memory task! You can earn €2,50 for a correct answer.

Demographics (5 Questions)

Gender **What gender do you identify as?**

- Male (1)
- Female (2)
- Non-binary / third gender (3)
- Prefer not to say (4)

Employment **What is your current employment status?**

- Employed full time (1)
- Employed part time (2)
- Unemployed looking for work (3)
- Unemployed not looking for work (4)
- Retired (5)

- Student (6)
- Disabled (7)

Nationality **What is your nationality?**

- Dutch (1)
- Other (2)

Age **What is your current age?**

- Under 18 (1)
- 18 - 24 (2)
- 25 - 34 (3)
- 35 - 44 (4)
- 45 - 54 (5)
- 55 - 64 (6)
- 65 - 74 (7)
- 75 - 84 (8)
- 85 or older (9)

Education **What is the highest level of education you have completed?**

- Less than high school (1)
- High school (2)
- MBO (3)
- HBO (4)
- WO - Bachelor (5)
- WO - Master (6)
- Prefer not to say (7)

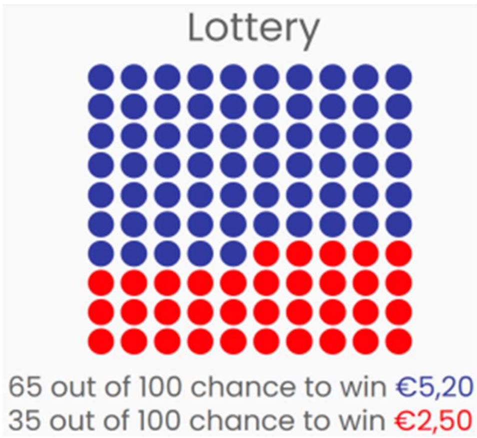
Test question (2 Questions)

→ answers need to be correct for this block to continue with the survey

Test question

To make sure you understand how the lotteries in the following questions work, this question tests your understanding of the concept.

Below you see a box containing 100 balls. 65 of the balls are blue and 35 of them are red. One ball will be drawn from the box to determine your payment. If this drawn ball is blue, you will receive a payment of 5,20 EUR and if a red ball is drawn you will receive a payment of 2,50 EUR. The lotteries throughout the survey will all be of this form.



What EUR amount will you win if a blue ball is drawn?

- 5,20 (1)
- 35 (2)
- 2,50 (3)
- 65 (4)

How many red balls are in the box?

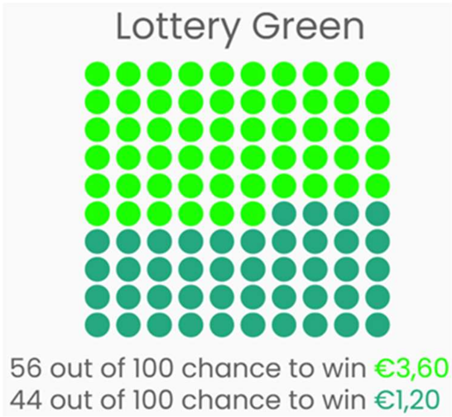
- 100 (1)
- 35 (2)
- 65 (3)
- 50 (4)

Choice Task 1 (2 Questions)

A vs. B **Lottery Green vs. Lottery Purple**

Below you see two boxes containing 100 balls each. For the green box, 56 of the balls are light green and 44 of them are darker green. One ball will be drawn from the box if chosen. If this drawn ball is light green, you will receive a payment of 3,60 EUR and if a dark green ball is drawn you will receive a payment of 1,20 EUR. This lottery is called Lottery Green.

In the other box, Lottery Purple, you see the following distribution. 62 of the balls are darker purple and 38 of the balls are light purple. If a dark ball is drawn you will receive a payment of 3,20 EUR and if the drawn ball is light purple, you will receive a payment of 1,40 EUR.



Which lottery do you prefer to play?

Keep your choice in mind for the memory task in the end.

- Lottery Green (1)
- Lottery Purple (2)

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C vs. D **Lottery Blue vs. Lottery Orange**

Below you see two boxes containing 100 balls each. For the blue box, 70 of the balls are dark blue and 30 of them are lighter blue. One ball will be drawn from the box if chosen. If this drawn ball is dark blue, you will receive a payment of 3, - EUR and if a light blue ball is drawn you will receive a payment of 1, - EUR. This lottery is called Lottery Blue.

