Endowment effect despite the odds.

Running head: Endowment effect

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ABSTRACT

Can ownership status influence probability judgments under condition of uncertainty? In three experiments, we presented our participants with a recording of a real horse race. We endowed half of our sample with a wager on a single horse to win the race, and the other half with money to spend to acquire the same wager. As the race progressed, participants were asked to update their buying or selling prices, and to estimate the probability that a given horse will win the race. Across three large studies (N = 750), we found the endowment effect – owners demanded significantly more for the wager than buyers were willing to pay to acquire it. However, we also found that probability estimates of each horse winning the race did not differ between owners and non-owners of the betting slip, despite the fact that the only information participants should use to inform their valuation is the strength of their belief that each horse will win the race. Our results demonstrate that distorted perception of probability is unlikely to be a mechanism explaining the endowment effect.

Keywords: endowment effect, loss aversion, betting, valuation, probability estimation

One of the most robust and widely-reported anomalies in behavioural economics is a pattern of preferences called the endowment effect, whereby people require more compensation to give up an object than they will pay to acquire it (Kahneman, Knetsch, & Thaler, 1991; Thaler, 1980). This asymmetry is apparent in studies where sellers' (owners) willingness-to-accept (WTA) is systematically found to be much higher than buyers' (non-owners) willingness-to-pay (WTP) for the same product. The effect is often explained using prospect theory (Kahneman & Tversky, 1979): the valuation disparity arises as a consequence of loss aversion from the perspective of the owner of the object, with losses being weighted more heavily than gains. Since loss aversion offers a purely descriptive account of the endowment effect, a number of efforts have been directed at explaining the cognitive and affective processes that may produce the WTA-WTP gap (Ariely, Huber, & Wertenbroch, 2005; Gal, 2006). A large proportion of this work focused on the comparison between owners' and non-owners' behavior for goods that are risky, such as monetary gambles or lottery tickets (see Yechiam, Ashby, & Pachur, 2017 for a recent meta-analysis).

One possible cause for the endowment effect under conditions of risk and uncertainty, which has been largely overlooked in the past literature, is that owners may overestimate the value of a possession due to a distorted perception of the probability with which a given object will bring a positive return (Okada, 2010; Walasek, Wright, & Rakow, 2014). Consider one of the most striking demonstrations of the endowment effect in risky choice – the unwillingness to trade lottery tickets (Bar-Hillel & Neter, 1996; Risen & Gilovich, 2007). One ticket in a random draw lottery is just as valuable as any other ticket and yet participants have shown reluctance to trade with each other, even if the exchange brings additional monetary reward and the transaction costs are minimal. When Bar-Hillel and Neter (1996) asked their participants to state the probability that a held ticket would be the winning one, the probabilities did not exceed the actual odds given by the lottery's structure. In the context of such a

transparent lottery, it should not be surprising that participants were able to simply report the objective probability of winning. However, this method cannot fully discount the possibility that participants' personal beliefs about their chance of winning were distorted by their ownership status.

In order to explore whether ownership status can distort probability estimates, we now turn to goods of uncertain value, for which the probabilities associated with outcomes are unknown to the decision maker. To investigate whether probability judgments can be distorted by the ownership status, we use horse racing as the context for our experiments. Horse races represent a good example of dynamic uncertainty experienced in the environment where probabilities associated with the different outcomes are often unknown. Before a race begins, bettors must integrate their prior beliefs, without any evidence from the present race, to decide which horse to bet on. As the race progresses, more information is available that can be used to update observers' beliefs. In the following three experiments, we endowed half of our sample with a wager on a single horse winning the race, and the other half with money to spend to acquire the same wager. As the race progressed and new information about the competitors was accumulated, participants were asked to update their buying or selling prices, and to estimate the probability that a given horse will win the race.

This unique experimental design allows us to test three possible effects of ownership status on stated probability judgments. First, it is possible that ownership status alone can be a source of bias in probability estimates. For example, participants who own a bet may believe that giving up their ticket "tempts fate" and increases the chance of a negative event occurring (Durand, Emhoff, Frey, Shea, & Holmes, 2015; Risen & Gilovich, 2007, 2008). However, we should also expect that the differences between owners and non-owners in probability estimates and valuation reduce as the race progresses and the uncertainty associated with the competing horses decreases (cf. Okada, 2010; Walasek et al., 2014). The

additional information about horses' performance should correct, at least in part, any misperception formed at the point when ownership of the bet was the only basis for forming a prediction about the race results. Second, an alternative prediction is that the size of the endowment effect and the discrepancy in probability judgments will increase as more information about the race is accrued. This prediction is based on the growing evidence that the WTA-WTP gap reflects differences in information-processing, which involve mechanisms of attention allocation (Carmon & Ariely, 2000), memory retrieval (Johnson, Häubl, & Keinan, 2007), or pre-decisional information search (Pachur & Scheibehenne, 2012). According to these accounts, ownership status leads to a biased evaluation of the product, elevating its value for owners but suppressing it for buyers (Morewedge & Giblin, 2015; Novemsky & Kahneman, 2005). While our study does not aim to discern between these individual process-based mechanisms, we predict that continuous and biased information processing can enlarge differences in the probability estimates between owners and non-owners. The third possibility is that there are no differences in the probability estimates of owners and non-owners, and that the (mis)perception of probability does not contribute to the size of the WTA-WTP gap. Here we summarize the three predictions in the form of competing hypotheses about the role of ownership status in probability judgments under condition of uncertainty:

H1: Ownership status is a source of bias in probability judgments when no diagnostic information is available. The bias should reduce as more information is accumulated, leading to a reduction of the endowment effect.

H2: Ownership status is a source of bias in information processing. As a result, the endowment effect should increase as more information is accumulated.

H3: Ownership status does not influence probability estimates and the endowment effect can arise in the absence of any distortions in people's judgments.

