Reference-Dependent versus Connection-Based Accounts of the Endowment Effect

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Abstract

People's well-documented reluctance to give up their possessions for available alternatives is known as the endowment effect. A debate has emerged between two theories of this effect. A seminal, reference-dependent theory, associated with Tversky and Kahneman, assumes that people evaluate changes from a reference point and are loss averse so that negative changes, like parting with endowments, outweigh positive changes. An incipient, connection-based theory invokes neither reference points nor loss aversion. It focuses on feelings. Receiving an item may engender connections or attachments to that item, and people may not part with endowments because breaking such bonds is unpleasant. We attempt to help resolve the debate between these theories, by showing that they offer opposing predictions when possession is uncertain and by experimentally investigating such uncertainty. For instance, we endow participants with an item then offer them the opportunity to trade their item for an alternative, as is standard. Extending standard protocols, we inform some participants that after desired trades are completed a coin flip will determine whether they keep or lose whichever item they then hold. Many real-world endowments are similarly uncertain. The connection-based view implies a diminished endowment effect given such uncertainty; the reference-dependent view implies an exacerbated endowment effect. Our data reveal that uncertain possession exacerbates the endowment effect, thereby corroborating the reference-dependent view. Importantly, we contest the implications of connections not their existence. People frequently form connections to possessions, but even profound connections to an item may not induce an inappropriate reluctance to part with it.

Keywords: Endowment effect, reference-dependence, connections, uncertainty

In a classic experiment, Knetsch (1989) gave a mug to some participants and a chocolate bar to other participants and told all participants that they could either keep the item they possessed or trade it for the other item. Very few participants chose to swap, only about ten percent. Such reluctance to trade has come to be seen as an instantiation of the endowment effect, the tendency to place greater value on an item when it might be given up from one's possession than when it is not in one's possession.

What psychological processes give rise to the endowment effect? In recent years, a debate has emerged between two competing answers to this question: the seminal, reference-dependent theory first suggested by Thaler (1980) and Tversky and Kahneman (1991; see also Kahneman, Knetsch, & Thaler 1990, 1991; Carmon & Ariely, 2000; Johnson, Haubl, & Keinan, 2007; McGraw, Larsen, Kahneman, & Schkade 2010; Small 2010; Strahilevtz & Loewenstein 1998; Wolf, Arkes, & Muhanna 2008) and an incipient, connection-based theory (Ariely, Huber, & Wertenbroch 2005; Ariely & Simonson, 2003; Beggan, 1992; Beggan & Scott, 1997; Carmon, Wertenbroch, & Zeelenberg, 2003; Gawronski, Bodenhausen, & Becker, 2007; Johansson, Hall, Sikström, & Olsson 2005; Kermer, Driver-Linn, Wilson, & Gilbert, 2006; Morewedge, Shu, Gilbert, & Wilson 2009; Peck & Shu 2009; Reb & Connolly, 2007; Sen & Johnson, 1997; Simonsohn and Ariely, 2007; Shu & Peck 2011; Zhang & Fishbach 2005). In the present article, we help resolve this debate by examining a setting in which the reference-dependent and connection-based accounts offer precisely opposite predictions. We next introduce each account, then specify the setting in which we will test between them, and subsequently detail the application of each account to that setting.

Reference-dependent theories explain the endowment effect on the basis of two assumptions. First, people construct their preferences by evaluating potential changes from a

reference point. Second, evaluations of changes are loss averse; negative changes are weighted more heavily than corresponding positive changes (Tversky and Kahneman, 1979). Returning to Knetsch's experiment, note that from the reference point of mug-holders, a trade consists of two simultaneous changes: the loss of the mug and the gain of the chocolate. From the reference point of chocolate-holders, a trade consists of the loss of the chocolate and the gain of a mug. If preferences depend on evaluations of changes from a reference point and evaluations of losses are accentuated relative to evaluations of corresponding gains, the sum of a simultaneous gain and loss will (on average) be a net negative; the loss of the possessed item will tend to outweigh the gain of the alternative item. People will thus be reluctant to trade; they will tend to prefer their current holding to the alternative.

Connection-based theories offer a fundamentally different perspective. Such theories do not invoke reference points nor do they posit the existence of loss aversion. Instead, these theories assume that feelings are responsible for reluctance to trade. In particular, receiving an item may very rapidly induce a minimal connection, attachment, or bond with that item, and people may be averse to breaking even minimal connections.

The essence of each account emerges when we consider the relationship between possession of an item and the subjective value placed on that item. According to the connection-based view, when an individual acquires an object, he or she immediately values it more than prior to acquisition; that is, mere possession increases subjective value. As Peck and Shu (2009) write in summarizing connection-based views: "[people's] valuation of an object increases once they have taken ownership of it." In contrast, according to the reference-dependent view, possession does *not* increase subjective value. Rather, the essence of the reference-dependent view is that people's valuation of an object increases only when they come to consider parting

with it – only when they consider the potential negative change of losing possession. As Kahneman, Knetsch, and Thaler (1991) write: "the main effect of endowment is not to enhance the appeal of the good one owns, only the pain of giving it up."

In what follows, we exploit these divergent perspectives on the relationship between possession and value to test between the connection-based and reference-dependent accounts. To do so, we examine the impact on the endowment effect of uncertain possession. In typical endowment effect experiments, participants' possession of an item is certain or guaranteed. Participants can part with an item voluntarily, via trade, but they cannot lose an item involuntarily. Knetsch's participants, for instance, were guaranteed to go home with either their initial endowment or the item for which they traded. After all desired trades had been completed no chance event or uncontrollable factor could cause participants to lose the item they held at that time. Accordingly, the first experimental design we implement juxtaposes such standard, *guaranteed possession* with *tentative possession*, under which participants know they might involuntarily lose their holding.

To be more concrete, in a guaranteed possession treatment, we endow participants with either a mug or a pack of highlighters and offer them the opportunity to trade. In the tentative possession treatment we likewise endow participants with either a mug or highlighters and offer them the opportunity to trade. In addition, prior to making their keep/trade decision, participants are informed that on the basis of a coin flip they might lose the item they hold once all desired trades are completed. So participants know that if they choose not to trade, they might end up losing the initial endowment they elected to keep; likewise, participants know that if they do choose to trade, they might end up losing the item they received in the exchange. Indeed, after

all desired trades are consummated, a coin is flipped to determine whether participants keep or lose the item they hold at that time.

Because many real-world endowments are uncertain rather than guaranteed, studying uncertain possession may be of pragmatic interest. More critically for our present concerns, contrasting guaranteed and tentative possession allows us to test between the connection-based and reference-dependent accounts. The connection-based view implies that tentative possession will diminish reluctance to trade relative to guaranteed possession. The reference-dependent view implies the opposite, that tentative possession will exacerbate reluctance to trade relative to guaranteed possession.

To appreciate the connection-based view of tentative possession, note that it seems reasonable to assume that people will be less connected to items they have been given only tentatively than to items they have been given for sure. Tentative possession may be thought of as "lesser possession." Lesser possession should yield weaker connections than guaranteed possession. Weaker connections are more readily broken. As a result, tentative possession should yield a diminished endowment effect. Note that because the essence of the connection-based account is that mere possession increases value, manipulating the degree of possession, by studying tentative possession, tests the connection-based account "on its home turf."

The connection-based account is amenable to exceedingly simple modeling. Let the subjective value of a mug and a pack of highlighters be denoted by positive numbers M and H. A straightforward way to represent connection strength and the notion that mere possession increases value is via a "connection parameter," $c > 0$. For example, upon receiving a guaranteed mug, an individual will come to have strength of connection to the mug equal to $(1 + c)M$. Suppose an individual is willing to trade if the subjective value of what is offered surpasses

the strength of connection to the current holding. Then a guaranteed mug holder will trade for guaranteed highlighters if $(1 + c)M < H$. Rearranging terms yields the condition $0 < c < (H - M)/M$, which more readily indicates that a guaranteed mug holder will trade when highlighters are sufficiently attractive to overcome the strength of connection to the mug.

