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The endowment effect in the future: How time shapes buying and selling prices

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Abstract

Previous research has focused on studying the endowment effect for transactions that take place in the present. Many real-world transactions, however, are delayed into the future (i.e., people agree to buy or sell, but the actual transaction does not materialize until a later time). Here we investigate how transaction timing affects the endowment effect. In five studies, we show that the endowment effect systematically increases as transactions are delayed into the future. Specifically, buying prices significantly decrease as the transaction is delayed, while selling prices remain constant, resulting in an amplified endowment effect (Experiment 1). This pattern is not produced by a discounting of the money involved in the transaction (Experiment 2), and it holds across different types of items (Experiment 3). We also show that the phenomenon cannot be explained by sellers anticipating becoming increasingly attached to the items over time (Experiment 4). Finally, we demonstrate that this increased endowment effect in the future holds in the field, in the context of a real market and with real transactions (Experiment 5).

Keywords: endowment effect, intertemporal choice, choice delay

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1 Introduction

It has been widely documented that, when people are endowed with an item, they ask for a greater compensation to give it up than they would be willing to pay to acquire it. This pattern has been called the *endowment effect* (Thaler, 1980) and it is one of the most prominent phenomena in judgment and decision making, with important implications for a variety of situations related to buying, selling and evaluating resources (for reviews, see Horowitz & McConnell, 2002; Kahneman et al., 1991; Tunçel & Hammitt, 2014). However, virtually all research on the endowment effect has investigated transactions that take place in the present (i.e., buying or selling items that will be exchanged here and now). This is a significant limitation, given that many real-world transactions have a temporal dimension. In many circumstances, people agree on a purchase or a sale but the transaction does not materialize until a later time in the future, for example in almost all forms of online buying and selling. In this paper, we investigate how delaying transactions into the future affects the endowment effect.

The endowment effect is often explained in terms of loss aversion (Kahneman & Tversky, 1979; Tversky & Kahneman, 1991). According to this explanation, buyers see an item they may acquire as a potential gain, whereas sellers view the same item they may give up as a potential loss. Because losses loom larger than gains, this difference creates the asymmetry between the two parties known as the endowment effect. Many other explanations and moderating factors have been suggested (see, e.g., Burson et al., 2013; Georgantzís & Navarro-Martinez, 2010; Johnson et al., 2007; Morewedge & Giblin, 2015; Morewedge et al., 2009; Plott & Zeiler, 2007). For instance, Johnson et al. (2007) proposed a memory-based account of the endowment effect, where buyers and seller retrieve different aspects of the items to produce their valuations. In a different line of research, Morewedge et al. (2009) suggested that the endowment effect happens because people associate the things they own to themselves and this in turn increases their valuations, rather than having an aversion to loses per se.

The most established way to measure the endowment effect (and the way we elicit it in this paper) is in terms of willingness to accept (WTA) and willingness to pay (WTP). In a typical experiment, subjects are randomly assigned to one of two conditions: one in which they are endowed with a target item and are asked for their WTA to sell it, and one in which they are not endowed with the item and are asked for their WTP to acquire it. WTA is normally higher than WTP, which constitutes the endowment effect (also called WTA-WTP disparity in this framework).

We find it surprising that few papers have investigated how the endowment effect, WTA and WTP relate to time, given that transactions with a temporal component or delay are very common in daily life. One of the clearest examples of this is arguably online markets such as Craigslist, eBay or Facebook Marketplace, where people buy and sell items, typically by agreeing on an exchange sometime in the future (in one day, one week, one month, etc.). These markets are growing and are home to billions of transactions of very diverse

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goods every year. For instance, Mark Zuckerberg announced at the Facebook 2021 first quarter earnings call that Facebook Marketplace was used by more than 1 billion people per month. On all these platforms, the endowment effect, with its associated reluctance to trade, is likely to make agreements and exchanges between buyers and sellers more difficult (see Bar-Hillel & Neter, 1996; Kahneman et al., 1990; Knetsch, 1989). If the endowment effect is mitigated when transactions are moved into the future, then delaying transactions may be a way to alleviate these frictions. If, on the other hand, delayed transactions amplify the endowment effect, then sooner exchanges will maximize the chances of getting to an agreement. Apart from these markets, online shopping more generally usually involves time delays, for example from Amazon or AliExpress, travel agencies, supermarkets, etc. Also outside the Internet, delayed transactions are widespread. A typical example would be buying or selling a car. The parties typically agree on the sale, but then there are several steps before the actual exchange happens (paperwork, often ordering the car, etc.). The same holds for countless other items of different types.

There is a small literature that has related gain-loss differences and the endowment effect to time in different ways, although none (to the best of our knowledge) in terms how delayed transactions affect the endowment effect. Several papers have documented the so-called *sign effect*, in which gains of money are shown to be discounted in time more than losses (Frederick et al., 2002; Thaler, 1981). Hardisty and Weber (2009) investigated this pattern in three different domains (money, the environment and health), showing that the sign effect holds in all three but is stronger in the health domain. Molouki et al. (2019) then showed that the effect is (partly) linked to the emotional reactions experienced when contemplating the delayed outcomes in the process of waiting for them. The sign effect, however, has not been studied in the context of the endowment effect or of the valuation of goods more generally. Loewenstein (1988) showed that WTP for a cassette recorder decreased as obtaining the recorder was delayed for one year, but he did not elicit WTA. If the sign effect holds in the context of the valuation of goods, we should expect an increasing endowment effect as transactions are delayed, because WTP would decrease more than WTA.

But goods are different from money because they generate attachment, and this could interact with time delays in different ways. On the one hand, there is evidence that people adapt to owning things and get increasingly attached to their possessions over time (Strahilevitz & Loewenstein, 1998), at least under some circumstances. If people anticipate this adaptation, this anticipation could magnify the sign effect in the context of goods, potentially even leading to an increasing WTA as transactions are delayed. This effect, however, is unlikely to be substantial, given that people have been shown not to significantly anticipate attachment in endowment effect situations (Loewenstein & Adler, 1995; Van Boven et al., 2000).

On the other hand, there is evidence that the endowment effect is linked to some extent to affective reactions (Peters et al., 2003; Reb & Connolly, 2007; Shu & Peck, 2011; Zhang & Fishbach, 2005), and we know that affective reactions are much more prevalent in relation to

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the present than to the future (Loewenstein, 1996; 2000). This could potentially undermine the endowment effect when transactions are delayed, by decreasing WTA. In other words, giving up something one owns might feel less dramatic if one only has to part from it in the future.

Overall, there is not a clear-cut prediction coming from previous literature and our research is, in that sense, exploratory. We present five experiments to investigate how the endowment effect (in terms of WTA versus WTP) is affected by delaying transactions into the future. In Experiment 1, we demonstrate that the endowment effect is systematically amplified as transactions are moved into the future. Buying prices consistently decrease as transactions are delayed, while selling prices remain roughly constant, resulting in an increasing WTA-WTP gap. Experiment 2 shows that this pattern is not a result of discounting the money involved in the transaction and is largely a feature of moving the exchange of the item in time. In Experiment 3, we replicate the same effect across different types of items. Experiment 4 provides evidence that the phenomenon cannot be explained by sellers anticipating becoming increasingly attached to the items over time. In Experiment 5, we show that the same pattern of an increased endowment effect in the future is obtained in a field environment, in the context of a real market and with real transactions.

