Review

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Explanations of the endowment effect: an integrative review

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The endowment effect is the tendency for people who own a good to value it more than people who do not. Its economic impact is consequential. It creates market inefficiencies and irregularities in valuation such as differences between buyers and sellers, reluctance to trade, and mere ownership effects. Traditionally, the endowment effect has been attributed to loss aversion causing sellers of a good to value it more than buyers. New theories and findings – some inconsistent with loss aversion – suggest evolutionary, strategic, and more basic cognitive origins. In an integrative review, we propose that all three major instantiations of the endowment effect are attributable to exogenously and endogenously induced cognitive frames that bias which information is accessible during valuation.

The endowment effect

People who own a good value it more than people who do not. This endowment effect [1,2] is usually demonstrated in two experimental paradigms. In the exchange paradigm (Box 1), participants who are randomly endowed with one of two goods are more reluctant to exchange it for the other good than would be expected by chance [3]. In the valuation paradigm (Box 2), the maximum amount of money that buyers are willing to pay to acquire the good (WTP) is lower than the minimum amount of money that sellers of a good are willing to accept to relinquish it (WTA), creating a WTP–WTA gap (see Glossary) [2,4]. The endowment effect is not confined to private goods or the laboratory. People demand more to give up entitlements such as time, intellectual property, public land, and environmental, health, and safety regulations than they are willing to pay to acquire them [5–7].

The endowment effect is important for psychology, marketing, economics, policy, law, and organizational behavior. It provides insight into preferences and value construction [8–11]. It provides evidence for economic theories of reference-dependent preferences, such as prospect theory [12,13], which have applications for consumption choice, contract theory, finance, industrial organization, insurance, and labor supply [14–17]. It violates the Coase theorem, a foundational assumption of law and policy governing the allocation and distribution of entitlements [2,14,18,19].

Loss aversion has traditionally been used to explain the endowment effect [1,2], but does not specify its underlying cognitive and neural processes. Evidence elucidating those processes has accumulated. A considerable amount is inconsistent with loss aversion. In this article, we describe the loss aversion explanation and five major process accounts: evolutionary advantage, strategic misrepresentation, reference prices, biased information processing, and psychological ownership. We organize these theories and new evidence into an integrative framework, attribute sampling bias. Attribute sampling bias is a cognitive process account that can connect these findings,

Glossary

Attachment style: an interpersonal relationship and interaction style; based on childhood relationship with one's primary caregiver.
Coase theorem: entitlements will be efficiently distributed through bargaining regardless of their initial allocation if transaction costs are minimal [18]. Initial allocations could influence the eventual wealth of parties, but the theorem assumes that initial ownership status of an entitlement should not affect its value.
Confirmatory hypothesis testing: searching for and evaluating evidence in a manner more likely to confirm than disconfirm the hypothesis one is testing.
Entitlement: a privilege or legal right to an economic benefit (e.g., property rights, social security, tax incentives, etc.).
Incentive-compatible design: an experimental design in which participants are incentivized to reveal their true preferences and valuations.
Indifference curves: rate at which people are indifferent between quantities of two goods. How much of Good A is equivalent in utility to an amount of Good B.
Loss aversion: a loss (e.g., −$100) has a greater psychological impact than a gain of the same size (e.g., +$100).
Opportunity costs: the utility that alternative options would provide.
Possession loss aversion: greater sensitivity to the loss of a possession than to its acquisition [90].
Private self-consciousness: extent to which one is self-aware and attends to one's internal thoughts and feelings [115]. People high in private self-consciousness chronically encode information as self-relevant [114].
Prospect theory: a descriptive theory of decision-making under uncertainty [12]. It assumes reference-dependence, loss aversion, diminishing marginal utility, and non-linear decision weights.
Reference-dependence: evaluating a stimulus by its value relative to a reference point rather than by its absolute value.
Self-affirmation: deliberate elaboration on one's past behavior in accordance with a personally important value, which may buffer or mitigate psychological threats to the self.
Self-referential memory effect: actively relating information to oneself (e.g., 'Does the word X describe you?'), makes it better remembered than processing it in other ways, such as with regard to other people, its semantic meaning (e.g., '... mean Y?'), or phonemic properties (e.g., '...rhyme with Y?').
Transaction costs: costs of exchanging resources, specific to the exchange itself.
Wealth effects: behavior resulting from actual or perceived changes in wealth.
Willingness to pay/willingness to accept (WTP–WTA) gap: the difference in the amount of money that people are WTP to acquire a good and are WTA to relinquish it.