Next consider a tentative mug holder exposed to a probability p risk of losing possession of the mug. Generalizing the above, let the strength of connection to a tentatively held mug be $[1 + (1 - p)c]M$. Then, a tentative mug holder will trade for tentative highlighters, which may themselves be lost with probability p, if $[1 + (1 - p)c]M < H$; that is, when $0 < c < (H - M)/[M(1 - p)]$. Clearly, the range of values of c that permit trades of tentative possessions is larger than the range of values of c that permit trades of guaranteed possession. As a result, trades of tentative endowments should be more likely than trades of guaranteed endowments. In this way, the connection-based account implies that tentative possession diminishes reluctance to trade; indeed, as possession becomes more tentative (i.e., as p increases), willingness to trade should become more pronounced.

The key to why trades are more frequent given tentative possession is that tentativeness of possession diminishes the connection to the current holding but has no consequence for the alternative holding. After all, a connection to the alternative holding does not exist in the first place. The uncertainty instantiated under tentative possession equivalently impacts the likelihood of retaining either the current or alternative possession, nevertheless its impact on connections is asymmetric and exclusive to the current holding.

In contrast to the connection-based view, the reference-dependent view implies that tentative possession will exacerbate the reluctance to trade. In fact, as possession becomes more tentative (i.e., as p increases), the reluctance to trade will become more pronounced. To see why,

consider first the trade of a guaranteed mug for guaranteed highlighters. The subjective value of the changes entailed by this trade, namely the loss of the mug and the gain of the highlighters, may be denoted as $M_- < 0$ and $H_+ > 0$. A straightforward way to model loss aversion is via a "loss aversion parameter," $\lambda > 1$, such that, for example, $M_+ = M$ and $M_- = -\lambda M$; in this scheme, a loss is experienced as a multiple of the subjective value of the corresponding gain. Suppose an individual is willing to trade if the sum of the subjective values of the gains and losses from a proposed trade is positive. Then a guaranteed mug holder will trade for guaranteed highlighters if $-\lambda M + H > 0$, which will occur when $1 < \lambda < (H/M)$. That is, a trade will occur if highlighters are sufficiently more attractive than the mug to overcome loss aversion. So far there is no substantive difference between the connection-based and reference-dependent analyses.

However, consider a tentative mug holder. This individual possesses the mug and is also exposed to a probability p risk of losing possession of the mug. As we have seen, the negative change of losing a mug has subjective value $-\lambda M$. The subjective value of exposure to the risk of losing a mug can thus be given by $-p\lambda M$. In this term, $-\lambda$ is included because forfeiture of the mug would constitute a negative change. Note, on the flip side, that elimination of exposure to the risk of losing a mug would constitute a positive change with subjective value $+p\lambda M$. Similar terms, with H subbed in for M, can be formulated for exposure to risk concerning possession of highlighters. Importantly, when a tentative mug holder trades for tentative highlighters, there are four separate, simultaneous changes. The tentative mug holder parts with the mug (a negative change), parts with the risk of losing the mug (a positive change), receives the highlighters (a positive change), and takes on the risk of eventually losing the highlighters (a negative change). If people weight all four changes equally (which is a simplifying assumption we will shortly

relax), the sum of the subjective values of these changes is $[-\lambda M + p\lambda M] + [H + -p\lambda H]$. The terms in the first bracket arise from parting with the mug and parting with exposure to the risk of losing it; the terms in the second bracket arise from receipt of the highlighters and the taking on of exposure to the risk of losing them. A tentative mug holder will trade for tentative highlighters if the sum of these terms exceeds zero, which occurs when $1 < \lambda < H/[(1 - p)M + pH]$. Notice that the range of values of λ that permit trades of tentative possessions is narrower than the range of values of λ that permit trades of guaranteed possessions, $1 < \lambda < (H/M)$. In this way, the reference-dependent account implies that trades of tentative endowments are less likely than trades of guaranteed endowments. Tentative possession exacerbates reluctance to trade.

To hone in on the intuition behind the reference-dependent prediction, consider three observations. First, given guaranteed possession, an individual will obviously never trade the item of superior value for the item of inferior value. Second, given guaranteed possession, an individual will only trade the inferior item for the superior item if the superior item is sufficiently better to overcome loss aversion. Third, trades are scarcer given tentative possession than guaranteed possession, because the risk of losing a tentative possession hurts the attractiveness of the superior item relatively more than it hurts the attractiveness of the inferior item. An item that is sufficiently superior to merit a trade when possession is guaranteed may not be sufficiently superior when possession is tentative. Note a contrast between the connection-based and reference-dependent analyses. The connection-based view presumes that uncertainty dilutes the connection to the item one holds but essentially does not impact the alternative item. The reference-dependent view presumes that uncertainty impacts both one's current holding and the alternative holding, but to different extents.

Our approach to modeling reference-dependence under uncertainty may be seen as a variant of the seminal analysis of reference-dependent risk attitudes put forth by Koszegi and Rabin (2006, 2007). In particular, the manner in which we model tentative possession is roughly analogous to Koszegi and Rabin's notion of a choice-acclimating personal equilibrium (CPE) that has the lotteries defined by tentative possession as reference points. We have not simply adopted the framework of Koszegi and Rabin for two reasons. First, these authors posit some notions of reference-*independent* evaluation that we find psychologically unrealistic. Second, our own modeling turns out to be mathematically simpler than Koszegi and Rabin's and thus more amenable to our need to construct a clear contrast of connection-based and reference-dependent analyses. In our concluding discussion, we closely consider the relationship and critical differences between our modeling, Koszegi and Rabin's analysis, and the insightful account of reference-dependence proposed by Sugden (2003; see also Schmidt, Starmer, & Sugden 2008). We also consider the relationship between our work and the well-known empirical investigation of Novemsky and Kahneman (2005a). Our modeling approach leads to a distinction between possession uncertainty and other forms of uncertainty and to the hypothesis that possession uncertainty impacts the endowment effect but other forms of uncertainty do not. The data reported by Novemsky and Kahneman are consistent with this hypothesis.

To be clear, our principal assumption in modeling reference-dependence is that a holding and any possession uncertainty relevant to that holding may constitute separate components of the reference point or of departures from it. Thus, for example, someone possessing a tentative mug which may be lost with probability ½ is characterized as both holding a mug and having the ½ chance of losing the mug. Likewise, someone who trades for tentative highlighters is characterized as taking on both the highlighters and the ½ chance of losing them. In either case,

the holding and the risk inherent to it are treated as separate components to be valued; they are not combined into a unitary representation equal to, say, the expectation of tentative possession (i.e., "½ chance of a mug" or "½ chance of highlighters").

Of course, as previously alluded to, people need not weight holdings and exposure to risk equally. Thus, we suppose that the weight a person places on exposure to risk is indexed by a parameter n, with $0 \leq n \leq 1$. Some arithmetic reveals that the range of values that permit trade under potential possession then becomes $1 < \lambda < H/[(1 - np)M + npH]$. Presumably, under tentative possession n will tend to be positive but small. That is, people will place some weight on exposure to risk but will not be so fixated on risk as to be handicapped by anxiety. To explicate, note that when n is equal to zero (so that people do not consider their exposure to risk and the reference point implicitly reduces to a unitary form), the range of values that permit trade reduces to $1 < \lambda < H/M$, just as under guaranteed possession. On the other hand, for large values of n, it is possible that the decision maker will not trade M for H, even if H is an item of extremely high value (e.g., let $n = 1$, $p = ½$, $\lambda = 2$, $M = 1$, and $H = 100$). Large values of n reflect an individual who is so anxious about exposure to risk, that he or she does not want to trade a mediocre item for a very attractive item just because of the fear of subsequently losing the attractive item.