Our experiments provide converging evidence that endowment effects significantly increase as transactions are delayed, as we see in many real-world settings, such as online markets. This result suggests that existing experimental research on the endowment effect may have underestimated its magnitude in some more realistic environments. This conclusion has important implications for the design of market institutions. Exchanging goods as soon as possible might be important to reach agreements between buyers and sellers.

2 Experiment 1: The Endowment Effect Moves to the Future

Our first study was designed to test how the endowment effect, in terms of the WTA-WTP gap, changes as transactions are progressively moved into the future, as it is typically seen in online markets.

2.1 Method

2.1.1 Subjects

We recruited 300 subjects for our experiment via Amazon Mechanical Turk (50% female, M_{age} = 38 years, age range: 19–76 years). The study took an average of 5 minutes and 47 seconds to complete and subjects received a fixed fee of $0.5. We excluded from our sample one subject who did not enter the code needed to receive payment.

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2.1.2 Design and procedure

Following standard practice in endowment effect experiments, subjects were randomized into a buyer or a seller condition. In the seller condition, people were asked to imagine that they had received an item as a gift, so that they now owned the item. In the buyer condition, they were asked to imagine that they had the opportunity to buy that same item, without being endowed with it. The item used in this experiment was a framed Game of Thrones poster with a retail price of €18.92.

Subjects were then asked to evaluate either selling or buying the poster (depending on the condition) and making the transaction in the present and in different future moments. Specifically, the sellers were asked "what is the minimum amount of money ($X) that you would require to sell the item and do the exchange (of money and item) [at time t]?"; the buyers were asked "what is the maximum amount of money ($X) that you would be willing to pay to buy the item and do the exchange (of money and item) [at time t]?" The transaction timing [at time t] was either today, tomorrow, in 1 month, or in 1 year. These four different time scenarios were randomized within subjects. We also used a graphical display to clarify the transaction timings (see Figure A1 in the Appendix).

Before responding to each of the four time scenarios, all subjects had to correctly answer a qualification question to verify they had understood the task. If subjects chose an incorrect response, this information was recorded and a pop-up window appeared and warned them that the answer was wrong. Subjects could not proceed until they answered correctly. After the main scenarios, subjects were asked how much they liked the item (on a scale with seven stars) and how strongly they felt ownership of the item (on a 7-point scale from 0 = *not at all* to 6 = *very strongly*). Finally, they were asked to complete a brief demographic survey, asking about their gender, age, English level, field of professional specialization, level of education, native language, and also how clear the instructions were.[1]

2.2 Results and discussion

Table 1 reports summary statistics for Experiment 1; Figure 1 presents a box plot showing the main patterns obtained in WTA and WTP across the different time scenarios.[2]

[1]For all the studies included in the paper, we conducted additional analyses controlling for the demographic characteristics we collected. All the results presented here remain qualitatively unaltered when adjusting for these variables. These analyses are available on request.

[2]WTA and WTP included a few disproportionately high values that suggested either mistakes or a lack of understanding, with a maximum as high as $1,000 for WTA and $600 for WTP. For this reason, the descriptive statistics and graphs reported here exclude observations with values more than one standard deviation above the mean. On average, 11.8% of the subjects gave wrong answers to the qualification question presented before each scenario. Our descriptive statistics also exclude these observations. All the fundamental patterns obtained are the same without these exclusions (the analyses are available on request). Our regression analyses, however, include all observations, using quantile regression methods to minimize the impact of outliers (Hao & Naiman, 2007) and controlling for the wrong answers with an additional variable.

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TABLE 1: Descriptive Statistics (Experiment 1).

	Time	Median	Mean	SD	Total N	Wrong&outliers
WTA	Today	20.2	36.7	41.2	150	21
	Tomorrow	20.0	32.8	39.4	150	34
	1 month	20.1	35.5	39.5	150	34
	1 year	25.0	50.5	59.7	150	29
WTP	Today	10.0	14.3	14.3	149	15
	Tomorrow	10.0	12.4	13.3	149	28
	1 month	6.2	11.8	13.1	149	22
	1 year	5.1	10.8	12.7	149	26

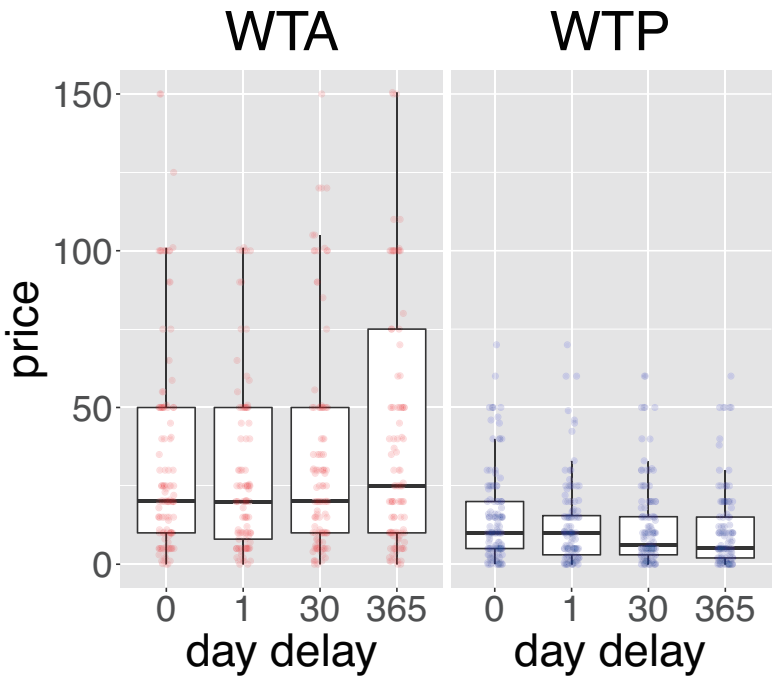

FIGURE 1: Selling (WTA) and Buying (WTP) Prices across Time Scenarios (Experiment 1). Each dot represents one observation. The horizontal line inside each box is the median; the bottom and top of the box are the first and third quartile, respectively.

When discussing our results, we will focus mostly on the medians (rather than the means), which are more robust to extreme values. All the main patterns, however, hold in terms of means as well (see Table 1). Consistent with previous findings on the endowment effect, the median WTA today ($20.2) was substantially higher than the median WTP today ($10.0), and this difference was statistically significant (Mann-Whitney test: $z = 5.51$, $p < .01$). As Figure 1 shows, WTA was roughly constant over time, with even a small increase in the 1 year scenario, while WTP consistently decreased as the transaction was delayed in

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time, resulting in an increasing endowment effect (i.e., WTA-WTP disparity) across time scenarios.

To further analyze these patterns, we conducted an analysis based on quantile regressions using both conventional and clustered standard errors (at the level of the individual)[3] (Table 2). We separately regressed WTA and WTP on two variables called Delay and Wrong. The Delay variable captures the different time scenarios measured in days of delay, so that it takes the value 0 if the scenario is today, 1 if it is tomorrow, 30 if it is in 1 month, and 365 if it is in 1 year. The variable Wrong is a dummy variable, taking the value 1 if the answer to the qualification question was incorrect. The regression results confirm that WTA did not significantly change across time scenarios, showing even a significant increase in Regression 2 (with clustered standard errors). On the other hand, WTP significantly decreased as the transaction was delayed. Specifically, median WTP decreased by around 1.3 cents per day of delay on average.