Experiment 1a

Method

Design and Materials

Participants were assigned to the group of owners or non-owners of a virtual betting slip for a wager on a particular horse (Severina). This bet could return $2.00 if Severina won the race, but nothing if the horse did not finish first. Instead of a betting slip, non-owners were given an additional $1.00 which they could use to purchase the wager. The field of eight horses was narrowed for wagering purposes to two, which were identified as being among the top four finishing horses. Unbeknownst to the participants, the two horses were in fact the first (Severina) and second-place (Happy Daze) finishers. Race footage was taken from the Lagoon Games package (Race 1 from Lagoon Handicap Hurdle; two miles and one furlong) with audio commentary muted; participants had no prior odds information. An online survey system (Qualtrics; www.qualtrics.com) controlled the display and timing of the video playback and questions.

We divided the race footage into three blocks in order to capture different beliefs about the probability of Severina and Happy Daze winning the race. At the beginning of each block participants had a chance to either buy or sell the wager by specifying their WTP or WTA, respectively. On the next screen, each participant was also asked to indicate the probability of the two horses winning the race. The first valuation and probability estimation occurred when horses were still at the starting gates. At this point, each horse was equally likely to win, as there was no prior information available to suggest otherwise. Between

blocks 1 and 2 Happy Daze and Severina were tied and in the lead, but with half of the distance still ahead of them. Block 2 ended just before the finishing line, with Happy Daze in the lead and Severina in 5th position.

Participants

A sample of 286 participants from the USA was obtained via the online platform Amazon Mechanical Turk (MTurk; www.mturk.com). When responses originated from the same IP address, only the earlier submission was retained, unless the two overlapped in time. Data from participants failing to answer every question were deleted. We also removed participants who did not provide correct valuation responses in the pricing task (e.g., switched multiple times in the price list). The final sample used in the analysis included 229 responses. Each individual received at least $0.50 for taking part in the study, which took approximately 15 minutes to complete.

Procedure

At the beginning of the experiment, participants were informed that they were going to watch a video recording of a horse race. They were then given either a $1.00 bet which would return $2.00 if Severina won the race, or $1.00 that could be used to obtain this wager. Both owners and non-owners were informed that at three points during the horse race, they would have the opportunity to choose between acquiring (selling) the bet and different amounts of money. This opportunity came at the beginning of each block: just before the start of the race (block 1), halfway through the race (block 2) and just before the finish line (block 3). The buying and selling task applied the Becker-DeGroot-Marschak incentive compatible method (BDM; Becker, DeGroot & Marschak, 1964). As it was explained to the participants, a random market price would be drawn at the end of the experiment to determine whether

participants purchased or sold the wager. The market value could be compared to any of the three valuations made during the experiment.

In addition to the valuation questions, participants were also asked about the probability that Happy Daze and Severina would win the race. Responses for each horse were recorded separately using two sliders that did not need to add up to 100 percent. Probability judgments were always collected at the end of each block (1, 2 and 3) but always after valuation questions. When the race finished, a random market price for the wager was generated to determine final ownership of the wager. Those who ended up with a bet were paid $2.50 ($0.50 participation fee + $2.00 winnings) minus the amount of money they spent in order to acquire the wager (buyers only). Individuals who ended up not owning the wager received a $0.50 participation fee plus either $1.00 (buyers only) or the amount they sold the wager for (sellers only).[3]

Results

A summary of owners' and non-owners' valuations across three stages of the race is presented in the top left panel of Figure 1.

*** Insert Figure 1 About Here ***

From the plot, it is clear that owners asked for more money for the wager than buyers were willing to pay for it, demonstrating the classic endowment effect. Furthermore, although valuations visibly drop from block 2 to 3, the WTA-WTP disparity remains stable across all three time points. Consistent with the events in the race, valuations of the wager are close to $1.00 when horses are still at the starting line (block 1) and when they are tied halfway

[3] At the end of the experiment we also collected responses on the Cognitive Reflection Test (Frederick, 2005) to test an auxiliary hypothesis. However, the majority of respondents indicated that they were familiar with the task, making these data unusable.

through the race (block 2). However, the value of the wager on Severina drops considerably when the horse is in the 5th position, just before the end of the race.

We analysed the valuation data for all three blocks simultaneously using linear mixed effect modeling (with *lme* R package; http://www.R-project.org/). The model included a random effect of participant and fixed effects for the ownership status and block (and their interaction). Summary of the results for valuation are shown in the top panel of Table 1. The corresponding p-values were calculated using the Satterthwaite approximation (lmerTest package in R, Kuznetsova, Brockhoff, & Christensen, 2014).

*** Insert Table 1 About Here ***

The results confirm that there is a significant endowment effect. Also, valuations drop significantly in block 3, just before the end of the race. From the lack of interaction with time at which valuation was made we can conclude that the size of the gap was relatively constant throughout the race. Indeed, owners demanded 22.4%, 21.6% and 25.0% more than non-owners, at each consecutive time point of the race. In comparison to other studies that used risky (but not uncertain) objects, our endowment effect was smaller than the median ratio of 1.52 found in a recent meta-analysis (Yechiam et al., 2017).

The probability judgments for both Severina and Happy Daze reveal that owners and non-owners of the wager shared approximately the same beliefs about the odds of the two horses winning the race. The surprising lack of any disparity is apparent in both left and right panels in the top part of Figure 2. This result is consistent with Hypothesis 3.

*** Insert Figure 2 About Here ***

Overall, whereas probability estimates varied throughout the race, the sum of the aggregate estimates is close to 100% in each block. Naturally, we would not expect the sum to always

be this high since Severina and Happy Daze were not the only horses involved in the race and participants were explicitly told that these two horses were among the top four finishers. We return to this issue in our general discussion. Notably, however, probability estimates appear to reflect relative changes in valuations that we can observe in Figure 1.

