Erasmus University Rotterdam

Master Thesis Behavioural Economics

August 26th, 2017

The Consequence of Choice – Asymmetrically Dominated Alternatives in Implicit Choice Tasks

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Abstract

Using an online experiment, the aim of this thesis was to investigate attitude change following choices based on decoys, and whether a decoy could improve the compliance rate of the implicit choice paradigm. The decoy is a product placed in the choice set with the purpose of making a target product more desirable and increase the number of times the target is chosen. This is the first study to my knowledge to examine post-choice attitude change in the presence of decoys. The results indicate preference change occurs after making a choice from a choice set with a decoy present under certain conditions. I find no evidence, however, that incorporating a decoy can improve the compliance rate of the implicit choice paradigm.

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1. Introduction

What makes those three scoops of ice-cream for €2.50 suddenly so much more attractive than the two scoops for €2.00 and the scoop for €1.00? This is known as the asymmetrical dominance effect (ADE) and has become a phenomenon in marketing – adding an alternative solely with the purpose of making another look better. This extra option is known in literature as an asymmetrically dominated alternative. Behavioural economist Dan Ariely brought this phenomenon to popular attention with a simple example in a TED talk on irrational decision making (TED, 2008), having tested the effectiveness of *The Economist* subscription prices on his students. At the time, *The Economist* offered a print subscription for $59, a web subscription for $125 and a print and web subscription for $125. 84% of his students chose the dominating option: the print and web subscription. Not surprisingly, no one chose the web subscription. However, when presented the choice without the web subscription, the majority chose the cheaper print subscription. This highlights how people are easily influenced in their choices.

Another, previously unrelated stream of literature has been dedicated to choice-induced preference change. As the term suggests, this also concerns choices, and particularly how the act of choosing can influence subsequent preferences. When asked to rank a series of items, choose between two, and then rank the same items again, fifty years of literature finds that subjects rank their chosen item higher and their rejected item lower in the second ranking. This is called spreading. These experiments, however, were methodologically flawed. Under this design, it is possible for positive or negative spreading to occur even if preferences remain unchanged. A relatively new experimental design, the implicit choice paradigm (Alós-Ferrer, Granić, Shi, & Wagner, 2012), can be used to measure choice-induced attitude change free from this selection bias. This design gives subjects the illusion of free choice during the choice tasks, but presents the choices as such that subjects choose a certain option predetermined by the experimenter. In essence, this is similar to what the asymmetrically dominated alternative aims to achieve. This thesis explores whether the implicit choice paradigm can be improved by incorporating these dominated alternatives in the choice tasks and the potential consequences this has on preferences. This will be done according to the following research question:

To what extent do preferences change following a choice based on asymmetrically dominated alternatives?

This thesis combines the measurement of choice-induced preference change with the asymmetrical dominance effect in a new experimental design. The implicit choice paradigm is at its most effective when subjects make choices as intended, in other words, when their choices follow from their preferences. This design attempts to increase that compliance rate using asymmetrically dominated alternatives. It also explores the robustness of the implicit choice paradigm in a consumer goods setting. This research is the first to my knowledge to measure how a choice framed with an asymmetrically dominated alternative influences preferences *after* making the choice. Previous literature has focused on the ability to influence the choice itself by adding this third option, but not on the resultant preferences. This is highly relevant for practical applications of the asymmetrical dominance effect in the field of marketing. If an asymmetrically dominated alternative can increase preference for a target item, for example, consumers may be more likely to purchase it again.

Using an online experiment in which participants completed pre-ranking, choice, and post-ranking tasks using an implicit choice design, choices including asymmetrically dominated alternatives and their effect on preferences are explored. The results provide evidence that, depending on the choice conditions, post-choice attitude change occurs and the presence of asymmetrically dominated alternatives influences the ranking spread.

2. Relevant Literature

This section will examine several important papers in the areas of choice-induced attitude change and the asymmetrical dominance effect. It will further highlight the novelty of this thesis' experimental design and provide a foundation for the hypotheses given in the next section.

2.1 Choice-Induced Attitude Change

Choice-induced preference change has been widely researched over the past fifty years. This research was largely focused on Festinger's (1957) theory of cognitive dissonance. He stated that a person can find themselves in a state of dissonance when two or more of their cognitions, such as beliefs or values, are inconsistent with one another. This state creates an uncomfortable tension, cognitive dissonance, and the person is motivated to reduce it, or in other words, achieve consonance by changing their cognitions. This adjustment serves as an explanation for why, to name but a few examples, mutual fund investors consider their own chosen funds more favourably than their performances warrant (Goetzmann & Peles, 1997), or why smokers are less likely than non-smokers to accept that smoking is damaging to health (Chapman, Wong, & Smith, 1993). One of the main experimental paradigms used to test the effect of a choice on subsequent preferences is the free-choice paradigm (FCP) (Brehm, 1956). When making a choice between two alternatives, any negative thoughts about the chosen alternative or any thoughts in favour of the rejected alternative are dissonant with the choice behaviour, the effect of which is stronger the closer the two alternatives are preferred. Subsequent experiments largely follow Brehm's (1956) methodology: participants rate or rank items, choose between two and finally rate or rank all original items again. There is overwhelming evidence that preferences for the chosen item tend to increase in the second ranking and preferences for the rejected item tend to decrease (Brehm, 1956; Festinger, 1957; Gerard & White, 1983; Egan, Santos, & Bloom, 2007; Lieberman, Ochsner, Gilbert, & Schacter, 2001). This is known as the spreading of alternatives. A positive spread suggests cognitive dissonance reduction.

There has been some criticism on the design of the FCP and the interpretation of positive spread as evidence for choice-induced attitude change. Recently, Chen and Risen (2010) claimed that the FCP cannot be interpreted as evidence for cognitive dissonance. They argue that positive spreading will occur using the FCP due to selection bias, even if preferences remain perfectly stable. By the mere act of making a choice, subjects self-select into being included or excluded in spread calculations. Although Chen and Risen's (2010) argument that positive spreading will always occur under the FCP has been disputed, the possibility of generating false spreading definitely exists (Alós-Ferrer & Shi, 2015). Moreover, another theory predicts the same outcome as Festinger's (1957) cognitive dissonance theory but is fundamentally different in its underlying mechanisms. The self-perception theory developed by Bem (1967) states that people form attitudes based on observations of their own behaviour. In this context, attitude change following a choice can occur because people infer attitudes from their choices and not because they are attempting to reduce any dissonance. The cognitive dissonance and self-perception theories are difficult to distinguish using the FCP.

Some modified designs escaping this methodological flaw of earlier FCP studies also find evidence that choices affect preferences. An interesting study alters the FCP by asking subjects to make a choice without seeing the alternatives (Sharot, Velasquez, & Dolan, 2010). During the choice task Sharot et al. (2010) did not present the subjects with the actual alternatives, holiday destinations, but showed a string of meaningless characters. Subjects were told the study investigated subliminal decision making and that the screen showed two masked destinations, of which they were to choose one. They were then shown their "subliminal choice" and rated all destinations once more. The results show that ratings for the "chosen" destination increase in the second rating task. When a computer, however, makes the choice, there is no change in ratings. This study shows that choice-induced preference change occurs as long as subjects *believe* they made the choice.

The implicit choice paradigm (ICP) also takes Chen and Risen's (2010) critique into account and improves upon the FCP (Alós-Ferrer, Granić, Shi, & Wagner, 2012). Contrary to Sharot et al. (2010), this design does study actual choices. As with the FCP, subjects undergo a ranking task. Rather than presenting subjects with a direct choice between two items *a* and *b*, however, an implicit choice pair is constructed. One of the two items is predetermined to be chosen, for example item *b*. Subjects then make two independent choices between choice pairs (a, h) and (b, ℓ). By design, this paradigm ensures *b* is freely chosen by the subject, as *h* is selected from the subject's ranking as strictly higher than *a* and *b*. ℓ is chosen because it is ranked strictly lower than *a* and *b*. Thus, when facing a choice between *a* and *h*, the subject will likely choose *h*, and when facing a choice between *b* and ℓ, the subject will likely choose *b*. Although the choice pairs are derived from the subject's preferences, the chosen and unchosen items are randomly assigned and do not depend on the subject's preferences, meaning this design does not suffer from the selection bias pointed out by Chen and Risen (2010). Furthermore, this design allows for a distinction to be made between the effect of cognitive dissonance and self-perception under the right experimental conditions. Alós-Ferrer et al. (2012) find significant post-choice attitude change, and the larger the ranking spread, the shorter the response times in choice tasks. Additionally, they test the effect of different distances between (a, h) and (b, ℓ), corresponding to the difficulty of the choice. A choice between two items ranked further apart is easier than a choice between two items ranked closely. The ranking spread does not, however, differ significantly between different distances.

2.2 The Asymmetrical Dominance Effect

A previously unrelated phenomenon known to influence choice behaviour and decision-making processes is the addition of an asymmetrically dominated alternative, or decoy, to a choice set. Including an item in a choice set that is dominated by at least one, but not by the other items belonging to the original choice set, can make the dominating item more attractive. This manipulation of contextual stimuli is known as the asymmetrical dominance effect. An early study conducted by Huber, Payne and Puto (1982) with consumer products shows that adding a decoy to a choice set can change preferences for existing alternatives and can increase the amount of times the dominating alternative is chosen. On average, the presence of any decoy increases the target's share of choices by 9.2 percentage points. They distinguish between strategies used to increase preference for the target, the most effective of which is defining the dimension on which the target is weaker and increasing the range of that dimension, thereby increasing the share of the average target by 13 percentage points.