Table 2: Quantile Regression Analysis (Experiment 1).

	(1) WTA	(2) WTA	(3) WTP	(4) WTP
Delay	0.015	0.015**	–0.013***	-0.013***
	(0.012)	(0.007)	(0.005)	(0.003)
Wrong	5.000	5.000	0.390	0.390
	(5.602)	(5.178)	(2.535)	(2.086)
Constant	24.552***	24.552***	10.013***	10.013***
	(2.360)	(3.099)	(0.954)	(1.502)
Clustered SE	No	Yes	No	Yes
N	600	600	596	596

Notes: Standard errors in parentheses; *, ** and *** stand for statistical significance at the 10%, 5% and 1% level respectively.

Overall, Experiment 1 shows that the endowment effect is amplified as transactions are moved into the future, in the form of a flat (or even somewhat increasing) WTA across time and a consistently decreasing WTP.

[3]This procedure corrects for effects of differences in within-subject standard error. The subject is the unit of analysis, analogously to a t-test across subjects.

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3 Experiment 2: Separating the Discounting of Item and Money

In Experiment 1, both the transaction of the item and of the money happened at the same time in the future. This resembles many real-world settings, such as online markets, in which buyers and sellers agree on a future moment to exchange money and item. However, this makes it difficult to know how the temporal discounting of these two elements (item and money) contributed to the pattern we observe. While it has been argued that buyers do not evaluate the money paid to acquire items as a loss (Novemsky & Kahneman, 2005), it could still be that to some extent sellers discount the future money they will receive (which is a gain for them) more than buyers discount the money they will pay (which is a loss for them). This could contribute to the increasing WTA-WTP disparity we obtained in Experiment 1. The main goal of Experiment 2 was to investigate the endowment effect in the future, controlling for this aspect. To achieve this, we fixed all the money transactions to take place in the present. This also corresponds to some relevant real-world settings, such as buying and selling with upfront payments.

3.1 Method

3.1.1 Subjects

We recruited 200 subjects (50% female, M_{age} = 36 years, age range: 19–86 years), who had not participated in Experiment 1, via Amazon Mechanical Turk. The study took an average of 5 minutes and 16 seconds to complete and subjects received a fixed fee of $0.5 for their participation.

3.1.2 Design and procedure

The design and procedure used in this experiment were the same as in Experiment 1, except that all monetary transactions were fixed to take place in the present.

In this case, the sellers were asked "what is the minimum amount of money ($X) that you would require receiving today to sell the item and give it up [at time t]?"; the buyers were asked "what is the maximum amount of money ($X) that you would be willing to pay today to receive the item [at time t]?" As in Experiment 1, the transaction timing of the item [at time t] was today, tomorrow, in 1 month, or in 1 year, with the different time scenarios randomized within subjects. We also used the same type of graphical display to clarify transaction timings.

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3.2 Results and discussion

Table 3 reports summary statistics for Experiment 2; Figure 2 shows the patterns obtained in WTA and WTP across the different time scenarios.[4]

TABLE 3: Descriptive Statistics (Experiment 2).

	Time	Median	Mean	SD	Total N	Wrong&outliers
WTA	Today	20.0	36.1	41.1	93	10
	Tomorrow	20.0	31.0	36.5	93	27
	1 month	20.0	30.4	31.1	93	20
	1 year	20.2	32.4	33.4	93	26
WTP	Today	10.0	13.3	14.8	107	15
	Tomorrow	10.0	12.7	13.5	107	21
	1 month	5.1	9.9	10.4	107	16
	1 year	3.5	6.5	9.0	107	21

Again, the results were broadly in line with previous findings on the endowment effect, namely, median WTA today ($20.0) was higher than median WTP today ($10.0), and this difference was statistically significant (Mann-Whitney test: $z = 4.50$, $p < .01$). As Figure 2 shows, WTA was again roughly constant over time (in this case without the slight increase in the 1 year scenario obtained in Experiment 1), while WTP again progressively decreased as the transaction of the item was delayed, which resulted in an increasing endowment effect across time scenarios. We also conducted the same quantile regression analysis as in Experiment 1 (Table 4). The first two columns of Table 4 confirm that WTA did not change across time scenarios. The last two columns of the table show that WTP significantly decreased over time, by an average of 1.4 cents per day of delay (slightly more than in Experiment 1).

As in this experiment only the item was moved in time, we can also cleanly estimate discount factors for it based on the WTA and WTP valuations. We have done this using the classic exponential discount function (Samuelson, 1937), $D(t) = \delta^t$, where t is the time delay to receive the relevant outcome and δ is the discount factor. $\delta = 1$ implies no discounting of outcomes as they are delayed; values of δ closer to zero imply greater temporal discounting. Including all observations, the yearly discount factor in the seller condition was $\delta^{365}_{WTA} = 1.01$; in the buyer condition, it was $\delta^{365}_{WTP} = 0.59$. This shows that in the seller condition the value of the item was not discounted, while in the buyer condition

[4]As in Experiment 1, the descriptive statistics and graphs reported exclude WTA and WTP values more than one standard deviation above the mean and observations in which subjects failed to correctly answer our qualification question (which happened on average in 15.1% of the responses). Our regression analyses, as in Experiment 1, include all observations and use quantile regression methods, with an additional variable for the wrong answers.

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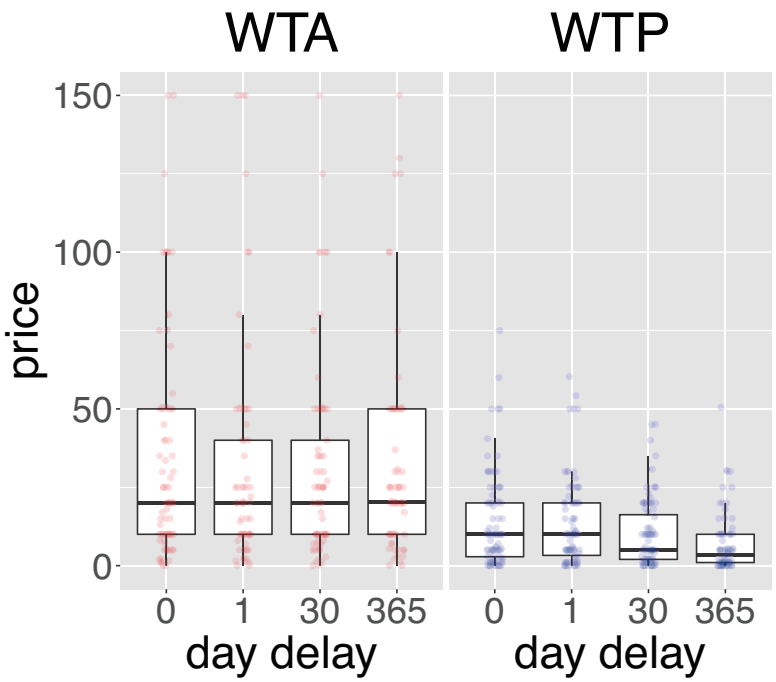

FIGURE 2: Selling (WTA) and Buying (WTP) Prices across Time Scenarios (Experiment 2). Each dot represents one observation. The horizontal line inside each box is the median; the bottom and top of the box are the first and third quartile, respectively.

