

Uncertain utilities, belief dynamics and the endowment effect

Peter Gärdenfors

Lund University Cognitive Science

Peter.Gardenfors@lucs.lu.se

1. Introduction

The endowment effect is the finding that people who own a good value it more than people who do not. The effect shows up as a difference between willingness to pay (WTP) and willingness to accept (WTA). The endowment effect has been widely studied both theoretically and experimentally (for reviews see e.g. Horowitz and McConnell (2002), Ericson and Fuster (2014) and Morewedge and Giblin (2015)).

To explain the effect, Thaler (1980) uses Kahneman and Tversky's (1979) loss aversion curve (which they applied to probabilistic settings) to decisions under certainty. In brief, the curve represents that 'losses loom larger than gains'. Losses and gains are evaluated in relation to a reference point, for example, the current possessions. Loss aversion is modeled by a kink of the utility curve so that it is steeper below the reference point than above it. Thaler's central argument for the endowment effect uses this feature of the loss aversion curve: "[G]oods that are included in the individual's endowment will be more highly valued than those not held in the endowment, *ceteris paribus*. This follows because removing a good from the endowment creates a loss while adding the same good (to an endowment) generates a gain" (Thaler 1980, p. 44). However, a considerable amount of empirical evidence speaks against loss aversion as an explanation for the endowment effect. Some of this evidence will be presented in the following section.

In this article I propose a new explanation of the endowment effect. The model is based on *uncertain utilities* that are introduced in analogy with uncertain (ambiguous) probabilities. The key element of my model is that decision makers also consider *potential new knowledge* about the goods they evaluate, in particular in situations when the seller may have more knowledge about the good than the buyer. I show that a reinterpreted version of the loss aversion curve can be derived from buyer and seller strategies that are based on uncertain utilities. I then argue that these strategies can explain the empirical findings for the endowment effect that have proved problematic for Thaler's model.

Other theories about the endowment effect have been proposed, such as ownership and psychological ownership (Morewedge et al. 2009, Morewedge and Giblin 2015). These theories will be presented later and compared to my model.

2. Empirical results that are problematic for the loss aversion explanation

There are several empirical results that are problematic for the loss aversion explanation of the endowment effect. In this section, I briefly present some of the main anomalies. The following section then introduces a model that can explain these findings.

1. People who own a good longer value it more (Strahilevitz and Loewenstein 1998, Reb and Connolly 2007, Nash and Rosenthal 2014). This is difficult to explain with loss aversion since the value of a good is assumed to be constant.

2. Physical contact with the good (even a short time) increases the endowment effect (Strahilevitz and Loewenstein 1998, Knetsch and Wong 2009). Again, this is difficult to explain with loss aversion if the value of a good is constant.
3. If the experiment is repeated with the same subjects, the WTA/WTP ratio decreases (Coursey et al. 1987, Plott and Zeiler 2005). The loss aversion model predicts that the WTA/WTP should be constant.
4. Revealing moderate reference prices reduces the endowment effect by lowering WTA (Weaver and Frederick 2012). According to loss aversion theory, revealing prices should not have an effect on the loss aversion curve.
5. The less the good is like a market good, the higher is the WTA/WTP ratio (Horowitz and McConnell 2002). Furthermore, exchange goods with a fixed value show no loss aversion (van Dijk and van Knippenberg 1996, Novemsky and Kahnemann 2005). Thus the loss aversion effect is smaller for certain types of losses, which goes against the assumption that the loss aversion curve is fixed for a particular individual.
6. Physical possession of the good is more important than ownership (Reb and Connolly 2007). This violates Thaler's explanation, since it is ownership that is supposed to generate the loss aversion.
7. Real experiments do not yield WTA/WTP ratios that are significantly different from those of hypothetical experiments (Horowitz and McConnell 2002). This is problematic if 'endowment' is taken literally (see the ownership theories presented in section 6).
8. In an egalitarian society, the endowment effect disappears (Apicella et al. 2014). The loss aversion theory cannot account for this effect.

It should be clear from these results that the so-called endowment effect has little to do with endowment, so it is a misnomer. Plott and Zeiler (2007) suggest to instead call it the 'exchange effect'. However, since the term 'endowment effect' is established in the literature, I will continue to use it.

In the following section, I will present a model based on uncertain utilities that can explain all these anomalies for Thaler's loss aversion model. There exist several other models that attempt to explain the deviations from Thaler's original model. The predictions from some alternative models concerning the empirical results presented above are compared to those from my model in section 7.