We used mixed effect modelling to predict probability judgments at block 1, 2 and 3 for each horse separately. Surprisingly, the effect of ownership status is significant in case of Happy Daze (bottom section of the Table 1) although it is clear from Figure 2 that the only evident difference occurs at the beginning of block 1 (but note that the interaction effect is not significant with *p*-values of .065 and .093). It therefore seems that while owners and non-owners were in agreement regarding the chances of Severina winning, their beliefs about Happy Daze may have differed marginally. Notably, compared to owners, non-owners tend to overestimate the probability that Happy Daze will win the race, which is hard to reconcile with the valuation data where the size of the endowment effect remained relatively stable in all three blocks.

Experiment 1b

The results of the Experiment 1a are surprising in that we find strong evidence for the endowment effect in the absence of differences in the subjective probability judgments between owners and non-owners of a wager. In order to determine whether these effects are robust, we conducted a replication study with a new sample of participants. In Experiment 1a, participants were always asked to value the wager before providing probability estimates. In Experiment 1b, we reversed the order of these questions, always asking our participants about the probability of each horse winning the race first.

Method

Design and Materials

Design and Materials were identical to those used in Experiment 1a.

Participants

We recruited 300 participants from the USA using MTurk. In Experiment 1b, we increased the base payment to $0.75. We used the same screening criteria as in Experiment 1a (16 removed) but additionally asked our participants if they have encountered any technical problems or have taken part in a similar study before (i.e. study with videos of horse races). Only one participant had an issue with the videos loading correctly and was excluded from the analysis. Our final sample included 283 responses.

Procedure

The procedure was identical to Experiment 1a with one exception. In the current study, participants were always asked to provide their probability estimates immediately after watching a video and before they could determine WTP or WTA for the wager.

Results

The right panel of Figure 1 illustrates the presence of the endowment effect in all three blocks of the horse race, which is consistent with the results of Experiment 1a. Owners of the bet demanded 28.1%, 31.1% and 28.6% more than non-owners in blocks 1, 2 and 3, respectively. Middle left panel of Figure 2 demonstrates that probability judgments for Severina winning the race were not different between owners and non-owners. For Happy Daze, on the other hand, we find that non-owners gave higher probability estimates than owners in all three blocks of the race. This interpretation is confirmed by the results of two regression analyses which are reported in the right column of Table 1. As in Experiment 1a,

the main effect of Ownership status is significant for the probability estimates of Happy Daze winning the race (bottom part of Table 1).

Overall, we find a clear WTA-WTP gap in valuation in the context of horse racing. At the same time, we do not find evidence supporting the hypothesis that this disparity is driven by a difference in beliefs about the odds of each horse winning the race. Consequently, we do not find that distortions of probability estimates (and valuation gaps) decrease (Hypothesis 1) or increase (Hypothesis 2) as the race goes on. Instead, we find further support for our Hypothesis 3 according to which ownership status does not impact probability judgments.

Experiment 2

One interpretation of the findings presented so far is that ownership status does not influence buyers' and sellers' probability estimates, and therefore cannot explain the observed endowment effect. Another possibility is that our measure of bettors' beliefs was not sensitive enough to identify differences between owners and non-owners of the wager. In fact, our measure was limiting in that it only allowed for a single point estimate for each of the two horses. It seems more plausible, however, that individual beliefs take a form of a distribution over some probability space, which simply reflects varying strength with which a given belief is held. In order to address potential limitation of our measurement, we elicited people's probability estimates in the form of distributions over a range of probabilities in Experiment 2. In other words, we gave our participants an opportunity to express their confidence in their estimates of probabilities that the horses Severina and Happy Daze will win the race.

Obtaining people's judgments as belief distribution allows us to test more precisely how ownership status influences people's probability estimates. First, it is possible that owners and non-owners differ in how confident they are in their probability judgments. Some

authors have argued that the prospect of losing owned possession motivates sellers to devote more cognitive resources to the task at hand. Indeed, it has been argued that the differences in cognitive effort and motivation between owners and non-owners may explain valuation gaps (Yechiam & Hochman, 2013). The second possibility is that owners and non-owners may differ in the amount of skew in their belief distributions. That is, while their mean judgment could be the same, owners may be nonetheless biased towards higher estimates while non-owners may be biased towards lower estimates. We therefore use skewness scores as a more sensitive measure for detecting biased representation of an object that could in part be responsible for the emergence of the endowment effect.

Method

Design and Materials

Design and Materials were identical to Experiment 1a, with only one key difference. In Experiment 2, we used DistributionBuilder tool (Andre, 2016) to collect our participants' subjective judgments that a given horse will win the race. This method was originally introduced by (Sharpe, Goldstein, & Blythe, 2000) and was subsequently employed to study people's subjective probabilities and confidence judgments (Goldstein, Johnson, & Sharpe, 2008). The tool permits participants to indicate their response by assigning tokens to individual bins that represent some chosen quantity. In the present study, we used 11 bins that ranged from 0% to 100% in 10% intervals. Each participant had 10 tokens to distribute such that their assignment reflected their confidence in the exact probability that a given horse would win the race. The maximum number of tokens that could be assigned to any individual bin was set to 10.

Participants

We recruited 332 participants from MTurk. The base payment for this study was set to $0.75. In addition to the exclusion criteria used in Experiment 1b, we also removed responses of participants who failed to complete our new distribution elicitation questions. Our final sample size included 238 responses.

Procedure

The procedure was identical to Experiment 1a with the exception of the new probability estimation questions replacing the probability point estimate questions used in the previous two experiments. We adapted our instructions and showed participants a screenshot of a distribution builder tool. Participants were asked to distribute all 10 tokens between the available bins. They were also informed that the more confident they are in a given probability, the more tokens they should assign to it.

Results

Mean valuations of owners and non-owners are shown in the bottom panel of Figure 1. Results are highly consistent with Experiment 1a and 1b, which is further confirmed by the regression analyses (see Table 2). As before, we find a significant effect of ownership (owners demanding 39.4%, 44.6% and 37.4% more than non-owners blocks 1, 2 and 3, respectively), and that valuations are lower in block 3 than in block 1.