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Box 1. The exchange paradigm

In the exchange paradigm, research participants are randomly endowed with one of two goods and are later given an opportunity to trade the endowed good for the good they did not receive. In an early example [3], one group of participants was endowed with a coffee mug. After completing a short questionnaire, they were given the opportunity to trade it for a 400 g Swiss chocolate bar. A second group of participants was initially endowed with the chocolate bar. After completing a short questionnaire, they were given the opportunity to trade it for the coffee mug. A third group of participants (controls) were not endowed with either good. They were simply offered the choice of the coffee mug or the chocolate bar.

Standard economic theory suggests that the good with which one is endowed should not matter [18]. People who normally prefer Good A to Good B should keep Good A if they are endowed with Good A. If they are endowed with Good B, they should trade it for Good A. Thus, the proportion of participants preferring the mug and the chocolate bar should be similar in all three conditions. Controls did not exhibit a meaningful preference for either good: 56% chose to receive the mug and 44% chose to receive the chocolate bar. By contrast, participants endowed with a good exhibited a strong preference for the endowed good. Of participants endowed with the coffee mug, 89% chose to keep the mug and 11% chose to trade it for the chocolate bar. Of participants endowed with the chocolate bar, 10% chose to trade it for the mug and 90% chose to keep the chocolate bar.

These asymmetric valuations violate standard economic theory because they suggest that indifference curves are not completely reversible. The results suggest that the rate of commodity substitution, the point at which one is indifferent between an amount of Good A and an amount of Good B, is influenced by whether one trades A for B or trades B for A [14,116]. People have a greater preference for their initial endowment, which creates irregularities in markets for goods and entitlements [2]. Taxpayers may demand more compensation from firms seeking to extract natural resources from public lands, for example, than they would be willing to pay to protect those resources.

parsimoniously explain the different instantiations of the endowment effect, and make new predictions.

Loss aversion

The endowment effect is traditionally attributed to two features of prospect theory [1,2]. Reference-dependence makes buyers frame goods as gains relative to the status quo, and sellers frame goods as losses relative to the status quo. Buying a good moves one from a reference point of not owning to owning the good, whereas selling moves one from a reference point of owning to not owning the good [20]. Because people are loss averse – the psychological impact of a loss is greater than an equivalent gain [12,21] – goods have greater perceived value when selling them than when buying them. Consistent with this theory, differences in negative arousal and the activity of brain regions associated with distress (i.e., insula) and reward (i.e., ventral striatum) while buying and selling goods are positively correlated with the propensity to exhibit a WTP–WTA gap [22–24]. Ingesting acetaminophen, which may reduce the psychological pain of loss, appears to also reduce how much sellers demand to relinquish a good [25].

Models of referent-dependent preferences now assume that reference points are not necessarily determined by present circumstances (e.g., current ownership status). They can instead be determined by expected future outcomes – whether or not one expects to own a good [14,20]. When determining the value of a good, people who expect to own it adopt ownership as a reference point (i.e., a loss frame), whereas people who expect to not own the good adopt not owning it as a reference point (i.e., a gain frame) [13]. Consistent with this theoretical extension, expectations of future ownership moderate WTP–WTA gaps. People who possess a good for a longer time value it more [26–28]. People who may acquire a good in the future value it more than do people who do not expect to acquire that good [24,29–31]. People who expect or intend to trade a good they own exhibit a weak or no endowment effect [32–34]. In addition, this theory suggests the endowment effect is driven by sellers' higher valuation of goods rather than by buyers' higher valuation of money. Being a medium of exchange, there should be no endowment effect for money because one does not expect to keep it [2,20,35].

Evolutionary advantage

Evolutionary accounts propose that a predisposition to overvalue goods evolved because it conferred an advantage in bargaining [36]. People who overvalued what they owned acquired more resources through trading, and could therefore support more offspring than could people who accurately valued (or undervalued) what they owned. This predisposition is unintentionally and inappropriately extended to incentive-compatible valuations, cases in which it is in people's best interest to reveal how they truly value a good [36,37].

Children do show an endowment effect [38], but this evolutionary theory is complicated by evidence that culture, relationship-schemas, and learning moderate the endowment effect. Furthermore, the endowment effect is exhibited by non-human primates [39–41]. People of European descent exhibit larger WTP–WTA gaps than do people of Asian and East Asian descent. Similarly, priming the independent and interdependent self-construals associated with these cultures moderates WTP–WTA gaps [40]. Members of hunter-gather (Hadza) tribes with high exposure to modern society and markets exhibit a reluctance to trade in the exchange paradigm, but Hadza with little exposure do not exhibit the same reluctance to trade [41]. Chimpanzees and capuchin monkeys exhibit an endowment effect in the exchange paradigm [42,43], but capuchin monkeys also exhibit more general forms of loss aversion [44] and in-group biases that are consistent with an ownership account (discussed later) [45]. It seems unlikely that the endowment effect is a specific evolutionary adaptation.