Wedell (1991) expands upon the results of Huber et al. (1982), running experiments with lotteries to distinguish between three models of contextually induced preference reversals[1]. His results support the dominance-valuing model, which states that decisions are made based on heuristics (Tversky & Kahneman, 1981), or mental shortcuts. This qualitative rather than quantitative approach minimizes the effort required to perform trade-offs and eliminate poor alternatives, as well as making choice justification simpler. Several studies performed by Simonson (1989) also support this model. Wedell

[1] The dimensional weight model suggests that a range decoy for a given dimension, as described by Huber et al. (1982), results in a decreased weight placed on the other dimension and increases preference for the target. The value-shift model predicts changes in subjective value of each alternative *along* the dimensions as a decoy is added. Some support for this model is found (Wedell, 1991; Wedell & Pettibone, 1996; Ratneshwar, Shocker, & Stewart, 1987)

and Pettibone (1996) further examine contextual effects using not choices but judgments of various consumer products and services. After having subjects rate the attractiveness of the alternatives and dimensions, as well as the difficulty of the choice, they find a decoy can make the target appear more attractive and can make it easier to justify a potential choice. This is in line with the dominance-valuing model. Park and Kim (2005) look at the roles of attractiveness of the alternatives and justification of choice. Contextual effects vary per evaluation of the alternatives prior to the choice. Prior evaluations can be compared, making identification of the most attractive alternative, and therefore the choice, easier. If the alternatives have not been evaluated pre-choice, a decoy influences justification post-choice.

Overall, there is a lot of evidence for the asymmetrical dominance effect and its robustness. The effect persists not only in hypothetical choice tasks, but when using real incentives in the form of monetary lotteries as well (Herne, 1999). Slaughter, Sinar and Highhouse (1999) argue that the decoy effect holds in more complicated, realistic choice situations, where attributes are not defined numerically. Preference reversals also occur under various buying frames of mind, when the decoy option is unavailable (phantom decoy), and in a field setting with baked beans (Doyle, O'Connor, Reynolds, & Bottomley, 1999). Park and Kim (2005) show that the target, competitor, and decoy do not need to be in the same product domain for the decoy to affect preferences.

It has been established that decoys can influence choice and lead to preference reversals. A question still of interest is whether decoys change *subsequent* preferences. Previous literature on asymmetrical dominance has focused on the decision-making process and models underlying choice, as well as judgments and evaluations prior to choice. No research has examined what happens *after* the choice has been made. The framework of the ICP will allow me to study post-choice attitude change in a context with decoys.

3. Hypotheses

I combine the ICP and asymmetrical dominance effect to investigate how preferences change following a choice based on asymmetrically dominated alternatives. By using the ICP design, calculation of the ranking spread will not be subject to Chen and Risen's (2010) selection bias critique. A decoy can be naturally incorporated in the implicit choice pairs (a, h) and (b, ℓ), giving participants three instead of two alternatives, while still allowing them to choose freely. As the decoys are dominated by h and b in their respective choice pairs, they increase the likelihood of h and b being chosen, and are not expected to be chosen themselves. The ranking spread can thus be calculated following Alós-Ferrer et al. (2012) and post-choice attitude change can be measured.

3.1 Ranking Spread

As described in section 2, making a choice results in a state of dissonance according to the theory of cognitive dissonance. To reduce this state, an individual can adapt their post-choice ranking, leading to the spreading of alternatives. Alós-Ferrer et al. (2012) find a ranking spread significantly larger than zero for both free-choice and implicit-choice conditions using holiday destinations. It has been shown that easy choices, where the two alternatives are not close in attractiveness, do not result in attitude change (Brehm, 1956). A choice between two alternatives ranked closely is more difficult, however, and is expected to lead to greater dissonance. Alós-Ferrer et al. (2012) vary the difficulty of the choice, but find no significant difference in spreading between easy and more difficult choices. Adding a decoy that makes the choice easier is therefore not expected to influence the ranking spread. This leads to the following hypotheses:

Hypothesis 1: The ranking spread for both the ICP and asymmetrical dominance (AD) tasks will be positive.

Hypothesis 2: The ranking spread for ICP tasks will be equal to the ranking spread for AD tasks.

3.2 Compliance Rate

Early studies using the FCP have found that giving subjects a choice between one option and an option they ranked higher does not guarantee they choose their highest-ranked option. Around 30% of choices, in fact, contradict the pre-choice ranking (Chen & Risen, 2010). Alós-Ferrer et al. (2012) find a compliance rate – the number of choices made as intended – of 77.5% in their ranking task using the ICP. In the presence of a pre-choice ranking task, decoys are expected to make choices easier (Park & Kim, 2005). The option that has been assigned to be chosen clearly dominates the decoy in each implicit choice set. In some cases, the item predetermined to be chosen will be ranked higher than the item predetermined to be rejected. The intended choice will therefore correspond to the pre-choice ranking. Doyle et al. (1999) have demonstrated that a decoy can still be effective, even if the target product already has a large market share. In the context of this thesis, the "large market share" could be interpreted as the higher ranking. In other cases, the item assigned to be chosen will be ranked lower than the item assigned to be rejected, contradicting the initial ranking. The studies discussed in section 2 show that the presence of a decoy can cause subjects to choose a certain option, while preferring the other option in a choice without a decoy. For both congruent and incongruent choices, the decoy is expected to facilitate choices. Hypothesis 3 can thus be stated as follows:

Hypothesis 3: Adding a decoy to the choice set in an implicit choice design will increase the compliance rate.

4. Methodology

4.1 Design of Hypothetical Goods: Laptops

In the existing literature on the asymmetrical dominance effect, it is common to define the hypothetical object of choice in terms of two dimensions. This has been done for a large range of consumer goods and services (Huber, Payne, & Puto, 1982; Wedell & Pettibone, 1996; Park & Kim, 2005; Heath & Chatterjee, 1991, 1995; Simonson, 1989; Pan & Lehmann, 1993; Ariely & Wallsten, 1995; Hamilton, 2003; Ratneshwar, Shocker, & Stewart, 1987; Malkoc, Hedgcock, & Hoeffler, 2013), job applicants (Highhouse, 1996; Slaughter, Sinar, & Highhouse, 1999; Slaughter, Kausel, & Quinones, 2011), lotteries (Wedell, 1991; Herne, 1999), apartments (Simonson, 1989), politicians (Pan, O'Curry, & Pitts, 1995) and even for an environmental management strategy for a lake (Bateman, Munro, & Poe, 2008).

In reality, choices may be more complicated, but several studies have measured the asymmetrical dominance effect under more natural choice settings and find that it holds, albeit a more moderate effect in some cases (Josiam & Hobson, 1995; Slaughter et al., 1999; Doyle et al., 1999; Simonson & Tversky, 1992; Pan et al., 1995). Using two dimensions to define products will keep the effort input required for the participants at a reasonable level and allow for a straightforward analysis of the results. It is also possible to incorporate these two dimensions in the ICP, as it does not require any modification of the original design. This thesis will explore the ICP and the asymmetrical dominance effect in a consumer choice setting, with the hypothetical objects of choice being laptops. A laptop is a consumer product participants will be familiar with in an every-day setting, but the purchase of one is not likely to be a habit or automated process. The laptops are defined along two dimensions: battery life in hours and hard disk capacity in gigabytes. These dimensions are comparable to previous studies researching the asymmetrical dominance effect, such as Huber et al.'s (1982). Each laptop was carefully constructed so that not one laptop dominates another on both dimensions. This is important, as a choice between any pair should induce dissonance. There should not be any particularly salient amounts of battery life or hard disk capacity. The laptops and their dimension values can be seen in Table 1. See Appendix A for a complete explanation of why and how the dimensions and laptops were created.

Laptop	Battery life (hours)	Hard Disk Capacity (GB)
A	7.8	1528
B	4.2	2007
C	11.5	1143
D	6.7	1716
E	9.1	1429
F	12.6	1002
G	10.3	1286
H	5.4	1859

Table 1: The Eight Laptops with Dimension Values

4.2 Procedure

The design of the experiment follows the general setup of Alós-Ferrer et al. (2012). In a between-subject experiment, each participant first performed a pre-choice ranking task for eight hypothetical laptops. They were asked to rank the laptops from most preferred to least preferred, completed two choice tasks and subsequently ranked all eight laptops again. Before completing the experiment, participants were asked to answer some demographic questions. See Figure 1 for a graphical representation of the experimental design. Participants were informed they could win a €10 gift card for Amazon.com and were given the option to provide their e-mail address at the end of the experiment. These were stored in a separate database to protect anonymity. Once enough responses had been obtained, one participant was randomly chosen to win.