TABLE 4: Quantile Regression Analysis (Experiment 2).

	(1) WTA	(2) WTA	(3) WTP	(4) WTP
Delay	0.000	0.000	–0.014***	–0.014***
	(0.014)	(0.007)	(0.004)	(0.004)
Wrong	-0.500	–0.500	0.014	0.014
	(5.720)	(4.313)	(1.590)	(2.766)
Constant	20.500***	20.500***	10.000***	10.000***
	(2.667)	(4.188)	(0.675)	(1.969)
Clustered SE	No	Yes	No	Yes
N	372	372	428	428

Notes: Standard errors in parentheses; *, ** and *** stand for statistical significance at the 10%, 5% and 1% level respectively.

the item lost on average 41% of its value in one year. Table A1 in the Appendix contains the details of these discount factor estimations.

The results of Experiment 2 show again that the endowment effect was consistently

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amplified as the transaction of the item was moved into the future, this time controlling for the discounting of the money involved in the transactions by fixing all monetary exchanges to take place in the present. More specifically, WTA remained constant as the item was delayed, but WTP progressively decreased, resulting in an increased WTA-WTP disparity. The patterns obtained in Experiment 2 are very similar to the ones in Experiment 1, which means that if differences between sellers and buyers in the discounting of the money involved in the transactions play a role, it is a very minor one. The patterns obtained seem to come primarily from the discounting of the item.

4 Experiment 3: Robustness across Items

In Experiments 1 and 2 we used the same item: a framed Game of Thrones poster. This raises questions about the generalizability of the patterns obtained and the extent to which they might depend on particular characteristics of the item used. To test the generalizability of our findings across items, in Experiment 3 we elicited WTA and WTP valuations in different time scenarios for three different items, the Game of Thrones poster (to be able to compare patterns directly) and two additional items with markedly different characteristics.

4.1 Method

4.1.1 Subjects

We recruited 299 subjects (56% female, M_{age} = 37 years, age range: 20–72 years) who had not participated in Experiments 1 and 2 via Amazon Mechanical Turk. The study took an average of 9 minutes and 52 seconds to complete and subjects received a fixed fee of $0.8 for their participation.

4.1.2 Design and procedure

The design and procedure of Experiment 3 were the same as in Experiment 2 (which was cleaner than Experiment 1 in terms of controlling for the discounting of the money), except that the subjects evaluated three different items instead of one. In addition to the Game of Thrones poster, they were presented with an ordinary IKEA mug with a retail price of €3.99, and with a hypothetical CD autographed by their favorite music artist or band. Subjects were first asked to indicate their favorite artist or band, and then they were told to imagine that there was a CD autographed by them. The order of the three items was randomized within subjects. Apart from the questions described in Experiment 1, we also asked subjects how strongly they thought they would be emotionally attached to each of the items if they owned them for real. The three items were chosen because they have very different characteristics in aspects such as link to the self, emotionality, practical value and depreciation.

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In this experiment, we eliminated the tomorrow scenario to keep the number of evaluations more manageable for subjects, so the transaction timings were today, in 1 month and in 1 year.

4.2 Results and discussion

First of all, our results show that the three items used in the experiment were indeed different in terms of liking, emotional attachment and monetary valuation. The CD was liked the most, followed by the poster and the mug (mean values: CD = 5.89, poster = 3.75, mug = 3.03; Friedman test: $Fr.$ = 298.84, $p < .01$). In terms of emotional attachment, the CD was also rated higher, followed by poster and mug (mean values: CD = 4.30, poster = 2.08, mug = 1.30 (Friedman test: $Fr.$ = 312.64, $p < .01$). Taking WTP in the today scenario as a benchmark, people were also willing to pay more for the CD, followed again by poster and mug (mean values: CD = \$41.11, poster = \$14.72, mug = \$4.88; Friedman test: $Fr.$ = 181.40, $p < .01$).

Table 5 reports summary statistics and Figure 3 shows boxplots like the ones used in the previous experiments.[5] The results clearly replicated the patterns obtained in Experiment 2 across all three items. In all cases, median WTA today was substantially higher than median WTP today, in line with the endowment effect literature. More importantly, WTA was always essentially flat across time scenarios, while WTP consistently decreased as the transaction of the item was delayed, resulting in an increasing endowment effect.

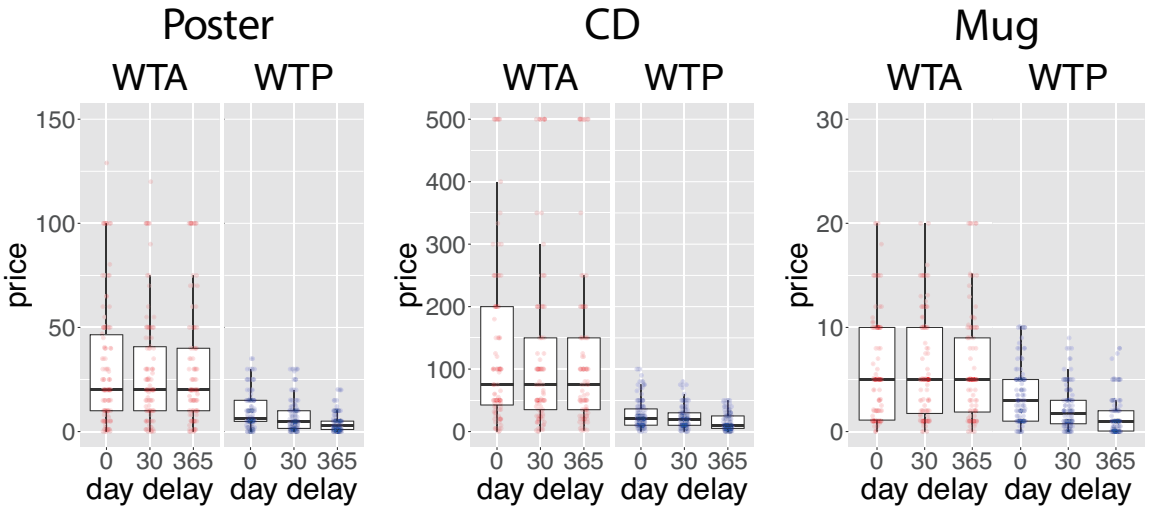

FIGURE 3: Selling (WTA) and Buying (WTP) Prices of the Three Items across Time Scenarios (Experiment 3). Each dot represents one observation. The horizontal line inside each box is the median; the bottom and top of the box are the first and third quartile, respectively.

[5]As in Experiments 1 and 2, the descriptive measures and graphs reported exclude WTA and WTP responses over one standard deviation higher than the mean and observations with wrong answers in the qualification questions (10.4% on average in this case). Our quantile regression analysis includes all observations.

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TABLE 5: Descriptive Statistics (Experiment 3).

