The effect of choice reminders on choice-induced preference change

An Implicit Choice Paradigm experiment

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Abstract

The phenomenon of choice-induced preference change illustrates that choices can sometimes cause a change in preferences, due to cognitive dissonance. Many psychologists have demonstrated this through Free-Choice Paradigm experiments, where subjects rank and choose between items. However, since it was exposed that these experiments and their results suffer from a methodological flaw, new experimental designs have emerged. Furthermore, recent research suggests that choice reminders could evoke additional cognitive dissonance and increase choice-induced preference change. This thesis therefore aimed to examine the effect of choice reminders on choice-induced preference change, while also replicating the results of one of the improved experimental designs.

An incentivized Implicit Choice Paradigm experiment was conducted, where 140 subjects ranked and chose between nine postcards in an online setting. Choice-induced preference change was measured by the ranking spread, which is compromised of the increase in the ranking of the chosen item plus the decrease in the ranking of the unchosen item. The choice reminder and the initial rank of the chosen item were randomized across subjects. The results showed that median ranking spreads were positive, although these findings were not robust for individual treatment groups. This thesis, therefore, contributed to the evidence of choice-induced preference change. However, no evidence was found that the choice reminders significantly increased ranking spreads, partly because subjects already had a good memory of their choices and that preferences on postcards were presumably weak. Hence, further research is necessary to understand the effect of choice reminders on choice-induced preference change.

Keywords: Choice-induced preference change, Choice reminder, Implicit Choice Paradigm, Cognitive dissonance, Decision making, Spreading of alternatives

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1. Introduction

The revealed preferences theory is a widely used approach to understanding and predicting consumer behaviour (Samuelson, 1938, 1948). According to this approach, individuals' preferences can be inferred from observed choices. Economists therefore use choice data to estimate consumer preferences and conduct economic analysis. Utilizing choice data requires the assumption that preferences are stable (Alós-Ferrer & Granic, 2021, p. 2). However, psychologists have found evidence of a phenomenon which conflicts with the assumption of stable preferences: choice-induced preference change. This phenomenon describes how the mere act of choosing between two equally preferred alternatives can alter preferences. As preferences are changed by the decision-making process according to this finding, they are not stable. Through Free-Choice Paradigm experiments, numerous psychologists have found evidence for this effect (amongst others: Brehm, 1956; Gerard & White, 1983; Lieberman et al., 2001). However, the methodology and the findings of Free-Choice Paradigm experiments have been criticized recently, and the extent to which choice-induced preference change exists is still unclear.

An established explanation for choice-induced preference change is the cognitive dissonance theory (Festinger, 1957). If an individual has equal preferences for two alternatives, while they also chose one of the alternatives over the other, this contradiction leads to a feeling of discomfort called "cognitive dissonance". To solve this mental discomfort, the individual increases their preference for the chosen item and decreases their preference for the rejected item, known as "spreading of alternatives" (Huang et al., 2022, p. 73). Reminding individuals about their previously made choices could evoke additional cognitive dissonance because individuals then have a better memory of their choices. Therefore, the discrepancy between the individual's choice and their equal preferences on the alternatives becomes more explicit, and thus choice-induced preference change increases. Two recent papers indeed suggest that spreading of alternatives could increase when subjects receive a choice reminder (Huang et al. 2022, Salti et al., 2014). The potential effect of choice reminders on choice-induced preference change is relevant to examine as it further explores how preferences are not always stable. Economic models might have to account for this, while companies could utilize this effect by reminding their customers of products they previously purchased.

As the evidence on the effect of choice reminders is still thin, more research on this topic would lead to a better understanding of the impact of choice reminders on choice-induced

preference change. Furthermore, experimental studies that account for the methodological critique on the Free-Choice Paradigm have painted a more nuanced picture of the evidence of choice-induced preference change. For example, in a study using an improved experimental design called the "Implicit Choice Paradigm", Alós-Ferrer and Granic (2018, p. 13) concluded that choice-induced preference change might not be as strong in economical domains. Further research on choice-induced preference change using improved experimental designs therefore helps to understand the strength of this phenomenon that challenges the common understanding of consumer behaviour, for example by looking at choice-induced preference change in an incentivized experiment.

Hence, to close the research gap on the effect of choice reminders and to replicate the results of one of the improved experimental designs, the aim of this master thesis was to examine the effect of choice reminders on choice-induced preference change in an incentivized Implicit Choice Paradigm experiment. This topic was examined using the following research question:

"Does reminding subjects of their choices increase the choice-induced preference change in an incentivized Implicit Choice Paradigm experiment?"

To examine this research question, an online survey was conducted, in which subjects participated in the Implicit Choice Paradigm experiment. The experiment consisted of three tasks: an initial ranking task, a choice task and a second ranking task. Choice-induced preference change was measured by the ranking spread, which consists of the average increase in the ranking of the chosen item plus the average decrease in the ranking of the unchosen item between the initial and the second ranking task. Half of the subjects were randomly assigned to receive the treatment, meaning they were presented with a reminder of their choices before the second ranking task. Furthermore, the initial rank of the chosen item was randomized, so subjects either had their fifth-ranking item intended-to-be chosen and the sixth-ranking item intended-to-be unchosen or vice versa. In the choice task, the chosen item was paired against a lower-ranking item and the unchosen item against a higher-ranking item. Landscape postcards were chosen as the items of interest in the experiment because subjects could easily form preferences on these objects without having to be familiar with the item. Subjects were incentivized to exert sufficient mental effort into the tasks through a price raffle in which they could win one of the postcards based on their indicated preferences.

The results of the experiment led to the following conclusions. Although the average ranking spread for subjects that received choice reminders was higher than for subjects that did not

receive choice reminders, there was no statistically significant effect of the choice reminder. Therefore, one of the conclusions of this experiment could be that the effect of choice reminders on choice-induced preference change does not exist or is at least weak. However, the results can also be explained by the limitations of this experiment. Subjects already had an almost perfect remembrance of the choices they made before they received the choice reminder, which could be the reason for the insignificant effect. Furthermore, as the incentives to exert sufficient mental effort into the survey were low and preferences for postcards were presumably weak, there was the problem that subjects' concern for the choices they made was relatively low. This made it harder for the treatments to evoke sufficient cognitive dissonance to yield statistically significant results on ranking spreads. Finally, the insignificant results could also be a problem of statistical power, as the sample size in the experiment was relatively low.

The median ranking spreads across the sample and in the four different treatment groups were positive, implying that there was indeed spreading of alternatives in this experiment. Hence, this thesis contributed to the existing evidence of choice-induced preference change. However, the only finding that was valid according to the robustness tests was that the median ranking spread of the total sample was positive. This is partly because the sample size was low for the four different treatment groups. It is also worth noting that the median ranking spread for chosen items was statistically significantly higher than the median ranking spread for unchosen items, implying that subjects found the postcards relatively unattractive, as follows from cognitive dissonance theory.

Concluding, the choice reminder had no statistically significant effect on choice-induced preference change in this Implicit Choice Paradigm experiment. This finding is partly due to the limitations of this study, therefore further research into the effect of choice reminders is necessary.

2. Literature Review

The aim of this thesis was to examine the effect of choice reminders on choice-induced preference change in an Implicit Choice Paradigm experiment. "Choice-induced preference change" is the phenomenon that choices can sometimes lead to changes in preferences. This has been repeatedly proven by psychologists through Free-Choice Paradigm experiments (amongst others: Brehm, 1956; Gerard & White, 1983; Lieberman et al., 2001). In these experiments, subjects initially rank or rate several items. Then they must choose between two

items which they prefer (almost) equally, after which they rank or rate the items again. This difficult choice can lead to a state of cognitive dissonance. Consequently, subjects increase their value of the chosen items and decrease their value of the rejected items, which is called "spreading of alternatives". A choice reminder could further increase cognitive dissonance, as this reminder could highlight the discrepancy between the subjects' choice and their equal preferences on the items. This leads to additional spreading of alternatives, according to the cognitive dissonance theory.

The relationship between choice reminders and choice-induced preference change has only been examined in a few studies. Further research on the effect of choice reminders is useful because this effect could have relevant scientific and economic implications. Examining if individuals indeed increase their subjective value of an item after being reminded that they chose this item over an equally preferred item deepens the understanding of consumer behaviour. Furthermore, companies could utilize this insight, by using purchase reminders to alter consumers' preferences on purchased products. Moreover, there is still debate on the extent to which choice-induced preference change exists, partly because improved experimental designs have painted a more nuanced picture than the Free-Choice Paradigm experiments. Therefore, it was relevant to examine if choice-induced preference change occurs in an improved experimental design like the Implicit-Choice Paradigm. This chapter gives an overview of the existing literature to clarify what is already known about choice-induced preference change and choice reminders, and to identify gaps in the existing literature.

The concept of choice-induced preference change was first introduced by Jack Brehm through the Free-Choice Paradigm. In the experiment that Brehm (1956) designed, subjects initially ranked or rated several items on their desirability. After they have chosen between two items of similar desirability, subjects must rank the items again. The difference between subjects' preferences before and after the choice task illustrates the possible choice-induced preference changes. As Izuma and Murayama conclude in their methodological review of choice-induced preference change in the Free-Choice Paradigm (2013, p. 1), many studies have demonstrated that subjects indeed increase their preference for chosen items and decrease their preference for rejected items. This is known as "spreading of alternatives" and is measured as the increase in the ranking (or rating) of the chosen item plus the decrease in ranking of the rejected item (Huang et al., 2022, p. 74).

Spreading of alternatives has often been explained by the cognitive dissonance theory, an influential psychological theory introduced by Leon Festinger. According to this theory,

holding contradicting cognitions induces a feeling of mental discomfort (Festinger, 1957). If someone chooses one out of two alternatives, whilst they prefer the two alternatives equally, this leads to cognitive dissonance: the person likes both alternatives equally, but still chose one of the alternatives. To decrease the state of discomfort, the person increases their preference for the chosen item and reduces their preference for the unchosen item. As preferences are now in line with previous choices, the cognitive dissonance is "solved". Cognitive dissonance theory has been supported by neuroimaging studies which have shown that choosing between equally preferred items changes the subjective values of the items in the brain. For example, in a paper in which Izuma et al. (2010, p. 22014) use self-reported preferences as well as data on brain activity, the authors find strong evidence for choice-induced preference change in accordance with the cognitive dissonance theory, while Voigt et al. (2019, p. 718) find similar results using brain activity as well as eye movement information.

Recently, the Free-Choice Paradigm and the conclusions derived from this method have been examined more thoroughly. In the past decennia, this experimental design has often been used by psychologists to demonstrate choice-induced preference change. As mentioned earlier, this design consists of three segments: the first ranking (or rating) task, a choice task, and finally a second ranking task. Using the Free-Choice Paradigm, many authors found that the act of choice leads to spreading of alternatives (amongst others: Brehm, 1956; Gerard & White, 1983; Lieberman et al., 2001). However, Chen and Risen demonstrated a crucial methodological flaw of the Free-Choice Paradigm in 2010. According to the authors, Free-Choice Paradigm experiments produce spreading of alternatives, even when this spread cannot be explained by an actual attitude change. They also demonstrate this mathematically. Such spreading is produced, because the choices in the choice task are driven by the underlying preferences of the subjects (Chen and Risen, 2010, p. 574). Therefore, Free-Choice Paradigm experiments are not able to control for the information that is revealed in the choice task (Chen and Risen, 2010, p. 589). Using a simulation, Izuma and Murayama (2013) also find evidence that preference change is systematically produced in the Free-Choice Paradigm.