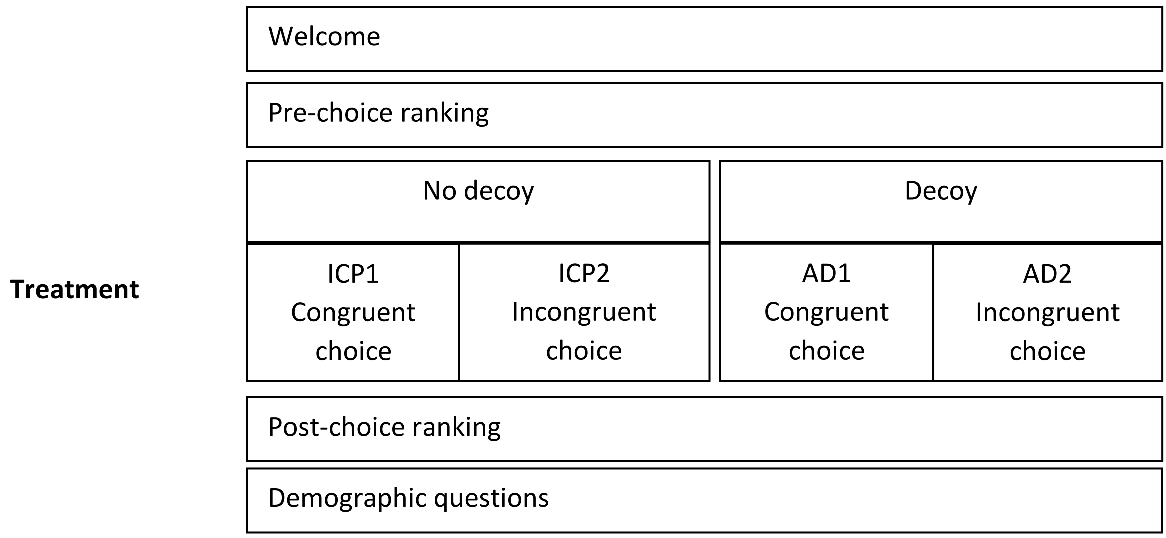


Figure 1: Experimental Design

4.2.1 The Website

The experiment was carried out online. For the purpose of this experiment, I coded a website myself using HTML, CSS, PHP and MySQL. Screenshots of the experiment can be found in Appendix I. The link to the experiment was posted on social media and sent to my contacts in private messages within the social network, where they could voluntarily click on it to participate in the survey. Participants were divided into four treatments upon clicking the link. The first person to click on the link was allocated to treatment one, the second to click was allocated to treatment two, the third to click the link was allocated to treatment three, the fourth to treatment four, the fifth to click the link was allocated to treatment one again, and so forth. As who clicks on the link and the order in which this happens is random, this approach is close to randomization, but within my ability to code.

4.2.2 Implicit Choice Pairs

The 4th- and 5th-ranked laptops were selected for the choice task to form direct choice pair $(4,5)$. For each of the four treatment groups, implicit choice sets were constructed differently. The treatments differ in whether a decoy is part of the choice set and in congruence with the initial ranking.

In treatment ICP1, the choice is *congruent* with the pre-choice ranking, meaning the higher-ranked laptop is assigned to be chosen. To construct the implicit choice pairs, the 3rd- and 6th-ranked laptops are selected. Participants in this treatment make a choice between $(4,6)$ and a choice between $(5,3)$. In treatment ICP2, the lower-ranked laptop is assigned to be chosen. This contradicts the participant's ranking and the choice is *incongruent* with pre-choice rankings. To ensure the lower-ranked laptop is chosen, the participant is asked to choose between $(4,3)$ and then asked to choose between $(5,6)$. If choices follow from preferences, the participant is expected to make the intended choice – the laptop they have ranked higher – for each implicit choice pair, as described in section 2. Note the two choices each participant makes are independent from each other. Implicit choice sets in treatments AD1 and AD2 are constructed in the same manner, but a decoy is calculated based on the laptops in each implicit choice pair and participants receive choices between three laptops.

4.2.3 The Decoy

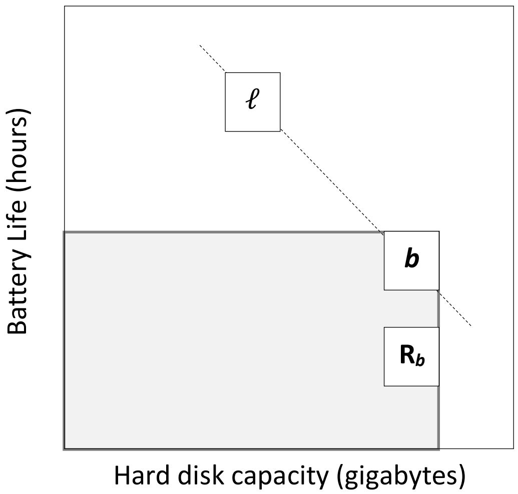


Figure 2: Range Decoy Placement

The type of decoy employed in this experiment is the range decoy. A range decoy increases the range of the dimension on which the target is weaker, thereby making the difference between a and h or b and ℓ seem less extreme (Huber et al., 1982). The range decoy is chosen because it is expected to have an effect under all models of contextually induced preference reversals (Wedell, 1991). My code identifies the implicit choice pairs and looks for the dimension on which the laptop assigned to be chosen is weaker than the laptop assigned to be rejected. It then subtracts a set amount of either 0.8 hours of battery life or 120 gigabytes of hard disk capacity from the appropriate dimension and presents the result as a third choice. The dimensions of the decoy are constructed so that a decoy never has the same values on either dimension as any of the laptops presented in the ranking tasks. The laptop intended to be chosen then dominates the decoy, but the laptop intended to be rejected does not. For example, suppose laptop b in Figure 2 is assigned to be chosen. It has a shorter battery life than laptop ℓ, but a greater hard disk capacity. 0.8 hours are thus subtracted from the battery life of laptop b, creating decoy R_b with the same hard disk capacity but a lower battery life. The decoy is objectively dominated by laptop b, but not necessarily by laptop ℓ.

4.2.4 Ranking Spread

After completing the post-choice ranking task, the ranking spread for each participant can be calculated. The ranking spread measures the amount the chosen laptop moves up in the post-choice ranking compared to the pre-choice ranking, added to the amount the rejected laptop moves down in the post-choice ranking compared to the pre-choice ranking:

$$Ranking\ spread = [R1(chosen) - R2(chosen)] + [R2(rejected) - R1(rejected)]$$

Suppose a participant has ranked laptops a and b 4th and 5th, respectively. They make their choices and subsequently rank all laptops again. They now assign laptop a rank 3 and laptop b rank 6. Laptop

a has moved up in ranking and laptop b has moved down, resulting in a ranking spread of 2 using the formula above. A positive ranking spread can be interpreted as evidence for post-choice attitude change (Alós-Ferrer et al., 2012).

5. Results

5.1 Ranking Spread

5.1.1 Descriptives

140 participants were recruited via the social media platform Facebook between August 12 and September 6, 2016. Of those 140 participants, 72 were female, 67 were male and one participant did not state their gender. The average age of the participants was 26 years, with a minimum of 14 years and a maximum of 64 years. Only nine participants mainly used their laptops while travelling, meaning they might place more weight on battery life than those participants who mainly work in proximity to a power supply. The majority of participants, 73.5 percent, were students and 23.7 percent of the participants worked.

Several participants were excluded from the analysis. Five participants chose the decoy in one or both choice tasks and for two participants a choice was not recorded, most likely due to an error in their internet browser. For these seven participants, it was not possible to calculate the ranking spread. For the two participants whose choice was not recorded, the compliance rate cannot be calculated either. This leaves 133 independent observations at the individual level, four independent observations at the group level and one independent observation at the session level. For the standard implicit choice and congruent-choice treatment (ICP1), 31 responses were recorded. 30 responses were recorded for the implicit choice and incongruent-choice treatment (ICP2). 30 responses were collected for the Asymmetrical Dominance congruent-choice treatment (AD1) and 42 for the Asymmetrical Dominance incongruent-choice treatment (AD2).

5.1.2 Ranking Spread Analysis

Hypothesis 1: The ranking spread for both the ICP and AD tasks will be positive.

Hypothesis 2: The ranking spread for ICP tasks will be equal to the ranking spread for AD tasks.

Each participant made two choices. The variable *spread* is the amount the chosen laptop moves up in ranking added to the amount the rejected laptop moves down. A positive ranking spread can thus be interpreted as post-choice attitude change. In order to calculate the ranking spread for the pair $(4{,}5)$[2], the participant must have chosen either alternative 4 or alternative 5 and rejected the other. If the participant chose both alternatives 4 and 5 or rejected both alternatives 4 and 5 in their two choice tasks, the ranking spread cannot be calculated. This occurred 45 times, leaving 17 observations for *spread* in ICP1, 23 in ICP2, 24 in AD1 and 31 in AD2. The mean ranking spread is 0.84 points. This is an early indication of choice-induced attitude change. Figure 3 shows the ranking spread per treatment group. The ranking spread for group ICP1 (*M*=0.000, *SE*=0.340, *SD*=1.404) is positive, with a narrow 95% confidence interval (-0.43, 1.02). The ranking spread for group ICP2 is larger (*M*=0.000, *SE*=0.599, *SD*=2.875) and a wider, positive 95% confidence interval (0.67, 3.16). This is also the most difficult choice among the treatment groups. The spread for group AD1 is also positive (*M*=0.000, *SE*=0.616, *SD*=3.017), but has a relatively wide 95% confidence interval (-0.11, 2.44). Group AD2 (*M*=0.000, *SE*=0.214, *SD*=1.193) shows no ranking spread and has a very narrow 95% confidence interval (-0.34, 0.53). The median ranking spread appears to be similar for all groups. The boxplot gives a first indication that the data is positively skewed for groups ICP1, ICP2 and AD1.

[2] Note the participants were never asked to choose between alternative 4 and 5 directly, but always implicitly via choice pairs $(h, 4)$ and $(\ell, 5)$, or $(\ell, 4)$ and $(h, 5)$. Depending on the treatment group a decoy is included.