Item	Condition	Time	Median	Mean	SD	Total N	Wrong&outliers
Poster	WTA	Today	20.0	30.5	29.7	148	22
		1 month	20.0	29.2	27.5	148	34
		1 year	20.0	30.2	30.1	148	37
	WTP	Today	6.5	9.6	8.4	151	23
		1 month	5.0	7.5	8.0	151	22
		1 year	3.0	4.3	4.7	151	22
CD	WTA	Today	75.1	131.8	138.0	148	33
		1 month	75.0	123.8	141.5	148	41
		1 year	75.0	126.1	144.5	148	43
	WTP	Today	20.3	27.9	22.6	151	15
		1 month	20.0	22.2	17.6	151	23
		1 year	10.0	15.3	14.1	151	27
Mug	WTA	Today	5.0	5.7	4.9	148	16
		1 month	5.0	5.8	4.8	148	22
		1 year	5.0	5.8	5.1	148	32
	WTP	Today	3.0	3.4	2.7	151	18
		1 month	1.7	2.2	2.0	151	21
		1 year	1.0	1.5	1.8	151	22

Our quantile regression analysis, summarized in Table 6 for WTA and in Table 7 for WTP, confirms that WTA did not significantly change as the transaction time was delayed for any of the items, while WTP significantly decreased for all of them (by 0.6 cents per day of delay in the case of the poster, 3 cents in the case of the CD and 0.4 cents in the case of the mug).

As in Experiment 2, we can estimate discount factors based on the WTA and WTP valuations, which we have done using the classic exponential discount function. Including all observations, the estimated yearly discount factors are $\delta^{365}_{WTAposter} = 1.02$, $\delta^{365}_{WTAcd} = 0.88$ and $\delta^{365}_{WTAmug} = 0.96$ in the seller condition, and $\delta^{365}_{WTPposter} = 0.56$, $\delta^{365}_{WTPcd} = 0.54$ and $\delta^{365}_{WTPmug} = 0.60$ in the buyer condition. This shows that discount factors are always substantially lower (implying more discounting) in the buyer condition. In the seller condition, the discount factors for poster and mug imply virtually no discounting, and the factor for the CD shows a mild degree of discounting. In the buyer condition, all discount factors are fairly similar and they entail substantial degrees of discounting (at least 40% of

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TABLE 6: Quantile Regression Analysis of WTA (Experiment 3)

	(1) Poster	(2) Poster	(3) CD	(4) CD	(5) Mug	(6) Mug
Delay	–0.001	–0.001	0.000	0.000	0.000	0.000
	(0.010)	(0.005)	(0.053)	(0.027)	(0.001)	(0.001)
Wrong	–3.700	–3.700	–49.010*	–49.010**	0.000	0.000
	(4.719)	(4.144)	(26.023)	(21.416)	(0.686)	(1.347)
Constant	20.200***	20.200***	100.000***	100.000***	5.000***	5.000***
	(2.079)	(2.848)	(11.357)	(17.947)	(0.280)	(0.627)
Clustered SE	No	Yes	No	Yes	No	Yes
N	444	444	444	444	444	444

Notes: Standard errors in parentheses; *, ** and *** stand for statistical significance at the 10%, 5% and 1% level respectively.

TABLE 7: Quantile Regression Analysis of WTP (Experiment 3)

	(1) Poster	(2) Poster	(3) CD	(4) CD	(5) Mug	(6) Mug
Delay	–0.006**	–0.006***	–0.030***	–0.030***	–0.004***	–0.004***
	(0.003)	(0.001)	(0.006)	(0.003)	(0.001)	(0.001)
Wrong	–0.889	–0.889	3.100	3.100	0.500	0.500
	(1.637)	(1.509)	(3.259)	(5.451)	(0.628)	(0.648)
Constant	6.189***	6.189***	20.896***	20.896***	2.500***	2.500***
	(0.581)	(0.758)	(1.264)	(1.496)	(0.211)	(0.320)
Clustered SE	No	Yes	No	Yes	No	Yes
N	453	453	453	453	453	453

Notes: Standard errors in parentheses; *, ** and *** stand for statistical significance at the 10%, 5% and 1% level respectively.

lost value with one year of delay). The details of these discount factor estimations are in Tables A2 and A3 in the Appendix.

Overall, Experiment 3 shows that the patterns obtained in Experiments 1 and 2 hold across different types of items. As transactions are delayed into the future, WTA remains largely constant, while WTP substantially decreases, resulting in an increasing endowment effect.

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5 Experiment 4: Do People Anticipate the Effects of Extended Endowment?

Experiments 1 to 3 provide converging evidence that the endowment effect is amplified as transactions are delayed into the future, in the form of a virtually constant WTA across transaction timings and a consistently decreasing WTP. This suggests that people discount the value of acquiring an item as the acquisition is delayed, which seems logical, but they do not discount the (negative) value of giving up an item they own, or at least not to a substantial extent.

There is, however, another possibility that can be derived from the small literature on endowment and time. Strahilevitz and Loewenstein (1998) showed that people's valuation of an item they are endowed with increases with the duration of ownership. Potentially, if people anticipate this increase in how much they will value the item, this could push WTA valuations up as the moment to give up the item is delayed. So, it could be that people are actually discounting the value of giving up the item, but this is compensated by their anticipated increase in how valuable the item will be to them. This would not undermine the findings of Experiments 1 to 3 in any way, but it would imply a different interpretation. As indicated in the introduction, this possibility seems unlikely, given that a few papers have shown that people do not anticipate becoming attached to items in endowment effect situations (Loewenstein & Adler, 1995; Van Boven et al., 2000). However, in our setting, people are already (hypothetically) endowed with the items and they only need to anticipate this endowment to have a stronger effect on them as time passes, so this possibility merits investigation.

The goal of Experiment 4 was to ask whether, in our set-up, people anticipate becoming increasingly attached to the items and valuing them more as time passes.

5.1 Method

5.1.1 Subjects

We recruited 201 subjects (50% female, M_{age} = 39 years, age range: 19–77 years) who had not participated in Experiments 1 to 3 via Amazon Mechanical Turk. The study took an average of 9 minutes and 12 seconds to complete and subjects received a fixed fee of \$0.5 for their participation. We excluded from our sample one subject who did not meet the minimum age requirement and two subjects whose ID was not recorded on Amazon Mechanical Turk, suggesting that they did not register as workers on this platform.

5.1.2 Design and procedure

In this experiment, all subjects faced the same scenarios and responded to the same questions (i.e., there was only one condition). As in the seller conditions of the previous experiments, subjects were asked to imagine that they had received the target item as a gift, so that they

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now owned it. Then they were asked "how valuable do you think the item would be to you [after owning it for t]?" And [after owning it for t] was either "today", "after owning it for 1 month" or "after owning it for 1 year", which are the same time delays used in Experiment 3. These questions were answered on an 11-point scale (from 0 = *not valuable at all* to 10 = *very valuable*). Subjects responded to these scenarios for the three items used in Experiment 3 (poster, autographed CD and mug). To deal with potential cross-contamination issues among the different items, subjects always evaluated the poster first, because we considered it the most relevant item in terms of relating it to the results of all the previous experiments. The order of CD and mug was randomized. Within each item, the different time scenarios were also randomized.