Although the mathematical argument of Chen and Risen (2010) has been challenged by Alós-Ferrer and Shi (2015), it did inspire authors to rethink the way of measuring choice-induced preference change. To solve for the bias of the Free-Choice Paradigm, three solutions have emerged. Chen and Risen introduced the first solution in the paper where they criticised the Free-Choice Paradigm (2010). In their "Rate-Rate-Choose Paradigm" the authors use a control group to account for the revealed preferences (Izuma & Murayama, 2013, p. 6). This

design compares preference changes of the group that follows the typical order of the experiment, so the first rating task, then the choice task and finally the second rating task (Rate-Choose-Rate), against a control group for which the choice task is placed after the two rating tasks (Rate-Rate-Choose). Chen and Risen thereby control for the information revealed by the choice task. Sharot et al. (2010) provided a second solution, by conducting a blind-choice experiment in which the experimenter declared one of the items as chosen, therefore avoiding the selection bias that arises from subjects' choices. However, as pointed out by Alós-Ferrer et al. (2012, p. 1337), the experiment does not test the effect of preference-based choices on preferences because choices in this experimental design are made exogenously.

In the same article, Alós-Ferrer et al. introduce their solution to the methodological problem of the Free-Choice Paradigm: the Implicit Choice Paradigm, in which choices are predetermined and follow from underlying preferences, and where it is randomly determined which item is intended-to-be chosen and which item is intended-to-be unchosen, thereby avoiding a large part of selection bias (2012, p. 1337). The chosen item (*b*) is paired against an item with a low ranking (*l*) and the unchosen item (*a*) against an item with a high ranking (*h*), to make sure the subject chooses the predetermined item. Nonetheless, there could still be a selection bias, as implicit choices (between *a* and *h* and *b* and *l*) also reveal information about the direct choice pair (*a* and *b*), as Izuma and Murayama explain (2013, p. 7). Therefore, Alós-Ferrer et al. provided a robustness check using imputed choices (2012, p. 1339). In this analysis, subjects' choices were treated as if the chosen item was always chosen and the unchosen item was always unchosen, thereby eliminating the selection bias (Izuma & Murayama, 2013, p. 7). Hence, only if the robustness check generates similar results, the results from the Implicit Choice Paradigm can be considered valid. The findings from the Implicit Choice Paradigm experiment of Alós-Ferrer et al. (2012) were statistically larger than zero, with and without imputed choices, implying the existence of choice-induced preference change.

However, not all experiments demonstrate the existence of choice-induced preference change. In an experiment following the Implicit Choice Paradigm design where subjects had to indicate their preferences on several lotteries, Alós-Ferrer & Granic (2018, p. 13) find less strong evidence for choice-induced preference change in an economic domain. They conclude that choice-induced preference change is not as strong as implied in earlier studies and probably also depends on other factors. The extent to which choice-induced preference change exists is thus still unclear, and this remains a relevant question. Namely, when preferences are partly derived from previous choices, this means that consumption is also based on previous choices.

Economical models predicting consumer behaviour therefore might have to be adjusted. Thus, experiments testing choice-induced preference change in different settings using designs like the Implicit Choice Paradigm can deliver a useful contribution to the current literature.

According to cognitive dissonance theory, choice reminders can increase choice-induced preference change. If an individual has difficulty recalling their choices, cognitive dissonance tends to decrease. That is, if an individual must choose between two similarly desirable items, the inconsistency of this choice with their preferences is less clear when they have little recollection of the choice. In contrast, when individuals remember their choices accurately, it creates a greater discrepancy between their choice and their equal preferences on the alternatives. Giving subjects a reminder of the choices they made in the choice task, could thus evoke additional cognitive dissonance and increase choice-induced preference change.

This is also implied by two experiments using the Rate-Rate-Choose Paradigm. In an experiment where preferences about holiday destinations where measured Salti et al. (2014) found larger ranking spreads for subjects that were reminded about their choices than for subjects that were not reminded (p. 7). Furthermore, in an experiment in which choice-induced preference change was compared between older and young adults, Huang et al. (2022, p. 78) found that older adults show diminished spreads compared to young adults. However, when older adults were reminded about their choice, they showed comparable spreads as young adults, thereby demonstrating the positive effect of choice reminders on choice-induced preference change, arguably because of increased cognitive dissonance. Thus, the literature suggests choice reminders increase choice-induced preference change, although the evidence is not yet extensive.

Therefore, further research on the effect of choice reminders would contribute to the existing literature and could also have economic implications. If a choice reminder could alter preferences, this implies that when individuals are reminded about their previous choices on equally preferred items, this could increase their subjective value of the chosen item. Companies could benefit from this by utilizing consumer data on previous purchases with regards to equally preferred products and increase customers' value of these items by reminding customers about these previous purchases, ultimately leading to more sales. Purchase reminders are already used often, as most people have encountered a reminder about past purchases or products they viewed when shopping online. To illustrate, Lerche et al. (2016, p. 28) find empirical evidence that consumers of the online retailer Zalando often use reminders on previously viewed or bought items as a starting point for subsequent purchases. Although

these kinds of reminders are not the same as choice reminders in the context of an experiment like the Implicit Choice Paradigm, this finding does demonstrate the relevance of choice reminders.

Whilst there is much evidence on choice-induced preference change (amongst others: Brehm, 1956; Gerard & White, 1983; Lieberman et al., 2001, Alós-Ferrer et al., 2012; Huang et al., 2022), there is still debate on the extent to which it exists, as different experimental designs led to more nuanced results. Moreover, the results of Free-Choice Paradigm experiments must be interpreted carefully, as this experimental design suffers from a bias. Additional research on this topic, with an experimental design that produces valid results, could therefore be relevant to the current debate. Two experiments using the Free-Choice Paradigm imply that choice reminders could increase choice-induced preference change, which could have relevant economic implications. More research could thus help clarify the effect of choice reminders on choice-induced preference change.

Therefore, this thesis was devoted to examining the effect of a choice reminder on choice-induced preference change using the Implicit Choice Paradigm design. This design avoids selection bias, while also using the real choices of subjects, unlike blind-choice designs that use exogenous choices. Moreover, keeping in mind the available resources for this thesis, the Implicit Choice Paradigm design was more practical than the Rate-Rate-Choose Paradigm, as only one treatment group was needed instead of two. To make sure the findings stemming from this experiment were valid, a robustness check was performed. Furthermore, to motivate subjects to exert sufficient mental effort into the experiment, participation was incentivized. This also aided to bring the experiment more towards a consumer choice setting, as the choices could lead to tangible consequences for subjects.

2.1 Research Question and Hypotheses

Based on my synthesis from the existing literature, my thesis investigated the following research question: “Does reminding subjects of their choices increase the choice-induced preference change in an incentivized Implicit Choice Paradigm experiment?”

Based on past findings in the literature that found positive spreading of alternatives (amongst others: Brehm, 1956; Gerard & White, 1983; Lieberman et al., 2001, Alós-Ferrer et al., 2012; Huang et al., 2022), as well as neuroimaging studies that support choice-induced preference change (Izuma et al., 2010, p. 22014; Voigt et al., 2019, p. 718), a positive spreading of

alternatives was expected, albeit a small effect. That is, subjects increase their subjective value of the chosen item and decrease their subjective value of the unchosen item. When the subjective value of an item increases, the subjects' ranking of the item increases. This is expressed by the ranking spread, which was measured in the same way as previous studies have done (for example Alós-Ferrer et al., 2012), by adding the increase in ranking of the chosen item to the decrease in ranking of the unchosen item. The ranking spread was measured by equation (1), in which R1 is the ranking of the item in the first ranking task and R2 in the second ranking task. In this equation, the increase in the ranking of the chosen item is calculated by subtracting the rank of the chosen item in the second ranking task from the rank in the first ranking task. This is added to the decrease in the ranking of the unchosen item, which is calculated by subtracting the rank of the unchosen item in the first ranking task from the rank in the second ranking task.

$$Spread = R1\ (Chosen) - R2\ (Chosen) + R2\ (Unchosen) - R1\ (Unchosen). \quad (1)$$

In the experiment that I conducted to analyze my research question, the rank of the chosen item was randomly predetermined to be either the fifth or the sixth in the initial ranking task. Thus, for half of the subjects the fifth-ranking item was predetermined as chosen and the sixth-ranking item as unchosen (treatment T5). For the other half of subjects, the sixth-ranking item was predetermined as chosen and the fifth-ranking item as unchosen (treatment T6). These two ranks were chosen, because subjects presumably have weaker preferences for the middle-ranking items. Nudging subjects to choose one of these two items thus creates a difficult choice, which could increase cognitive dissonance.

The effect of a choice reminder on choice-induced preference change was expected to be positive, implying a larger spreading of alternatives for the treatment group than for the control group. This expectation was based on the theory, as the choice reminder likely increases cognitive dissonance, as well as on existing literature (Salti et al., 2014; Huang et al., 2022). The first hypothesis of this thesis was therefore:

$$Spread\ CR > Spread\ NR \text{ (H1)}.$$

In line with earlier statements, a positive spreading of alternatives was expected across the whole sample, as well as for the treatment groups: the group that receives a reminder (CR), the group that does not receive a reminder (NR), the group for which the fifth-ranking item is chosen (T5), and the group for which the sixth-ranking item is chosen (T6). This leads to the second hypothesis, which is divided into sub-hypotheses:

$$Spread \geq 0 \text{ (H2.1)};$$

$$Spread\ NR \geq 0 \text{ (H2.2)};$$

$$Spread\ CR \geq 0 \text{ (H2.3)};$$

$$Spread\ T6 \geq 0 \text{ (H2.4)};$$

$$Spread\ T5 \geq 0 \text{ (H2.5)}.$$

Choosing the fifth-ranking item and rejecting the sixth-ranking item likely is more intuitive for subjects than rejecting the fifth-ranking item and choosing the sixth-ranking item, as subjects are set-up to choose an item they ranked lower and refuse an item they ranked higher. Therefore, the treatment T6 could evoke more cognitive dissonance than treatment T5, as choices for subjects in T6 are less in less with their initial rankings. To examine if having the fifth-ranking item determined as chosen versus having the sixth-ranking item determined as chosen influences spreading of alternatives, the following null hypothesis was examined:

$$Spread\ T5 = Spread\ T6 \text{ (H3)}.$$

3. Methods

This chapter explores the methods that were used to examine the research question, by discussing the experimental design, the optimal sample size, the sample, the stimuli of the experiment, the procedure for subjects, and the statistical methods that were used.

The effect of a choice reminder on choice-induced preference change was tested using an incentivized online experiment with an Implicit Choice Paradigm design, using postcards as the items of interest. Subjects were randomly assigned to either receive a choice reminder or not and were also randomly assigned to have either the fifth- or the sixth-ranking item determined as the chosen item. The survey passed the ethical thesis check and approval was granted by default. Moreover, subjects explicitly agreed that their data was collected and used for scientific purposes.

3.1 Experimental Design

The experiment was programmed in Qualtrics and measured subjects' preferences and choices regarding nine postcards with landscape pictures. Screenshots of the decision screens are presented in Appendix 1. The experiment followed the design of the Implicit Choice

Paradigm that Alós-Ferrer et al. created in 2012. This experimental design is composed of three tasks: one initial ranking task, followed by a choice task and a second ranking task.

After subjects consented to the use of their data and agreed to participate in the survey, the first ranking task started, in which subjects were asked to rank nine postcards based on which they preferred the most. Then subjects participated in the choice task, where they were confronted with two implicit choice pairs, in which the intended-to-be chosen postcard was paired with a low-ranking postcard and the intended-to be unchosen postcard was paired with a high-ranking postcard, thereby inducing the subjects to follow the predetermined choice paths. After this task, subjects were asked to answer three filler questions. Before the second ranking task started, half of the subjects received a choice reminder that showed the previously made choices. Then the second ranking task started, in which subjects ranked the nine postcards again based on which they preferred the most. Thereafter, subjects were asked if they could remember the postcards they chose in the choice task, to assess the subjects' memory of their choices. This gave insights into the impact of the choice reminder. Finally, subjects were asked to indicate their age and gender. The experiment was incentivized, and all subjects had a 20% chance of being rewarded with one of the postcards that were used in the experiment. Subjects' preferences in the second ranking task were used to determine which postcard was used as the reward.