3. Uncertain utilities

3.1 Belief dynamics in decision making

Major decision theories assign a *unique* utility function to the decision maker. This builds on the assumption that the decision maker has complete knowledge about the values of goods or outcomes. In most cases, however, the real utility of a good is only partially known. More information about a good may change the evaluation of it. To model this aspect of incomplete knowledge, I introduce *uncertain* utilities in analogy with models of uncertain (ambiguous) probabilities (see also Butler and Loomes 1998).

For comparison, uncertainty (ambiguity), that is, an unknown or partially known probability distribution over states, has been represented by sets of probability

distributions. One model for decision under uncertainty is to apply *maximin* expected utility (Wald 1950, Gärdenfors and Sahlin 1982) where the utility of an alternative is evaluated with respect to all probability distributions in the set, and then the alternative with the maximal minimal utility is selected. This decision rule was axiomatized by Gilboa and Schmeidler (1989).¹

The underlying idea for the models of decision under uncertainty is that people do not only consider the knowledge they have at the moment, but also takes *potential new knowledge* into account. In this article, I propose a parallel account for decisions based on uncertain utilities.

This comparison leads me to suggest that one can identify (at least) three levels of cognitive processes underlying decisions: Level 0 involves no cognition at all – the decision is made without deliberation based on instinct or a ‘gut feeling’ (see Pfister and Böhm (2008) for an analysis of the role of emotions in decision making). For example, this kind of decision making typically applies when an animal decides whether something is edible. When making decisions on level 1, the subject evaluates the imagined consequences of different actions and chooses the action that leads to the best overall consequences. The traditional rule of maximizing expected utility is of this kind.

Level 2 decisions involve considering potential new knowledge before evaluating consequences. Decision makers have limited knowledge about the state of the world, but also about the real value of goods to be obtained or other outcomes. They consider various types of new knowledge that they may acquire and then evaluate the decision alternatives, *conditional* on such new knowledge. In brief, level 2 decision making takes belief dynamics into account (Gärdenfors 1988).

An important case of limited knowledge in relation to the endowment effect is when other people may have more information about the decision alternatives than the decision maker has. In this case, the model presented in this article says that decisions are made on the basis of a fear of being fooled, that is, a fear that others may take advantage of their more extended knowledge (Morris 1997, Gärdenfors 2014).² This is a form of level 2 reasoning where the subjects consider new knowledge that may lead them to *regret* a decision.³ In this context, it should be noted that the general motivation for why an agent should strive for a Nash equilibrium can be interpreted as avoiding being fooled. In an equilibrium no player can exploit the choices of the others.

In agreement with my position, Weaver and Frederick (2012, p. 696) write that “the endowment effect is often best construed as an aversion to bad deals rather than an aversion to losing possessions”. In particular, when evaluating an offer to buy a good *x*, a common situation is when the buyer believes that the seller has more knowledge about the good that he exploits in the offer. After all, the seller has had the opportunity to examine the properties of the good.

¹ Schmeidler (1989) presented an axiomatization of a more general class of decision rules involving uncertainty.

² Casey (1995), footnote 1, mentions the informational asymmetry between buyers and sellers, but he does not consider its role for the endowment effect.

³ Loomes and Sugden’s (1982) regret theory takes this into account, but they do not consider uncertain utilities.

3.2 A model of uncertain utilities

I next to turn to a model of some aspects of level 2 decision making. In this paper, I will, for simplicity, only consider limited information about utilities and not uncertain probabilities. The reason is that most studies of the endowment effect do not involve any probabilistic outcomes.

In order to model uncertainty about utility a *knowledge situation* K is assumed, represented by a set of maximal knowledge states k_i (Gärdenfors 1988). Traditionally, such sets are modeled as a logically closed collection of sentences that are maximal in the sense that adding a sentence not in the set would make it inconsistent. The maximal states k_i represent maximal knowledge (that is, knowing all the relevant properties) about the decision alternatives, for example about a good x . The *states* of the world that are part of traditional decision theory are part of the information in the maximal knowledge sets. Hence K , represents, among other things, the knowledge about the states. The difference with traditional knowledge states is that the k_i s also contain information about the possible utilities of good.

If k_i is in K , let $u_i(x)$ denote the (unique) utility for the buyer of x given k_i . Learning more about the alternatives in a decision situation (an expansion in the terminology of Gärdenfors (1988)) thus involves removing those k_i s that are inconsistent with the new information. In other words, the more knowledge that the decision maker has, the fewer maximal set are in K .