In the other box, Lottery Orange, you see the following distribution. 78 of the balls are bright orange and 22 of the balls are darker orange. If a bright orange ball is drawn you will receive a payment of 2,70 EUR and if the drawn ball is darker orange, you will receive a payment of 1,20 EUR.

Which lottery do you prefer to play?

Keep your choice in mind for the memory task in the end.

- Lottery Blue (1)
- Lottery Orange (2)

Rating Task 1 (5 Questions)

Instructions WTS **Willingness to Sell**

In this part, you receive boxes with lotteries. You can choose to either keep the box and play out the lottery, or sell the box for a certain amount of money. You must state for each box the amount of money you are willing to sell it for. In other words what is the minimum price you are willing to sell the box for?

Think thoroughly about your answer because after you state your minimum selling price, a random price will be generated. If this generated price is equal to or above your stated price, you will receive this fixed amount of EUR and the box is sold. If the price is below your stated price, you will keep the box and play out the lottery.

You will thus receive the randomly generated price or the price from the lottery if this decision is played out for real. State your true minimum price for the outcome to be in your best interest.

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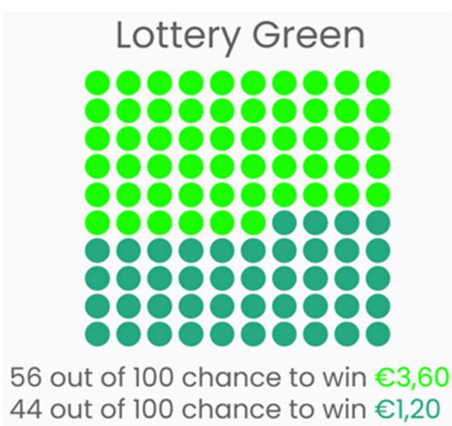
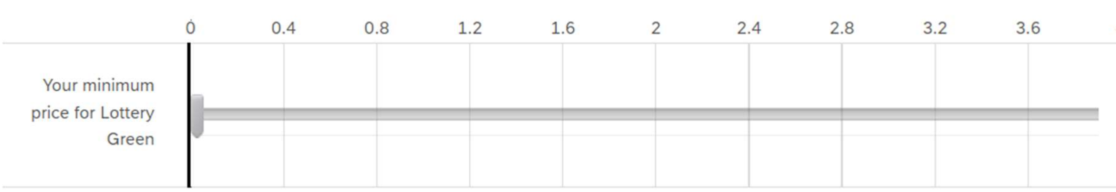
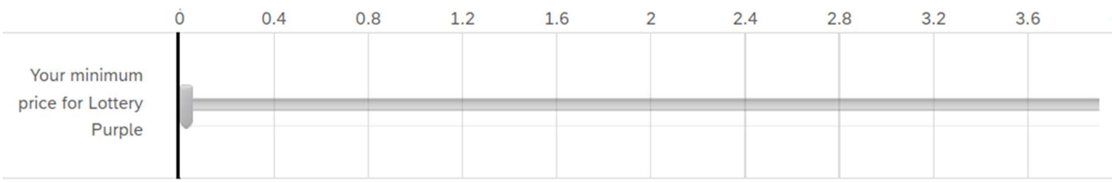
A **For what amount of EUR are you willing to sell Lottery Green instead of playing the lottery?**





-- Page Break --

B **For what amount of EUR are you willing to sell Lottery Purple instead of playing the lottery?**



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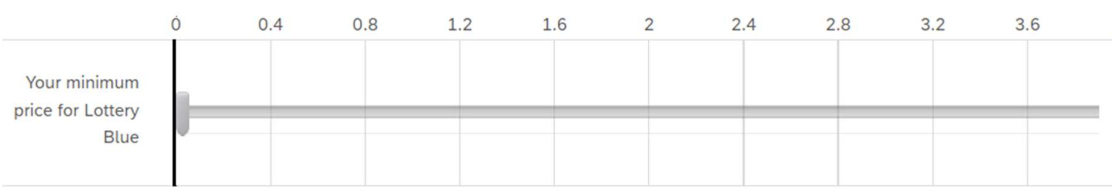
C **For what amount of EUR are you willing to sell Lottery Blue instead of playing the lottery?**