Subjects were randomized into four treatments. Firstly, subjects were randomly distributed to the group that received a choice reminder (CR) or the group that did not receive a choice reminder (NR). Secondly, it was randomly determined for each subject if either the fifth-ranking item (T5) or the sixth-ranking item (T6) was the intended-to-be chosen item. If the fifth item was the intended-to-be chosen item, the sixth was the intended-to-be unchosen item, and vice versa. The fifth and sixth items were chosen as the ranks of interest because subjects likely had less strong preferences for these middle-ranking items. This could increase cognitive dissonance because this led to harder choices for the subject. As mentioned before, all subjects were asked if they remembered their choices in the choice task. By comparing these answers against actual choices, a variable was created that indicated how many choices the subject remembered correctly. Furthermore, subjects were asked to indicate their age and gender, to examine the representativeness of the sample.

The independent variables of this research were the variables that indicated if the subject received a choice reminder (CR), if the fifth item was chosen (T5), if the subject remembered their choices correctly, and gender and age. These were all between-subjects variables. The

dependent variable was the ranking spread, which was measured by equation (1) in paragraph 2.1. This ranking spread variable compared the ranks of the chosen and unchosen items in both ranking tasks. Therefore, this was a within-subject variable.

Postcards were chosen as items of interest because paintings and art prints have been commonly used in experiments that examine choice-induced preference change, for example by Chen and Risen (2010). Just like with paintings and art prints, subjects do not have to be familiar with postcards to form a preference for them, as opposed to foods or cosmetic products for example. As most individuals presumable have some preferences for landscape postcards, this discourages subjects from ranking the items randomly, which would have been bad for the experiment, as the rankings would not reflect actual preferences. Postcards were chosen as opposed to paintings because postcards are more frequently bought than paintings. This means that ranking postcards is closer to a consumer choice situation, thereby making the experiment more representative of the real world. Furthermore, the difference between subjects' value of the middle-ranking postcards (in this case, the fifth- and the sixth-ranking postcards) was presumably small, as preferences on postcards are relatively weak. The advantage of this is that it is easier to invoke a state of cognitive dissonance with these items, as they create more difficult choices. This makes it more likely that choices will not be in line with initial rankings, which motivates subjects to alter their preferences. However, the downside of weak preferences is that they could induce subjects to choose and rank the items more arbitrarily, which in turn makes it harder to evoke a feeling of mental discomfort and to create cognitive dissonance.

The treatments T5 and T6 led to the following implicit choice pairs. If the subject was assigned to T5, their first choice was the fifth-ranking item versus the eighth-ranking item, and their second choice was the sixth-ranking item versus the third-ranking item. If the subject was assigned to T6, their first choice was the sixth-ranking item versus the ninth-ranking item, and their second choice was the fifth-ranking item versus the second-ranking item. Hence, these implicit choice pairs were presented in a way that it is likely that the intended-to-be chosen postcard was likely to be chosen and the intended-to-be unchosen postcard was likely to be rejected. Furthermore, the distance in pre-choice rankings between the postcards was kept constant in all choice pairs. If this would have varied across choice pairs, it could have influence the evocation of cognitive dissonance, as Alós-Ferrer et al. (2012, p. 1339) show in their Implicit Choice Paradigm experiment.

3.2 Sample Size

To obtain the optimal sample size necessary to perform relevant tests in this experiment, power calculations were made using the G*Power Calculator. To estimate the effect size for each test, the standard deviation and estimated effects were needed. The estimated effect is the difference between the outcome of the null hypotheses and the alternative hypotheses. In all tests, an alpha of 0.05 and a beta of 0.8 were used, which are standard values. These values imply that there is a 5% chance of making a Type I error, which signifies rejecting the null hypothesis when it should not have been rejected, and a 20% chance of making a Type II error, which signifies not rejecting the null hypothesis when it should have been rejected. This paragraph explains the values that were estimated for the specific tests.

The one-sided Mann-Whitney U test was used to test the first hypothesis, which states that spreads are higher for subjects who receive a choice reminder than for subjects who do not receive a choice reminder. In two Implicit Choice Paradigm experiments, Alós-Ferrer et al. (2012, p. 1339-1340) find standard deviations of 0.41 and 1.53 for the ranking spreads. These experiments are similar to this experiment and therefore the standard deviation is representative for this experiment. However, because there are also differences between the experiments it was best to be conservative and decrease the likelihood of making a type-II error. For example, a larger standard deviation was expected in this experiment, because an online survey likely leads to more arbitrary answers than a laboratory experiment. Thus, a standard deviation of 1.5 was assumed. The null hypothesis for the test was that the difference between the average spreads subjects with and without choice reminder was 0. For the predicted outcome of the alternative hypotheses, the results of Huang et al. (2022, p. 77) were used. These authors found that choice reminders increase rating spreads by 0.17 for subjects who rated food items. However, a larger increase was expected for this experiment, as subjects likely have less strong preferences for postcards than for food items, which increases cognitive dissonance and could strengthen the effect of the choice reminder. Therefore, the expected difference between spreads for subjects who received a choice reminder and subjects who did not receive a choice reminder was 1. This led to an effect size of 0.67. The estimated effect size resulted in an optimal sample size of 60 as the two samples (CR and NR) had an optimal sample size of 30 observations.

To test hypotheses two, which state that a positive spreading is expected for all groups, the one-sided Wilcoxon Signed Rank test was used. A standard deviation of 1.5 was assumed for

this test, following the same reasoning as for the first test. In the null hypothesis, it was assumed that ranking spreads are 0. For the outcome of the alternative hypothesis, the results of Alós-Ferrer et al. (2012, p. 1339-1340) were once again used. In their two experiments, the authors found spreads of 0.25 and 1.18. As these experiments were comparable to this experiment, an average positive spread of 0.5 was expected for this experiment, leading to a difference in the outcome of 0.5. These estimations led to an effect size of 0.33. Furthermore, in a meta-analysis, Izuma & Murayama (2013, p. 8) concluded that studies that addressed the concerns of Chen & Risen (2010) found an average effect size of 0.26, which is similar to the estimated effect size. The effect size implied that all samples (the total sample, NR, CR, T6, and T5) should have a minimum sample size of 60, leading to an optimal total sample size of 120, as approximately 50% of all subjects were assigned to either CR or NR and either T5 or T6.

For the third hypothesis, which states that ranking spreads are the same for subjects for which the fifth-ranking item is chosen (T5) as for subjects which the sixth-ranking item is chosen (T6), the two-sided Mann-Whitney U test was used. A standard deviation of 1.5 was assumed for this test, following the same reasoning as for the first test. In the null hypothesis, the average difference between ranking spreads was 0. There was no data published from similar experiments in which the chosen item was randomized, making it difficult to accurately predict an alternative outcome. Intuitively, having the sixth item as chosen is less intuitive for subjects, and would presumably lead to more cognitive dissonance higher spread. Therefore, an average difference in spreads of 1 was assumed, leading to a difference in outcomes of 1. This resulted in an effect size of 0.67. Therefore, the two samples (T5 and T6) should both have 39 observations under these assumptions, resulting in an optimal sample size of 78.

Thus, 120 was the largest sample size necessary for the three tests and this was therefore the number of subjects who was strived for.

3.3 Sample Description

All people aged 18 or older that live in the Netherlands were eligible to participate in this online survey. The age minimum was due to ethical concerns with minors, while subjects had to live in the Netherlands because of practical reasons, as it would become costly to send the rewarded postcards to other countries. Subjects were recruited via two channels. Firstly, the websites SurveySwap and SurveyCircle were used to gather subjects. On these websites, students fill in surveys of other students and receive responses for their surveys in return. Secondly, the survey was shared with fellow students and friends.

In total, there were 146 subjects who filled in the survey completely. Subjects who only answered part of the questions were removed from the sample. As subjects were partly recruited via websites such as SurveyCircle and SurveySwap, there was a higher risk of subjects not filling in the survey seriously and providing random preferences, as students earn points by participating in surveys and therefore have an incentive to complete many surveys in a short time. This problem was hard to tackle, but an apparent indication of not providing serious answers was if subjects kept the items in the exact order of ranks that they were presented to them. With nine items, there were 362,880 possible orderings in this experiment, making it highly unlikely that the initial ordering in the experiment corresponded to the subjects' preferences. There were six subjects who indeed provided an unchanged ranking in the second ranking task (meaning that they kept postcard 1 on place 1, postcard 2 on place 2, etc.) while they had completely different rankings in the first ranking task. This, in combination with the low duration of their participation, provided a sufficient indication that they did not fill in the second ranking task seriously. Therefore, these subjects were removed from the sample, leading to a sample of 140 subjects.

These 140 subjects were not used for the main analysis, as 24 subjects did not follow the predetermined choices. Subjects were expected to choose the first postcard in the first implicit choice pair and the second postcard in the second choice pair, as these postcards ranked the highest in the subjects' initial ranking task. In total, 116 (82,86%) subjects followed these predetermined choices, while 24 subjects had a different combination of choices. Because these subjects deviated from the predetermined choices, including these observations in further analysis would introduce confounding factors. To ensure that merely the effect of choosing the chosen item and rejecting the unchosen item is studied, these subjects were excluded from further analysis and were only included in the robustness test.

The final sample, therefore, consisted of 116 subjects. Of these subjects, 61 were male (52.59%), 54 were female (46.55%) and 1 subject was non-binary/third gender (0.86%). The average age of the sample was 26.56 (with a standard deviation of 10.36), indicating that the average subject was relatively young. This can also be seen in Table 3.1, which indicates that 74.14% of the sample was between 18 and 24 years old.

Table 3.1

Distribution of age groups

Age group	Frequency	Percentage	Cumulative
18-24	86	74.14	74.14
25-44	19	16.38	90.52
45-60	8	6.90	97.41
65+	3	2.59	100.00
Total	116	100.00	

Notes. This table illustrates the distribution of the subjects across the age groups, by showing the frequency of observations in this age group, the percentage of the total, and the cumulative percentage. The total number of observations was 116.

3.4 Stimuli

Participation in the online survey took subjects on average 3-6 minutes and subjects were compensated for their time by partaking in a prize raffle. The raffle had the following design. All subjects had a 20% chance of winning one of the postcards that were used in the experiment. Out of the nine postcards that were used in the experiment, three postcards were selected to be rewarded to the subjects who won the raffle. To motivate subjects to answer the questions in line with their true preferences, the preferences of the second ranking tasks were used to determine the postcard that was potentially rewarded. Hence, out of the three selected postcards, the one that the subject ranked the highest in the second ranking task was chosen as the reward and was sent after communication via e-mail. Rewarding subjects with items on which they indicated their preferences creates a situation which is closer to a consumer choice setting, as this created tangible consequences in the experiment. Therefore, the experiment was more representative of a real-world situation. Moreover, this reward system was an affordable and efficient way of incentivizing subjects to exert sufficient mental effort into the three tasks.

Subjects were informed about this raffle and were told that they had a 20% chance of winning one of the postcards out of a selection of the nine postcards. To make sure that subjects indicated their true preferences in all three tasks and not merely in the second ranking task, subjects were informed that their preferences in one of the three tasks were used to determine the rewarded postcard. If subjects wanted to participate in the lottery, they could fill in their email address at the end of the experiment.