The set K of maximal knowledge sets generates an interval of 'potential' utilities $[\min_i u_i(x), \max_i u_i(x)]$ for the good x . The more that is known about the properties of x , the narrower is the interval.

Avoiding being fooled leads to a cautious decision strategy. Consider a situation where a seller offers a buyer x (for example, a mug) at a price p . If the buyer considers it possible that the seller may be in any of the k_i states, then their best strategies are as follows.

Buyer strategy: Buy x at price p if $u(p) \leq \min_i u_i(x)$, otherwise don't buy.⁴ The WTP with respect to x can therefore be defined as $\min_i u_i(x)$.⁵

Assuming that the seller has complete information about the good x and thus is in a maximal knowledge state k_j , the seller strategy is: Offer to sell at $u'(p) \geq u'_j(x)$, where u' is the sellers utility function. The WTA with respect to x can therefore be defined as $u'_j(x)$. In cases where the seller also has uncertain utilities, this strategy can be generalized to: sell at $u'(p) \geq \max_j u'_j(x)$.

These two strategies will here be called the *uncertain utility model* – or the UU model for short.⁶

⁴ The utility of money is supposed to be independent of knowledge, that is $u_i(p) = u(p)$ for all k_i in K . This is a way of formalizing the fungibility of money.

⁵ The buyer strategy can also be modeled with the aid of uncertain probabilities, but this makes the model more complicated than required for the purposes of this paper.

⁶ The strategies are similar to the heuristics proposed by Bayrak (2016, p. 59). His model will be discussed later.

The loss aversion account presumes that selling and buying are psychologically fundamentally different. In contrast, the strategies proposed here present no inherent psychological difference in selling versus buying (see also Weaver and Frederick 2012). Similar to Akerlof's (1970) lemon markets, it is the asymmetry of information that leads to limitations of market exchanges.

It follows from the strategies that when knowledge about a good is more or less complete and shared, there will be very little difference between WTP and WTA. In support of this prediction, van Dijk and van Knippenberg (1996) show that for exchange goods with a fixed value there is no loss aversion. An extreme case is money that is almost completely fungible.

The UU model is supported by some experimental findings other than those presented in section 2. Nayakankuppam and Mishra (2005) and Saqib et al. (2010) report that buyers of a good recall fewer positive features than sellers. This indicates that the buyers focus on those properties of the good that generate the lowest utilities in their perceived interval, while the sellers focus on those that generate the highest utilities (see also Bordalo et al. (2012) and Ashby et al. (2012)).

If the buyer thinks that the seller does not know more about the good (for example, oil prospecting rights), then the fear of being fooled may diminish and the buyer can, for example, decide more in line with expected utility calculated over the possible knowledge states.

In the model, I make the idealizing assumption that the decision makers really consider all possible expansions of knowledge. In other words, no additional information about x can diminish $\min_i u_i(x)$ or decrease $\max_i u_i(x)$. This idealization has the consequence that if more knowledge about a good x is obtained by the decision maker, then the new set of maximal knowledge states K^+ is a subset of K . Consequently, $\min_i u_i(x) \leq \min_i u_i^+(x)$ and $\max_i u_i^+(x) \leq \max_i u_i(x)$. Thus $[\min_i u_i^+(x), \max_i u_i^+(x)]$ is a subinterval of $[\min_i u_i(x), \max_i u_i(x)]$.

In practice, however, the idealization may not hold, so that negative information about a good may lower the WTP and positive information raise the WTA. The decision maker may think that some negative information, even though possible, is so unlikely that it is not taken into consideration when evaluating the WTP. A parallel argument holds for extreme positive information in relation to the WTA.⁷ Taking these possibilities into consideration, the model still leads me to the following two predictions.

Prediction 1: New information about a good that is positive for an individual will raise her WTP more if she is a buyer than her WTA if she is a seller.

When positive information is obtained for a buyer this will take away some of the possible knowledge states that assigns a low utility to the good so the WTP will raise. In contrast the positive information is typically included in the judgments of the seller so it will not have a strong effect on the WTA. A symmetric argument results in a second prediction.

⁷ A similar strategy is used by Gärdenfors and Sahlin (1983) in relation to decisions with uncertain probabilities.

Prediction 2: New information about a good that is negative for an individual will lower her WTA more if she is a seller than her WTP if she is a buyer.