As in the previous experiments, subjects had to answer a qualification question before responding to each scenario. After the main questions described above, people were also asked how much they liked the item, how strongly they felt ownership of the item, and to complete our demographic survey, as described in Experiment 1.

5.2 Results and discussion

Figure 4 presents box plots showing the valuations of the different items across time scenarios.[6]

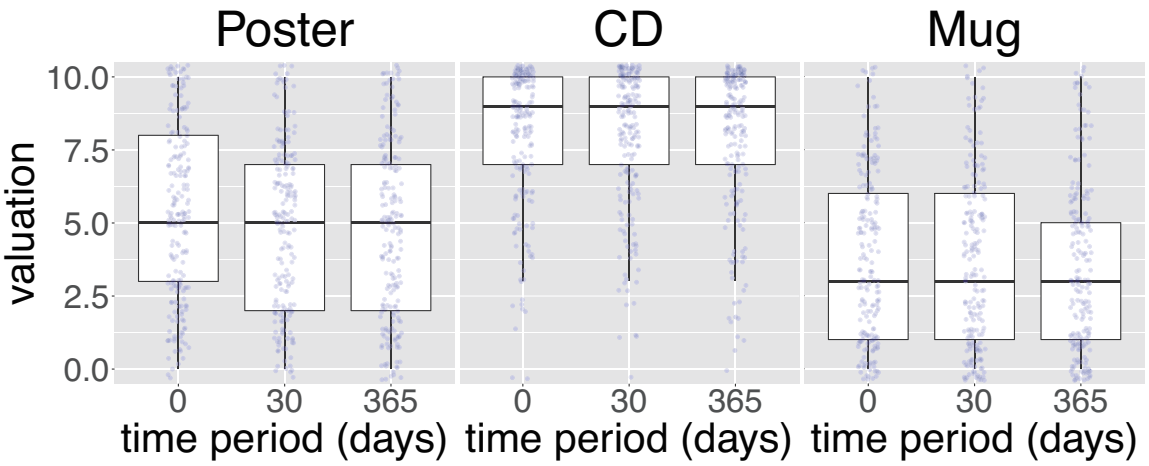

FIGURE 4: Valuations of Items across Owning Periods (Experiment 4). Each dot represents one observation. The horizontal line inside each box is the median; the bottom and top of the box are the first and third quartile, respectively.

There were clear differences between the items in terms of how valuable they were considered. The CD was perceived as more valuable than the poster (Wilcoxon signed-rank test: $z = 32.34$, $p < .01$), which was in turn more valuable than the mug ($z = 12.18$, $p < .01$). This shows that subjects were using the scale in a meaningful way. More importantly,

[6]As in the previous experiments, our descriptive statistics exclude observations with mistakes in the qualification questions (5.2% on average). Our quantile regression analysis includes all observations.

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valuations did not change across the different owning periods. As the plots show, for all the items, the medians were the same in the different owning periods. People did not seem to anticipate any changes in how valuable the items would be to them as they owned them for longer.

To further investigate this pattern, we conducted quantile regressions using both conventional and clustered (at the individual level) standard errors, like we did in the previous experiments (Table 8). In this case, our dependent variable was people's valuations of the items, and we changed the name of our daily Delay variable used before to Period, to reflect the fact that we are now looking at ownership periods (in terms of days) rather than time delays. The regression results confirm that people's valuations did not significantly change across ownership periods for any of the items.

TABLE 8: Quantile Regression Analysis of Valuations (Experiment 4).

	(1)	(2)	(3)	(4)	(5)	(6)
	Poster	Poster	CD	CD	Mug	Mug
Period	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Wrong	0.00	0.00	–3.00***	–3.00*	2.00*	2.00**
	(0.75)	(0.56)	(0.50)	(1.71)	(1.19)	(0.99)
Constant	5.00***	5.00***	9.00***	9.00***	3.00***	3.00***
	(0.23)	(0.26)	(0.12)	(0.22)	(0.30)	(0.29)
Clustered SE	No	Yes	No	Yes	No	Yes
N	594	594	594	594	594	594

Notes: Standard errors in parentheses; *, ** and *** stand for statistical significance at the 10%, 5% and 1% level respectively.

Overall, these results show that subjects did not anticipate that the items would be more valuable to them if they owned them for a longer period of time, which suggests that people simply discount the value of acquiring an item as it is delayed in time but do not discount the (negative) value of giving it up.

6 Experiment 5: Transactions in a Real Online Market

The experiments presented above provide evidence of endowment effects being amplified as transactions are delayed into the future. Two limitations of the previous experiments, however, are that the decisions are hypothetical and they are not linked to a real-world context. In Experiment 5, we tested the robustness of our findings in the context of a real online market called Wallapop and with incentivized decisions. Wallapop is the largest

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online flea market service in Spain, currently with more than 15 million users who have uploaded over 180 million products (according to the Wallapop website). It is essentially a Spanish version of the American Craigslist, where people buy and sell second-hand items and agree on a price and a time to exchange them. This provides an ideal platform for our study.

6.1 Method

6.1.1 Subjects

We used a web service to recruit subjects who were active Wallapop users, defined as people who had (right before being contacted for the experiment) a Wallapop account with at least one item on sale. They also had to live in the city in which the authors were based and be willing to provide the URLs of the web pages where their items were posted on Wallapop. These URLs allowed us to check the details and history of the items on Wallapop. Following these criteria, we recruited a sample of 130 valid subjects (48% female, M_{age} = 34 years, age range: 18–72 years), who were paid a fixed fee for their participation (managed by the recruiting company) and also had some probability of conducting one of the transactions they were asked about for real. The study took an average of 19 minutes to complete.

6.1.2 Design and procedure

In this experiment, we manipulated two factors within subjects: role (seller and buyer conditions) and time scenario (transaction tomorrow and in 1 month). The order of the role and of the time scenario was randomized within subjects. The transaction timings were reduced to two in this case to make the whole experiment simpler for the subjects.

In the seller condition, people were told to provide the URL of the last active (i.e., still on sale) item they had posted on Wallapop. Then they were asked about their WTA to sell this item for the two different time scenarios (exchanging money and good tomorrow and in 1 month). The set-up here is analogous to that in Experiment 1, where money and item were also exchanged at the same time, so the specific questions used were the same as in Experiment 1. This also mimics the typical situation found in Wallapop, in which sellers and buyers need to agree on a future time to exchange item and money.

In the buyer condition, subjects were asked to pick the item they liked the most out of a selection of five different items that were on sale on Wallapop: a smartwatch, a wireless speaker, a backpack, an electric toothbrush, and a ukulele. These items were selected based on a pre-test of various Wallapop items to make sure that they were on average well-valued by people. The items were presented to the subjects in the standard Wallapop format. Then they were asked about their WTP for the item they had picked in the two time scenarios (exchanging money and good tomorrow and in 1 month).

It is important to note that in this experiment WTA and WTP valuations were elicited for different items, so they are not directly comparable. We can, however, analyze the pattern

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of valuations across transaction timings within WTA and within WTP, which is the key aspect of our findings.