The following variables were tested. Firstly, the ranking spread was tested, which is measured by equation (1) in paragraph 2.7. To obtain this variable, the increase in the ranking of the chosen item was added to the decrease in the ranking of the unchosen item. Secondly, the ranking spreads between the four different treatment groups were compared. Thus, the ranking spreads of the group that received a choice reminder (CR) were compared with the ranking spreads of the group that did not receive a choice reminder (NR) and the ranking spreads of the group for which the fifth-ranking item was chosen (T5) were compared with the ranking spreads of the group for which the sixth-ranking item chosen (T6). Thirdly, the demographic variables age and gender were tested, as well as the duration of the survey for subjects. Fourthly, the variable that indicates the number of correctly remembered choices by the subject was tested.

3.5 Procedure

The procedure for subjects was as follows. The online survey was distributed via social media and the websites SurveySwap and SurveyCircle. Upon opening the survey, subjects were told that they were to participate in a survey for a master thesis, focussed on preferences and choices regarding nine postcards. Moreover, subjects were told that the survey consisted of multiple tasks and that their decisions in these tasks mattered. Subjects were also informed that they had a 20% chance of being rewarded with one postcard out of a selection of all the postcards and that their preferences in one of the three tasks were used to determine the reward. The exact information that subjects received is attached in Appendix 1.1. Before the three tasks started, subjects had to indicate if they were at least 18 years old and that they consented to the collection, use, and storage of their anonymous data for scientific purposes. Subjects were informed that their data was protected by the data protection laws. Furthermore, subjects were told that they could stop the survey at any time. They were also given contact information for any questions. See Appendix 1.1 for the details of the informed consent.

After agreeing to the informed consent and reading the survey information, subjects participated in the first ranking task, in which they had to rank the nine landscape postcards based on which they liked the most. Subjects were told to express their honest opinion, as there were no right or wrong answers. The first ranking task can be found in Appendix 1.2. In the choice task subjects were presented with two pairs of postcards and had to choose which postcards they liked the most. Subjects who were assigned to treatment T5 had to choose between their fifth and eighth-ranking postcards, as well as their sixth and third-ranking

postcards, while subjects that were assigned to treatment T6 had to choose between their sixth and ninth-ranking postcards, as well as their fifth and second-ranking postcard. The details of the choice task can be found in Appendix 1.3.

Ahead of the second ranking task, subjects were confronted with three filler questions and were informed that these questions were unrelated to the choice and ranking tasks, and that the questions would give the mind time to reset. The purpose of this filler task was to increase the time between the choice task and the choice reminder, so not all subjects would remember the choices they made, thereby increasing the potential effect of the choice reminder. The exact questions that were asked are shown in Appendix 1.4. As the second ranking task started, the subjects who were randomly assigned to receive a choice reminder were shown which postcards they chose in the previous task. The choice reminder can be found in Appendix 1.5. Subjects were told to once again rank the nine postcards based on which they like the most in the second ranking task. It was emphasised that this was not a memory task and that their preference at that exact moment mattered. See Appendix 1.6 for the second ranking task.

Thereafter, subjects were asked to indicate which postcards they chose in the choice task, to assess if they remembered their choice. Appendix 1.7 shows the exact question that was asked. In the last section of the survey, subjects were asked to indicate their age and gender, which can be found in Appendix 1.8. Finally, subjects were debriefed and could choose to submit their email addresses to participate in the prize raffle. In the debriefing, subjects were told that the aim of the study was to examine if the choices they made in the choice task affected their preferences in the ranking task, a concept known as choice-induced preference change. The exact debriefing is attached in Appendix 1.9.

3.6 Statistical Methods

Non-parametric tests were conducted to investigate the main hypotheses. Non-parametric tests were considered the most appropriate for this sample because the sample size was low and because non-parametric tests make fewer assumptions about the data than parametric tests (Corder & Foreman, 2014, p. 1-3). For example, parametric tests assume that the dependent variable is normally distributed. Appendix 2 illustrates that the ranking spread could be approximately normally distributed, but the Shapiro-Wilk test, that tests if the dataset is normally distributed, yielded statistically insignificant results ($W = 0.992$, $p = 0.723$). Therefore, non-parametric tests were a more reliable statistical method to examine the hypotheses.

The Wilcoxon Signed Rank test and the Mann-Whitney U tests were used to analyse the data. The three necessary assumptions to perform these tests are that both samples are randomly taken from the population, that there is independence inside and between the samples and that the data is at least ordinal (Dodge, 2008, p. 328 & 577). These assumptions are likely to hold because the data is ordinal, subjects were randomly assigned to the respective treatments, and it was, therefore, improbable that observations depend on each other.

To test the second hypothesis, that states that the ranking spread is positive across the whole sample as well as for the individual treatment groups, the Wilcoxon Signed Rank tests were performed. This is a non-parametric test for one sample with paired observations (Corder & Foreman, 2014, p. 39). The Wilcoxon Signed Rank test was the most appropriate test because the ranking spread is composed of the ranks of chosen and unchosen items before and after the choice task, thereby utilizing within-group variation.

In the first and the third hypothesis, the ranking spread is compared between the treatment groups. Since both hypotheses compare two independent groups and utilize between-group variation, a Mann-Whitney U test was performed in both cases. This is a non-parametric test for two independent samples (Corder & Foreman, 2014, p. 70). The first hypothesis assesses if the ranking spreads of subjects who received a choice reminder were higher than the ranking spreads of subjects who did not receive a choice reminder, and thus a one-sided Mann-Whitney U test was performed. The third hypothesis assesses if the ranking spreads for subjects who had the fifth-ranking item as chosen were different than ranking spreads for subjects who had the sixth-ranking item as chosen. Therefore, a two-sided Mann-Whitney U test was performed. Moreover, to test if the ranking spreads for chosen and unchosen items differed significantly, a Wilcoxon Signed Rank test was performed. This test was one-sided, as spreads for chosen items were expected to be higher than spreads for unchosen items. Additionally, a series of Mann-Whitney U tests were performed to assess if the four treatments have a different effect on ranking spreads of chosen and unchosen items.

Furthermore, a linear Ordinary Least Squares (OLS) regression was performed. This test assumes a linear relationship between the independent and the dependent variable, a normal distribution of the error term, and homoscedasticity, which means that the variance of the error term is constant (Greene, 2003, p. 10). There was no evidence to assume that a linear relationship between the ranking spread and the treatments, nor was there any evidence to assume a normal distribution of the error term or homoscedasticity. To account for the homoscedasticity assumption, robust standard errors were used. However, as the other

assumptions of this method did not hold, the results from the OLS were merely seen as indications and not as causal effects. In the regression, the ranking spread was the dependent variable, the treatments were the main independent variables, and age, gender, and the duration of participation were control variables.

Moreover, a robustness analysis was performed to examine if the use of imputed choices yielded similar results as the initial tests. In this analysis, the same non-parametric tests were conducted to test the hypotheses, but now subjects were treated as if the intended-to-be chosen item was always chosen and the intended-to-be unchosen item was always rejected, to eliminate selection bias. The 16 subjects who did not follow predetermined choices were thus included in the analysis.

Finally, the main hypotheses were tested using t-tests to examine if this statistical method yielded similar results as the non-parametric tests. T-tests assume a normal distribution of the data (Sheskin, 2011, p. 163 & 447). This normality assumption does not hold, as implicated by the statistically insignificant outcome of the Shapiro-Wilk test. Furthermore, the t-test for two independent samples assumes homogeneity of variance (Sheskin, 2011, p. 447), meaning that the variances of the underlying populations of the two samples are equal. To test this assumption, the variance ratio test was used. The two-sided variance ratio test rejected the null hypothesis that the variances of the ranking spread was equal for subjects who received a choice reminder and subjects who did not receive a choice reminder (with a p-value of 0.038). This null hypothesis was not rejected when comparing subjects for which the fifth-ranking item was chosen with subjects for which the sixth-ranking item was chosen (with a p-value of 0.467). Thus, the homogeneity assumption did not hold when comparing the ranking spreads of subjects with and without a choice reminder. Because the normality assumption did not hold and the homogeneity assumption did not hold when testing the first hypothesis, the reliability of the t-tests was compromised. Nonetheless, the t-tests could still be used as an indication of the robustness of the results from the non-parametric tests.

To test the first hypothesis, which states that the ranking spread is higher for subjects who received a choice reminder than for subjects who did not receive a choice reminder, the one-sided t-test for two independent samples was used. A one-sided one-sample t-test was used to test second hypothesis, that states that ranking spreads are positive across all samples. This test was also used to test if ranking spreads of chosen items were higher than ranking spreads of unchosen items. A two-sided t-test for two independent samples was used to examine the third hypothesis, which states that there is no difference between ranking spreads of subjects for

which the fifth-ranking item is chosen and subjects for which the sixth-ranking item is chosen.

4. Results

In this chapter, the results of the Implicit Choice Paradigm experiment are discussed, by examining descriptive statistics as well as the results of various tests for the three hypotheses. However, it was first assessed if the treatment groups were comparable. Table 4.1 shows how the 116 subjects were divided over the four treatments. In total, 58 people received the choice reminder and 58 subjects did not, while 57 subjects had the sixth-ranking item predetermined as chosen and 59 subjects had the sixth-ranking item predetermined as chosen. Thus, the number of subjects per treatment group was similar.

Table 4.1

Treatment distribution across the sample

Rank of the chosen item	No reminder (NR)	Reminder (CR)	Total
Sixth (T6)	30	27	57
Fifth (T5)	28	31	59
Total	58	58	116

Notes. This table illustrates the distribution of subjects across the two treatments and shows the total number of subjects who received a choice reminder (CR), that did not receive a choice reminder (NR), for which the fifth item was chosen (T5), for which the sixth item was chosen (T6), as well as the combined treatment groups. The total number of observations was 116.

Furthermore, Appendix 3 displays how subjects' age and gender were distributed across the treatments. Although there were some minor differences between the groups, the distribution of these demographic variables is mostly similar across the sample. This implies that the random assignment of subjects into the different treatment groups was successful. Hence, the treatment groups were comparable and consequently, any difference in ranking spreads could be attributed to the treatment variables.

4.1 Choice Reminders

The first and most important hypothesis of this experiment was that ranking spreads are higher for subjects who received a choice reminder than for subjects who did not receive a choice reminder. The descriptive statistics in Table 4.2 illustrate that average ranking spreads were indeed higher for subjects who received a choice reminder. This was in line with expectations because when individuals remember their choices accurately, it creates more discrepancy between their choice and their equal preferences on the alternatives. More cognitive dissonance thus leads to an increased ranking spread. Furthermore, there seemed to be more dispersion within ranking spreads of subjects who were exposed to a choice reminder, as indicated by the higher standard deviation for this group.

Table 4.2

Summary statistics of ranking spreads for subjects with and without choice reminder

Choice reminder	Obs.	Mean	Std.dev.	Min	Max
NR	58	0.414	1.633	-3	4
CR	58	0.897	2.158	-4	6
Total	116	0.655	1.921	-4	6

Notes. This table displays summary statistics of the ranking spreads, by the choice reminder treatment. Subjects were either presented with a choice reminder (CR) or were not presented with a choice reminder (NR). The total number of observations was 116.

A one-sided Mann-Whitney U test was performed to assess if the choice reminder significantly increased median ranking spreads. The null hypothesis for this test was that median ranking spread of subjects with choice reminders was equal to the median ranking spreads of subjects without choice reminders. This hypothesis could not be rejected at a 0.05 significance level ($z = -1.143$, $p = 0.126$). Hence, there was no evidence to accept the alternative hypothesis that subjects who were presented with a choice reminder had an increased median ranking spread compared to subjects who were not presented with a choice reminder. The choice reminder, therefore, did not evoke sufficient cognitive dissonance to significantly increase the median ranking spread.