*** Insert Table 2 About Here ***

In order to compare probability estimates, we first computed a modal response given by the participants in the distribution builder task. We simply computed the weighted average based on the tokens that people assigned to different probability bins. The results are plotted in the bottom panel of Figure 2. Visibly, the pattern of results is consistent with our previous findings, despite using a rather different methodology to elicit people's probability estimates.

First, while we find that probability judgments follow the events of the race, there are no differences between owners and non-owners in judged probability of Severina winning the race. In the case of Happy Daze, the effect of ownership is also absent. These conclusions align with the results of our regression analyses, which are reported in Table 3.

*** Insert Table 3 About Here ***

The use of distribution builder allows us to explore two further features of the elicited beliefs. First, we computed the confidence of people's judgments, by calculating the standard deviation of people's responses. Table 3 summarizes results of the regression analysis, which tells us that standard deviation was lower in Blocks 2 and 3 compared to Block 1. However, buyers and sellers did not differ in terms of the confidence with which they judged the probability of each horse winning the race. Next, we computed skewness scores among our participants. One possibility is that owners are biased towards high estimates, while non-owners are biased towards low estimates, even if their modal responses are the same. We computed skewness statistic for each participant's responses (package *e1071*; Joanes & Gill, 1998). The score of 0 represents a perfectly symmetrical distribution. Regression results in Table 3 show that, once more, we find no differences between owners and non-owners. In other words, ownership of the wager did not lead owners and non-owners to be biased towards higher and lower estimates, respectively. Both standard deviations and skewness scores are plotted in Figure 3.

*** Insert Figure 3 About Here ***

General Discussion

Our results show that ownership status does not influence probability judgments under condition of uncertainty. Consistent with the endowment effect literature, we found

that people endowed with a wager demanded more money in exchange for it than buyers were willing to pay for it. As the race progressed and new information about the horses was accumulated by the participants, the valuation gap remained constant. Finally, perceived probability of each horse winning the race did not differ between owners and non-owners of the betting slip. Thus, although owners overvalued their wager on Severina, they did not think that this horse was more likely to win, or that the challenger (Happy Daze) was less likely to succeed. This is surprising since the only information participants should use to inform their valuation is the strength of their belief that each horse will win the race.

To the best of our knowledge we are the first to show how the endowment effect evolves across time in a realistic setting, with accumulation of new evidence under conditions of uncertainty. Our design allowed us to explore three unique stages of belief formation. At the beginning of the race, we observed equal probability estimates of owners and non-owners when no prior information about the horses was available. At the end of the first block, participants had a chance to evaluate both horses when they were tied. Despite the fact that everyone was free to evaluate the horses' performance throughout the race, the probability judgments of the two groups did not diverge. In the final stage, the poor performance of Severina is reflected in probability judgments, although once again, the perception is the same among owners and non-owners of the betting slip. Clearly, perception of probability was unrelated to the size of the endowment effect.

We observed some differences in judged probability of Happy Daze winning the race. In Experiment 1a, buyers' estimates were higher before the race began, and in Experiment 1b buyers' estimates were slightly higher in all three blocks of the race. In Experiment 2, on the other hand, there were no differences between owners and non-owners at any point in the race. The observed distortions were generally too small (~3%) to be able to explain the robust endowment effect that was found in all blocks in all three experiments.

While probability estimates generally followed events of the race and reflected people's valuations, we also observed that estimates were generally very high. More specifically, since participants were informed that Severina and Happy Daze are among top four finishers, it is surprising that probability estimates for the two target horses often summed up to 100%. It therefore appears that our participants ignored the fact that other horses could also win the race. One possible explanation for this result is that our instructions and experimental design reinforced individuals' belief that the winner must be either Severina or Happy Daze. Nonetheless, there is no apparent reason why this could obscure our main finding that the estimates of probability are the same for owners and non-owners of the betting slip.

Since we did not find that distorted probability judgments accounted for the endowment effect, it is likely that other mechanisms are responsible for the WTA-WTP disparity in our experiment. One obvious candidate is regret aversion (Bar-Hillel & Neter, 1996; Kogler, Kühberger, & Gilhofer, 2013; Ratan, 2013; Risen & Gilovich, 2008). Anticipated feelings of regret associated with giving up a winning bet or wasting money on an unsuccessful one has been shown to be a strong contributor to the endowment effect. For example, Ratan, (2013) demonstrated that when holders of a lottery tickets can reverse their decision to sell or keep their endowment, they are more likely to trade. Similarly, inducing feelings of regret (Martinez, Zeelenberg, & Rijsman, 2011) or making them less vivid (Maimaran, 2011), reduce the under trading in lottery tasks. Although some have suggested that misperception of probability might contribute to the WTA-WTP disparity alongside feelings of regret, our results suggest that this is an unlikely scenario. In line with the work of Walasek et al. (2014), we find that the perception of probability does not seem to explain the endowment effect. However, in contrast to their findings, we did not observe that the endowment effect decreases in magnitude as the uncertainty about the value of a risky asset decreases.

Our results, together with those reported by Bar-Hillel and Neter (1996; also Walasek et al., 2014), show that a difference in valuation between owners and non-owners for objects of risky or uncertain value can arise even when these two groups do not differ in their perception of probability associated with these goods/assets. Despite this, plenty of empirical evidence shows that owners and non-owners differ in their evaluation of an object, in both risky and riskless contexts. For example, Johnson, Häubl and Keinan (2007) argued that perspective (i.e., being a buyer vs. a seller) influences internal information search when people generate valuations of goods. The process is explained by Query Theory (QT; Weber & Johnson, 2006), which posits that buyers and sellers retrieve information about the value of goods based on their current status quo. Specifically, buyers initially retrieve information that decreases the value of a prospective purchase, while sellers tend to first recall features that enhance the value of their asset/possession. Several studies (e.g., Johnson et al., 2007) found support for QT's predictions with differences in information retrieval being shown to mediate the endowment effects. According to these accounts, the top-down effect of ownership status influences attention allocation to positive and negative attributes of a good (Ashby, Dickert, & Glockner, 2012; Carmon & Ariely, 2000; Nayakankuppam & Mishra, 2005). Lastly, ownership status also appears to influence the pre-decisional information search. Pachur and Scheibehenne (2012) found that when probabilities and outcomes of gambles are not known to the participants, but this information can be acquired by repeatedly sampling from different alternatives, the stopping rule of this search differs as a function of ownership status. In their study, owners were more likely to stop their information search after encountering a positive outcome, whereas buyers were more likely to stop having seen a negative outcome. The authors showed that these differences predicted the size of the endowment effect in their study.