Experiments that Test Between the Two Theories

Before detailing our two experiments we provide a summary of our findings. The data from Experiment 1 reveal that tentative possession consistently *exacerbates* the endowment

effect relative to guaranteed possession. Experiment 1 thus corroborates the reference-dependent account and contradicts the connection-based explanation of the endowment effect.

A question which then arises is whether exacerbated (or diminished) endowment effects might be predicted as a function of the reference points induced by other forms of uncertain possession, beyond tentative possession. Accordingly, in Experiment 2, in addition to guaranteed and tentative possession, we examine a variant of uncertain possession that we term *potential possession*. In a potential possession treatment, participants are endowed with either a lottery ticket that offers a mug as a prize or a lottery ticket that offers highlighters as a prize; participants have the opportunity to trade their ticket for the alternative ticket. Prior to making their keep/trade decision, participants are informed that a coin will be flipped, and if the coin lands heads, all tickets will be winning tickets. That is, if the coin lands heads, the owner of each ticket will receive the available prize. Then, after all desired trades are consummated, a coin is indeed flipped to determine whether participants receive the item listed on their ticket. Several authors have reported that potential possession yields an endowment effect, but these authors did not compare potential possession to other forms of possession (Bar-Hillel & Neter, 1996; Casey, 1995; Knetsch & Sinden, 1984; Risen & Gilovich, 2007; van Dijk & Knippenberg, 1996, 1998).

Tentative and potential possession offer objectively equivalent situations that are differentially framed. Under tentative possession, participants initially hold an item they might lose. Under potential possession, participants initially hold a ticket, and if this ticket is a winner, they then obtain an item. As we detail in a subsequent section, our reference-dependent analysis predicts that potential possession will show a reluctance to trade that is intermediate to that of guaranteed and tentative possession. Experiment 2 corroborates this prediction and thus lends additional credence to reference-dependent explanations of the endowment effect.

We wish to emphasize that our work is not meant to deny the existence of connections, attachments, and bonds to one's possessions. Life clearly reveals that people can become connected to their possessions, sometimes dramatically so. In addition, research shows that just about any possession can come to have meaning or implications for the self (Beggan 1992; Beggan & Scott 1997; Gawronski, Bodenhausen, & Becker 2007; Greenwald & Banaji 1995; Johansson, Hall, Sikstrom, & Olsson 2005; Jones, Pelham, Cavallo, Mirenberg 2004). As we discuss in full in our conclusion, our argument concerns not the existence of connections but the implications of connections and in particular the implications of the sort of rapidly-emerging connections that may arise in experimental settings. Contrary to a connection-based account, we suggest that many rapidly-emerging connections do not make parting with a possession inherently aversive. Thus, while people may frequently be connected to their possessions, the reluctance to trade may nevertheless stem from reference-dependence.

Experiment 1

Method. Undergraduates enrolled in a core course at NYU were endowed with either an NYU mug or a pack of Bic highlighters. We used a transparently random endowment procedure: experimenters walked by participants' desks and alternately gave each individual either a mug or highlighters. Participants were provided with written instructions that were read aloud by an experimenter. The study was conducted in a classroom setting, in sessions of between 30 to 65 participants.

We implemented the following three treatments (each treatment was run in multiple sessions; each session included just one treatment). In the baseline, guaranteed possession (*GP*)

treatment (n = 102), there was no uncertainty whatsoever; participants were guaranteed to go home with either the item they kept or the item for which they traded. To indicate their keep versus trade decision, participants circled one of these options on their instruction sheet. Trades were conducted with the experimenter – participants did not trade with one another. Once all participants had made their keep/trade decision, requested trades were immediately implemented.

The one coin flip tentative possession (*1CTP*) treatment (n = 117) differed from the baseline, guaranteed possession treatment as follows. Prior to making their keep/trade decision, participants were informed that after all requested trades were consummated a coin would be flipped to determine whether participants kept or lost the item they held at that time. Critically, then, participant knew that if they chose not to trade, they might end up losing the initial endowment they elected to keep; likewise, participants knew that if they did choose to trade, they might end up losing the item they received in the exchange. In other words, participants made their keep/trade decision knowing they would subsequently be exposed to the resolution of uncertainty via the coin flip. The coin flip was indeed carried out after trades were completed; depending on the outcome of the coin flip, participants either kept the item they held or had it taken back by the experimenter.

The two coins flips tentative possession (*2CTP*) treatment (n = 75) was identical to the one coin flip treatment except that two separate coins were flipped. Prior to making their keep/trade decision, participants were informed that after all requested trades were consummated, one coin would be flipped for the mug and another coin would be flipped for the highlighters. The mug coin flip would apply to participants holding a mug at that time (either because they kept the mug with which they were endowed or because they opted to trade a pack of highlighters for a

mug). Likewise, the highlighter coin flip would determine whether those holding a pack of highlighters after all trades had been consummated would keep or lose their highlighters.

Savage's sure-thing-principle (Savage, 1954) suggests that the uncertainty we engender should normatively have no impact, so that trading rates will be equivalent across all three treatments. That is, $TradeRate(2CTP) = TradeRate(1CTP) = TradeRate(GP)$. To see why, note that one coin flip tentative possession instantiates a possible state of the world in which both a person's current holding would be lost and his or her alternative holding would be lost; this treatment also instantiates a complementary state in which either holding would be retained. Two coin flip tentative possession breaks away from this perfect ordinal correlation in the consequences of keeping versus trading an initial endowment but not in a way that is meaningful. The sure-thing principle essentially asserts that any state of the world for which all options yield the same outcome can be ignored. Thus, from a normative standpoint, our participants could, first, reduce a decision under uncertainty into two separate within-state decisions, one corresponding to a coin flip that turns out well and the other corresponding to a coin flip that turns out badly. Then, because only the decision corresponding to the winning coin flip is material, participants could simply edit out or put aside the possibility of a losing coin flip and essentially make their decisions about keeping or trading their tentative endowments as if their endowment were guaranteed. If participants constructed their decision in such a state-by-state manner, we would by definition observe no differences across the three treatments in our design. Note that there is a special case in which reference-dependent behavior could yield behavior consistent with the sure-thing principle, the case in which $n = 0$.

However, rather than reacting to uncertainty state-by-state, people may react to uncertainty in a manner that is either connection-based or reference-dependent with n departing

from zero. The connection-based account implies that relative to guaranteed possession (*GP*), one coin flip (*1CTP*) and two coin flips (*2CTP*) tentative possession will diminish the reluctance to trade, and to the same extent. In other words $TradingRate(GP) < TradingRate(2CTP) = TradingRate(1CTP)$. The reference-dependent account implies that both forms of tentative possession will exacerbate the reluctance to trade, again to the same extent. That is, $TradingRate(2CTP) = TradingRate(1CTP) < TradingRate(GP)$.

It is notable that neither account on which we focus distinguishes between the one and two coin flip tentative possession treatments. Consequently, if these treatments indeed yield equivalent results, then whichever of the reference-dependent and connection-based views agrees with the data may be considered doubly corroborated. On the other hand, the observation of different results in these treatments would implicate decision processes that lie beyond either reference-dependence or connection-based explanations.

The work of Bar-Hillel and Neter (1996), Casey (1995), Risen and Gilovich (2007) and van Dijk and Knippenberg (1996, 1998) suggests two processes that might engender greater reluctance to trade given two coin flips than given one coin flip. First, people may have a marked apprehension of giving up an item whose coin flip turns out to be a winner for an item whose coin flip turns out a loser. In other words, people may be reluctant to trade in part because they would deeply regret a "trading mistake" that exposes them to a coin flip that goes sour rather than a coin flip that goes well. However, even if such anticipated regret were quite powerful under two coin flips, it is by definition impossible given one coin flip. (For discussions of anticipated regret see Zeelenberg, 1999; Zeelenberg, van Dijk, Manstead, & van der Pligt, 2000; Gilovich & Medvec, 1995; and Bleichrodt, Cillo, & Diecidue, 2010). Second, some participants may believe that trading is likely to induce a coin flip that turns out badly – in other

words, that trading is tantamount to tempting fate. Such magical thinking, though not necessarily ruled out given one coin flip, seems more likely to arise when there are two separate coin flips (magical beliefs are considered by Gilovich & Savitsky 2002; Kruger, Wirtz, & Miller 2005; Pronin, Wegner, Rodriguez, & McCarthy 2006; Risen & Gilovich 2008; Rozin, Millman, & Nemeroff 1986; Rozin & Millman 2002). In sum, if either anticipated regret or magical thinking were manifest in our data, and neither reference-dependence nor connection-based processes arose, we would observe $TradingRate(2CTP) < TradingRate(1CTP) = TradingRate(GP)$.