Neither Thaler's account in terms of loss aversion, nor any of the theories that will be discussed below make these predictions. They are readily testable.

A particular type of information about a good is its price (or range of prices). As mentioned above, Weaver and Frederick (2012) show in a series of experiments that revealing low reference prices reduces the endowment effect. The reference price provides information to sellers about how others value the good and consequently they may realize that it is not realistic to use the best possible utility assignments to it in a bargaining situation. The result is that reducing the reference price of a good significantly affects the bid of the sellers but not of the buyers. This is indirect support for prediction 2 since a low reference price can be seen as negative information about the good by the sellers.

To be sure, there exist other accounts of uncertain utilities. Butler and Loomes (1998, 2007, 2011) introduce a model of imprecise preferences and show in a series of experiments that subjects have difficulties identifying the 'certainty equivalent' that they should be able to, if they had a unique utility function as postulated in standard expected utility theory. They use imprecise preferences to explain the preference reversals that have been observed empirically (see also Bayrak and Hey 2017). However, they neither discuss the endowment effect, nor belief dynamic aspects of their model. More recently, Bayrak (2016) proposed a model that builds on imprecise preferences. His investigations of 'valuation gaps' are similar to the utility intervals of the UU model. He uses these gaps to derive differences in WTA and WTP using buyer and seller strategies that are basically the same as those proposed above. He does, however, not consider the belief dynamics of the valuations gaps and consequently he cannot generate predictions 1 and 2. Furthermore, he cannot relate the valuation gaps to the loss aversion curve, as I will do in the following section.

4. Loss aversion reconsidered

Kahneman and Tversky (1979) introduced the loss aversion curve as an explanation of people's tendency to avoid losses to gaining monetarily equivalent sums. This argument presumes that the decision maker has a *reference point* in relation to which gains and losses are determined (Kahneman and Tversky 1979, Thaler 1980). They present the curve as an *empirical fact* and estimate that losses loom at least twice as large as gains. As is standard, one can assume that utilities are marginally decreasing for gains. Kahneman and Tversky argue that it is also marginally decreasing for losses and, for simplicity, I make the same assumption here.

In this section I show that a reinterpreted version of the loss aversion curve can be *derived* from the buyer and seller strategies presented in the previous section. My derivation shows that the strength of loss aversion is not fixed for a given decision maker, but dependent on his or her knowledge situation.

Consider a good x . If it assumed that before the buyer has acquired x , her utility estimates are uncertain and hence the associated utility interval $[\min_i u_i(x), \max_i u_i(x)]$ (right blue lines in figure 1) may be large. The zero point of the vertical axis represents

the reference value. According to the buyer strategy presented above, the WTP is the minimum value of this interval.

When the decision maker obtains x , the reference point typically changes to include x .⁸ Furthermore, the decision maker's knowledge about x increases in most cases and according to the model, the utility interval therefore diminishes (hatched lines). When considering selling x (marked as $-x$ in figure 1), the corresponding selling strategy generates the WTA (lowest point of the left blue line) that is larger than the earlier WTP. In this way, the typical kink in loss aversion curve can be derived from the minimax strategies for the buyer and the seller. The size of the kink depends on the type of knowledge the decision maker gains about x — the more information the individual has, the more the interval shrinks, and, consequently, the larger the change in the direction of the utility curve.