The accounts summarized above suggest that owners and non-owners form a biased representation of an object, which gives rise to the WTA-WTP disparity. Our results suggest that the endowment effect can occur even if owners and non-owners share the same perception of how profitable an uncertain asset is. In explaining the endowment effect, further studies are needed to address the apparent discordance between different process level measurements, valuation, and evaluative judgments.

References

Andre, Q. (2016). DistributionBuilder v 1.0.0. Retrieved from https://zenodo.org/record/166736/export/dcite3#.WTK-9WjyuUk

Ariely, D., Huber, J., & Wertenbroch, K. (2005). When do losses loom larger than gains? *Journal of Marketing Research*, *42*(2), 134–138. https://doi.org/10.1509/jmkr.42.2.134.62283

Ashby, N. J. S., Dickert, S., & Glockner, A. (2012). Focusing on what you own: Biased information uptake due to ownership. *Judgment and Decision Making*, *7*(3), 254–267.

Bar-Hillel, M., & Neter, E. (1996). Why are people reluctant to exchange lottery tickets? *Journal of Personality and Social Psychology*, *70*(1), 17–27. https://doi.org/10.1037/0022-3514.70.1.17

Carmon, Z., & Ariely, D. (2000). Focusing on the forgone: How value can appear so different to buyers and sellers. *Journal of Consumer Research*, *27*(3), 360–370. https://doi.org/10.1086/317590

Durand, A., Emhoff, C., Frey, K., Shea, B., & Holmes, K. J. (2015). Negative outcomes for

those who tempt fate. Retrieved October 27, 2016, from http://www.psychfiledrawer.org/replication.php?attempt=MjIy

Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic Perspectives*, *19*(4), 25–42. https://doi.org/10.1257/089533005775196732

Gal, D. (2006). A psychological law of inertia and the illusion of loss aversion. *Judgment and Decision Making*, *1*(1), 23–32. https://doi.org/10.1037/e683162011-083

Goldstein, D. G., Johnson, E. J., & Sharpe, W. F. (2008). Choosing outcomes versus choosing products: Consumer-focused retirement investment advice. *Journal of Consumer Research*, *35*(3), 440–456. https://doi.org/10.1086/589562

Joanes, D. N., & Gill, C. A. (1998). Comparing measures of sample skewness and kurtosis. *Journal of the Royal Statistical Society: Series D (The Statistician)*, *47*(1), 183–189. https://doi.org/10.1111/1467-9884.00122

Johnson, E. J., Häubl, G., & Keinan, A. (2007). Aspects of endowment: a query theory of value construction. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *33*(3), 461–74. https://doi.org/10.1037/0278-7393.33.3.461

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 263. https://doi.org/10.2307/1914185

Kogler, C., Kühberger, A., & Gilhofer, R. (2013). Real and hypothetical endowment effects when exchanging lottery tickets: Is regret a better explanation than loss aversion? *Journal of Economic Psychology*, *37*, 42–53. https://doi.org/10.1016/j.joep.2013.05.001

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2014). lmerTest: Tests for random and fixed effects for linear mixed effect models (Lmer objects of Lme4

package).

Maimaran, M. (2011). To trade or not to trade: The moderating role of vividness when exchanging gambles. *Judgment and Decision Making*, *6*(2), 147–155.

Martinez, L. F., Zeelenberg, M., & Rijsman, J. B. (2011). Regret, disappointment and the endowment effect. *Journal of Economic Psychology*, *32*(6), 962–968. https://doi.org/10.1016/j.joep.2011.08.006

Morewedge, C. K., & Giblin, C. E. (2015). Explanations of the endowment effect: an integrative review. *Trends in Cognitive Sciences*, *19*, 339–348. https://doi.org/10.1016/j.tics.2015.04.004

Nayakankuppam, D., & Mishra, H. (2005). The endowment effect: Rose-tinted and dark-tinted glasses. *Journal of Consumer Research*, *32*(3), 390–395.

Novemsky, N., & Kahneman, D. (2005). The boundaries of loss aversion. *Journal of Marketing Research*, *42*(2), 119–128. https://doi.org/10.1509/jmkr.42.2.119.62292

Okada, E. M. (2010). Uncertainty, risk aversion, and WTA vs. WTP. *Marketing Science*, *29*(1), 75–84. https://doi.org/10.1287/mksc.1080.0480

Pachur, T., & Scheibehenne, B. (2012). Constructing preference from experience: the endowment effect reflected in external information search. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *38*(4), 1108–16. https://doi.org/10.1037/a0027637

Ratan, A. (2013). Anticipated regret or endowment effect? A reconsideration of Exchange asymmetry in laboratory experiments. *Journal of Economic Analysis & Policy*, *14*(1), 277–298. https://doi.org/10.1515/bejeap-2013-0018

Risen, J. L., & Gilovich, T. (2007). Another look at why people are reluctant to exchange lottery tickets. *Journal of Personality and Social Psychology*, *93*(1), 12–22. https://doi.org/10.1037/0022-3514.93.1.12

Risen, J. L., & Gilovich, T. (2008). Why people are reluctant to tempt fate. *Journal of Personality and Social Psychology*, *95*(2), 293–307. https://doi.org/10.1037/0022-3514.95.2.293

Sharpe, W. J., Goldstein, D. G., & Blythe, P. W. (2000). *The distribution builder: A tool for inferring investor preferences*. Retrieved from http://www.stanford/.edu/˜wfsharpe/art/qpaper/qpaper.html