An important indication of the impact of the choice reminder was the extent to which subjects were able to recall the choices they made in the choice task. Table 4.3 provides insight into this as it presents the number of choices that subjects correctly remembered out of the two choices. These results were not insightful for subjects who were presented with the choice reminder, as they were expected to remember their choices after receiving the choice reminder. However, the results for subjects that did not receive a choice reminder suggest that subjects already had a clear cognizance of their choices, as the average number of correct remembered choices is close to 2, which is the maximum score. Because subjects were randomly distributed over the treatments, the assumption can be made that the two groups (NR and CR) were similar. This implies that the choice reminder possibly did not help subjects remember which choices they made, but instead only served as a reminder of their choices, as subjects already knew which choices they made.

Table 4.3

Summary statistics of correct remembered choices with and without choice reminder

Choice reminder	Obs.	Mean	Std. dev.	Min	Max
NR	58	1.931	0.256	1	2
CR	58	1.983	0.131	1	2
Total	116	1.957	0.204	1	2

Notes. This table shows summary statistics of the number of correct remembered choices, by the choice reminder treatment. Subjects were either presented with a choice reminder (CR) or were not presented with a choice reminder (NR). The minimum possible score of correct remembered answers was 0 and the maximum possible score was 2. The total number of observations was 116.

4.2 Spreading of Alternatives

Subjects were expected to spread their alternatives in this experiment. The second hypothesis, therefore, stated that the ranking spreads are positive for the total sample (H2.1), the group that did not receive a choice reminder (H2.2), the group that did receive a choice reminder (H2.3), the group for which the sixth-ranking item was chosen (H2.4), and the group for which the fifth-ranking item was chosen (H2.5). Table 4.4 shows descriptive statistics of

the ranking spreads for the total sample and the different treatment groups.

There was variability in the ranking spreads, with a minimum ranking spread of -4 and a maximum of 6. The average ranking spread was positive, with a value of 0.655. In other words, the average increase in the ranking of the chosen item combined with the average decrease in the ranking of the unchosen item was 0.655. This spreading of alternatives was expected, as the choice task was set up to lead to a situation where subjects experienced cognitive dissonance. The four treatment groups all had a positive average ranking spread. This implies that there was spreading of alternatives for all treatment groups, on average. Furthermore, the average ranking spread was the highest for subjects who received a choice reminder and the subjects for which the sixth-ranking item was chosen. These treatment groups also had the highest standard deviation, indicating that there was more dispersion within the ranking spreads of these groups.

Table 4.4

Summary statistics of ranking spreads for the total sample and the treatment groups

Group	Obs.	Mean	Std. dev.	Min	Max
Total	116	0.655	1.921	-4	6
NR	58	0.414	1.633	-3	4
CR	58	0.897	2.158	-4	6
T6	57	0.772	2.018	-4	6
T5	59	0.542	1.832	-3	5

Notes. This table displays summary statistics of the ranking spreads for the total sample, the group that received a choice reminder (CR), the group that did not receive a choice reminder (NR), the group for which the fifth-ranking item was chosen (T5), and the group for which the sixth-ranking item was chosen (T6). The total number of observations was 116.

Table 4.5 illustrates descriptive statistics of the ranking spreads for the combined treatment groups. Because having the sixth-ranking item predetermined as chosen and receiving a choice reminder is associated with a higher average ranking spread (as indicated by the results in Table 4.4), it is not surprising that the subjects who received both these treatments (CRT6) had the highest average ranking spread, reaching 1. In contrast, subjects who did not receive a choice reminder and had the fifth item determined as chosen (NRT5) displayed a lower average

ranking spread of 0.25. Additionally, observations within the CRT6 group also display the highest standard deviation, which implies that there is a greater degree of dispersion within the ranking spreads of this group.

Table 4.5

Summary statistics of ranking spreads for the various combined treatment groups

Group	Obs.	Mean	Std. dev.	Min	Max
NRT6	30	0.567	1.569	-2	4
CRT6	27	1	2.434	-4	6
NRT5	28	0.25	1.713	-3	3
CRT5	31	0.806	1.922	-3	5
Total	116	0.655	1.921	-4	6

Notes. This table displays summary statistics of the ranking spreads, by the combined treatment groups. NR means the subject did not receive a choice reminder and CR means the subject did receive a choice reminder. T6 shows that the initial rank of the chosen item was the sixth and T5 shows that the initial rank of the chosen item was the fifth. The total number of observations was 116.

Table 4.4 demonstrated that average ranking spreads were positive for the total sample and the treatment groups. To test if the median ranking spreads were statistically significantly positive for the different groups, a series of Wilcoxon Signed Rank tests were conducted. This test uses rank-order data to examine if the median of the population is of a certain value (Sheskin, 2011, p. 245). The null hypothesis of this test was that the median ranking spread was 0, while the one-sided alternative hypothesis was that the median ranking spread was positive. The results of these tests are displayed in Table 4.6.

The Wilcoxon Signed Rank test produced a p-value smaller than the 0.05 significance level for the total sample and the different treatment groups. The p-values for the different treatment groups were all higher than the p-value for the total sample, which is not surprising, as splitting the sample up into groups leads to less power and less significance. The null hypothesis that the median ranking spread is 0 was rejected for all groups, as the p-values were smaller than 0.05. Consequently, the alternative hypothesis that the median ranking spread is positive was accepted. Hence, the Wilcoxon Signed Rank tests provided evidence that spreading of alternatives occurred for the total sample, the group that did not receive a choice reminder, the

group that did receive a choice reminder, the group for which the sixth-ranking item was determined as chosen, and the group for which the fifth-ranking item was determined as chosen. Hypothesis 2.1 to 2.5 were therefore accepted, suggesting that the experiment might have been successful in evoking cognitive dissonance by presenting the implicit choice pairs.

Table 4.6

Results of the Wilcoxon Signed Rank tests

Tested group	Obs.	Z-value	P-value	Hypothesis
Total sample	116	3.252	0.001***	H2.1
NR	58	1.767	0.039**	H2.2
CR	58	2.788	0.003***	H2.3
T6	57	2.231	0.013**	H2.4
T5	59	2.346	0.010**	H2.5

***p < 0.01; **p < 0.05; *p < 0.1.

Notes. This table shows the results of the Wilcoxon Signed Rank tests for the total sample, the group that did not receive a choice reminder (NR), the group that did receive a choice reminder (CR), the group for which the sixth-ranking item was chosen (T6), and the group for which the fifth-ranking item was chosen (T5). These robustness tests use imputed choices. The total number of observations was 116.

4.3 Initial rank of the Chosen Item

The initial rank of the chosen item and the unchosen item were randomized in this experiment. Either the item that the subject ranked fifth (T5) or sixth (T6) in the first ranking task was intended-to-be chosen and subsequently paired up against a lower-ranking item. To examine if these treatments influenced ranking spreads, the third hypothesis of this thesis states that ranking spreads of subjects for which the sixth-ranking item was predetermined as chosen are equal to the ranking spreads of subjects for which the fifth-ranking item was predetermined as chosen.

Table 4.7 displays the ranking spreads split by which item was predetermined as chosen. The descriptive statistics illustrate that the average ranking spread of subjects for whom the sixth-ranking item was predetermined to be chosen was higher than the average ranking spread of subjects for whom the fifth-ranking item was predetermined to be chosen (0.772 vs. 0.542).

A plausible explanation for this is that choosing the postcard that initially ranked sixth and rejecting the postcard that initially ranked fifth is more contradicting than choosing the postcard that initially ranked fifth and rejecting the postcard that initially ranked sixth because choosing the intended-to-be chosen item is now less in line with the initial preferences of the subject. This evokes additional cognitive dissonance and increases the spreading of alternatives.

Table 4.7

Summary statistics of ranking spreads for subjects with the fifth- and the sixth-ranking item predetermined as chosen

Rank chosen item	Obs.	Mean	Std. dev.	Min	Max
T6	57	0.772	2.018	-4	6
T5	59	0.542	1.832	-3	5
Total	116	0.655	1.921	-4	6

Notes. This table displays summary statistics of the ranking spreads, by the initial rank of the chosen item. This is either the sixth-ranking item (T6) or the fifth-ranking item (T5). The total number of observations was 116.

To test if ranking spreads were statistically significantly different for the treatment groups T5 and T6, a two-sided Mann-Whitney U test was performed. The Mann-Whitney U test uses data in rank-order format to examine if two populations are similar, by comparing the population medians (Sheskin, 2011, p. 531). The null hypothesis was that the median ranking spread of subjects with the fifth-ranking item predetermined as chosen is equal to the median ranking spread of subjects with the sixth-ranking item predetermined as chosen. The results from the Mann-Whitney U test did not provide evidence to reject this null hypothesis, as the p-value was larger than the significance level of 0.05 ($z = 0.068$, $p = 0.945$). Thus, there was no evidence to support the alternative hypothesis that the median ranking spreads from T5 and T6 differ significantly. Although rejecting the fifth-ranking postcard might be more contradicting than rejecting the sixth-ranking postcard for subjects, this did not have a significant effect on the ranking spread.

4.4 Chosen and Unchosen Items

Ranking spreads consist of the increase in ranking for the chosen item and the decrease in ranking for the unchosen item. Table 4.8 displays the ranking spreads for chosen and unchosen items in this experiment. Notable is that the average ranking spread for chosen items was much higher than the average ranking spread for unchosen items (0.560 vs. 0.095). This could imply that in a situation where preferences on two alternatives are similar, having to choose an item leads to more cognitive dissonance than having to reject an item. Therefore, the increase in the ranking of the chosen item is larger than the decrease in the ranking of the unchosen item, on average.

Table 4.8

Summary statistics of ranking spreads for chosen and unchosen items

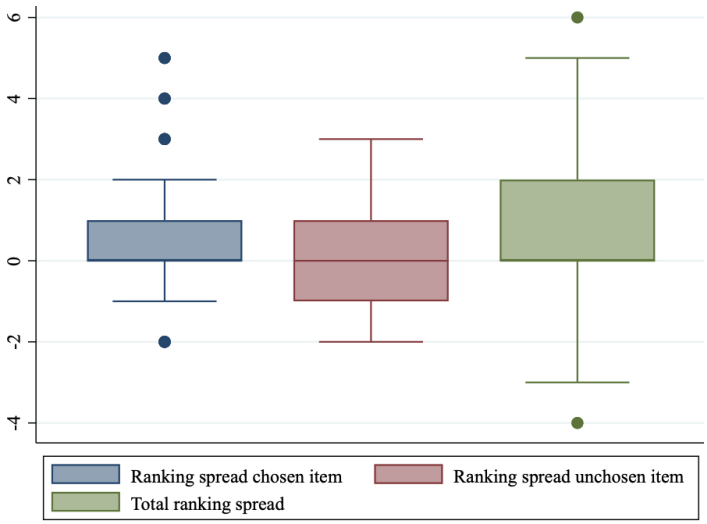
Variable	Obs.	Mean	Std. dev.	Min	Max
Total spread	116	0.655	1.921	-4	6
Spread unchosen	116	0.095	1.172	-2	3
Spread chosen	116	0.560	1.321	-2	5

Notes. In this table, summary statistics are displayed for the total ranking spread, the ranking spread of unchosen items, and the ranking spread of chosen items. The total number of observations was 116.

The boxplot in Figure 4.1 suggests that the lower ranking spread for unchosen items can be explained by the finding that there were more negative ranking spreads for unchosen items than for chosen items. In other words, the figure suggests that unchosen items were frequently ranked higher after the choice task, while chosen items were less frequently ranked lower after the choice task.

Figure 4.1

Boxplot of the ranking spread, by chosen and unchosen items



Notes. This figure shows three boxplots of ranking spreads and illustrates the medians, the interquartile range, the range of the data, and the outliers. The left boxplot displays the ranking spread of chosen items, the middle boxplot displays the ranking spread of unchosen items, and the right boxplot displays the total ranking spread.