Results. To interpret Figure 1, note that given guaranteed possession 17% of mug holders traded and 62% of highlighter holders traded. The sum of these proportions is 79%, and their average is 40%. We return to item-by-item assessments further down, but focusing for a moment on average trading rates reveals an important preliminary: all three treatments exhibited a significant endowment effect. The 40% average trading rate given guaranteed possession is statistically distinct from the 50% average trading rate expected if there were no endowment effect (χ^2=5.3, p=.02, φ=.23). The average trading rates given one and two coin flip tentative possession, each 26%, are also both statistically distinct from 50% (χ^2=24.2, $p < .001$, φ=.47 given one flip; χ^2=16.3, $p < .001$, φ=.45 given two flips).

More critically, both one and two coin flip tentative possession exacerbated the endowment effect relative to guaranteed possession, and to virtually an identical extent. Planned contrasts indicated that average trading rates were lower given either form of tentative possession than under certainty (ps ≤ .03, ds > .32). Furthermore, looking within-item, mug holders and highlighter holders each traded less given either variant of tentative possession than

given guaranteed possession. Though only 17% of mug holders traded given guaranteed possession, the proportion trading given tentative possession was even lower, 11% given two flip tentative possession and 8% given one flip tentative possession. Likewise, 62% of highlighter holders traded given guaranteed possession, but only 41% traded given two flip tentative possession and 44% given one flip tentative possession.

In sum, we observe the pattern $TradingRate(2CTP) = TradingRate(1CTP) < TradingRate(GP)$. This pattern indicates that people do not process uncertainty in a state-by-state manner that accords with the sure-thing principle (or with reference-dependence given $n = 0$). It also suggests that anticipated regret and magical thinking are not prominent forces in the setting we study. Most importantly, it is incompatible with connection-based theories and, highly consistent with reference-dependence (with $n > 0$; that is, reference-dependence that is sensitive to exposure to possession uncertainty).

Guaranteed, Tentative, and Potential Possession

The question arises of whether exacerbated (or diminished) endowment effects might be predicted by a reference-dependent analysis of other forms of uncertain possession, beyond tentative possession. With this question in mind, we turn to what we have termed potential possession. Recall that under potential possession an individual receives a lottery ticket that, subject to a coin flip, either becomes redeemable for an item or becomes worthless. As we have mentioned, potential and tentative possession offer objectively equivalent odds of leaving the experiment with a mug or highlighter versus leaving empty-handed. Nevertheless, these different forms of uncertain possession engender distinct reference points and changes.

In particular, the assumption that a current holding and any possession uncertainty relevant to that holding may constitute separate components of the reference point or of departures from it implies that a potential mug holder will have a three-component reference point. The potential mug holder's reference point will consist of (i) the holding of a ticket, (ii) exposure to the upside risk of actually receiving a mug if the ticket is a winner, and (iii) exposure to the downside risk of receiving nothing if the ticket is a loser. To derive the subjective values of each of these three components, suppose the ticket offers a probability $1 - p$ of winning a mug. Then the subjective value of holding the ticket is $(1 - p)M$, which is just the expected subjective value of the ticket. The upside risk of potentially receiving the mug because the ticket turns out to be a winning ticket thus has subjective value $p(1 - p)M$; with probability $1 - p$ the ticket will be a winner and the individual will in a sense accrue the "p portion" of the mug that is not incorporated into his or her a priori expectation. By the same logic, the downside risk of missing out on the mug because the ticket turns out to be a loser has subjective value $-\lambda p(1 - p)M$; with probability p the individual will miss out on even the "$1 - p$ portion" of the mug built into his or her expectation, and this would be a negative development. Similar terms, with H subbed in for M, can be formulated for a person holding a ticket for potential highlighters.

When a potential mug holder trades for potential highlighters, there are thus six separate, simultaneous changes. The individual parts with the ticket offering a mug (a negative change), parts with the upside risk of the ticket turning out to be a winner (a negative change), and parts with the downside risk of the ticket turning out to be a loser (a positive change). In turn, this person receives the ticket offering highlighters (a positive change), takes on the upside risk of that ticket turning out to be a winner (a positive change), and takes on the downside risk of that ticket turning out to be a loser (a negative change). If these changes are weighted equally then

the sum of the subjective values of the changes is $[-\lambda(1-p)M - \lambda(1-p)pM + \lambda(1-p)pM] + [(1-p)H + (1-p)pH - (1-p)p\lambda H]$. A potential mug holder will trade for potential highlighters if the sum of these terms exceeds zero, which occurs when $1 < \lambda < ([H + pH]/[M + pH])$. More generally, if we again suppose that the weight a person places on exposure to risk is indexed by a parameter n, with $0 \leq n \leq 1$, the range of values of λ that permit trades of potential possessions will be $1 < \lambda < ([H + npH]/[M + npH])$.

This range of values is clearly somewhat narrower than the range of values that permit trades of guaranteed possessions, which we have seen is $1 < \lambda < (H/M)$. Some algebra reveals that the range of values of λ that permit trades of potential possessions is also somewhat narrower than the range of values of λ that permit trades of tentative possessions, $1 < \lambda < (H/[(1 - np)M + npH])$. The overall predicted ordering of trade frequencies, guaranteed ≤ potential ≤ tentative, makes intuitive sense: Recall that given guaranteed possession, an individual will obviously never trade the item of superior value for the item of inferior value; moreover, an individual will only trade the inferior item for the superior item if the superior item is sufficiently better to overcome loss aversion. Trades are scarcer given tentative possession because the downside risk of losing tentative holdings hurts the attractiveness of the superior item relatively more than it hurts the attractiveness of the inferior item. Trades are of intermediate frequency given potential possession, because the inclusion of the upside risk of winning dilutes the impact of the downside risk of losing.

We suggest a weak inequality for the relationship of trading rates under potential and tentative possession in part because we do not rule out the possibility that someone who has tentative possession may conceive of his or her circumstance in terms of the reference points and possible changes we have cited for potential possession. While we believe that tentative

possession will, as a rule, be conceived of as the status quo of holding the relevant item and being exposed to the risk of losing it, some individuals may frame their circumstance and choices in terms of the expected consequence plus the upside risk of improvement over expectation and the downside risk of not meeting expectation. The status quo (e.g., of holding a mug under tentative possession) is a powerful influence on the reference point, but it is not the exclusive determinant of the reference point.

In sum, by our analysis, the frequency of trades of potential possessions should fall somewhere in between the frequency of trades of guaranteed and tentative possessions. Empirical corroboration of this prediction would lend further credence to the notion that the endowment effect is explained by reference-dependence.

Unfortunately, a connection-based account does not offer a definitive prediction concerning potential possession. On one hand, it could be argued that potential possession of a mug or highlighters constitutes lesser possession of these items than does guaranteed possession. In this case, the connection-based account would imply that potential possession should yield a diminished endowment effect relative to guaranteed possession, just like tentative possession does. On the other hand, people may form connections to lottery tickets themselves and not just to the prizes available via the lottery tickets. If so, then the connection-based account makes no prediction about potential possession versus guaranteed possession, because the strength of connection to a guaranteed mug need not have any particular relationship to the strength of connection to a lottery ticket offering a mug as a prize.