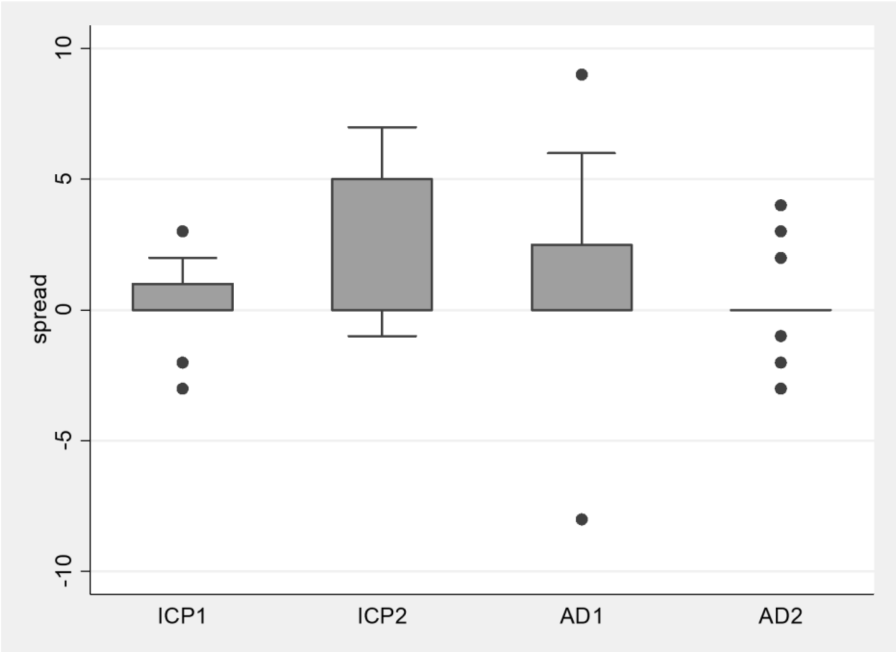


Figure 3: Ranking Spread per Treatment Group

Before performing a statistical analysis of the ranking spread, the suitability of the ranking spread data for parametric testing must be determined. Parametric tests are more powerful than non-parametric tests, provided several assumptions are met. An explanation of the assumptions and test results can be found in Appendix B. The results of the Shapiro-Wilk test for normality and Levene's test for homogeneity of variances show both assumptions are violated. This means non-parametric tests are more suitable. The non-parametric Kruskal-Wallis H test can be used to determine whether ranking spread between the four groups differs. See Appendix C for the mean and median ranking spreads. The null hypothesis of equal populations can be rejected ($\chi^2(3)$ =8.937, *p*=0.030). There is thus a significant difference in ranking spread between at least two of the groups. This can be further investigated using *t*-tests.

To test whether the ranking spread is significantly different from zero, indicating post-choice attitude change, a one sample *t*-test can be used. Although the assumptions of normality and homogeneity of variances have been violated, the *t*-test is generally considered robust to non-normality and can be corrected for heterogeneity. Non-parametric tests will be used to check the robustness of the *t*-test results. Pooling all data, the *t*-test shows the null hypothesis of a mean ranking spread equal to zero can be rejected (*M*=0.842, t(94)=3.501, *p*<0.001). Tests were also carried out for each of the four treatment groups separately, the results of which can be found in Appendix D. The ranking spread in the ICP2 and AD1 groups is significantly greater than zero (*M*=1.913, *t*(22)=3.191, *p*=0.002 and *M*=1.167, *t*(23)=1.895, *p*=0.035). The spread in groups ICP1 and AD2 is not significantly different from zero (*M*=0.294, *t*(16)=0.864, *p*=0.400 and *M*=0.097, *t*(30)=0.452, *p*=0.655). These results suggest choice-induced attitude change has occurred within these two groups. The non-parametric equivalent of the one sample *t*-test is the one sample Wilcoxon signed-rank test. The sign rank test confirms the results of the t-tests. The ranking spread in groups ICP1 and AD2 is not significantly different from zero (*z*=1.215, *p*=0.224 and *z*=0.072, *p*=0.943, respectively). The ranking spread for groups ICP2 and AD1 is significantly different from zero (*z*=2.452, *p*=0.014 and *z*=2.701, *p*=0.007, respectively).

Group ICP2 has the highest mean ranking spread. By design, this should be the most difficult choice, as participants are induced to make a choice between two laptops they ranked close together that contradicts their ranking. A positive ranking spread here is in line with expectations. The mean ranking spread for group AD1 is also positive, whereas the mean ranking spread for group ICP1 is not significantly different from zero. This is slightly surprising, as the choice participants in AD1 face is congruent with their ranking, and the decoy provides additional justification for choosing the target. the ranking spread in group AD2 is not significantly different from zero. This choice is relatively easy compared to the choices in the other treatment groups.

After finding the initial evidence of post-choice attitude change, I want to explore whether the presence of a decoy in the choice set affects post-choice preferences. To do this, the ranking spread of the different groups can be compared. An independent two sample *t*-test that corrects for unequal variances can be carried out to test whether the ranking spread for congruent choices differs significantly from the ranking spread for incongruent choices. This reveals whether the difficulty of a choice – relatively easier choices that are congruent with the initial ranking and relatively difficult choices that are incongruent with the initial ranking – influences the ranking spread. The null hypothesis of equal mean ranking spread between the congruent (*M*=0.805) and incongruent (*M=0.870*) conditions cannot be rejected (*t*(83.14)=-0.132, *p*=0.890). Differences within the congruent and incongruent conditions resulting from the presence of a decoy can also be explored using the two-sample *t*-test.

For congruent choices, the null hypothesis of equal mean ranking spreads between groups ICP1 (*M=0.294*) and AD1 (*M=1.167*) cannot be rejected (*t*(35.724)=-1.240, *p*=0.223). For incongruent choices, however, the mean ranking spread differs significantly between ICP2 (*M*=1.913) and AD2 (*M*=0.097) (*t*(28.157)=2.853, *p*=0.008). The non-parametric two-sample Wilcoxon rank-sum test supports these results. There is no significant difference between the congruent and incongruent conditions (*z*=1.330, *p*=0.184). For congruent choices, groups ICP1 and AD1 do not differ significantly (*z*=-1.212, *p*=0.226). The null hypothesis of equal population distributions in groups ICP2 and AD2 can be rejected (*z*=2.472, *p*=0.015). This indicates that the presence of a decoy in the choice set alters the ranking spread under certain conditions, in this case when the choice to be made is incongruent with the initial ranking. When the choice is congruent with the initial ranking, post-choice attitudes do not differ significantly between a decoy and non-decoy choice set.

The first hypothesis, predicting the spread for both the decoy and no decoy treatments is positive, cannot be rejected. The ranking spread following incongruent choices without a decoy, and congruent choices with a decoy present, is positive. The second hypothesis, stating the ranking spread for ICP tasks will be equal to the ranking spread for AD tasks, is rejected. The analysis shows adding a decoy to the choice set influences the ranking spread for choices incongruent with the initial ranking.

5.1.3 Imputed Choices as a Robustness Check

A robustness check of the analysis above is carried out by repeating the analysis using imputed choices. In this scenario, it is assumed that all participants have made the choice exactly as intended in both their choice tasks. Under this assumption, the ranking spread can be calculated for all subjects. There are now 140 observations for ranking spread at the individual level, 4 independent observations at the group level and 1 independent observation at the session level. There are 32 observations in group ICP1, 31 observations in group ICP2, 33 observations in group AD1 and 44 observations in group AD2. In effect, including the participants who have not made the choice as intended, but calculating ranking spread as if they did, results in the worst possible case scenario. The mean ranking spread is 0.09 ranking points and a one sample *t*-test shows the mean ranking spread is not significantly different from zero (*M*=0.093, t(139)=0.487, *p*=0.627). The graph in Appendix F shows positive spreading for groups ICP2 (*M*=0.000, *S.E.*=0.483, *S.D.*=0.750) and AD1 (*M*=0.000, *S.E.*=0.441, *S.D.*=2-534). The spread for group AD2 (*M*=0.000, *S.E.*=0.272, *S.D.*=1.807) appears to be zero, whereas participants in group ICP1 show a mostly negative ranking spread (*M*=0.000, *S.E.*=0.350, *S.D.*=1.977). The results of the one sample *t*-tests for each group can be found in Appendix G, and show the ranking spread is not significantly different from zero in any group. This is supported by the results of the Wilcoxon signed rank test.

Two sample t-tests can be carried out to see whether the ranking spread for congruent and incongruent choices differs between the decoy and no decoy treatments. For congruent choices, the null hypothesis of equal mean ranking spreads between groups ICP1 (*M*=-0.343) and AD1 (*M*=0.121) cannot be rejected (*t*(62.074)=-0.826, *p*=0.412). For incongruent choices, the ranking spread does not differ significantly between groups ICP2 (*M*=0.806) and AD2 (*M*=-0.114) (*t*(49.878)=1.660, *p*=0.103). As the ranking spread is not normally distributed for all groups, see Appendix E, the robustness of the t-test results is checked using a non-parametric test. The results are supported by the Wilcoxon rank-sum test (*z*=-1.296, *p*=0.195 and *z*=1.608, *p*=0.1077). In the imputed choice scenario, there is no evidence that adding a decoy to the choice set affects the ranking spread. This does not mean, however, that the results found in the analysis above are invalid, as the imputed choice analysis includes all data, also those working against the implicit choice paradigm.

5.2 Compliance Rate

5.2.1 Descriptives

Each participant was asked to make two choices, resulting in 280 choice situations. Two participants are excluded from the analysis because one of their choices was not recorded. The variable compliance rate per participant was calculated by looking at the two choices each participant made; making zero choices or one choice as intended resulted in a compliance rate of zero percent and making both choices as intended resulted in a compliance rate of 100 percent. There are 138 independent observations for compliance rate at the individual level, four independent observations at the group level and one independent observation at the session level. Of these participants, 39.13 percent made either zero choices or one choice as intended, and 60.87 percent made both choices as intended.