Initially, there were no hypotheses formulated regarding the difference in ranking spreads for chosen and unchosen items. However, as the descriptive statistics implied that the average spread for chosen items was higher than for unchosen items, a non-parametric test was conducted to examine if this was a statistically significant effect. A one-sided Wilcoxon Signed Rank test was performed to test the null hypothesis that the median spread for unchosen items is equal to the median spread for chosen items. The p-value of this test was much smaller than the 0.05 significance level ($z = -3.295$, $p < 0.001$), and therefore the null hypothesis could be rejected. Consequently, the test provided evidence to accept the alternative hypothesis that median ranking spreads were higher for chosen items than for unchosen items. Having to choose the chosen item likely yields more cognitive dissonance than having to reject the unchosen item.

A possible explanation for this finding could be that the choice reminder had a stronger effect on chosen items than on unchosen items. To test if the effect of the choice reminder was different for chosen items and unchosen items, two one-sided Mann-Whitney U tests were performed, one for the chosen items and one for the unchosen items. The null hypothesis of

both tests was that the median ranking spread of subjects who were presented with a choice reminder was equal to the median ranking spread of subjects who were not presented with a choice reminder. The tests were not statistically significant at a 0.05 significance level, for the chosen items ($z = -0.942$, $p = 0.173$), as well as for the unchosen items ($z = -1.121$, $p = 0.131$). Therefore, the alternative hypothesis that the median ranking spread was larger for subjects who received a choice reminder than for subjects who did not receive a choice reminder had to be rejected. Thus, there was also no evidence to support the hypothesis that the effect of the choice reminder was different for chosen and unchosen items.

The initial rank of the chosen item could also be the driver of the difference in median ranking spreads of chosen and unchosen items. Therefore, two one-sided Mann-Whitney U tests were performed, one for the chosen items and one for the unchosen items. The null hypothesis of both tests was that the median ranking spread of subjects for whom the sixth-ranking item was chosen was equal to the median ranking spread of subjects for whom the sixth-ranking item was chosen. As average ranking spreads were higher for subjects with the sixth-ranking item as chosen, the alternative hypothesis was that the median ranking spread was larger for subjects in treatment T6 than for subjects in treatment T5. Again, the p-values of both tests were higher than the 0.05 significance level (with $z = 1.529$, $p = 0.063$ for chosen items and $z = -0.379$, $p = 0.352$ for unchosen items). Thus, the alternative hypothesis that the median ranking spread for subjects in treatment T6 was larger than for subjects in treatment T5 had to be rejected for both chosen and unchosen items. Hence, there was also no evidence that the effect of having the sixth-ranking item vs the fifth-ranking item predetermined as chosen was different for chosen and unchosen items.

Therefore, the two treatment variables cannot explain the difference between the ranking spreads of chosen and unchosen items. The most plausible explanation for the difference thus remains that having to choose the chosen item evokes more cognitive dissonance than having to reject the unchosen item.

4.5 Linear Regression

To examine the effect of being in one of the combined treatment groups on the ranking spread, as well as the effects of other variables, the following linear equation was developed:

$$Spread = B0 + B1Age + B2Male + B3CRT6 + B4NRT5 + B5CRT5 + B6Duration \quad (2)$$

This equation was tested using the OLS method with robust standard errors. As explained in paragraph 3.5, the assumptions of this test do not hold. The results were therefore treated as indications of possible effects. The regression tested the effect on the ranking spread of being in one of the combined treatment groups compared to being in the group that receives no choice reminder and has the sixth-ranking item predetermined as chosen (NRT6). Table 4.9 shows the results of the regression. The results were in line with those of the non-parametric tests, as they indicate that there is no statistically significant effect of being in one of the combined treatment groups. Merely the duration of the survey in seconds had a p-value that is lower than 0.05. Therefore, the regression implied that the ranking spread was higher for subjects who had a longer participation time in the survey. An explanation for this finding could be that subjects who participate in the survey for a long time are mentally more invested in the experiment and care more about their choices. Hence, the choice task could evoke more cognitive dissonance for these subjects. However, the coefficient for the duration was very small. Hence, the linear regression did not provide evidence for any effect that is both significant and substantial.

Table 4.9

Results of the linear regression of the ranking spread

Variable	Coefficient (95% CI)	Std. Err.	P-value
Male	0.020 (-0.710, 0.750)	0.368	0.957
Age	0.017 (-0.021, 0.055)	0.019	0.388
CRT6	0.401 (-0.705, 1.507)	0.558	0.474
NRT5	-0.410 (-1.291, 0.471)	0.445	0.359
CRT5	0.153 (-0.720, 1.027)	0.441	0.729
Duration	0.000 (0.000, 0.000)	0.000	0.006***
Constant	0.111 (-1.017, 1.239)	0.569	0.846

***p < 0.01; **p < 0.05; *p < 0.1.

Notes. In this table, the results of the linear regression on the ranking spread are presented. The coefficient shows the effect of the variable on the ranking spread. NR means the subject did not receive a choice reminder and CR means the subject did receive a choice reminder. T6 shows that the initial rank of the chosen item was the sixth and T5 shows that the initial rank of the chosen item was the fifth. The variables 'CRT6', 'NRT5', and 'CRT5' show the effect of being in one of these combined treatment groups compared to being in the treatment group NRT6. The variable 'Male' indicates if the subject was male, and 'Age' is the numeric variable of the age of the subject. Finally, 'Duration' indicates how many seconds the participation in the survey lasted.

4.6 Imputed Choices

Subjects who did not follow predetermined choices were excluded from the analysis in this experiment. However, to eliminate the selection bias that follows from this exclusion, a robustness check was conducted using imputed choices. In this robustness test, subjects were treated as if the intended-to-be chosen item was always chosen and the intended-to-be unchosen item was always rejected. The same non-parametric tests were conducted to see if the findings still hold when imputed choices are used. The 24 subjects who did not follow predetermined choices were added to the sample, resulting in a total sample of 140 subjects.

The use of imputed choices did not lead to different results for the first hypothesis, which states that the median ranking spread is higher for subjects that received a choice reminder than for subjects who did not. The results of the Mann-Whitney U test did not provide evidence to reject the null hypothesis that median ranking spreads with and without choice reminder differed significantly at a 0.05 significance level ($z = -0.453$, $p = 0.325$). Thus, the alternative hypothesis that the median ranking spread was higher for subjects who received a choice reminder could not be accepted. This is in line with earlier results.

The robustness test did produce different results for the second hypothesis, which states that the median ranking spread is positive for the total sample as well as for the different treatment groups. Table 4.10 shows the results of the Wilcoxon Signed Rank test for each group. The null hypothesis that the median ranking spread is 0 could only be rejected for the ranking spread of the total sample at a 0.05 significance level. Consequently, the alternative hypothesis that the median ranking spread was positive could only be accepted for the total sample, while the initial Wilcoxon Signed Rank tests demonstrated a positive median ranking spread for every treatment group. However, the results are all in the positive direction and some are marginally significant. Thus, the insignificant results could also be due to a lack of power. Moreover, these results were in accordance with expectations, as the inclusion of subjects that did not follow predetermined choices logically leads to lower ranking spreads

The third hypothesis states that the median ranking spread of subjects for which the fifth-ranking item was chosen is equal to the median ranking spread of subjects for which the sixth-ranking item was chosen. The Mann-Whitney U test using imputed choices did not lead to different results for this hypothesis, as the null hypothesis that the medians are equal could not be rejected at a 0.05 significance level ($z = 0.570$, $p = 0.569$). Thus, there was no evidence to support the alternative hypothesis that the treatments led to different median ranking spreads.

Furthermore, The Wilcoxon Signed Rank test with imputed choices again demonstrated that the median ranking spread was higher for chosen than for unchosen items ($z = -3.301$, $p < 0.001$). The null hypothesis that the medians of chosen and unchosen items are equal could be rejected in favour of the one-sided alternative hypothesis that the median ranking spread of chosen items is higher, at a 0.05 significance level.

Thus, the robustness test yielded similar findings for the first and third hypotheses, as well as for the ranking spread of the total sample (H2.1) and for the difference between chosen and unchosen items. However, the findings of positive median ranking spreads for the different treatment groups (H2.2 to H2.5) were not robust to the use of imputed choices. Hence, these results must be interpreted with caution, as they are not truly reliable.

Table 4.10

Results of the Wilcoxon Signed Rank tests with imputed choices

Tested group	Obs.	Z-value	P-value	Hypothesis
Total sample	140	1.754	0.040**	H2.1
NR	69	1.112	0.133	H2.2
CR	71	1.414	0.079*	H2.3
T6	70	1.627	0.052*	H2.4
T5	70	0.831	0.203	H2.5

***p < 0.01; **p < 0.05; *p < 0.1.

Notes. This table shows the results of the Wilcoxon Signed Rank tests for the total sample, the group that did not receive a choice reminder (NR), the group that did receive a choice reminder (CR), the group for which the sixth-ranking item was chosen (T6), and the group for which the fifth-ranking item was chosen (T5). These robustness tests use imputed choices. The total number of observations was 116.

4.7 T-tests

Finally, a series of t-tests were performed to examine if the results from this parametric statistical method were similar to the results of the non-parametric tests. This shows the robustness of the findings. Because the assumptions of the one-sample t-test and the two-sample t-test presumably do not hold, as explained in paragraph 3.6, the reliability of the results was limited. The results of the t-tests were therefore merely used to assess the robustness of the

findings of the non-parametric tests.

The t-tests led to similar results as the non-parametric tests. The average ranking spread for subjects who received a choice reminder was not statistically significantly higher than for subjects who did not receive a choice reminder, at a 0.05 significance level. Moreover, the average ranking spread was positive for the total sample, as well as for the different treatment groups, at a 0.05 significance level. Furthermore, the t-test did not provide evidence that average ranking spreads were different for subjects for whom the fifth-ranking item was chosen versus subjects for which the sixth-item ranking was chosen. Finally, the t-test demonstrated that average ranking spreads were higher for chosen items than for unchosen items. Hence, the results of the t-tests indicate that the findings of this experiment are robust to the use of a different statistical method. A more extensive presentation and discussion of the various t-tests can be found in Appendix 4.

5. Discussion

In this incentivized Implicit Choice Paradigm experiment, choice-induced preference change was measured by letting subjects rank and choose between nine postcards. The aim of the experiment was to examine the effect of choice reminders on the ranking spread, while also randomizing the rank of the item that was predetermined as chosen. This discussion examines the implications of the experiment, by looking at the main findings, the limitations of the experiment and suggestions for further research.

5.1 Findings of the Experiment

The choice reminder and the treatment that randomized the initial rank of the chosen item did not have significant effects on median ranking spreads in this experiment. The experiment did provide evidence that the median ranking spread was positive for all groups and that the median ranking spread for chosen items was significantly larger than for unchosen items. However, a robustness test demonstrated that the finding that spreads were positive for the different treatment groups was not robust to the use of imputed choices. In this paragraph, each finding is related to the existing literature, and possible discrepancies are explained further.

The main finding of this thesis was that the choice reminder did not increase the median ranking spread, as demonstrated by the Mann-Whitney U test. Although the average ranking

spread of subjects who were presented with a choice reminder was substantially higher than the average ranking spread of subjects who were not, this was not a statistically significant effect. This is neither in line with the first hypothesis nor with the existing literature, as the findings of Salti et al. (2014) and Huang et al. (2022) suggest that choice reminders increase choice-induced preference change. Therefore, it is possible that the effect of a choice reminder on choice-induced preference change is non-existent or weaker than the literature suggests. Another explanation could be that the incentives in this experiment decreased the effect of the choice reminder on choice-induced preference change. Alós-Ferrer & Granic (2018) concluded that choice-induced preference change is less strong in more economic domains. As this experiment was incentivized, it was more in an economic domain than the experiments of Salti et al. (2014) and Huang et al. (2022), which did find positive effects of the choice reminder. However, the discrepancy with the existing findings can also be explained by two other reasons.