Walasek, L., Wright, R. J., & Rakow, T. (2014). Ownership status and the representation of assets of uncertain value: The balloon endowment risk task (BERT). *Journal of Behavioral Decision Making*, *27*(5), 419–432. https://doi.org/10.1002/bdm.1819

Weber, E. U., & Johnson, E. J. (2006). Constructing preferences from memory. In S. Lichteinstein & P. Slovic (Eds.), *The Construction of Preference* (pp. 397–410). New York, NY. https://doi.org/10.2139/ssrn.1301075

Yechiam, E., Ashby, N. J. S., & Pachur, T. (2017). Who's biased? A meta-analysis of buyer–seller differences in the pricing of lotteries. *Psychological Bulletin*, *143*(5), 543–563. https://doi.org/10.1037/bul0000095

Yechiam, E., & Hochman, G. (2013). Losses as modulators of attention: review and analysis of the unique effects of losses over gains. *Psychological Bulletin*, *139*(2), 497–518. https://doi.org/10.1037/a0029383

Table 1. The effect of ownership status and block on valuation and probability judgments.

		Experiment 1a				Experiment 1b			
		Est.	*SE*	*t*	*p*	*Est.*	*SE*	*t*	*p*
Valuation	Intercept	0.89	0.04	22.70	< .001	0.85	0.04	22.88	<.001
	Ownership	0.20	0.06	3.47	< .001	0.24	0.05	4.44	<.001
	Block 2	0.04	0.04	1.25	.213	0.04	0.03	1.37	.172
	Block 3	-0.25	0.04	-6.90	<. 001	-0.16	0.03	-6.03	<.001
	Ownership * Block 2	<0.01	0.05	0.05	.962	0.04	0.04	0.88	.380
	Ownership * Block 3	-0.04	0.05	-0.73	.466	-0.04	0.04	-0.93	.354
		Pseudo R^2 = .758				*Pseudo R^2 = .828*			
p(Severina wins)	Intercept	60.37	1.75	34.25	< .001	56.61	1.64	34.55	<.001
	Ownership	-0.29	2.57	-0.12	.909	1.60	2.36	0.68	.499
	Block 1	3.41	2.13	1.60	.110	10.82	1.84	5.90	<.001
	Block 2	-19.20	2.13	-9.01	< .001	-16.39	1.84	-8.93	<.001
	Ownership * Block 2	0.66	3.12	0.21	.834	0.24	2.65	0.09	.927
	Ownership * Block 3	-0.82	3.12	-0.26	.792	-0.89	2.65	-0.33	.740
		Pseudo R^2 = .553				*Pseudo R^2 = .653*			
p(Happy Daze wins)	Intercept	54.77	1.59	34.70	< .001	53.99	1.52	35.54	<.001
	Ownership	-5.12	2.31	-2.22	.027	-5.19	2.19	-2.37	.018
	Block 1	4.58	1.82	2.52	.012	4.96	1.81	2.74	.006
	Block 2	19.42	1.82	10.67	< .001	20.52	1.81	11.34	<.001
	Ownership * Block 2	4.93	2.66	1.85	.065	1.34	2.61	.51	.609
	Ownership * Block 3	4.49	2.66	1.69	.093	2.92	2.61	1.12	.263
		Pseudo R^2 = .611				*Pseudo R^2 = .574*			

Note. For the fixed effect of ownership, sellers are used as a reference point. "Est." stands for the non-standardized beta coefficient.

Table 2. The effect of ownership status and block on valuation in Experiment 2.

	Est.	*SE*	*t*	*p*
Intercept	0.72	0.03	22.43	<.001
Ownership	0.28	0.05	6.22	<.001
Block 2	0.03	0.03	1.16	.248
Block 3	-0.10	0.03	-3.85	<.001
Ownership * Block 2	0.05	0.04	1.36	.175
Ownership * Block 3	-0.05	0.04	-1.39	.165
	Pseudo R^2 *= .807*			

Table 3. The effect of ownership status and block on valuation and probability judgments in Experiment 2.

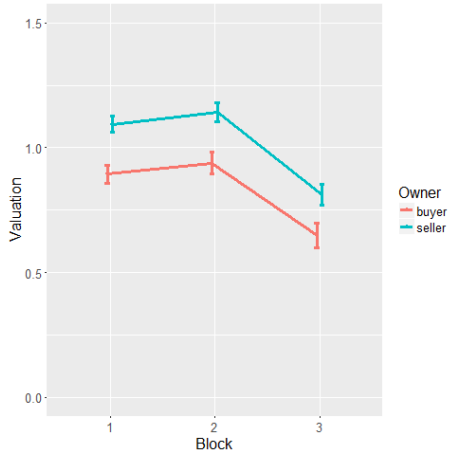
		Severina				Happy Daze			
		Est.	*SE*	*t*	*p*	*Est.*	*SE*	*t*	*p*
Modal Prob. Estimate	Intercept	52.60	1.72	30.62	<.001	46.86	1.58	29.68	<.001
	Ownership	1.30	2.44	0.53	.595	-3.05	2.24	-1.36	.174
	Block 2	4.81	1.67	2.88	.004	0.78	2.24	0.48	.633
	Block 3	-13.13	1.77	-7.85	<.001	17.43	1.62	10.76	<.001
	Ownership * Block 2	1.77	2.38	0.74	.457	3.45	2.30	1.50	.135
	Ownership * Block 3	1.68	2.38	0.71	.481	3.00	2.30	1.30	.193
		Pseudo R^2 = .719				*Pseudo R^2 = .701*			
St. Dev.	Intercept	8.99	0.62	14.44	<.001	9.27	0.63	14.73	<.001
	Ownership	0.23	0.88	-0.26	.797	0.20	0.89	0.22	.825
	Block 1	-1.86	0.58	-3.20	.001	-2.35	0.60	-3.76	<.001
	Block 2	-1.66	0.58	-2.84	.005	-2.33	0.60	-3.90	<.001
	Ownership * Block 2	-0.65	0.83	-0.79	.431	-0.19	0.85	-0.23	.819
	Ownership * Block 3	-0.59	0.83	-0.72	.473	-0.02	0.85	-0.03	.979
		Pseudo R^2 = .713				*Pseudo R^2 = .705*			
Skewness	Intercept	-0.12	0.05	-2.41	.016	-0.06	0.05	-1.14	.257
	Ownership	0.06	0.07	0.81	.421	0.04	0.08	0.53	.597
	Block 1	0.10	0.07	1.34	.183	0.08	0.07	1.11	.270
	Block 2	0.21	0.07	3.09	.002	-0.09	0.07	-1.19	.236
	Ownership * Block 2	-0.08	0.10	-0.80	.425	-0.07	0.11	-0.67	.506
	Ownership * Block 3	-0.15	0.10	-1.61	.109	0.02	0.11	0.24	.815
		Pseudo R^2 = .306				*Pseudo R^2 = .047*			