5.2.2 Non-parametric Tests

Hypothesis 3: Adding decoys to the choice sets in an implicit choice design will increase the compliance rate.

I want to determine whether a decoy can increase the number of choices made as intended. There are thus two variables of interest, each consisting of two categories. The variables compliance rate for congruent and incongruent choices take on the value 0 for none or one choice made as intended and value 1 for both choices made as intended, and there is either a decoy present or no decoy present. The Fisher Exact test is suitable for this data. For congruent choices, the null hypothesis of equal compliance rates between the decoy and no-decoy treatments cannot be rejected (*p*=0.236). for incongruent choices, the compliance rate does not differ significantly between the two treatments either (*p*=0.222).

5.2.3 Regression Analysis

To test whether the presence of a decoy in the choice set increases the number of choices made as intended, a regression analysis is run. This will also allow me to explore the effect of several independent control variables such as age, gender, and main manner of using a laptop. The model of choice is a logistic regression model, as the dependent variable, compliance rate, is binary. Logistic models do not require any assumptions to hold regarding normality, linearity, and homoscedasticity. The output of the models is presented in Table 2 and Table 3 below. The results show that the presence of a decoy in the choice set has no significant effect on the probability of making both choices as intended for both the congruent-choice and incongruent-choice models. The demographic and usage control variables also have no significant effect on the probability of making both choices as intended.

Dependent Variable	**Model 1: Congruent Choice** *compliescong*		**Model 2: Incongruent Choice** *compliesincong*	
	Coefficient	**Marginal effects**	**Coefficient**	**Marginal effects**
AD1	0.495 (0.514)	0.120 (0.124)		
AD2			0.494 (0.494)	0.115 (0.115)
constant	0.065 (0.362)		0.268 (0.371)	

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

Table 2: Logistic Regression Output with Clustering and Marginal Effects

Dependent Variable	**Model 3: Congruent Choice** *Compliescong*		**Model 4: Incongruent Choice** *compliesincong*	
	Coefficient	**Marginal effects**	**Coefficient**	**Marginal effects**
AD1	0.467 (0.534)	0.112 (0.126)		
AD2			0.594 (0.514)	0.136 (0.118)
age	0.016 (0.029)	0.004 (0.007)	0.017 (0.030)	0.004 (0.007)
female	0.170 (0.556)	0.040 (0.131)	-0.025 (0.505)	-0.006 (0.113)
purpose2	0.724 (1.313)	0.171 (0.307)	-0.003 (0.967)	-0.001 (0.217)
purpose3	-0.177 (0.575)	-0.042 (0.136)	0.016 (0.534)	0.004 (0.120)
constant	-0.378 (1.061)		-0.190 (1.064)	

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

Table 3: Logistic Regression Output with Control Variables and Clustering and Marginal Effects

Another measure of compliance is the ability to calculate the ranking spread. The presence of a decoy in the choice set is hypothesized to increase the ability to calculate ranking spread. A logistic regression with marginal effects is run for both the congruent and incongruent choice conditions using the ability to calculate ranking spread as the dependent variable and treatment group (decoy versus no decoy) as the independent variable. The output of the regressions can be found in Appendix H. The presence of a decoy has no significant effect on the probability of being able to calculate ranking spread for both congruent and incongruent choices. Hypothesis 3, stating that decoys will increase the compliance rate, is thus rejected.

6. Discussion

The effect adding a decoy has on preferences following a choice differs between treatments. What occurs after making a choice based on decoys is relevant in the field of marketing and consumer decisions. There are various factors that play a role in decision making. Consumers, for example, are motivated to minimize cognitive effort and avoid negative emotions, and prefer choices that are easily justifiable (Bettman, Luce, & Payne, 1998), all of which can be achieved by placing a decoy. As discussed in section 2, the decoy provides a mental shortcut for decision-making, thereby reducing effort, and provides an objective justification of the choice. It can also mitigate emotion-laden choices, such as a choice between two closely ranked alternatives.

A relatively demanding choice set is the choice set in ICP2. Here, participants are induced to choose in contradiction to their pre-choice ranking: the target is the laptop ranked lower in the initial ranking task. The observed mean ranking spread for this group is relatively large, which is in line with the theory (see section 2.1). When a decoy is added to this choice set, post-choice attitude change almost disappears and the mean ranking spread is no longer significantly different from zero. The difference in spread between these two groups is statistically significant. Although Alós-Ferrer et al. (2012) find no significant difference in ranking spread upon varying the difficulty of the task, the decrease in ranking spread in the presence of a decoy found in this thesis is theoretically reasonable. The decoy reduces cognitive effort and negative emotion and provides a justification for the choice (Bettman et al., 1998; Simonson, 1989; Wedell, 1991). This, in turn, leads to lower levels of post-choice dissonance (Brehm, 1956). Interestingly enough, the decoy causes the exact opposite effect for choices congruent with the initial ranking.

The results for group ICP1 show that there is no significant positive spreading when the choice is relatively easy. That is, when the two laptops presented are two ranks apart and the intended choice is the laptop ranked highest. Participants experience little dissonance after making their choice. This is still in line with the findings of Brehm (1956). When a decoy laptop is added to the choice set, theoretically making the choice even easier, significant positive spreading occurs (group AD1). This cannot be explained by the existing literature on decoys. Another of Brehm's theories from the field of psychology might provide an explanation. He states that individuals strive to regain their behavioural freedom if they perceive it as threatened (Brehm, 1966). Adding a decoy does not restrict free choice, but participants might sense they are being nudged towards a certain choice, increasing dissonance. The difference between the mean ranking spreads of groups ICP1 and AD1, however, is not statistically significant.

The results for the two ICP groups appear to contradict the cognitive dissonance theory. As the target laptop in this experiment was objectively better that the decoy, the cognitive dissonance following a choice involving a decoy should be minimal for both congruent and incongruent choices. Even if the emotional weight cannot be completely removed from the choice, there should be no difference between congruent and incongruent choices. The self-perception theory, stating that individuals infer their attitudes from observations of their own behaviour, could predict the observed outcome. Choices congruent with the initial ranking do not provide participants with new information about their attitudes. Choices incongruent with the initial ranking, on the other hand, do, and we expect to see some attitude change. However, we cannot compare ICP1 and ICP2 directly, as the choice sets employ different ranking distances between the choice alternatives. The self-perception theory might also explain why I observe a positive ranking spread when a congruent choice is made easier by adding a decoy. If the choice process itself is too easy, participants may not be able to infer their attitudes from it, leading to post-choice attitude change.

This is one of the first studies to my knowledge that examines the consequence of making a choice based on decoys. As described above, I find some evidence of post-choice attitude change in the presence of a decoy. This attitude change suggests that a decoy does not just aid the choice process itself, but results in an adaptation of preferences. A practical application: consumers who have been nudged into selecting a certain product by a decoy, whereas they would have normally chosen the competitor's product, for example, may adjust their preferences in favour of their selected product. The results also indicate, however, that this is not a "golden rule", as the incorporation of a decoy also appears to lead to stronger post-choice dissonance under certain conditions. Although the results are far from conclusive, they are informative and do provide these interesting insights.

Aside from studying the influence of a decoy on preferences, this thesis studied the effectiveness of adding a decoy as a means of improving the methodology of the ICP. Under the ICP, the ranking spread for a participant can only be calculated if they make the choices as intended by the experimenter. Even if choices follow from preferences, participants do not always choose as intended. The findings of this thesis suggest the incorporation of a range decoy in the choice sets of the ICP does not increase the number of choices made as intended, and therefore does not improve the ICP. This does not conclusively mean decoys are incapable of improving the ICP. Although the range decoy was found to be among the most effective under various models of decision making (Wedell, 1991), other types of decoys have not been studied in the context of the ICP. This study has extended the findings of the ICP to a consumer goods setting. In combination with the abundance of evidence of post-choice preference change and the decoy effect in previous literature and the relative novelty of the ICP, the results of this thesis provide an interesting starting point for future research.

7. Limitations and Future Research

There were several limitations to this research. For one, the online experiment was not incentive compatible. A participation incentive in the form of a €10 gift certificate was provided, but only half of the participants were interested and provided their e-mail address at the end of the experiment. Laptops do not allow for the use of real incentives, as this would not be realistic even if I did possess the resources. Economists prefer incentivised experiments, as they offer control by subduing intrinsic motivation (Smith, 1982) and improve performance by motivating effort. Incentives do not necessarily improve performance if tasks are too easy or too difficult. The ranking tasks in this study do require cognitive effort, especially because participants are asked to rank hypothetical items based on two quantitative dimensions. The tasks do not, however, require any particular skills to complete. Given the need for quantitative dimensions to allow for the calculation of an objectively dominated decoy in real time, using real instead of hypothetical products and improving the incentive structure proves to be difficult. Therefore, this is not a fully controlled experiment as specified by Smith's (1982) five precepts.

The quality of the data is also of concern. The link was sent out in the middle of the summer vacation. It was extremely difficult to obtain enough responses. Only around half of the people who opened the link completed the experiment. A larger sample size will increase the performance of statistical tests (Field, 2013). I also suspect participants did not read the instructions properly. On several occasions, participants contacted me after completing the experiment, mentioning it was a nice surprise that one could win a €10 gift card. Some also asked whether the second ranking task was the same as before. As the gift card was mentioned on the very first page, and the instructions to the post-choice ranking task explicitly stated the task was identical to the first, it indicates the instructions were not well read. Moreover, 5% of the participants chose the decoy in the choice tasks. One participant even chose the decoy in both of their choice tasks. As the laptop intended to be chosen objectively dominates the decoy, there is no justification for selecting the decoy. Previous studies report lower percentages: 0% (Highhouse, 1996), 1% (Doyle et al., 1999), 2% (Huber et al., 1982; Wedell, 1991) and 3% (Wedell, 1991). The highest percentages are reported for the more complicated choice tasks. The relatively large number of times the decoy was chosen in this study could indicate participants had trouble understanding the task or exerted too little effort.