Experiment 2

Method. Instead of mugs and highlighters, we used two new items, rulers and a small pack of Post-Its. We also ran participants individually in a lab setting rather than in large classroom sessions. Otherwise, our methodology was just as in Experiment 1. We had three separate treatments: guaranteed possession, one coin flip tentative possession, and potential possession.

Results. Figure 2 summarizes the data. As predicted by reference-dependence, the average trading rate was greater under guaranteed possession, 42%, than under tentative possession, 28 % (χ^2=4.1, p=.04, φ=.16), and was intermediate under potential possession, 31%. Moreover, looking within-item, ruler holders and Post-Its holders each traded most often given guaranteed possession, at an intermediate rate given potential possession, and least often given tentative possession. Thus, rather than being edited out in accordance with the sure-thing principle, or diminishing the endowment effect, tentative possession again exacerbated the endowment effect relative to guaranteed possession. Moreover, potential possession fell in between guaranteed and tentative possession. This set of results further corroborates a reference-dependent account of the endowment effect.

Though they were run using somewhat different methodologies, it may be instructive to compare Experiments 1 and 2. This comparison can shed light on a "cognitive economizing" explanation of our results. Introducing an element of uncertainty into a keep/trade decision may simultaneously raise the cognitive demands of thinking through one's choice (because the injection of uncertainty constitutes added complexity) and lower the expected payoff of discerning which option one truly prefers (because one might lose possession via the coin flip). People frequently shy away from mental effort when properly thinking through some situation seems excessively difficult or not worthwhile (Payne, Bettman, & Johnson, 1993). Thus, it

could be argued that tentative and potential possession induce greater reluctance to trade than guaranteed possession only because participants in these uncertainty treatments "opt out" of effortful consideration of their choice and mindlessly settle for keeping their initial endowment. By this argument, neither connection-based nor reference-dependent mechanisms are revealed by our results. Instead, our results simply show that excessive cognitive demands and inadequate pecuniary rewards can induce inertia that allows "cognitive economizing."

However, a comparison of the mug-highlighter pairing with the ruler-Post-It pairing casts doubt on such an analysis. At the NYU Bookstore, the mugs we used were priced at $8 and the highlighters at about $5. Both the ruler and Post-Its cost just slightly more than $1. Thus, the mug and highlighters each cost considerably more than the ruler and Post-Its; moreover, the price difference between the mugs and highlighters was greater than the price difference between the ruler and Post-Its. If cognitive economizing contributed to reluctance to trade, we would then expect that, given guaranteed possession, the ruler-Post-It pairing would show substantially less trading than the mug-highlighter pairing. However, the two pairings show virtually identical trading rates (about 40% average trading rate for each pairing). Likewise, given tentative possession, cognitive economizing would predict that the two pairings would show distinct levels of reluctance to trade; yet they show virtually identical levels of reluctance to trade (26% and 28% average trading rates, respectively). We therefore suggest that cognitive economizing is not likely to be a significant contributor to our results.

Discussion

We have observed that tentative possession induces more pronounced reluctance to trade than guaranteed possession. This finding is consistent with a reference-dependent explanation of

the endowment effect rather than a connection-based explanation. We have also observed that potential possession engenders a level of trading that is intermediate to that of guaranteed and potential possession. This finding lends additional credence to the reference-dependent view.

We wish to reiterate that our work is not intended to deny the existence of connections, attachments, and bonds to one's possessions. It seems entirely evident that people can become connected to some possessions. Our work contests the implications of connections not their existence. To explicate, let us begin by distinguishing between minimal connections that may arise very quickly and deeper, more profound connections that likely emerge only over extended durations. Deep, profound connections may sometimes – though not always – make parting with an item inherently aversive. For instance, if a mother gives a daughter a watch, the daughter might initially have only measured feelings for the watch. However, if, over time, the daughter comes to see the watch as representing the relationship and affection between her and her mother, the daughter may come to prize the watch and, accordingly, be extremely reluctant to part with it. On the flip side, consider a young fashion designer who draws a stylish print, sketches a pattern for a dress, chooses just the right silk, dyes the print onto the silk, expertly cuts the silk according to the pattern, and sews dresses from the resulting fabric pieces. For this designer, pride and joy in one's work likely constitute a substantial, positive connection to the finished garments. Does this connection make parting with the dresses (say via sale) inherently unappealing? We suggest not. Thus, it seems clear that no theory of even deep, meaningful connections will assume that *any* connection invariably constitutes an impediment to trade.

Therein lies our core thesis: while some types of connection can make parting with possessions inherently negative, many other types of connections may not. In particular, we suggest that the rapidly-emerging, minimal connections that can arise in endowment effect

experiments (which typically involve only short durations of ownership of highly prosaic items) do not necessarily constitute an impediment to parting with one's possessions. Rapid, minimal connections surely exist (as many research findings show), and have many important behavioral implications (as many research findings also show), but a systematic reluctance to trade may not be one of them (a similar notion seems implicit in the analysis of Loewenstein & Issacharoff, 1994).

Consider, for instance, the work of Morewedge, Shu, Gilbert, and Wilson (2009). In their primary experiment, these authors found, per the norm, that participants who had been given a mug required more money to sell that mug (roughly $4) than participants who had not been given a mug were willing to pay for one (roughly $2). Under reference-dependence, such findings indicate that the pain from parting with a mug via sale is greater than the pleasure from receiving a mug by purchasing it. In an ingenious additional treatment, Morewedge et al. subsequently observed that mug holders were willing to pay about $4 for a *second* mug – so mug holders were willing to pay more to receive a second mug than non-holders were willing to pay to receive a first mug. On this basis, the authors concluded that (i) mug holders had formed connections that increased the subjective value placed on a mug. They further concluded that (ii) connections rather than reference point effects must explain why mug holders' selling prices for a first mug exceeded non-holders buying prices for a first mug.

Our interpretation of Morewedge et al's results agrees with point (i) concerning the existence of connections but challenges the inference in (ii) concerning the implications of connections. In our estimation, the greater value that mug holders place on additional mugs may well arise because they have formed positive connections to the first mug. Conditional on holding a first mug, a person may become fond of mugs. As a result, when offered a second

mug, a person may be willing to pay quite a lot. However, that does not imply that connections drive the endowment effect for the first mug. Again, if connections did drive the endowment effect for a first mug, then in our experiments we should observe that tentative possession of a mug attenuated the endowment effect. We observed the opposite. Moreover, note that Morewedge et al's novel treatment does not even concern participants who might part with a mug. It concerns only participants who may receive a (second) mug. Thus, Morewedge et al's additional treatment by definition cannot directly indicate that connections have any effect on parting with a mug. In contrast, making possession uncertain rather than guaranteed allows us to directly examine participants asked to part with an item. Because uncertain possession can be thought of as lesser possession, our methodology, unlike that of Morewedge et al, both manipulates strength of connection and concerns participants asked to part with an item.

Much recent research has demonstrated a role for emotions in modulating or producing the endowment effect as well as other well-known patterns of decision making (Bechara, Damasio, Tranel, & Damasio 1997; Dhar & Wertenbroch 2000; Finucane, Alhakami, Slovic, & Johnson 2000; Lerner & Keltner 2000; Mellers, Schwartz, & Ritov 1999; Peters & Slovic 2000; Rottenstreich & Hsee 2001; Shiv, Loewenstein, Bechara, Damasio, & Damasio 2005; Winkielman, Berridge, & Wilbarger 2005). For instance, Lerner, Small, and Loewenstein (2004) observed that the tendency for selling prices to exceed choice equivalents was eliminated by disgust induced by a prior, irrelevant situation. They observed that sadness in a prior, irrelevant situation carried over as well, reducing selling prices but increasing choice prices and sometimes even producing a reversal of the endowment effect. An intriguing approach taken by some studies is to very tightly link hypotheses concerning feelings, physiological correlates of feelings, and observed patterns of loss aversion. For instance, Sokol-Hessner et al (2009) found that

experimental participants were (i) on average more aroused per dollar to losses relative to gains, as measured with skin conductance response, (ii) that the difference in arousal to losses versus gains correlated with loss averse choices, and (iii) that emotion regulation strategies that reduced arousal also reduced the tendency to make loss averse choices. Results of this kind suggest that there may exist very specific biological pathways between emotions and loss aversion. For instance, affective experiences that magnify arousal or are magnified by arousal may lead to more loss aversion, while affective experiences that suppress arousal may lead to little loss aversion. We speculate that the affective experiences induced by attachments, connections, bonds and the like are highly diverse; pondering some connections may be arousing, pondering others may suppress arousal, pondering still others may have no impact on arousal whatsoever. As such, the implications of attachments and connections for willingness to trade may be quite variable, sometimes inhibiting trade, sometimes promoting it, and others times having no consequence at all.