The first reason is that subjects who did not receive a choice reminder remembered their choices almost perfectly. As it can be assumed that the treatment groups had similar characteristics, this suggests that the same applies to subjects who did receive a choice reminder. Thus, subjects already had a perfect remembrance of their choices before they were presented with the choice reminder. Thus, the time between the choice task and the reminder was presumably too small for the choice reminder to have a significant effect. The second reason has to do with the nature of the items used in the tasks, as well as the stakes of the experiment. Subjects presumably have weak preferences for postcards, as these are not items that they are familiar with or have an existing affection towards. Moreover, the 20% chance of winning a postcard only provided a small incentive for subjects to really care about the choices they made. Consequently, the choice task evoked diminished cognitive dissonance because subjects were not that concerned about the choices between the postcards in the experiment. Therefore, the ability for the choice reminder to evoke cognitive dissonance was weakened as the highlighted choices created less discrepancy with the equal preferences on the alternatives.

Another conclusion that can be taken from the insignificant effect of the choice reminder is that there was no significant experimenter-demand effect in this experiment. This effect refers to “changes in behaviour by experimental subjects due to cues about what constitutes appropriate behaviour” (Zizzo, 2010, p. 75). In this context, subjects were presented with a choice they made which they already remembered well. This could have induced subjects to think that they needed to use this information in the ranking task and thus this could have led to an increase in the ranking spread of the chosen items. However, the choice reminder did not

increase ranking spreads significantly, which means that the experimenter-demand effect was at least limited.

This thesis contributes to the evidence for choice-induced preference change. The results from a series of Wilcoxon Signed Rank tests demonstrated that the median ranking spread of the total sample, as well as of the treatment groups, was significantly larger than 0 and that the second hypothesis can be accepted. However, a robustness test using imputed choices solely found evidence for a positive median ranking spread for the total sample. The findings that the four different treatment groups (CR, NR, T5 and T6) have a positive median spread, possibly contained a selection bias, as these findings only hold when subjects who did not follow predetermined choices are excluded. These results should thus be interpreted with caution. Yet, this could also be a power issue, as the results of the tests for the treatment groups were all in the positive direction and some of the results were marginally significant.

Either the fifth-ranking or the sixth-ranking item was predetermined as chosen and subsequently paired against a lower-ranking item. Although average ranking spreads were higher for subjects with the sixth-ranking item as chosen, the results of the Mann-Whitney U test implied that there was no significant difference in the median ranking spreads for the two groups. This is in line with the third hypothesis. Theoretically, choosing the sixth-ranking postcard and rejecting the fifth-ranking postcard is more contradicting than vice versa, resulting in more cognitive dissonance and an increased median ranking spread. However, as preferences on postcards in an online experiment are likely weak, the difference in preference between the fifth- and the sixth-ranking item for subjects was presumably not large enough to evoke a difference in cognitive dissonance and subsequently in median ranking spreads. Therefore, this finding is in line with the theory.

The ranking spread consists of the spread for chosen and unchosen items. Interestingly, the Wilcoxon Signed Rank test demonstrated that the median ranking spread for chosen items was significantly higher than for unchosen items. The choice reminder and the treatment of the initial rank of the chosen item did not have significantly different effects on the chosen and the unchosen items. Hence, the difference in the ranking spreads of chosen and unchosen items could not be explained by these variables. The plausible interpretation is, therefore, that when preferences on two alternatives are equal, the act of choosing an item is more contradicting than rejecting an item, resulting in an increased spreading of alternatives for chosen items. Izuma and Murayama (2013, p. 4) found that when subjects make choices between unattractive items, the spread of alternatives is mostly driven by the chosen items. As the authors explain,

this follows from the cognitive dissonance theory, because choosing an unattractive item or rejecting an attractive item evokes more cognitive dissonance than choosing an attractive item or rejecting an unattractive item. It is presumable that the postcards were relatively unattractive for subjects because preferences on these items are probably weak. Therefore, the increased cognitive dissonance for chosen items can be seen as a logical consequence of the cognitive dissonance theory.

5.2 Limitations of the Experiment

This experiment had several limitations that might have influenced the results. The first and most important limitation is that the choice reminder did not help subjects remember their choices. Subjects had an almost perfect memory of the choices they made in the choice task, as displayed in Table 4.3. Thus, the choice reminder did not have the effect of helping subjects remember their choices. Instead, it only reminded them of something they already knew. This was likely due to the small space between the choice task and the choice reminder. Due to this limitation, the experiment probably did not succeed in measuring the effect of a choice reminder on choice-induced preference change.

The second limitation of this experiment was that preferences on items like postcards are likely weak. Although the use of postcards enabled every subject to form and express an opinion on the items, subjects probably also had relatively low familiarity and affection with postcards, making it harder to evoke cognitive dissonance. An item on which preferences are stronger (like daily consumables) could have been more successful in evoking cognitive dissonance and could therefore be more useful in assessing the potential effect of a choice reminder on choice-induced preference change. Yet, stronger preferences also tend to be stickier, making it harder to change these preferences by eliciting cognitive dissonance. Preferences on the items used in the experiment should therefore also not be too strong.

The third limitation of this research is that incentives were low for subjects. Even though subjects had a 20% chance of winning one of the postcards used for this experiment, this probably only provided a small incentive for subjects to exert sufficient mental effort into the survey and provide their serious preferences. To illustrate, the median duration of participation was approximately 4.5 minutes, which is just sufficient to complete in the survey. There were also many subjects who finished the survey a lot quicker. Furthermore, there were six subjects who left the ranking tasks completely unchanged. Although these subjects were removed from the sample, this still indicates that not all subjects filled in the survey seriously. This problem

was partly due to the use of external websites such as SurveySwap and SurveyCircle to recruit subjects, as these platforms incentivize students to rapidly fill in many surveys in a short time. As incentivizes were low, not all subjects exerted sufficient mental effort into the survey, and therefore the indicated preferences did not always reflect the true preferences of the subjects. This weakens the representativeness of the findings of this study.

The final limitation of this experiment is the low sample size. The survey had 146 subjects in total. However, after excluding the subjects who did not fill in the survey seriously and the subjects who did not follow predetermined choices, the number of observations was 116. This is smaller than the optimal sample size of 120 that followed from the power calculations. Furthermore, the optimal sample size for the analysis of the different treatment groups was 60 per group, whereas the actual number of subjects for the treatment groups ranged from 57 to 59 subjects. A larger sample size could have reduced the impact of random variability across the sample and could have increased the power of the performed tests. It is thus conceivable that the test could have found a significant effect of choice reminders on ranking spreads if the sample size was larger.

5.3 Suggestions for Further Research

In this master thesis, no significant effect of choice reminders on ranking spreads was found, partly due to the limitations of this study. Further research on this topic remains relevant, as the current evidence on the effect of choice reminders on choice-induced preference change is still thin, while the possible existence of this effect could have relevant academic and economic implications. There are five suggestions to improve the experimental design for further research.

First, because preferences on postcards are presumably weak, it would be better to choose an item for which subjects have more familiarity and affection. For example, products that are consumed daily (like snacks or fruits), could be more successful in evoking cognitive dissonance in an Implicit Choice Paradigm design. This would help expose the potential effect of choice reminders on choice-induced preference change. However, as strong preferences also tend to be stickier, preferences on the items used in the experiment should also not be too strong.

Second, the experimental design could be improved by increasing the time between the choice task and the choice reminder, for example through an extended filler task. As almost all

subjects in this design already remembered the choices they made before the choice reminder intervention, this would increase the potential effect that the choice reminder has on the remembrance of choices. Subsequently, the choice reminder could be more successful in evoking cognitive dissonance.

Third, increasing the incentives for subjects to exert sufficient mental effort in the experiment would help to make sure that true preferences are measured. Thereby, less serious and arbitrary observations can be avoided. For this suggestion, it is important that there are enough resources for the experiment, as a thesis research naturally has limited resources.

Fourth, the sample size of the study should be increased to have enough power to perform the necessary tests. This would make it easier to find a possible significant effect of choice reminders on choice-induced preference change. This suggestion can also be resolved with increased resources.

Finally, to deepen the understanding of the impact of choice reminders on choice-induced preference change, it would be relevant to examine the effect of choice reminders in a consumer choice setting. After all, this are also the circumstances where choice reminders could be of potential use. The experimental design could be adjusted to a consumer choice setting by for example changing the incentives of the experiment or by conducting a framed field experiment.

6. Conclusion

The aim of this thesis was to explore the effect of choice reminders on spreading of alternatives, while also replicating the results of an improved experimental design with regard to choice-induced preference change. In an incentivized Implicit Choice Paradigm experiment, subjects indicated their preferences on nine postcards. Half of the subjects were presented with a choice reminder. As expected, the median ranking spreads were positive across the sample and the different treatment groups, although the results for the different treatment groups were not robust to the use of imputed choices. Moreover, despite the expectations based on two recent papers, the choice reminder did not significantly increase the median ranking spread. Hence, the answer to the research question, “Does reminding subjects of their choices increase the choice-induced preference change in an incentivized Implicit Choice Paradigm experiment?” is that the findings of this experiment did not provide evidence to support the claim that a choice reminder increases choice-induced preference change.

These results could mean that the effect of a choice reminder on choice-induced preference change is not significant or at least smaller than suggested by the literature. Yet, this discrepancy with the literature can also be attributed to the limitations of this study. As subjects had an almost perfect memory of the choices they made before the choice reminder, the potential effect of the choice reminder was limited. Furthermore, because of the low incentives and because preferences for postcards are probably weak, subjects had a diminished concern for the choices they made in the experiment. Therefore, the choice reminder could not evoke sufficient cognitive dissonance to result in a statistically significant increase of ranking spreads. Furthermore, the low sample size of this study decreased the power of the tests, making it more difficult to find significant effects.

Notwithstanding the limitations of the study, several key insights can be derived from this Implicit Choice Paradigm experiment. Firstly, as the median ranking spread for the sample was positive, the experiment contributed to the existing evidence for choice-induced preference change among improved experimental designs like the Implicit Choice Paradigm. Secondly, the median ranking spread for chosen items was significantly larger than for unchosen items. This finding is a confirmation of the cognitive dissonance theory if the assumption is made that the postcards were relatively unattractive to the subjects because choosing an unattractive item evokes more cognitive dissonance than choosing an attractive item. This assumption is presumable, as preferences on postcards are likely weak. Thus, this study also supports the theory that subjects experience cognitive dissonance in an experiment like the Implicit Choice Paradigm. Thirdly, this study provides several improvements for further research on choice reminders. As most subjects already knew which choices they made, the time between the choice task and the choice reminder needs to be increased, so the potential effect of a choice reminder is larger. Furthermore, higher incentives could make the experiment more realistic, and increase the potential to evoke cognitive dissonance. Finally, changing the items of interest and making the conditions of the experiment more like a consumer-choice setting would make the experience more realistic for subjects, and would lead to a better comprehension of the effect of choice reminders.

Through the approach of revealed preferences, economists utilize choice data to predict consumer preferences and conduct economic analysis. A fundamental assumption of the revealed preferences theory is that preferences are stable. Yet, in the past decades, psychologists have studied a phenomenon that is at odds with this assumption: choice-induced preference change. Although the method that was used to demonstrate this effect has been

criticised, choice-induced preference change has also been illustrated in improved experimental designs. The results from this thesis contributed to the evidence of this phenomenon, although not all results were robust. Recent studies suggest that choice reminders could evoke extra cognitive dissonance and thus increase choice-induced preference change. However, the results of this thesis did not provide evidence for this effect, partly due to the limitations of this experiment. Hence, further research remains necessary to deepen the understanding of the effect of choice reminders on choice-induced preference change.

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8. Appendix

A1 The Survey

A1.1 Briefing and Informed Consent

Thank you for helping me by participating in my thesis survey!