As in the previous experiments, all scenarios were preceded by qualification questions to make sure that people had understood the instructions, and they included graphical displays to clarify transaction timings (see Experiment 1). Subjects completed also a final survey, asking when they had bought the item, the purchasing price, how many buyers had contacted them about the item, the condition of the item, if they had reposted the item on Wallapop, the reason for selling the item, how many times they had bought items on Wallapop, and if they would be in the city in 1 month from the day of the experiment.

6.1.3 Incentive system

In this experiment, we also incentivized people's valuations with the widely used Becker-DeGroot-Marschak (BDM) method (Becker et al., 1964, described below). Several randomly selected subjects had the chance to implement for real one of the transactions they had been asked about. Specifically, we randomly selected three people to implement one of their WTA valuations (also randomly selected) and two people to implement one of their WTP valuations (also randomly selected). Subjects knew from the beginning that they could be picked to carry out one of the transactions, so that any one of their valuations could have real consequences.

In the case of the selected WTA valuations, the computer then generated a random number (from a pre-specified range). If the valuation was smaller than or equal to this number, people were asked to sell the item to us for the generated amount; if the valuation was higher than the number, the item was not sold. If the item was sold, we then agreed with the selected subject on a suitable location to exchange money and item at the corresponding transaction time (or as close to it as possible), as is usually done on Wallapop. These subjects were also asked to immediately change the status of their item on Wallapop to "sale already agreed".

For the selected WTP valuations, the computer also generated a random number. If the valuation was higher than or equal to the number, people were entitled to receive the item; if the valuation was lower than the number, people were entitled to receive an amount of money equal to the generated number. This set-up is often used when applying the BDM method to elicit WTP to avoid making people pay money out of their own pockets. We then agreed with the selected subjects on a suitable location to give them their outcome at the corresponding time (or as close as possible to it).

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6.2 Results and discussion

Table 9 reports the summary statistics for Experiment 5; the box plot in Figure 5 shows the main patterns observed in the different scenarios.[7] The results obtained are broadly in line with Experiment 1. Focusing on the medians, WTA slightly increased as the transaction was delayed (i.e., in the 1 month scenario compared to the tomorrow scenario), while WTP considerably decreased.

TABLE 9: Descriptive Statistics (Experiment 5).

	Time	Median	Mean	SD	Total N	Wrong&outliers
WTA	Tomorrow	28.5	62.8	98.3	130	22
	1 month	30.0	70.3	113.2	130	20
WTP	Tomorrow	20.0	31.3	65.8	130	38
	1 month	15.0	20.0	22.8	130	41

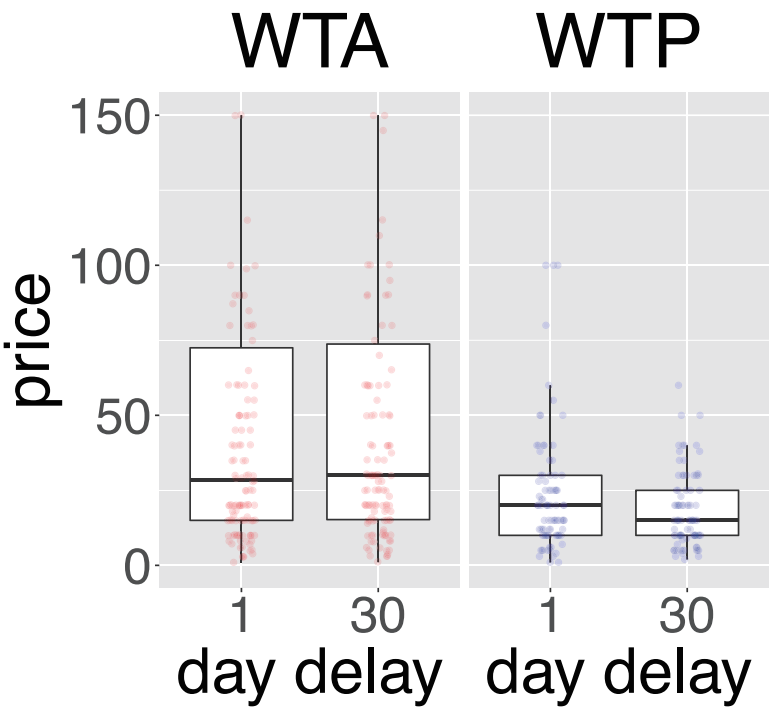

FIGURE 5: Selling (WTA) and Buying (WTP) Prices across Time Scenarios (Experiment 5). Each dot represents one observation. The horizontal line inside each box is the median; the bottom and top of the box are the first and third quartile, respectively.

[7] As in the previous experiments, both WTA and WTP included some disproportionately high values. So, the descriptive measures and graphs reported exclude again WTA and WTP responses over one standard deviation

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As in the previous experiments, we further analyzed the results using quantile regressions, with both conventional and clustered standard errors (at the level of the individual) (Table 10). Given that in this case we only had two transaction timings, we substituted the Delay variable used in Experiments 1 to 3 with a dummy variable called 1_month, which takes the value 1 if the transaction was in 1 month and 0 if it was tomorrow. The regression results show that WTA was not significantly different between the time scenarios, but WTP significantly decreased as the transaction timing was delayed.[8]

TABLE 10: Quantile Regression Analysis (Experiment 5).

	(1) WTA	(2) WTA	(3) WTP	(4) WTP
1_month	1.00	1.00	–5.00**	–5.00***
	(6.11)	(1.73)	(2.26)	(1.34)
Wrong	0.00	0.00	0.00	0.00
	(8.30)	(7.23)	(2.47)	(2.66)
Constant	26.00	26.00***	25.00***	25.00***
	(21.68)	(7.20)	(3.64)	(3.18)
Clustered SE	No	Yes	No	Yes
N	260	260	260	260

Notes: Standard errors in parentheses; *, ** and *** stand for statistical significance at the 10%, 5% and 1% level respectively.

The results of Experiment 5 show that the same pattern we consistently observed in the previous experiments is also obtained in the context of a real market, in which sellers evaluated items they already owned and were already planning to sell, and with incentivized valuations. Again, WTA was roughly flat across transaction timings and WTP consistently decreased, which would result in an amplified endowment effect in the future.

7 General Discussion and Conclusions

Our five experiments provide clear and converging evidence that endowment effects are amplified as transactions are delayed into the future. Across experiments, WTA remained roughly constant and WTP consistently decreased as the transactions were delayed. Experiment 2 showed that this pattern is not produced by the discounting of the money involved in the transactions, but comes largely from moving the transaction of the item in time;

[8]We also conducted additional analyses adjusting for the variables we collected in the final survey, but the main results did not change and no other systematic patterns emerged. These analyses are available on request.

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Experiment 3 proved that the pattern holds across diverse items; Experiment 4 ruled out people's anticipation of changes in value related to owning the item as an explanation for the non-decreasing WTA; and Experiment 5 showed that the same WTA and WTP patterns hold in the context of a real market, with goods that were meant to be sold, and with incentivized decisions.