Figure 1. Mean valuations of buyers and sellers of the bet for Severina to win the race at the beginning of each block.

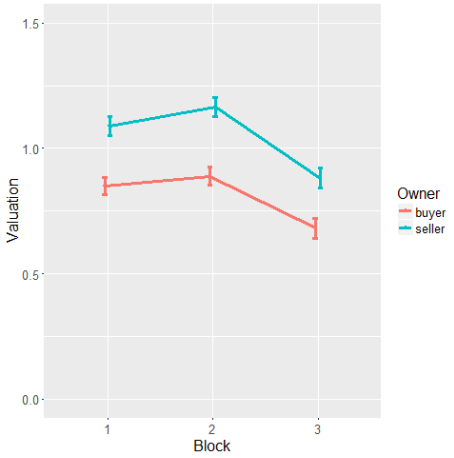
Figure 2. Probability estimates for Severina (left panel) and Happy Daze (right panel), for Experiments 1a, 1b and 2.

Figure 3. Standard deviation (top panel) and skewness (bottom panel) of probability estimates for Severina (left panel) and Happy Daze (right panel) in Experiment 2.

Experiment 1a



Experiment 1b



Experiment 2

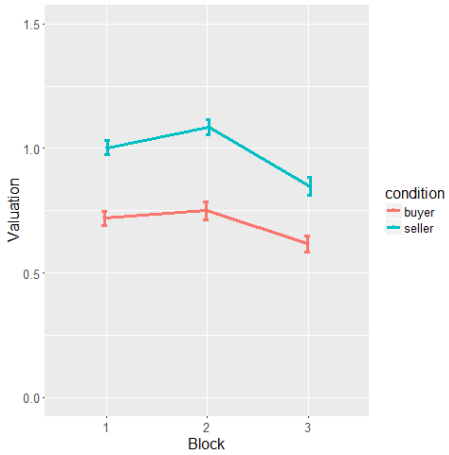
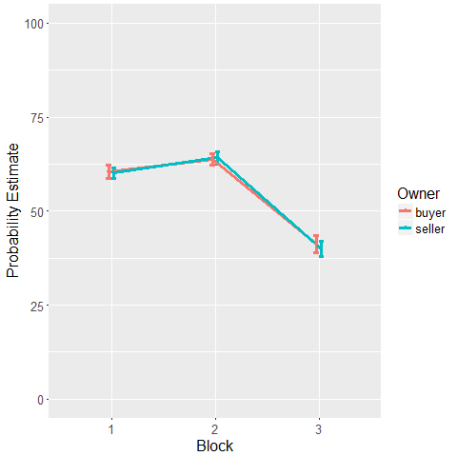
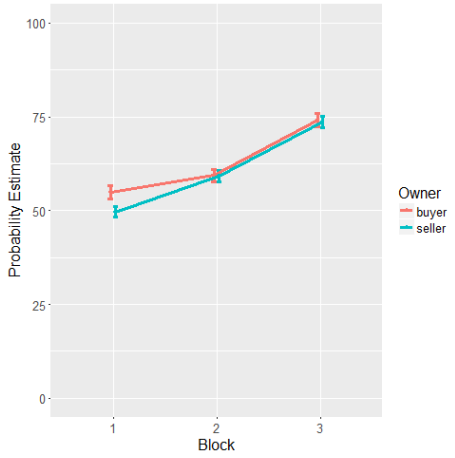


Figure 1. Mean valuations of buyers and sellers of the bet for Severina to win the race at the beginning of each block.