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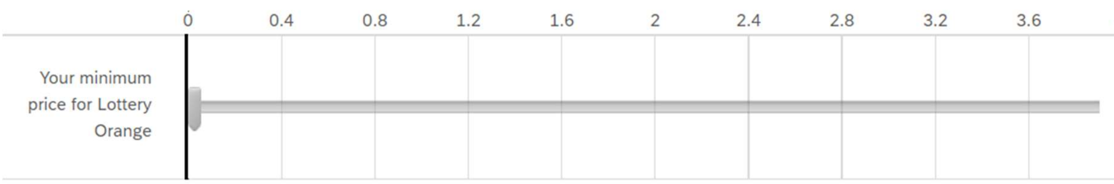
D **For what amount of EUR are you willing to sell Lottery Orange instead of playing the lottery?**



Fake Choice Task (2 Questions)

Z vs. Y **Lottery Grey vs. Lottery Pink**

Below you see two boxes containing 100 balls each. For the grey box, 72 of the balls are dark grey and 28 of them are lighter grey. One ball will be drawn from the box if chosen. If this drawn ball is dark grey, you will receive a payment of 2,50 EUR and if a light grey ball is drawn you will receive a payment of 1, - EUR. This lottery is called Lottery Grey.

In the other box, Lottery Pink, you see the following distribution. 63 of the balls are bright pink and 37 of the balls are light pink. If a bright pink ball is drawn you will receive a payment of 1,90 EUR and if the drawn ball is light pink you will receive a payment of 1,10 EUR.

Which lottery do you prefer to play?

Keep your choice in mind for the memory task in the end.

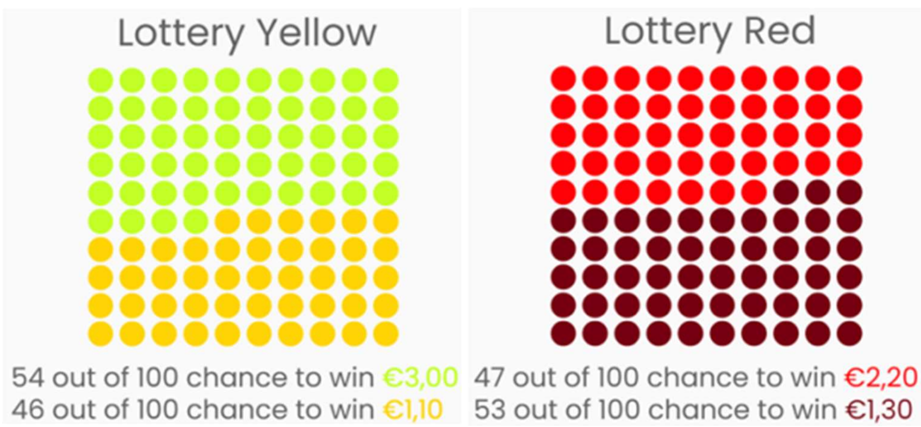
- Lottery Grey (1)
- Lottery Pink (2)

-- Page Break --

X vs. W **Lottery Yellow vs. Lottery Red**

Below you see two boxes containing 100 balls each. For the yellow box, 54 of the balls are greenish-yellow and 46 of them are orange-yellow. One ball will be drawn from the box if chosen. If this drawn ball is greenish-yellow, you will receive a payment of 3, - EUR and if an orange-yellow ball is drawn you will receive a payment of 1,10 EUR. This lottery is called Lottery Yellow.

In the other box, Lottery Red, you see the following distribution. 47 of the balls are bright red and 53 of the balls are a darker red. If a bright red ball is drawn you will receive a payment of 2,20 EUR and if the drawn ball is dark red you will receive a payment of 1,30 EUR.



Which lottery do you prefer to play?

Keep your choice in mind for the memory task in the end.

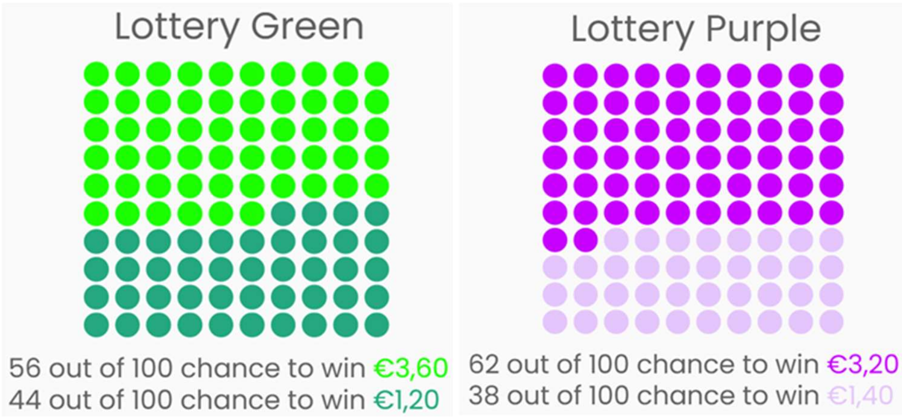
- Lottery Yellow (1)
- Lottery Red (2)

Memory Task 1 (2 Questions)

AB Memory

<u>Memory Task</u>

What box did you choose before?