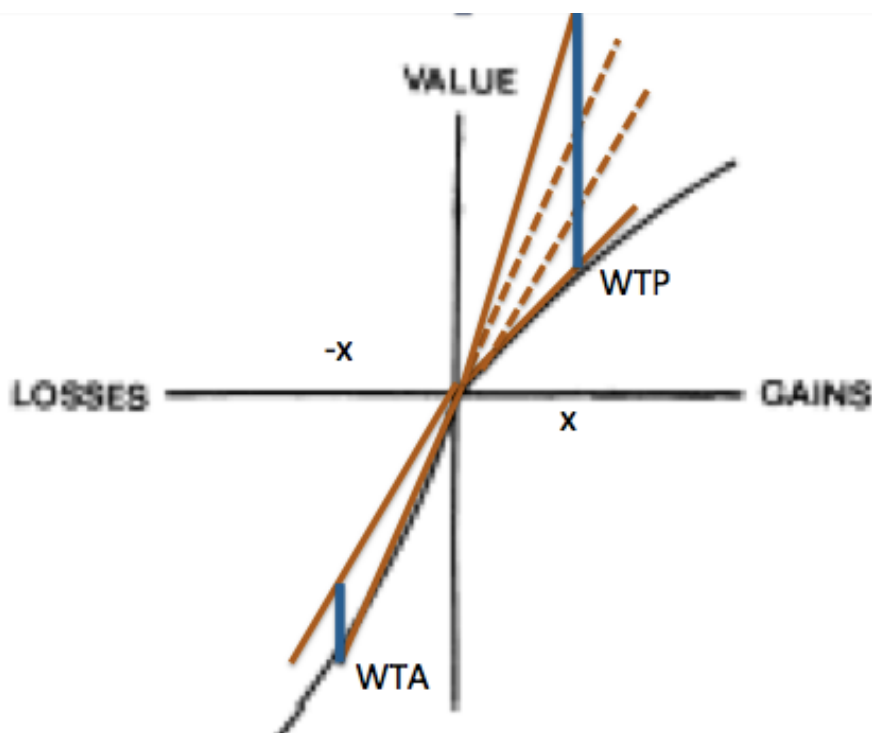


Figure 1: Deriving the loss aversion curve from uncertain utilities.

This argument behind the UU model shows that Thaler's use of Kahneman and Tversky's loss aversion curve contains two misrepresentations in relation to the endowment effect:

1. It *conflates* two states of knowledge: The 'gain' side of the diagram concerns the evaluation of the good x given the knowledge K that the buyer has before acquiring x , while the 'loss' side concerns the evaluation of the good x given the expanded knowledge K^+ after acquiring x (assuming that the reference point has shifted after the acquisition).
2. It assumes that there is a *unique* curve for each individual. In contrast, the UU model predicts that the factor depends on the knowledge about the good. The more that is known about the good before acquiring it, the smaller will be the loss aversion effect.

⁸ An exception is when the buyer already from the beginning plans to sell the goods acquired (see List 2003, 2004).

As a matter of fact, empirical results show that WTA/WTP ratios vary between products from 2:1 to 10:1 (Morewedge and Giblin 2015, p. 341).

The upshot of this reconstruction of the loss aversion curve(s) is that loss aversion is not so much a framing effect (Morewedge and Giblin 2015, p. 340) as a consequence of trying to avoid bad deals. This mechanism is a simpler explanation than the biased information processing suggested by Morewedge and Giblin (2015, p. 341).

5. Evaluating uncertain utilities applied to the empirical findings

I next argue that the WTP and WTA that are derived from the buyer and seller strategies presented in section 3 can explain all of the anomalies for Thaler's loss aversion theory that were presented in section 2.

1. People who own a good longer value it more

Acquiring a good x and using it increases the knowledge about x . Hence the utility interval decreases and according to the buyer strategy the WTP thereby increases. An experiment by Morewedge et al. (2009) provides evidence for this. They showed that buyer who already owned a mug were, on average willing to buy one more mug at the same price that the sellers asked. The mug owners who were considering buying one more mug had, on average, the same information about the mug as the seller and thus there is no difference between WTP and WTA (see also van Dijk and van Knippenberg 1996). If this situation is interpreted as that the mug owners have almost complete knowledge about the mug, the UU model predicts that their utility intervals would be narrow and thus WTP would be close to WTA in accordance with the data. In the following section, I will return to how Morewedge et al. (2009) interpreted the experiment.

2. Physical contact with the good (even a short time) increases the endowment effect

Strahilevitz and Loewenstein (1998) performed a series of experiments testing the effects for the endowment of how long a subject have been in physical possession of a good. Their results suggest that for objects in a subject's physical possession, the valuation of the objects increase with duration of ownership. For objects not in the subject's possession, earlier ownership increases valuation in relation to the length of ownership before loss. As above, physically possession of a good x increases knowledge about x and the longer it is possessed the more knowledge can be acquired. Hence the utility interval decreases and according to the UU model the WTP thereby increases. This argument can also explain the results from Bushong et al. (2010), who found that valuations for a good increase when physical barriers are removed. For example, WTP was higher when a product was taken out of its package and placed in close proximity than when it was behind a glass barrier or just shown in a photograph.