We believe it is especially useful to recognize that the data speak in favor of reference-dependence as an explanation for the endowment effect and against a connection-based view, because the simple, natural intuition underlying the connection-based view appears to make it profoundly alluring. Indeed, it is common for even reference-dependent theorists to inadvertently lapse into connection-based thinking. For instance, in a well-known review article that we have already cited, Kahneman, Knetsch, and Thaler (1991) explain the endowment effect in terms of reference-dependence. They write: "the main effect of endowment is not to enhance the appeal of the good one owns, only the pain of giving it up." Yet, just one year earlier, in a separate article presenting their seminal "Cornell mugs" experiment (Kahneman, Knetsch, & Thaler, 1990), these same authors summarize their findings using the language of connection:

"the value that an individual assigns to … objects … appears to increase substantially as soon as that individual is given the object." Likewise, in a highly influential pair of articles, Hoch and Loewenstein (1991) and Strahilevitz and Loewenstein (1998) offer an analysis of how reference points may shift over time. Their analysis is inarguably reference-dependent. Yet, Strahilevitz and Loewenstein fall into connection-based language, writing that "people become attached to an object almost instantly upon being endowed with it," and in a related paper Van Boven, Dunning, and Loewenstein (2000) state that "the endowment effect [is] the tendency to value an object more once one owns it." Absent explicit endorsement of reference-dependent theorizing over connection-based theorizing, it may be all too easy to fall into a connection-based view.

Reference-Dependence Incompatible with State-by-State Consideration of Uncertainty

Our results suggest that the nature of people's reference-dependence is not consistent with state-by-state consideration of uncertainty. To explicate, consider the model of Sugden (2003; Schmidt, Starmer, & Sugden 2008). Sugden's model describes a decision maker who is both reference-dependent and operates state-by-state. In the model, a one coin flip tentative mug holder decides whether to trade by evaluating the outcomes that might ensue in each possible state of the world. If the coin flip turns out well, a state that will arise with probability $(1 - p)$, then by trading the individual would have highlighters rather than a mug $(+H, -\lambda M)$. If the coin flip turns out poorly, a state that will arise with probability p, then the individual would have nothing whether trading or keeping the mug (0, 0). The individual's decision is derived from a probability-weighted sum of these within-state comparisons. Thus, a tentative mug holder would trade if $(1 - p))(+H - \lambda M) > 0$, which can be simplified to $H - \lambda M > 0$. Of course, this is the same

inequality that emerges under guaranteed possession. Therefore, contrary to the findings of Experiments 1 and 2, Sugden's model predicts that guaranteed and tentative possession will yield equivalent trading rates. Indeed, Sugden's model predicts that guaranteed, tentative, and potential possession will all yield equivalent trading rates.

The divergence between the true nature of reference-dependence and state-by-state thinking is not surprising; recall that state-by-state thinking is closely related to the sure-thing principle, and we have seen that participants' responses to uncertain possession do not accord with that principle. Indeed, moving beyond the study of uncertain possession, there is a plethora of evidence that people do not respond to uncertainty by reducing it to a series of within-state assessments. For instance, Tversky and Shafir (1992; see also Shafir & Tversky 1992) required participants to play an initial round of a gamble offering a 50% chance to win $200 and a 50% chance to lose $100 and then asked participants if they were willing to play another round of the same gamble. Separate groups of participants were informed they had lost the first round of the gamble, informed they had won the first round, or not informed of whether they had won or lost the first round. First round winners and first round losers both tended to accept a second round of the gamble. The sure-thing principle thus mandates that uninformed participants also tend to accept a second round of the gamble. Yet, uninformed participants tended to turn down a second round. Evidently, uninformed participants did not reduce their decision under uncertainty into two within-state decisions. They did not consider their preference given a winning first round, consider their preference given a losing first round, and aggregate these assessments to arrive at decision. Had they done so, they would have realized that they would play the second gamble whether they had initially won or initially lost.

On what basis did uninformed participants decline a second round? Tversky and Shafir point to the workings of reference points. First round winners might view a second round of the gamble as a 50% chance to finish up $400 overall (summing across two wins of $200) and a 50% chance to finish up $100 overall (summing across an initial win of $200 and a subsequent loss of $100). In most empirical fittings of prospect theory-like value functions, concavity in the domains of gains implies $.5v(400) + .5v(100) > v(200)$, which would explain the tendency of first round winners to play the second round. Informally, what this value inequality indicates is that first round winners play the second round because they feel like they are playing with house money. First round losers might view a second round of the gamble as a 50% chance to finish up $100 overall (-$100 + $200) and a 50% chance to finish down $200 overall (-$100 + -$100). In most empirical fittings, convexity in the domain of losses implies $.5v(100) + .5v(-200) > v(-100)$, which would explain the tendency of first round losers to play the second round. Informally, this inequality indicates that first round losers play the second round because they are markedly averse to finishing even a little bit in the red. Finally, uninformed participants may have a null reference point, corresponding to matters prior to even the first play of the gamble. If so, then for them, a second round will be framed simply as a fifty-fifty chance of winning $200 or losing $100; most empirical fittings assume a loss aversion factor slightly greater than two and somewhat more concavity of gains than convexity of losses, so that $.5v(100) + .5v(-200) < v(0) = 0$; informally, this inequality reflects the classic notion that people are highly averse to losses. They thus reject a single, isolated play of the gamble in question. In sum, from a winner's reference point, a second round may have been attractive, from a loser's reference point, a second round may have also been attractive, but from the reference point of someone uninformed

about their initial outcome, an additional round of play may have been unattractive. We infer that reference-dependent responses to uncertainty do not operate state-by-state.

Possession Uncertainty versus Other Forms of Uncertainty

The analysis we have offered leads to a distinction between possession uncertainty and other forms of uncertainty. To explicate the concept of non-possession uncertainty, we introduce a well-known study by Novemsky and Kahneman (2005a). These authors investigated the monetary values people place on mugs and other goods. Of particular relevance are their notions of "choice equivalents," "selling prices," and "risky selling prices." A choice equivalent is the maximum monetary amount a participant endowed with nothing would choose over guaranteed possession of an available item. A selling price is the minimum a participant endowed with guaranteed possession of some item requires to give up that item. A risky selling price is the minimum a participant endowed with guaranteed possession of some item requires to accept a gamble offering an equal likelihood of (a) receiving that amount and (b) losing the item. Novemsky and Kahneman note that risky selling "is analogous to a player placing his or her mug into a poker pot. If the player wins the hand, he or she keeps the mug and gains some money. If the player loses, he or she gives up the mug and receives nothing." Risky selling involves non-possession uncertainty, because, the exposure to uncertainty is voluntarily entered into (for a price). A risky seller is someone who starts out with guaranteed possession and who willingly puts their guaranteed possession in jeopardy not someone who to begin with has a tenuous property right.

In Novemsky and Kahneman's methodology, selling prices that exceed choice equivalents indicate that giving up an item of which one has guaranteed possession hurts more than receiving guaranteed possession of the same item. Selling prices that exceed choice equivalents thus constitute evidence of an endowment effect under guaranteed possession. This endowment effect could in principal reflect either connection-based or reference-dependent processes. Risky selling prices that exceed choice equivalents indicate that losing an item of which one initially has guaranteed possession by exposing it to non-possession uncertainty that turns out badly hurts more than receiving guaranteed possession of the same item. Risky selling prices that exceed choice equivalents thus constitute evidence of an endowment effect under non-possession uncertainty.