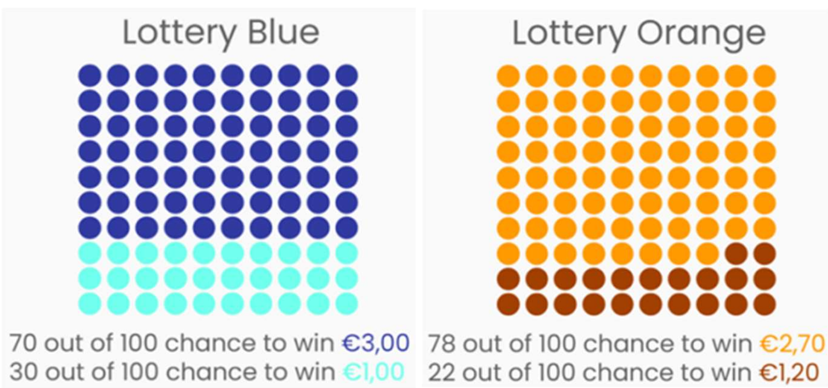


If answered correctly you can earn 2,50 EUR if this question is chosen to be played out for real.

- Lottery Green (1)
- Lottery Purple (2)

-- Page Break --

CD Memory **What box did you choose before?**



If answered correctly you can earn 2,50 EUR if this question is chosen to be played out for real.

- Lottery Blue (1)
- Lottery Orange (2)

Choice Task 2 (2 Questions)

B vs. A **Lottery Green vs. Lottery Purple**

Below you see two boxes containing 100 balls each. For the green box, 62 of the balls are light green and 38 of them are darker green. One ball will be drawn from the box if chosen. If this drawn ball is light green, you will receive a payment of 3,20 EUR and if a dark green ball is drawn you will receive a payment of 1,40 EUR. This lottery is called <u>Lottery Green</u>.

In the other box, Lottery Purple, you see the following distribution. 56 of the balls are darker purple and 44 of the balls are light purple. If a dark ball is drawn you will receive a payment of 3,60 EUR and if the drawn ball is light purple, you will receive a payment of 1,20 EUR.

Which lottery do you prefer to play?

Keep your choice in mind for the memory task in the end.

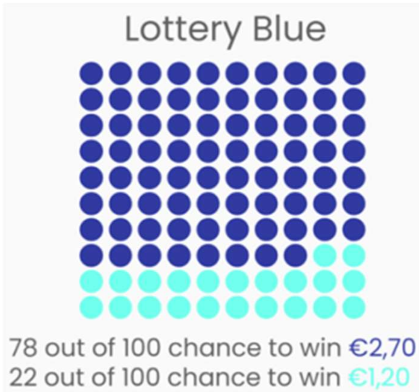
- Lottery Green (1)
- Lottery Purple (2)

-- Page Break --

D vs. C **Lottery Blue vs. Lottery Orange**

Below you see two boxes containing 100 balls each. For the blue box, 78 of the balls are dark blue and 22 of them are lighter blue. One ball will be drawn from the box if chosen. If this drawn ball is dark blue, you will receive a payment of 2,70 EUR and if a light blue ball is drawn you will receive a payment of 1,20 EUR. This lottery is called Lottery Blue.

In the other box, Lottery Orange, you see the following distribution. 70 of the balls are bright orange and 30 of the balls are darker orange. If a bright orange ball is drawn you will receive a payment of 3,- EUR and if the drawn ball is darker orange you will receive a payment of 1,- EUR.



Which lottery do you prefer to play?

Keep your choice in mind for the memory task in the end.

- Lottery Blue (1)
- Lottery Orange (2)

Rating Task 2 (5 Questions)

Instructions WTS **Willingness to Sell**

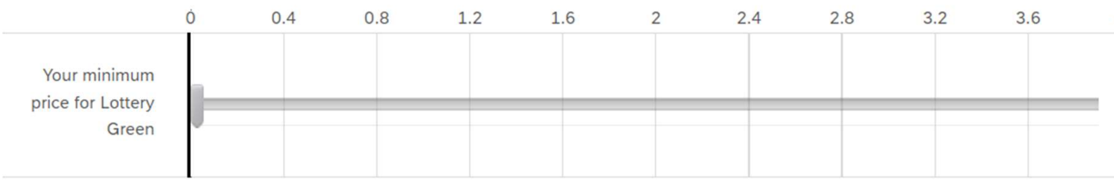
In this part, you receive boxes with lotteries. You can choose to either keep the box and play out the lottery, or sell the box for a certain amount of money. You must state for each box the amount of money you are willing to sell it for. In other words what is the minimum price you are willing to sell the box for?