Knetsch and Wong (2009) found a similar effect. In Treatment 1 of their experiments, a mug and a pen were passed around and the subjects were allowed to examine them. Then each subject was randomly assigned either a mug or a pen. In Treatment 3, each participant was given either a mug or pen and was allowed to inspect it, but not the other object.⁹ In both treatments, subjects were allowed to exchange the object they

⁹ Treatment 2 was intermediary.

have for the other. In treatment 1, there was no endowment effect, but in Treatment 3, there was a strong effect. Again, the UU model predicts that if you are allowed to get more knowledge about one object, but not another one, the value of the first object will be judged to be higher.

3. If the experiment is repeated with the same subjects the WTA/WTP ratio decreases.

A study by Coursey et al. (1987) showed that repeating an experiment with the same group of subjects lead to a smaller WTA/WTP ratio. They note that, through the series of repetitions, WTA moves down and WTP moves up (Coursey et al 1987, p. 687). Also Plott and Zeiler (2005) find that if subjects are allowed to practice buying and selling in a number of rounds (where they get feedback), the WTA/WTP ratio becomes close to 1. Using the UU model these results can be explained as that the maximum and minimum values of the utility interval for individuals come successively closer to each as more knowledge about the good is acquired.

Another aspect of repetition is engaging in trading. People who expect to trade the good show no endowment effect (List 2003, 2004, Novemsky and Kahneman 2005, Engelmann and Hollard 2010). List (2003) ran an experiment with participants at a sports card show. Inexperienced traders exhibited strong endowment effects, while the effects more or less vanished for experienced traders. In another experiment with mugs and chocolate bars (List 2004), he found similar effects. Novemsky and Kahneman (2005) note that the money that is given up when good are bought is not subject to loss aversion since one “expects to trade” money.¹⁰ Traders have more knowledge about a good and therefore regard it as more or less fungible.

4. Revealing moderate references prices reduces the endowment effect.

Weaver and Frederick (2012) present a series of experiments where they provide the subjects with various (sometimes fictional) reference prices for the goods involved in the transactions. Let r stand for the reference price for a good and v for the buyers' average WTP valuation of the good. When $r > v$, then the market displays an endowment effect since sellers can then maintain their WTA at r or higher. However, if $r \approx v$, then the effect disappears since sellers take the information about r as an indication that their original WTA is too high and thus adjust in the direction of r . Perhaps more surprisingly, Weaver and Frederick show that if $r < v$, then the endowment effect appears again since now the buyers will take the reference price as an indication that they need not offer as much as their initial WTP. Their explanation for these results is “that the endowment effect is often better understood as an aversion to transacting on unfavorable terms than as an aversion to parting with objects one possesses”.¹¹ Such an aversion to bad deals is a weaker form of the fear of being fooled that is the motivation for the UU model. The belief expansions induced by the additional information about r can explain Weaver and Frederick's results. Weaver and Frederick note that their explanation is not readily applicable to non-market goods that have no reference price. The UU model, however, covers also such goods since it considers also other types of information about a good than its reference price.

¹⁰ Uncle \$crooge is an exception.

¹¹ Also Brown (2005) finds evidence supporting that seeking a good deal is more important to subjects than loss aversion.

5. The less the good is like a market good, the higher is the WTA/WTP ratio.

Horowitz and McConnell (2002) conclude in their review of WTA/WTP studies that the ratio is “highest for public and non-market goods, next highest for ordinary private goods, and lowest for experiments involving different forms of money”. These results are readily explained by the UU model since people have almost complete knowledge about the value of forms of money, some knowledge about the value of ordinary goods, and much less about the value of non-market goods. The differences in background knowledge explains the difference in the WTA/WTP ratios.

A related effect appear in experiments by Chapman (1998) and van Dijk and van Knippenberg (1998). Their results suggest that the endowment effect is reduced when the two items that can be exchanged are similar. Novemsky and Kahneman (2005, p. 124) argue that “goods with different attributes that provide the same benefits can be exchanged without loss aversion”. They give the following example: “[T]here is no loss aversion for an old car that is traded as part of the purchase of a new car if the new car is perceived as having all the benefits of the old one” (ibid.). These results can be explained by the UU model since the knowledge about the combined utility of the attributes will be transferred from the owned item to the new one and thus the uncertainty of the utility of the new item is considerably reduced.

6. Physical possession of the good is more important than ownership

Reb and Connolly (2007) asked subjects to evaluate a chocolate bar. They were divided into four groups where they either owned or did not own the chocolate bar and where they either were in physical possession or not in possession of it. Reb and Connolly found a significant effect of possession, but not of ownership. Possession leads to a higher evaluation. Unlike Thaler’s loss aversion model (and unlike the model by Morewedge et al. (2009), to be discussed below), the UU model can explain this result since it is the presence of the chocolate bar that generates knowledge about its value and there by increases your WTP, not the fact that you own it.