Our findings in the context of goods are partially in line with the sign effect typically observed in the context of money (Frederick et al., 2002; Thaler, 1981). In the sign effect, both gains and losses of money are discounted, but gains are discounted more than losses. This pattern has also been obtained in the context of health (where it is actually stronger) and of decisions that relate to the environment (Hardisty & Weber, 2009). In our experiments, the value of acquiring the items is also discounted more than the (negative) value of giving them up, but in our case giving up the items does not seem to be discounted at all. This could be seen as a more extreme form of sign effect in the context of goods. One of the key differences between money and goods is that the latter can create psychological attachment, and this can bring in psychological mechanisms that affect WTA and how much it is discounted. We explored, and ruled out, one such mechanism in Experiment 4, namely that people anticipate becoming increasingly attached to the items with time. Other potential mechanisms can be extracted from the literature on the sign effect, although this is currently a rather small literature that has not explored too much the psychological underpinnings of the effect.

The sign effect is sometimes explained in terms of loss aversion (Kahneman & Tversky, 1979), which posits that losses are more impactful than gains of the same nominal magnitude and that this difference, in turn, reduces discounting of losses. This account is in a way just a description of the pattern obtained. Reasoning along these lines, it seems natural that this effect is stronger in the context of the valuation of goods, because the psychological attachment created by goods could make the loss even more impactful. In other words, in the context of goods, the person is not only losing an economic asset but also the psychological connection with the item she has created. This is consistent with our findings, in which losing the item is virtually not discounted.

In a recent paper, Molouki et al. (2019) proposed a "contemplation-emotion" account of the sign effect, according to which it is the more impactful emotional experience of waiting for the outcome in the case of losses that produces the sign effect. In the context of this explanation, our findings also seem quite natural. The psychological attachment component of goods is likely to make waiting for their loss more impactful than waiting for the loss of less emotional outcomes such as money, which would result in less discounting of the loss and a more pronounced sign effect. There is still room to further explore the psychological mechanisms behind different types of sign effects for money, goods and other outcomes, but this is beyond the scope of this paper.

Finally, our findings are also of practical relevance. We live in a world in which delayed transactions are more and more prevalent. In virtually all forms of online buying and

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selling transactions are subject to some form of delay. The rise of online platforms such as Amazon, AliExpress, Craigslist, Facebook Marketplace, etc. has made delayed transactions one of the most standard practices. On the one hand, this implies that existing studies of the endowment effect (based on transactions in the present) are likely to have underestimated the strength of the effect, at least in relation to some real-world settings. On the other hand, our results provide relevant guidelines on how to design market institutions. Providing tools for buyers and sellers to exchange goods as soon as possible, or even nudging them into doing so, might be important to maximize agreements and minimize the market frictions associated with endowment effects.

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Appendix

TABLE A1: Estimation of Yearly Discount Factors (Experiment 2).

	(1) Poster	(2) Poster	(3) CD	(4) CD	(5) Mug	(6) Mug
δ^{365}	1.022	0.962	0.884***	0.859***	0.957	0.942
	(0.057)	(0.039)	(0.043)	(0.055)	(0.047)	(0.041)
Constant	22.714***	18.682***	102.028***	73.782***	5.914***	5.267***
	(0.455)	(0.257)	(1.788)	(1.630)	(0.105)	(0.078)
All_obs	Yes	No	Yes	No	Yes	No
N	444	351	444	327	444	374

Notes: Clustered standard errors in parentheses; *, ** and *** stand for statistically different from 1 (i.e., from no discounting) at the 10%, 5% and 1% level respectively. These models assume an exponential discount function (Samuelson, 1937) with a daily discount factor δ. The variable δ^{365} reported is the yearly discount factor. Columns 2 and 4 show results excluding observations one standard deviation above the mean and with wrong answers in the qualification questions. All regressions include individual fixed effects.

TABLE A2: Estimation of Yearly Discount Factors for WTA (Experiment 3).

	(1) Poster	(2) Poster	(3) CD	(4) CD	(5) Mug	(6) Mug
δ^{365}	1.022	0.962	0.884***	0.859***	0.957	0.942
	(0.057)	(0.039)	(0.043)	(0.055)	(0.047)	(0.041)
Constant	22.714***	18.682***	102.028***	73.782***	5.914***	5.267***
	(0.455)	(0.257)	(1.788)	(1.630)	(0.105)	(0.078)
All_obs	Yes	No	Yes	No	Yes	No
N	444	351	444	327	444	374

Notes: Clustered standard errors in parentheses; *, ** and *** stand for statistically different from 1 (i.e., from no discounting) at the 10%, 5% and 1% level respectively. These models assume an exponential discount function with a daily discount factor δ. The variable δ^{365} reported is the yearly discount factor. Columns 2, 4 and 6 show results excluding observations one standard deviation above the mean and with wrong answers in the qualification questions. All regressions include individual fixed effects.

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TABLE A3: Estimation of Yearly Discount Factors for WTP (Experiment 3).

	(1) Poster	(2) Poster	(3) CD	(4) CD	(5) Mug	(6) Mug
δ^{365}	0.558***	0.536***	0.542***	0.508***	0.603***	0.591***
	(0.025)	(0.028)	(0.033)	(0.035)	(0.022)	(0.024)
Constant	7.863***	6.612***	21.499***	19.600***	3.754***	3.279***
	(0.129)	(0.126)	(0.477)	(0.467)	(0.050)	(0.047)
All_obs	Yes	No	Yes	No	Yes	No
N	453	386	453	388	453	392

Notes: Clustered standard errors in parentheses; *, ** and *** stand for statistically different from 1 (i.e., from no discounting) at the 10%, 5% and 1% level respectively. These models assume an exponential discount function with a daily discount factor δ. The variable δ^{365} reported is the yearly discount factor. Columns 2, 4 and 6 show results excluding observations one standard deviation above the mean and with wrong answers in the qualification questions. All regressions include individual fixed effects.

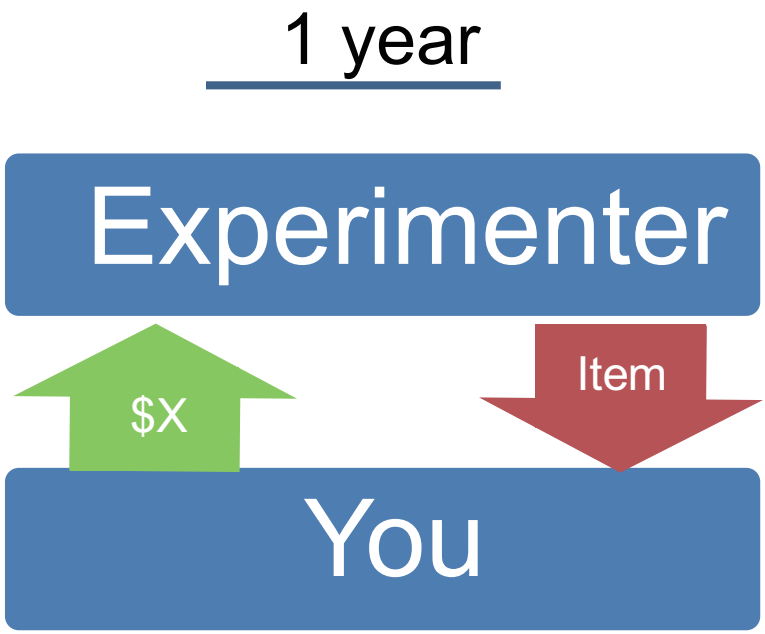

FIGURE A1. Graphical Display used to Clarify Transaction Timing (Buyer Condition, 1 Year Scenario).

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