Think thoroughly about your answer because after you state your minimum selling price, a random price will be generated. If this generated price is equal to or above your stated price, you will receive this fixed amount of EUR and the box is sold. If the price is below your stated price, you will keep the box and play out the lottery.

You will thus receive the randomly generated price or the price from the lottery if this decision is played out for real. State your true minimum price for the outcome to be in your best interest.

-- Page Break --

B **For what amount of EUR are you willing to sell Lottery Green instead of playing the lottery?**

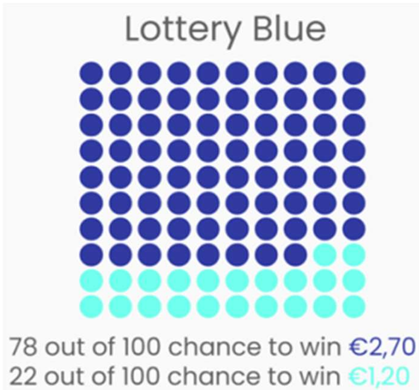


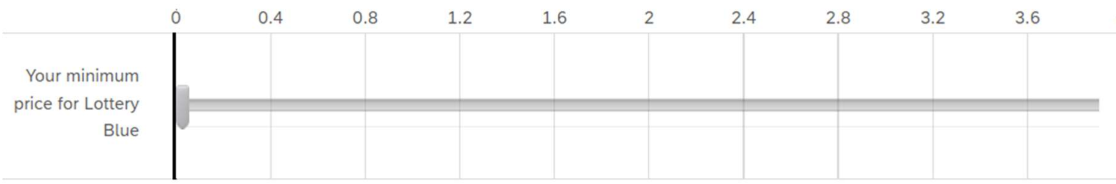
--- Page Break ---

A **For what amount of EUR are you willing to sell Lottery Purple instead of playing the lottery?**

--- Page Break ---

D **For what amount of EUR are you willing to sell Lottery Blue instead of playing the lottery?**





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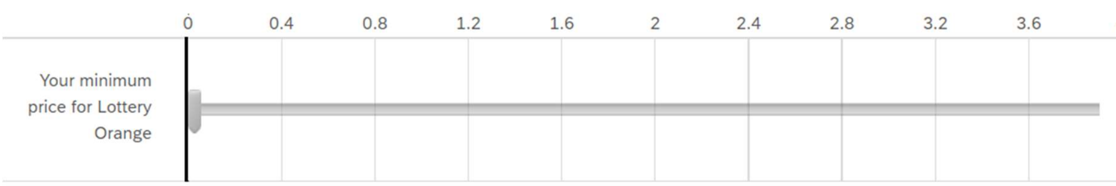
C **For what amount of EUR are you willing to sell Lottery Orange instead of playing the lottery?**

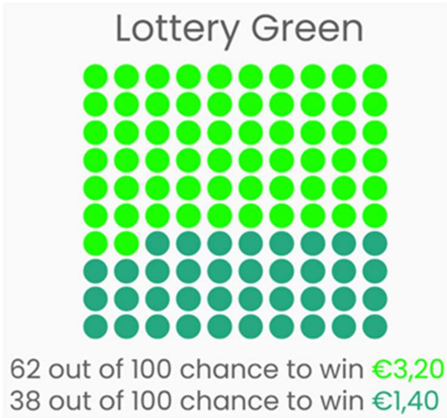


Memory Task 2 (2 Questions)

BA Memory

<u>Memory Task</u>

What box did you choose before?



If answered correctly you can earn 2,50 EUR if this question is chosen to be played out for real.

- Lottery Green (1)
- Lottery Purple (2)

--- Page Break ---

DC Memory **What box did you choose before?**

If answered correctly you can earn 2,50 EUR if this question is chosen to be played out for real.

- Lottery Blue (1)
- Lottery Orange (2)

RLI (1 Question)

Email address

Thank you for participating! For taking part in the random lottery for playing out one of your decisions, leave your email address in the bar below. I will get in contact with the five winners to play out one of their decisions.