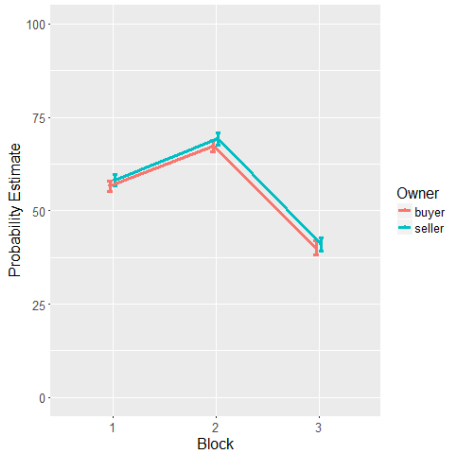
Experiment 1a: Severina



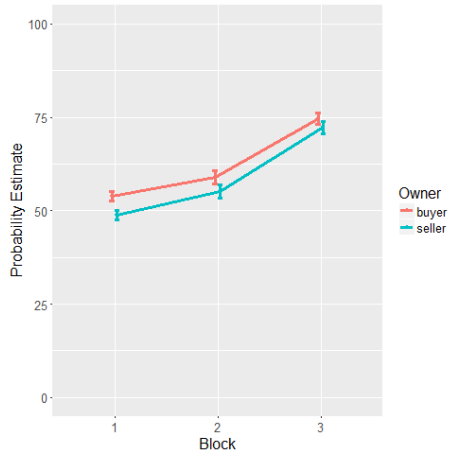
Experiment 1a: Happy Daze



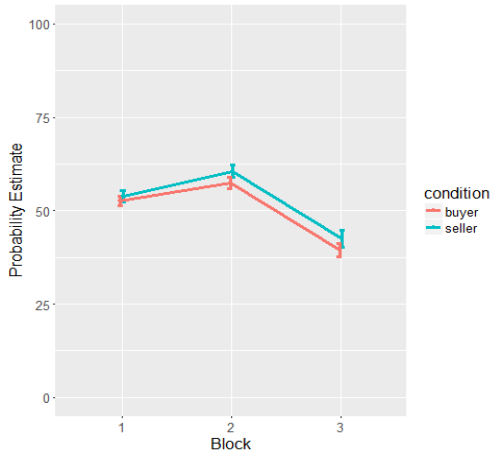
Experiment 1b: Severina



Expriment 1b: Happy Daze



Experiment 2: Severina



Experiment 2: Happy Daze

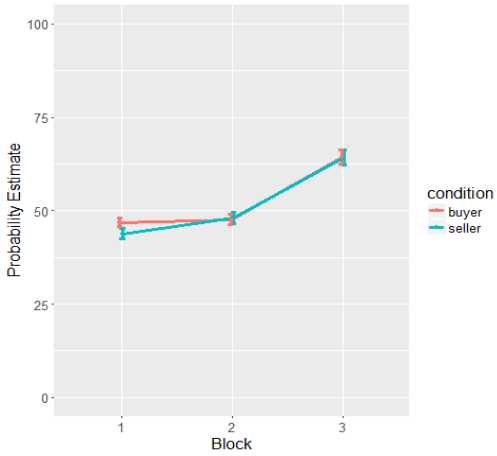


Figure 2. Probability estimates for Severina (left panel) and Happy Daze (right panel), for Experiments 1a, 1b and 2.

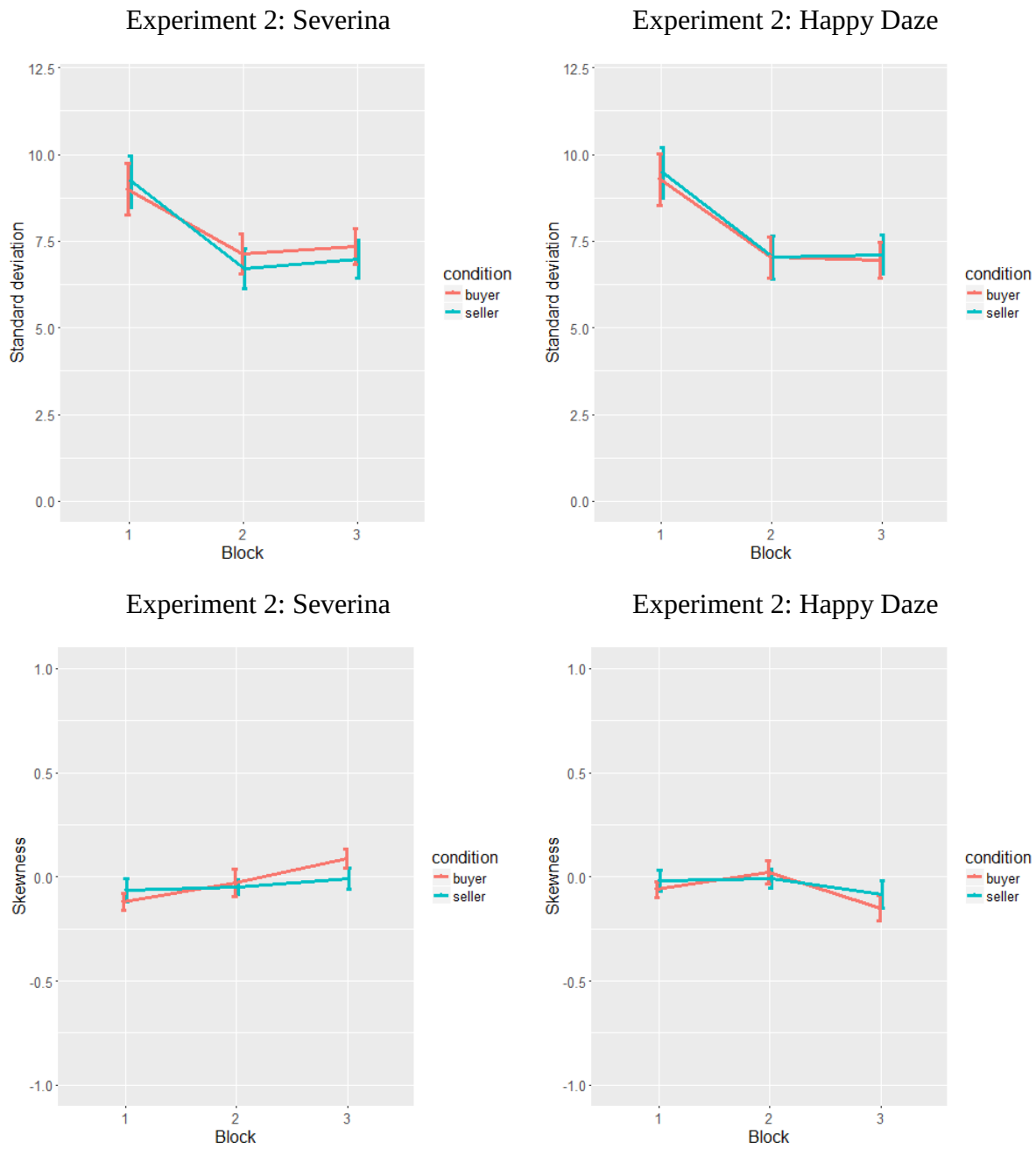


Figure 3. Standard deviation (top panel) and skewness (bottom panel) of probability estimates for Severina (left panel) and Happy Daze (right panel) in Experiment 2.