The quality of the data could be increased if one of the other limitations to this thesis is improved upon: the quality of the website. I did not have any knowledge of coding prior to writing this thesis, so the layout of the website was quite basic. The ranking task therefore required more effort than it could have to complete. Moreover, the website was not phone compatible. Improving the layout of the ranking tasks, by creating a drag and drop option, for example, as well as formulating the instructions in smaller blocks of text and ensuring phone compatibility, could mitigate this problem in future research. A formal survey of which attributes of laptops are most important to consumers could also be carried out.

The experimental design of the experiment does not allow for a comparison between choices that are congruent, and choices that are incongruent with the pre-choice ranking. This limits the conclusions that can be drawn, as the effect of adding a decoy to the choice set can only be examined within either the congruent or the incongruent condition. Future research could improve upon this limitation by exploring different difficulties of choice measured in distance on the ranking scale and employing the same distance for the congruent and incongruent conditions, as in Alós-Ferrer et al. (2012). Allowing for comparisons between the congruent and incongruent choice conditions will make it possible to distinguish between the cognitive dissonance and self-perception theories. This could provide a more thorough understanding of the decoy on post-choice preferences.

8. Conclusion

The aim of this thesis was to investigate attitude change following choices based on decoys and whether a decoy could improve the compliance rate of the implicit choice paradigm using an online experiment. This is the first study to my knowledge to examine post-choice attitude change in the presence of decoys. A series of *t*-tests and non-parametric tests show a positive ranking spread for incongruent choices, and for choices congruent with the pre-choice ranking and a decoy present. This can be interpreted as evidence for attitude change. Using a binary logistic regression, I find no evidence that adding a decoy to a choice set can increase the number of choices made as intended. These results have both theoretical and practical implications. The findings of Alós-Ferrer et al. (2012) have been replicated in a consumer goods setting. Regarding the experimental design, this particular decoy was not successful in significantly increasing the compliance rate. Moreover, the decoy interacts undesirably with the ranking spread for congruent choices. In this case, the asymmetrical dominance effect does not perform well as a method of improving the experimental design of implicit choice paradigm. The effect of the decoy on ranking spread, however, is an interesting finding in itself. It implies that participants adjust their preference following a choice with a decoy present. This also has practical implications in marketing: not only is it possible to induce consumers to choose a certain product, they adjust their preferences towards the target product following the choice as well. Finally, the results provide a foundation for future research into the use of the ICP to measure post-choice preference change, as well as the effect of decoys on post-choice preferences.

Acknowledgement

I would like to extend my gratitude to Georg Granić for his valuable insights, feedback, and patience. I especially appreciate all the time he took to discuss and help develop my research. It has been a wonderful topic to work on.

Appendix

A. Creating Hypothetical Laptops

To define the hypothetical laptops, actual laptops currently available on the market were compared. The two dimensions for the laptops are defined below in table 4. Battery life and hard disk capacity were found to be particularly important in the process of choosing a laptop.

Dimension 1: Battery Life (hours)								
Value	4.2	5.4	6.7	7.8	9.1	10.3	11.5	12.4
Level	1	2	3	4	5	6	7	8

Dimension 2: Hard Disk Capacity (GB)								
Value	1002	1143	1286	1429	1528	1716	1859	2007
Level	1	2	3	4	5	6	7	8

Table 4: Dimensions of Laptops

Dimension 1 is the battery life in hours, as reported by the manufacturer. This ranges from 3 to 17 hours for laptops currently being sold. To make the choice between laptops slightly more difficult, I decreased the range of battery life for the hypothetical laptops. These range from 4 to 12 hours. Dimension 2 is the hard disk capacity in gigabytes (GB). This ranges from 16 GB to 2000 GB for laptops currently being sold. The hypothetical laptops will range from a 1000 GB capacity to a 2000 GB capacity. The levels are defined by taking symmetrical distances between the top and bottom values within the range, a common method in studies investigating the decoy effect (see afore-mentioned studies in section 2). These values were then adapted slightly to make the pattern less apparent. Level 1 denotes the worst value, level 8 the highest.

These two dimensions have a large enough range to design a variety of hypothetical products that will appear realistic enough to the subject and do not require technical knowledge of the products to understand. Moreover, both dimensions are interesting to every potential buyer and can be seen as objective qualities of a laptop, in the sense that 10 hours of battery are objectively better than 4 hours of battery and 2000 GB is objectively better than 1000 GB, regardless of what the subject intends to use the laptop for. This is crucial for the ICP and AD design, which requires the calculation of a decoy. Other specifications such as weight, the keyboard, screen size and resolution, processing speed or RAM are much more dependent on intended use, like gaming or work. The brand and operating system are highly subjective criteria to judge a laptop by. All in all, these two dimensions should provide a simplistic but realistic enough choice setting.

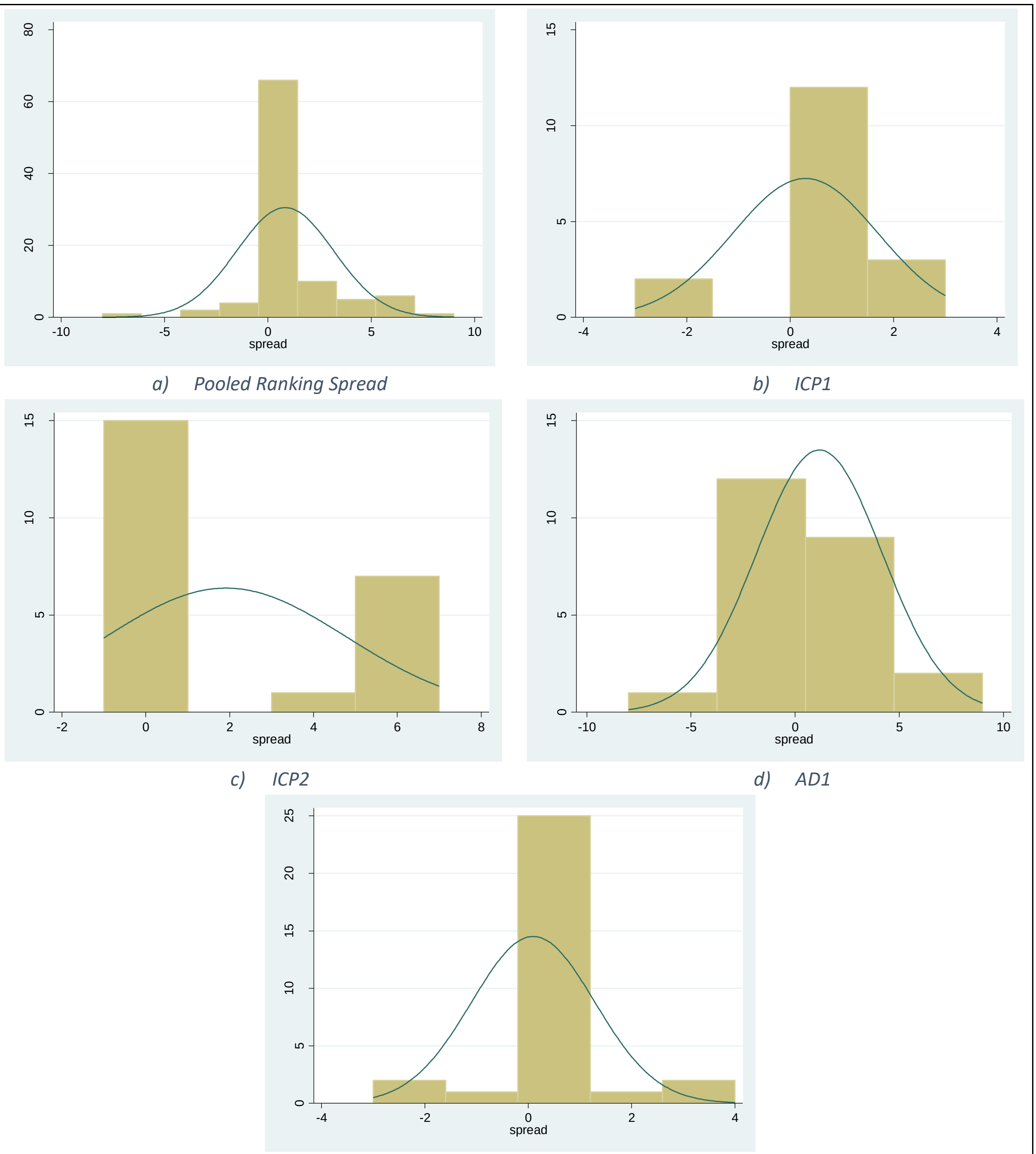
B. Underlying Assumptions for Parametric Testing

Provided several underlying assumptions hold for the data, parametric tests are preferred to non-parametric tests. The assumptions for parametric testing are independence of observations, linearity and additivity, normality, and homogeneity of variance (Field, 2013). Another potential source of bias are outliers. Non-parametric tests overcome violations of these assumptions by ranking the data and analysing the ranks rather than the original data. As this results in the loss of information, however, their statistical power is lower and they should therefore only be used when the assumptions are not met.