Though the distinction between possession and non-possession uncertainty is a matter of framing, we hypothesize that, in contrast to possession uncertainty, non-possession uncertainty will not impact the magnitude of the endowment effect. That is, non-possession uncertainty will yield an endowment effect that is neither exacerbated nor diminished relative to the endowment effect that prevails under guaranteed possession and absent any uncertainty whatsoever.

Both a connection-based and a reference-dependent account are consistent with this hypothesis. Deriving the connection-based analysis is straightforward. Because both selling prices and risky selling prices are provided contingent upon initial guaranteed endowment, these two response variables reflect the same connections. They should therefore yield endowment effects of equivalent magnitudes.

Deriving the reference-dependent analysis is somewhat more intricate. If the subjective value of the selling price for a mug is SP, and the subjective value of the choice equivalent is CE, then we would have $SP = \lambda M > M = CE$. Next, recall that the assumption underlying the

prediction that possession uncertainty will exacerbate the endowment effect is that a holding and any possession uncertainty relevant to that holding constitute separate components of the reference point or of departures from it. For instance, someone possessing a tentative mug which may be lost with probability ½ is characterized as both holding a mug and having the ½ chance of losing the mug. Someone who trades for tentative highlighters is, likewise, characterized as taking on both the highlighters and the ½ chance of losing them. The holding and the risk inherent to it are treated as separate components to be valued; they are not combined into a unitary representation equal to, say, the expectation of tentative possession (i.e., "½ chance of a mug" or "½ chance of highlighters"). This is because someone who has uncertain possession of an item indeed starts out with a tenuous property right. In contrast, consider the choice entailed by risky selling. The reference point in question is the guaranteed possession of a mug; it is not the mug along with exposure to the risk of losing it, because the individual starts out without any such exposure. We therefor suggest that the appropriate way to characterize non-possession uncertainty is via unitary representations (or, essentially equivalently, by setting $n = 0$). As a result, a ½ chance of losing guaranteed possession of the mug will have subjective value $-½\lambda M$. Let the subjective value of a risky selling price be RSP. By a parallel argument, the ½ chance of receiving that monetary amount will have subjective value $½RSP$. From here, things are simple. The subjective values just detailed must satisfy $½RSP + -½\lambda M = 0$. Basic arithmetic thus yields $RSP = \lambda M$. So RSP will equal SP. Putting everything together yields $RSP = SP > CE$, an endowment effect of equal magnitudes for risky selling and standard selling. We should note that Koszegi and Rabin's framework can also accommodate a prediction of equal magnitudes for the endowment effect under non-possession uncertainty while permitting an exacerbated endowment effect under possession uncertainty. To a rough approximation, Koszegi and

Rabin's framework is consistent with the notion that possession uncertainty engenders choice-acclimating equilibria and separate-component reference points while non-possession uncertainty engenders unacclimating equilibria and unitary reference points.

Novemsky and Kahneman's data bear out the prediction just developed. Selling prices were on average nearly twice as large as choice equivalents. Yet, risky selling prices and selling prices were about equal. In sum, unlike the possession uncertainty in our Experiments, the non-possession uncertainty investigated by Novemsky and Kahneman did not impact the endowment effect. Novemsky and Kahneman's results thereby underscore the utility of investigating uncertain possession. Both connection-based and reference-dependent analyses predict no impact of non-possession uncertainty. So only examining uncertain possession can disentangle connection-based and reference-dependent processes.

Using Models of Reference-Dependence to Identify the Prevailing Reference Point

In putting together our analysis of reference-dependence, we did not simply adopt the seminal modeling framework of Koszegi and Rabin for two reasons. First, these authors posit some notions of reference-*independent* evaluation that we find psychologically unrealistic and do not wish to invoke. Second, our own modeling turns out to be mathematically simpler than Koszegi and Rabin's and thus more amenable to our need to construct a clear contrast of connection-based and reference-dependent analyses.

A highly attractive feature of Koszegi and Rabin's framework, which we have tried to mimic in the section just above (and indeed throughout this paper), is its ability to characterize how different types of situations and uncertainty might influence the reference point that people

tend to adopt. With this in mind, recent research has attempted to leverage Koszegi and Rabin's model to identify the ways in which expectations may enter the reference point. Ericson and Fuster (2010) endowed participants with an item and randomized the probability that participants would be granted the opportunity to trade this item for an alternative. Participants with a lower probability of being granted the opportunity to trade (and who thus most strongly expected to keep their item) were less likely to trade when given the opportunity. Note that this result is consistent with a connection-based analysis, because participants with a low probability of being able to trade, and who thus were more certain that they would be keeping their initial endowment, should form the strongest connections to their endowment. However, Ericson and Fuster offer a reference-dependent explanation for their result. Participants with a lower likelihood of trading may experience parting with their object as a loss, exactly because they expected to keep the item. On the other hand, participants with a high likelihood of trading may never expect to keep their item and thus may not view it as a loss. In other words, the possessed item may form the reference point for those who expect that they will be forced to keep it. On the other hand, those who from the outset anticipate trading the item may not integrate it into their reference point.

Heffetz and List (2011) offer important evidence that, at least in a trading environment, the impact of expectations might disappear without endowment. That is, when people are not endowed with an item, their expectations may not impact the prevailing pattern of trade. In one treatment, participants had a 1% probability of receiving an item that was assigned to them but not receiving the opportunity to trade their assigned item for an alternative. Participants also had the complementary 99% probability of being granted a choice between the item assigned to them and an alternative. There was no endowment in this treatment; both items were placed in front of

participants, and participants were not exposed to any instructional language indicating possession or the like. This treatment produced a marginally significant "assignment effect"; participants tended to choose their assigned item. But the magnitude of the assignment effect was not altered when expectations of having to keep one's assignment were substantially strengthened. In a second treatment, participants had a 99% probability of receiving an item assigned to them but not the opportunity to trade it and a 1% probability of receiving both the item and the opportunity to trade it. But participants in this second treatment showed essentially the same pattern of choices as participants in the first treatment.

Pragmatics of Uncertain Possession

Many real-world settings explicitly expose people to a risk of losing their possessions in a manner reminiscent of tentative possession. Understanding that uncertain possession may exacerbate the endowment effect may thus be of applied utility. To illustrate, consider a well-known study of the endowment effect, which implicitly presumes guaranteed possession, and its potential extension to uncertain possession. In a study of the Boston condominium market, Genevose and Mayer (2001) observed discrepancies between sellers' and buyers' valuations of residences consistent with reluctance to trade (sellers' valuations were consistently higher). Imagine building on Genevose and Mayer's study by contrasting the condominium market in Boston with the condominium market in regions of Florida susceptible to hurricanes. To most Bostonians, the possibility of losing a home is not salient. Bostonians, that is, may essentially perceive of residences as endowments held with certainty. However, especially after a storm or with one looming, many Floridians may perceive substantial uncertainty about whether their

residences will survive the next major weather event. Floridians, that is, may perceive of residences as tentative endowments. Such uncertainty will depress prices in general, but how will it impact the reluctance to trade, say by selling one local condominium in order to buy another? Our results suggest the perhaps counter-intuitive implication that Floridians may be even more reluctant to switch local residences than Bostonians.

Likewise, many real-world settings involve endowments that offer upside and downside risk in a manner reminiscent of potential possession. For instance, holders of Microsoft stock in essence possess a ticket that may (at each point in) the future be redeemable for different monetary amounts. Will the endowment effects associated with holdings of Microsoft stock be more pronounced than the endowment effects associated with holdings of Microsoft debt (which is much less volatile and uncertain)? Again, our results suggest that the answer is yes. We hope future researchers are able to obtain field data that may test such predictions, which follow from reference-dependence but do not seem easily derivable from a connection-based view.