7. Real experiments give the same WTA/WTP ratios as hypothetical experiments.

Horowitz and McConnell (2002) show in their review that experiments with real goods do not yield WTA/WTP ratios that are significantly different from experiments involving hypothetical goods. This is problematic for Thaler’s explanation of the endowment effect (as well as for ownership models like that of Morewedge et al. (2009)). However, it is not a problem for the UU model since it is the knowledge about the good, not the ownership that determines the WTP and WTA values.

8. In an egalitarian society, the endowment effect disappears

A seemingly odd variation of the endowment effect is reported by Apicella et al. (2014). They studied the Hadza hunter-gatherers in Tanzania and found that Hadza living in isolated areas do not display the endowment effect, while Hadza living in areas that are exposed to modern markets do show the effect. This seems to go against List’s (2003, 2004) finding that exposure to market exchanges diminishes the endowment effect (see Apicella et al 2014, p. 1795). However, I propose that the explanation lies in the difference in terms of the fear of being fooled. When you meet strangers in market situations, you must always be aware of deceit of different kinds, including that your opponent in a transaction may know more about the good than you do and exploit this

in the bargaining. However, people in a Hadza group who live in isolated areas all know each other and fraud on one part in an exchange transaction will be reported in the entire group and is therefore unlikely. Hence there is little risk that a seller does not transmit relevant knowledge about a good to be exchanged and hence the WTA/WTP ratio will, in general, be close to one.

In summary, the UU model can explain all the empirical results presented in section 2 that are anomalies for Thaler's original explanation of the endowment effect in terms of loss aversion. However, there are also other theories that have been proposed as explanations of these findings. I next turn to a discussion of these theories.

6. Alternative theories

Already Hume (Treatise, Part II, Section III) discussed a phenomenon that comes close to the endowment effect: "Such is the effect of custom, that it not only reconciles us to any thing we have long enjoy'd, but even gives us an affection for it, and makes us prefer it to other objects, which may be more valuable, but are less known to us. What has long lain under our eye, and has often been employ'd to our advantage, that we are always the most unwilling to part with; but can easily live without possessions, which we never have enjoy'd, and are not accustom'd to" (1689/1978, p. 503).

Hume hints at the effects of *ownership* on our attitudes to goods. Morewedge et al. (2009) argue that ownership of the good and not loss aversion explains the endowment effect. They refer to earlier research in psychology, showing that owning an object creates an association between the object and the self that increases the perceived value of the object (see Gawronski et al. 2007 and Chatterjee et al. 2013). Indeed, the 'choice blindness' effect (Johansson et al. 2005, Hall et al. 2010) shows that when subject can choose between x and y and choose x, but by a clever experimental design are led to believe that they chose y, then it is y, not x, that increases in value.

The ownership theory can explain why long possession of a good increases WTA (case 1 in section 2) since the ownership attachment increases over time as Hume pointed out. To some extent it may also explain why people who expect to trade show no endowment effect (case 4 in section 2) since they presumably are less attached to the good as a result of planning to sell it. This can also be described as that the traders do not change their reference point when a good is bought. However, the ownership theory still has problems explaining the other cases that were listed in section 2.

In their review of the endowment effect, Morewedge and Giblin (2015) present an alternative theory based on *psychological ownership*. The theory contains two components: (1) The good is incorporated into the self-concept of the owner. It may take the form of an emotional attachment to the good. Most self-evaluations are positive and therefore this association between the good and the self is usually positive. (2) Ownership increases value through a 'self-referential memory effect' that involves a better encoding of stimuli associated with the self-concept. Morewedge and Giblin (2015, p. 343) suggest that the self-referential memory effect acts as an endogenous framing effect. This leads to an 'attribute sampling bias'. They write: "Attributes of the endowed goods should thus be most accessible to owners, particularly its most positive attributes." They then suggest that "framing effects similarly bias attention to attributes supporting the status quo – keeping the endowed good" (Morewedge and Giblin 2015, p. 345).

Their attribute sampling bias could be seen a weaker version of the knowledge dynamics of the UU model, since they write that owners have more access to the attributes. This may make it difficult to distinguish the empirical predictions of the UU model from those of the psychological ownership model. There is, however, no account of the knowledge dynamics in the psychological ownership model. In the case of only having psychological ownership, but not possession of the good, the ‘owner’ may lack knowledge about several of the attributes of the good. This means that the theory of psychological ownership cannot account for the fear of being fooled that is central to the UU model. Consequently, psychological ownership cannot explain the fact that no endowment effect is found in egalitarian societies (case 7 in section 2).