This is my thesis survey for the master Behavioural Economics at the Erasmus University Rotterdam. The aim of the survey is to look at your preferences and choices regarding nine postcards. Participation takes about 5 minutes.

By checking the box below you explicitly give me consent that

1. You are 18 years or older;

2. Your anonymous, non-sensitive personal data is collected and used for scientific purposes;

3. Your data will only be presented on group level and cannot be linked back to you;

4. Your data will be stored anonymously using password protection for a period up to 5 years after publication.

You can stop the survey at any time without consequences. Your data will be protected according to the data regulation laws.

For questions, you can contact me (Thomas Bodlaender) at 504753tb@eur.nl.

P.S.: This survey contains credits to get free survey responses at SurveySwap.io and SurveyCircle.

I understand and agree

Explanation and potential reward

You will perform three tasks in which you rank and choose between nine postcards, in addition to some simple questions. Your decisions in the three tasks matter, and it is important that you answer the questions honestly.

You have a 20% chance of being rewarded with one postcard out of a selection of the 9 postcards. Your preference in one of the three tasks will be used to determine which postcard is used as your potential reward.

A1.2 First Ranking Task

First ranking

Please rank the following nine postcards based on your preferences, with (1) being the postcard you like the most and (9) the postcard you like the least.

There are no right or wrong answers in this task. I simply want you to think about the postcards and to express your honest opinion about them.

1 

2 

3 

4 

5 

6 

7 

8 

9 

A1.3 Choice Task

Choices

Below you see two of the nine postcards. Please choose which one you like better.

Choices

Below you see two of the nine postcards. Please choose which one you like better again.

A1.4 Filler Task

A few fun questions

Now, we move over to some questions that are unrelated to the ranking and choice task. These questions will provide some variety in the survey and give your mind a time to reset. Please answer the questions thoughtfully and honestly.

If you were running a race and passed the person in second place, what place would you then be in?

Please fill in the missing number in this number sequence: 1 - 3 - 5 - 7 - ... - 11

A farmer has 17 sheep, and all but 9 die. How many sheep are left?

A1.5 Choice Reminder

Second ranking

In the previous round you have chosen these postcards:

A1.6 Second Ranking Task

Please rank the following nine postcards based on your preferences, with (1) being the postcard you like the most and (9) the postcard you like the least. There are no right or wrong answers in this task. I simply want you to think about the postcards and to express your honest opinion about them.

This is not a memory test. I truly care about how you feel about the postcards right now.

1 

2 

3 

4 

5 

6 

7 

8 

9 

A1.7 Remembering Choices

Remembering choices

Earlier, I asked you to choose between two of the nine postcards twice. Below you see the postcards that were presented to you. Do you remember which postcard you chose?

Don't know which I chose

Do you remember which postcard you chose?

Don't know which I chose

A1.8 Demographic Questions

Demographics

Finally, I want to ask you to answer the following demographic questions. What is your age?

What is your gender?

Prefer not to say

Non-binary / third gender

Female

Male

A1.9 Debriefing

Debriefing and reward

Thank you very much for participating in my survey. The aim of the survey was to see if the choices you made in the choice task affected your preferences in the ranking task, a concept known as 'Choice-Induced Preference Change.'

Please fill in your email address if you want to make a chance to receive one of the postcards as a reward. Your email address will be treated anonymously and confidentially.

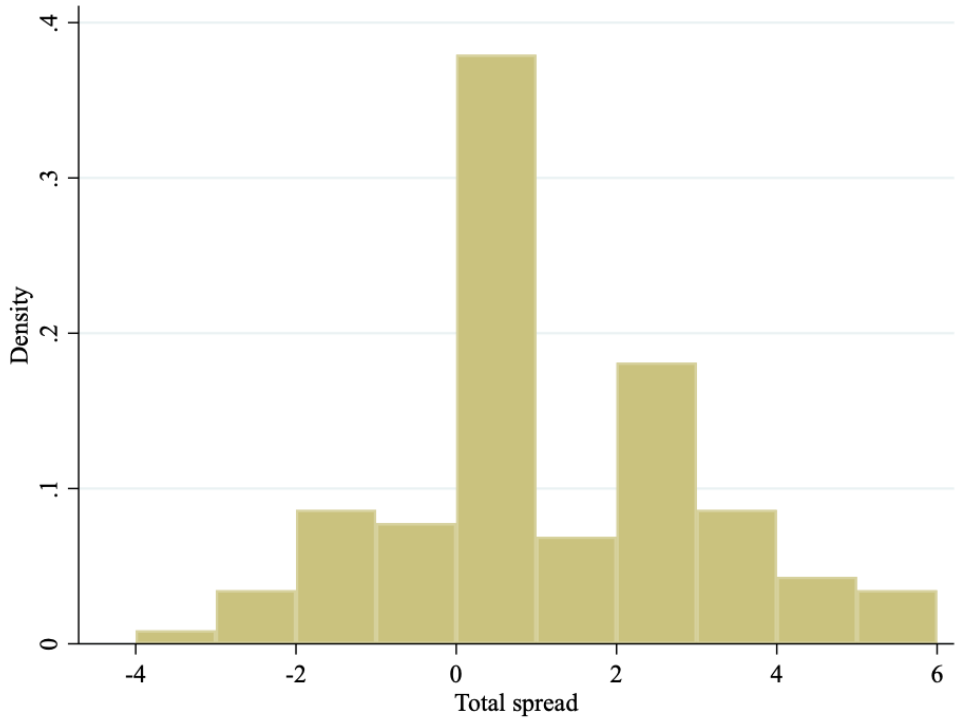
For SurveyCircle users (www.surveycircle.com): The Survey Code is: SG1M-7472-RB9S-JBS4

For SurveySwap users: https://surveyswap.io/sr/4NTP-EHM5-96CI Or, alternatively, enter the code manually: 4NTP-EHM5-96CI

A2 Distribution of the Ranking Spread

Figure 8.1

Distribution of the ranking spread



Notes. In this graph, the distribution of the ranking spread is shown. The x-axis indicates the level of the ranking spread, while the y-axis indicates the density of the different levels.

A3 Distribution of Demographic Variables Across Treatments

Table 8.1

Age group distribution with and without choice reminder

Age group	No reminder (NR)	With reminder (CR)	Total
18-25	45	41	86
	77.59%	70.69%	74.14%
25-44	6	13	19
	10.34%	22.41%	16.38%
45-60	5	3	8
	8.62%	5.17%	6.90%
65+	2	1	3
	3.45%	1.72%	2.59%
Total	58	58	116
	100.00%	100.00%	100.00%

Notes. This table illustrates the distribution of subjects across the different age groups, by the choice reminder treatment. Subjects were either presented with a choice reminder (CR) or were not presented with a choice reminder (NR). The table presents the number of observations per age group, as well as the percentage of the total observations per age group, for both treatment groups. The total number of observations was 116.

Table 8.2

Age group distribution for the initial rank of the chosen item

Age group	Sixth chosen (T6)	Fifth chosen (T5)	Total
18-25	43	43	86
	75.44%	72.88%	74.14%
25-44	8	11	19
	14.04%	18.64%	16.38%
45-60	5	3	8
	8.77%	5.08%	6.90%
65+	1	2	3
	1.75%	3.39%	2.59%
Total	57	59	116
	100.00%	100.00%	100.00%

Notes. This table illustrates the distribution of subjects across the different age groups, by the treatment of the initial rank of the chosen item. Either the fifth-ranking item (T5) or the sixth-ranking item (T6) was selected as chosen. The table presents the number of observations per age group, as well as the percentage of the total observations per age group, for both treatment groups. The total number of observations was 116.

Table 8.3

Gender distribution with and without choice reminder

Gender	No reminder (NR)	Choice reminder (CR)	Total
Female	25	29	54
	43.10%	50.00%	46.55%
Male	33	28	61
	56.90%	48.28%	52.59%
Other	0	1	1
	0.00%	1.72%	0.86%
Total	58	58	116
	100.00%	100.00%	100.00%

Notes. This table illustrates the distribution of subjects across the different gender categories, by the choice reminder treatment. Subjects were either presented with a choice reminder (CR) or were not presented with a choice reminder (NR). The 'Other' category includes subjects who identified as a third gender, as well as subjects who would rather not indicate which gender they were. The table presents the number of observations per gender category, as well as the percentage of the total observations per gender category for both treatment groups. The total number of observations was 116.

Table 8.4

Gender distribution for the initial rank of the chosen item

Gender	Sixth chosen (T6)	Fifth chosen (T5)	Total
Female	27	27	54
	47.37%	45.76%	46.55%
Male	30	31	61
	52.63%	52.54%	52.59%
Other	0	1	1
	0.00%	1.69%	0.86%
Total	57	59	116
	100.00%	100.00%	100.00%

Notes. This table illustrates the distribution of subjects across the different gender categories, by the treatment of the initial rank of the chosen item. Either the fifth-ranking item (T5) or the sixth-ranking item (T6) was selected as chosen. The 'Other' category includes subjects who identified as a third gender, as well as subjects who would rather not indicate which gender they were. The table presents the number of observations per gender category, as well as the percentage of the total observations per gender category, for both treatment groups.

A4 Results of the t-tests

Table 8.5 shows the results of the t-tests that were performed as an additional robustness test to assess if this parametric statistical method yielded similar results as the non-parametric tests. First, a one-sided two sample t-test was performed to test if the average ranking spread was higher for subjects who received a choice reminder than for subjects who did not receive a choice reminder (hypothesis 1). The null hypothesis that the average ranking spread was equal for these groups could not be rejected at a 0.05 significance level, and therefore the alternative hypothesis that the average ranking spread was higher for subjects who received a choice reminder could not be accepted. Second, a one-sided one sample t-test was performed to test if the average ranking spread was positive for the total sample, as well as for the different treatment groups (hypothesis 2.1 to 2.5). The null hypothesis that the average ranking spread was 0 could be rejected in all cases. Moreover, the alternative hypothesis that the average ranking spread was positive was accepted at a significance level of 0.05, for the total sample and for the different treatment groups.

Third, a two-sided two sample t-test was conducted to examine if the average ranking spread

was different for subjects for which the fifth-ranking item was chosen versus subjects for which the sixth-ranking item was chosen (hypothesis 3). The null hypothesis that the average ranking spread was equal for the two groups could not be rejected at a 0.05 significance level. Thus, there was no evidence to support the alternative hypothesis that the average ranking spread was different for T5 and T6. Fourth, a one-sided one sample t-test was conducted to test the null hypothesis that the average ranking spread of chosen and unchosen items was equal. This null hypothesis was rejected at a significance level of 0.05, in favour of the alternative hypothesis that the average ranking spread of chosen items was larger than the average ranking spread of unchosen items. The specific outcomes of all the tests can be found in Table 8.5.

Table 8.5

Results of the t-tests

T-test	Tested group	Obs.	Degrees of freedom	T-value	P-value	Hypothesis
One sample t-test	Total sample	116	115	3.674	0.000***	H2.1
One-sample t-test	NR	58	57	1.929	0.029**	H2.2
One-sample t-test	CR	58	57	3.164	0.001***	H2.3
One-sample t-test	T6	57	56	2.888	0.003***	H2.4
One-sample t-test	T5	59	58	2.274	0.013**	H2.5
Two sample t-test	T5 and T6	116	114	0.642	0.522	H3
Two sample t-test	CR and NR	116	114	-1.359	0.089*	H1
One sample t-test	Unchosen/ chosen items	116	115	3.142	0.001***	-

***p < 0.01; **p < 0.05; *p < 0.1.

Notes. This table shows the results of the t-tests for the total sample, the group that did not receive a choice reminder (NR), the group that did receive a choice reminder (CR), the group for which the sixth-ranking item was chosen (T6), and the group for which the fifth-ranking item was chosen (T5). The total number of observations was 116.