Independence of observations is satisfied due to the between-subjects design, with each subject only completing the task once. The Figure 3 boxplot for ranking spread does show some outliers in the data, so the assumption of no outliers is not satisfied.

In large samples normality is usually not an issue, but in small samples this assumption matters. The boxplot in Figure 3 shows evidence of non-normality. Plotting the data for ranking spread in a histogram in Figure 4a), shows the variable *spread* is not normally distributed. The results of the Shapiro-Wilk test show the variable *spread* (pooled for all data) does not follow a normal distribution, as the null hypothesis of a normal distribution is rejected (W=0.908, p<0.001). The results of a Shapiro-Wilk test for normality per treatment group can be found below in Table 5.

The null hypothesis of a normal distribution is rejected for groups ICP2 and AD1. Groups ICP1 and AD2 follow a normal distribution according to the Shapiro-Wilk test, but the histogram plots in Figure 4 contradict this. Normality can therefore not be assumed.



a) Pooled Ranking Spread *b) ICP1*

c) ICP2 *d) AD1*

e) AD2

Figure 4: Histograms for Pooled Ranking Spread and per Treatment Group

Group	Description	Obs	W	V	z	Prob>z
ICP1	Congruent, no decoy	17	0.976	0.504	-1.367	0.914
ICP2	Incongruent, no decoy	23	0.828	4.491	3.055	0.001
AD1	Congruent, decoy	24	0.869	3.523	2.568	0.005
AD2	Incongruent, decoy	31	0.963	1.201	0.38	0.352

Table 5: Results Shapiro-Wilk Test for Normality

Another assumption that must hold to use parametric tests is homogeneity of variances. Levene's test for homogeneity of variances for *spread* shows the null hypothesis of equal variances can be rejected ($F(3,91)=10.11$, $p<0.001$). This means the variance is not equal for ICP1, ICP2, AD1 and AD2.

C. Mean and Median Ranking Spread

Group	Description	Mean (Standard Deviation)	Median
ICP1	Congruent, no decoy	0.294 (1.404)	0.00
ICP2	Incongruent, no decoy	1.913 (2.875)	0.00
AD1	Congruent, decoy	1.167 (3.017)	0.00
AD2	Incongruent, decoy	0.097 (1.193)	0.00

Table 6: Mean (Standard Deviation) and Median Ranking Spread

D. Results *t*-test Ranking Spread per Treatment Group

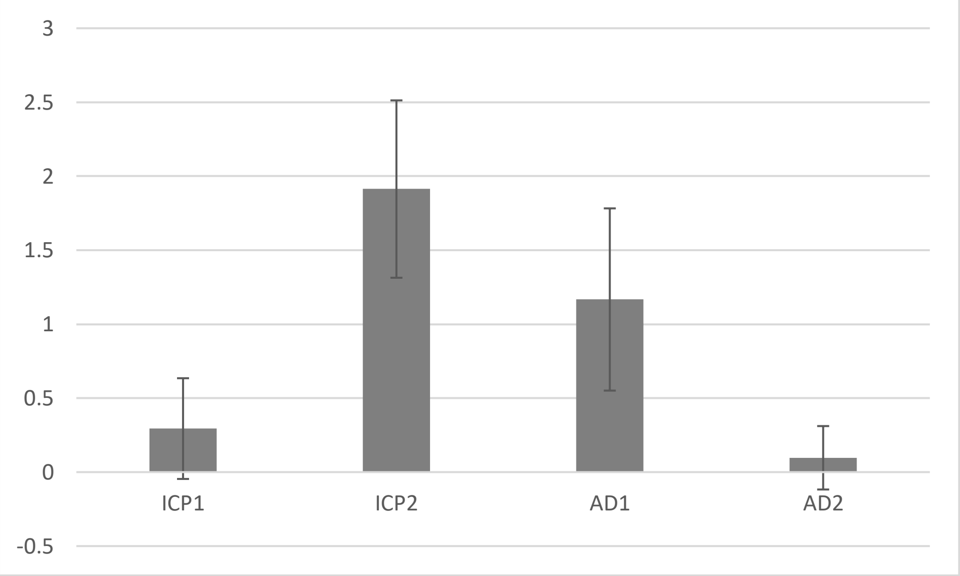


Figure 5: Mean Ranking Spread per Treatment Group with Standard Errors

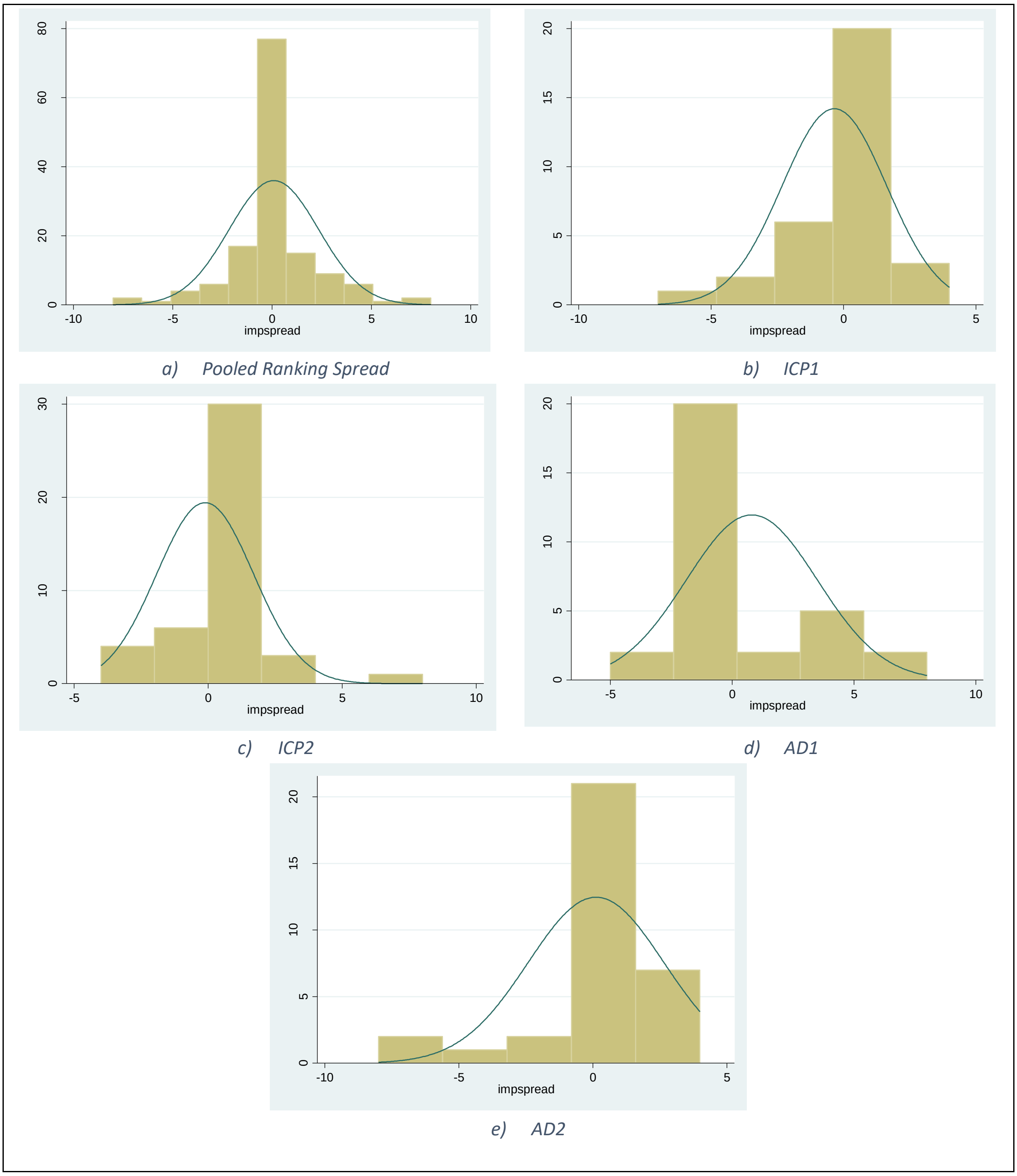
Group	Obs	Mean	Std. Err.	Std. Dev.	95% Conf. Interval		p-value
ICP1	17	0.294	0.340	1.404	-0.428	1.016	0.400
ICP2	23	1.913	0.599	2.875	0.670	3.156	0.004
AD1	24	1.167	0.616	3.017	-0.107	2.441	0.071
AD2	31	0.097	0.214	1.193	-0.341	0.534	0.655

Table 7: Results One Sample t-test Ranking Spread per Treatment Group

E. Testing the Assumption of Normality for Imputed Spread

Group	Description	Obs	W	V	z	Prob>z
0	Congruent, no decoy	32	0.937	2.099	1.539	0.062
1	Incongruent, no decoy	31	0.939	1.979	1.414	0.079
2	Congruent, decoy	33	0.901	3.364	2.523	0.006
3	Incongruent, decoy	44	0.875	5.333	3.543	0.000

Table 8: Shapiro-Wilk Test Results for Imputed Spread



a) Pooled Ranking Spread

b) ICP1

c) ICP2

d) AD1

e) AD2

Figure 6: Histograms for Pooled Ranking Spread and per Treatment Group for Imputed Choices