Another difference is that is difficult to explain both by the ownership and the psychological ownership theories is that revealing low references prices reduces the endowment effect (case 4). But also for some other cases, psychological ownership does not yield very clear predictions. In particular, it is not obvious that repeated experiments should change the salience of the properties that are evaluated (case 3). And the facts that the less the good is like a market good, the higher is the WTA/WTP ratio (case 5), and that physical possession has bigger effect than ownership (case 6) are better explained by the increased knowledge of the owners and only indirectly by a theory of psychological ownership.

The table below summarizes the comparisons between the predictions of the UU model with the ownership and the psychological ownership theories.

Experimental finding	Ownership	Psychological ownership	Uncertain utilities
1. Long possession increases WTP	+	+	+
2. Physical contact with the good increases the effect	-	+	+
3. Repeated experiments decreases WTA/WTP ratio	-	?	+
4. Revealing low reference prices reduces the endowment effect	-	-	+
5. The less the good is like a market good, the higher is the WTA/WTP ratio	-	+?	+
6. Physical possession has bigger effect than ownership	-	+?	+
7. Real experiments give the same results as hypothetical	-	+	+
8. No endowment effect in an egalitarian society	-	-	+

Table 1: Comparing the predictions of the UU model with the theories of ownership and pshychological ownership.

As can be seen from the table, the UU model explains the phenomena better than any of the other theories. Even though the psychological ownership model fares comparatively well, the UU model is simpler than the psychological ownership theory since the UU model depends less on extra psychological concepts such as 'self-referential memory effect', 'attitude bias' or the 'warm glow' of a possession (Bordalo et al. 2012). Due to the imprecision of these concepts, they are difficult to use to make empirical predictions.

7. Conclusion

Apart from using uncertain utilities as part of the model, the main novelty of the UU model is that it is a level 2 decision theory, that is, it assumes that decision maker take potential new knowledge into account when deciding. This brings in the fear of being fooled as a central component in the strategy choices. I have argued that the UU model explains the phenomena concerning the endowment effect that are anomalies for Thaler's theory of loss aversion and that the model explains the data better than the major alternative theories.

The UU model can be used to explain several other market phenomena, for example, that people prefer well-known brands (Muthukrishnan et al. 2009). The reason is that for a known brand the uncertainty of the utility is smaller than for a brand about which the buyer only has little knowledge and where the utility interval thus is broader. The model also explains the marketing practice of offering a free or low-cost trial of a good since this will provide the buyers with opportunities to gather more knowledge and thereby their WTP will often increase. A third example is that buyers' fear of being fooled can be alleviated by the possibility to return goods or price guarantees.

One question that should be considered is whether there really is a conflict between the UU model and the ownership or the psychological ownership theory. It may be that they complement each other so that the endowment effect is a combination of (psychological) ownership and the UU model. Indeed, Huck et al. (2005) show that a (limited) ownership effect is evolutionarily beneficial since it improves the bargaining positions of the individuals. Huck et al. (2005, p. 17): write: "In our setting individuals behave sincerely according to their preferences. Neither do they lie nor do they commit themselves to non-credible threats. They simply develop an endowment effect because individuals with an endowment effect end up with more resources and therefore higher fitness. Note, however, that overall the endowment effect causes an inefficiency since there is a suboptimal amount of trade. Feasible allocations which would be mutually beneficial in terms of fitness are not implemented due to the bias in preferences." The last remark indicates that only a comparatively small endowment effect is supported by their arguments. It is therefore interesting to look for other evolutionary factors.

According to the UU model, the basic cause of the endowment effect for a good is lack of knowledge about the good. Having a good typically leads to more knowledge about the good. Such a gain of knowledge can be seen as an investment and it should therefore not be given up for goods about which one has less knowledge. An evolutionary mechanism that complements the investment by an emotional component will strengthen the

ownership effect. In this way, the influence of ownership on the endowment effect can be partially explained.¹²

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¹² The situation reminds of the territorial defence exhibited by many animal species. The holder of the territory has more knowledge about the value of the territory so his 'WTP' is higher than that of the intruder that has less knowledge and thereby is more uncertain of the value.

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