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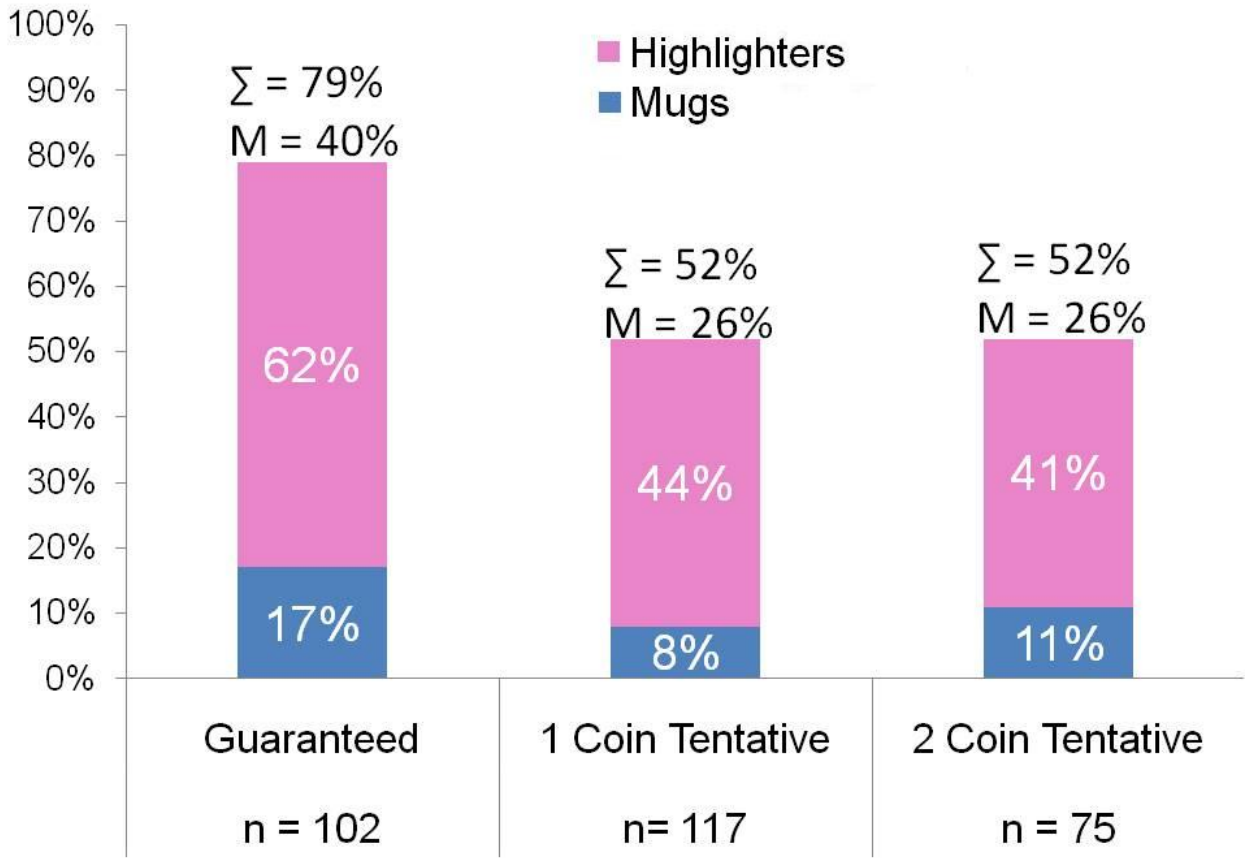

Figure 1. The proportion of participants electing to trade, by initial endowment, in each of the different possession treatments of Experiment 1. For example, in the guaranteed possession treatment, 17% of those endowed with a mug opted to trade. The null hypothesis of no endowment effect implies a sum of trading rates equal to 100%, or an average trading rate of 50%, within each treatment.

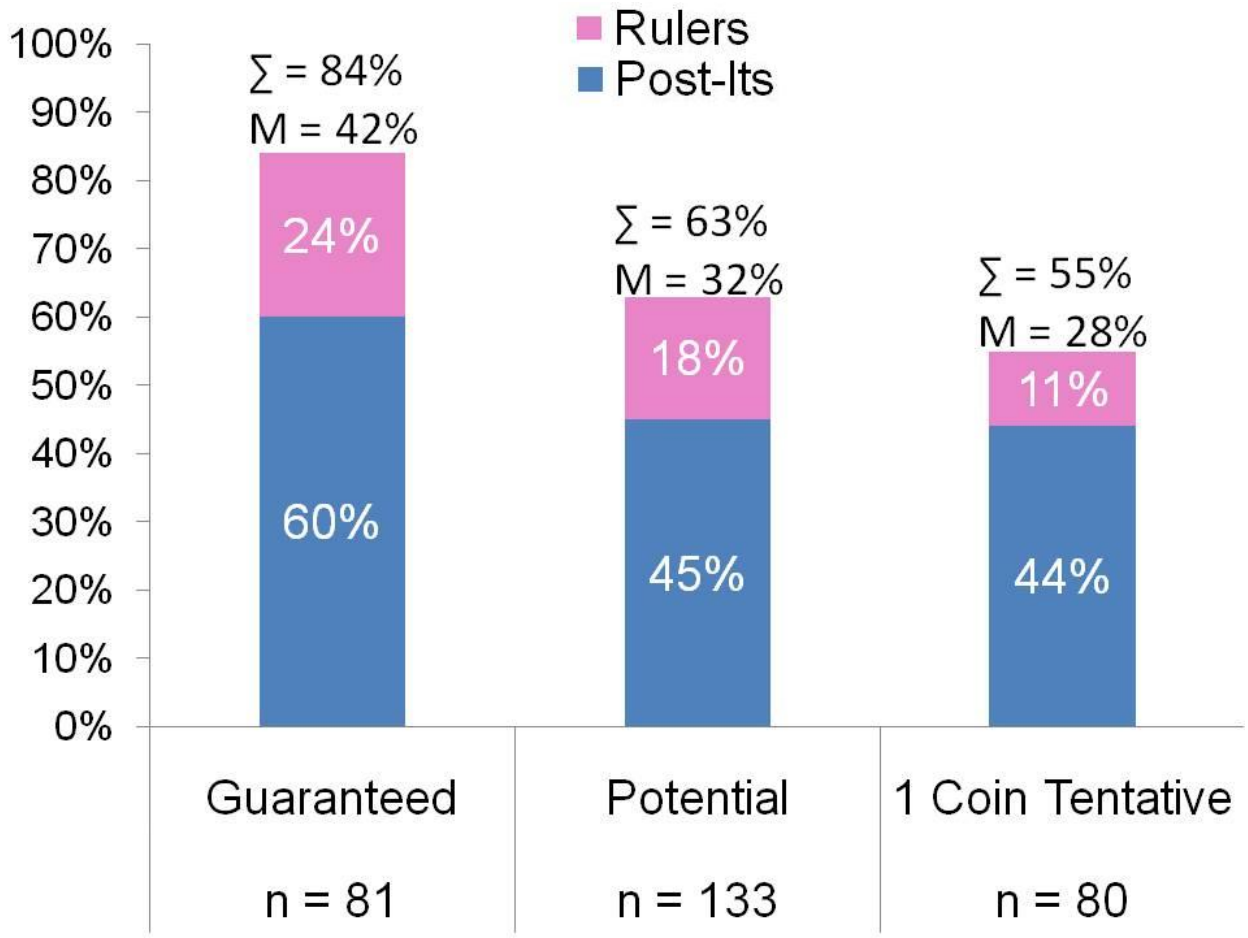

Figure 2. The proportion of participants electing to trade, by initial endowment, in each of the different possession treatments of Experiment 2. For example, in the guaranteed possession treatment, 60% of those endowed with Post-Its opted to trade. The null hypothesis of no endowment effect implies a sum of trading rates equal to 100%, or an average trading rate of 50%, within each treatment.