F. Distribution of Ranking Spread for Imputed Choices

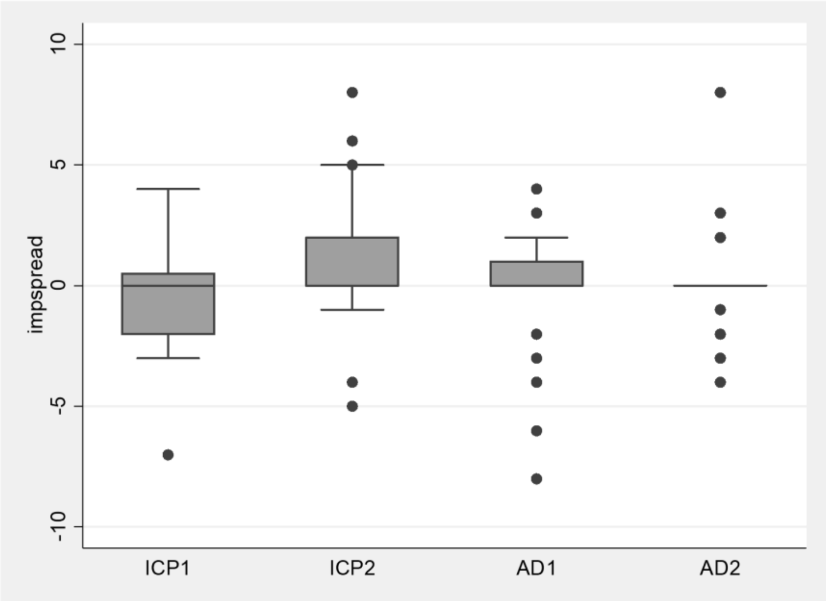


Figure 7: Ranking Spread per Treatment Group for Imputed Choices

G. t-test Results for Imputed Spread

Group	Obs	Mean	Std. Err.	Std. Dev.	95% Conf. Interval		p-value
ICP1	32	-0.344	0.350	1.977	-1.057	0.369	0.333
ICP2	31	0.806	0.483	2.688	-0.180	1.793	0.105
AD1	33	0.121	0.441	2.534	-0.777	1.020	0.785
AD2	44	-0.114	0.272	1.807	-0.663	0.436	0.679

Table 9: Results t-test per Treatment Group Imputed Choices

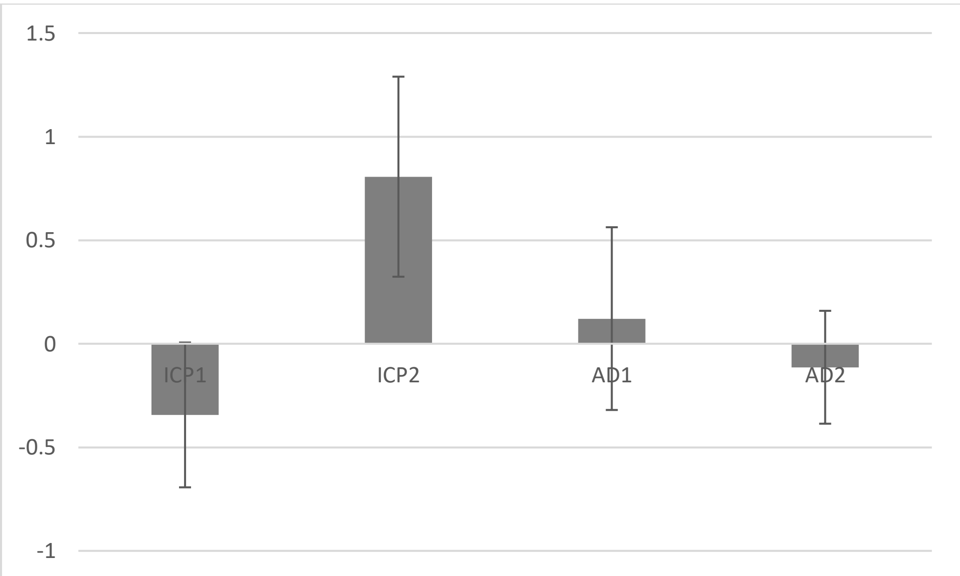


Figure 8: Ranking Spread per Treatment Group with Standard Errors for Imputed Choices

H. Regression Output for the Probability of Making Both Choices as Intended

Dependent Variable	Model 1: Congruent Choice *cancalccong*		Model 2: Incongruent Choice *cancalcincong*	
	Coefficient	**Marginal effects**	**Coefficient**	**Marginal effects**
AD1	-0.078 (0.408)	0.129 (0.093)		
AD2			0.537 (0.394)	-0.017 (0.091)
constant	-0.661 (0.309)		-0.633 (0.301)	

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

Table 10: Logistic Regression Output with Marginal Effects

I. Sample Survey from the Website

Welcome

Thank you for participating in this survey! This survey is part of a Master Thesis written at the Erasmus University Rotterdam.

You will be asked to complete four tasks in a hypothetical choice environment and to answer some additional questions. It is important that you answer according to your preferences at the moment of completing the tasks. There are no right or wrong answers. Simply think about the situations presented to you and report your honest opinion. This survey complies with the code of conduct for good scientific practice set out by Erasmus University. One specific requirement is that survey participants are not to be deceived. This means that all instructions presented to you are true. Also note that your responses will be completely anonymous and will be used for research purposes only.

Once all responses have been collected, one participant will be randomly selected to win a €10 gift card for amazon.com. If you would like to win this, you will have the opportunity to leave your e-mail address upon completing the survey.

If you have any questions, contact me at 377999ah@student.eur.nl

When you are ready, click Continue to start the survey.

Continue

In the table below and to the left you will see eight hypothetical laptops. You can assume that battery life and hard disk capacity are the *only* two relevant dimensions that distinguish these laptops from one another. The battery life is defined as the amount of hours the laptop lasts without being connected to a power supply. The hard disk capacity is the amount of data in gigabytes that can be stored. You may disregard any other possible attributes or characteristics. Although this is a simplistic, hypothetical situation, please consider the options carefully.

Your task is to rank these eight laptops in terms of their desirability to you. Please assign ranks in decreasing order of desirability, meaning rank 1 corresponds to the to the laptop you prefer the most, rank 2 to the laptop you prefer the second-most, rank 3 to the laptop you prefer the third most, and so on until rank 8, which corresponds to the laptop you prefer least. Each row in the table below and to the right corresponds to a rank. To assign a rank, select the corresponding laptop in each row, making sure you only rank each laptop once. Keep in mind there is not one correct answer to this task, so please answer purely according to your own preferences at this very moment.

Laptop	Battery Life (hours)	Hard Disk Capacity (GB)
A	7.8	1572
B	4.2	2007
C	11.5	1143
D	6.7	1716
E	9.1	1429
F	12.6	1002
G	10.3	1286
H	5.4	1859

	A	B	C	D	E	F	G	H
1	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○	○
6	○	○	○	○	○	○	○	○
7	○	○	○	○	○	○	○	○
8	○	○	○	○	○	○	○	○

When you are ready, click Next.

Next

You will now be asked to make two choices between laptops. Assume that you have to choose one of the laptops described below. Please select the laptop you would choose.

Laptop D has 6.7 hours of battery life and a hard disk capacity of 1716 GB.

Laptop C has 11.5 hours of battery life and a hard disk capacity of 1143 GB.

○ Laptop D ○ Laptop C

When you are ready for the next task, click Next.

Next

Assume that you have to choose one of the laptops described below. Please select the laptop you would choose.

Laptop E has 9.1 hours of battery life and a hard disk capacity of 1429 GB.

Laptop F has 12.6 hours of battery life and a hard disk capacity of 1002 GB.

○ Laptop E ○ Laptop F

When you are ready for the next task, click Next.

Next

Please rank all laptops once more. Notice that the laptops and your task are the same as before. The laptops are identical to the previous ones. This is **not** a memory test. Answer according to what you feel at the moment. There are no right or wrong answers. For your convenience, the instructions from before will be repeated now:

In the table below and to the left you will see eight hypothetical laptops. You can assume that battery life and hard disk capacity are the *only* two relevant dimensions that distinguish these laptops from one another. The battery life is defined as the amount of hours the laptop lasts without being connected to a power supply. The hard disk capacity is the amount of data in gigabytes that can be stored. You may disregard any other possible attributes or characteristics. Although this is a simplistic, hypothetical situation, please consider the options carefully.

Your task is to rank these eight laptops in terms of their desirability to you. Please assign ranks in decreasing order of desirability, meaning rank 1 corresponds to the to the laptop you prefer the most, rank 2 to the laptop you prefer the second-most, rank 3 to the laptop you prefer the third most, and so on until rank 8, which corresponds to the laptop you prefer least. Each row in the table below and to the right corresponds to a rank. To assign a rank, select the corresponding laptop in each row, making sure you only rank each laptop once. Keep in mind there is not one correct answer to this task, so please answer purely according to your own preferences at this very moment.

Laptop	**Battery Life (hours)**	**Hard Disk Capacity (GB)**
A	7.8	1572
B	4.2	2007
C	11.5	1143
D	6.7	1716
E	9.1	1429
F	12.6	1002
G	10.3	1286
H	5.4	1859

	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
1	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○	○
6	○	○	○	○	○	○	○	○
7	○	○	○	○	○	○	○	○
8	○	○	○	○	○	○	○	○

When you are ready, click Next.

Next

Please answer the following questions:

What is your age?

What is your nationality?

What is your gender?

○ Male
○ Female

Where would you mainly use a laptop? Select the option that mostly applies to you.

At work or university ▾

I am currently...?

○ Working
○ Studying
○ Unemployed
○ Other

Continue

If you would like a chance of winning a €10 gift card for amazon.com, please fill in your e-mail address here:

One participant will be selected and will receive a digital gift card via e-mail.

Finish

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