Strategic misrepresentation

A prominent debate in economics concerns whether WTP–WTA gaps simply reflect a misunderstanding of the elicitation procedures in the valuation paradigm [46–50]. If participants believe they are in a negotiation, they may strategically misrepresent their valuation of the good. Considerable evidence suggests that strategic misrepresentation alone does not explain WTP–WTA gaps. Buyers and sellers do not predict an endowment effect, suggesting it is not premeditated [51,52]. WTP–WTA gaps are comparable in real and hypothetical experiments, and making

Box 2. The valuation paradigm

In valuation paradigms, half of the participants are randomly endowed with a good such as a coffee mug. Participants endowed with the good are told it is theirs to keep, but have the option to sell it back to the experimenter. These 'sellers' then indicate the minimum amount of money they are willing to accept (WTA) for the good. Participants not endowed with the good, 'buyers', are offered the chance to purchase the good from the experimenter, and indicate the maximum amount of money they are willing to pay (WTP). To control for wealth effects and a possible shortage of cash, non-endowed 'choosers' are given an option to receive the good or money [2]. Some have suggested that comparing choosers and sellers is a better demonstration of the endowment effect given the lack of these two potential confounds [106].

Sellers typically demand more (WTA) to relinquish the good than buyers are willing to pay (WTP) to acquire it. The ratio of this WTP-WTA gap ranges from approximately 2:1 for easily substitutable market goods, such as mugs, lotteries, and chocolate, to as much as 10:1 for non-market public goods that are have few or no substitutes, such as clean air and public land [5]. The WTP-WTA gap is smaller between sellers and choosers than between sellers and buyers, but still persists [23].

WTP-WTA gaps are found in a variety of elicitation measures that including open-ended questions ('How much are you WTA?'), yes or no choices at a given price (e.g., 'Sell the mug for $5?), choosing between several prices (i.e., multiple-choice elicitations), and incentive-compatible measures such as the Becker–DeGroot–Marschack procedure [117]. In this procedure, choosers and sellers make pairwise choices between different amounts of money and keeping (or receiving) the good. One choice pair is then selected and participants receive what they chose (the money or the good) with no opportunity to revise their choices [5].

WTP-WTA gaps are important because they violate the reference-independence assumption of value in rational choice theories and the Coase Theorem [2,18]. This irregularity implies that entitlements will be traded less often than traditional economic theory and legal analysis assumes, which complicates policies and laws regarding their initial allocation, reassignment, exchange, protection, and vindication [19].

valuations incentive-compatible increases these gaps [5]. People exhibit an endowment effect even when given a single opportunity to buy, choose, or sell a good at a single price [23]. Moreover, many findings attributed to miscomprehension are attributable to the expectation of participants that they will own the good in the future, which shifts the reference point they use to evaluate the good [14]. Other findings are attributable to training procedures that may induce experimental demand. In other words, procedures that indicate to participants how the experimenter hopes they will respond [53].

Reference prices

Buying and selling prices can be compared to reference prices – comparison standards drawn from the external environment or retrieved from memory [54]. One good can have multiple reference prices. Tickets to concerts and sporting events often have different face and resale values [55]. A 'fair' price for a bottle of beer is higher if it is sold at an upscale resort than at a run-down grocery store [56–58].

Reference price theory [58] proposes that when the true value of a good to a person compares unfavorably to salient reference prices, buyers will reduce their stated WTP and sellers will inflate their stated WTA to avoid transaction disutility (getting a 'bad deal'). Attending a basketball game might be worth $500 to a ticket buyer, for example, but she would not pay more for a ticket than its market value (e.g., $250). Conversely, attending that game might be worth $100 to a ticket holder, but she would not sell the ticket for less than its market value.

Buyers and sellers do spontaneously attend to and search for the reference prices that have the greatest influence on their transaction utility. Buyers and agents acting on their behalf attend more to low reference prices, whereas sellers and their agents attend more to high reference prices [47,55,59–61]. Sellers attend more to the highest suggested value of a used car, for instance, whereas buyers attend more to its lowest suggested value [59].

Reference price theory makes a unique prediction that WTP–WTA gaps will be smallest when reference prices are moderate and when buyers and sellers are similarly affected by transaction disutility. In one study, WTP–WTA gaps were found for a small-stakes lottery when buyers and sellers were prompted to consider its minimum or maximum payout (a low or high reference price). WTP–WTA gaps were driven by a decrease in WTP in the low reference price condition, and by an increase in WTA in the high reference price condition [58]. No gap was found when participants were prompted to consider its expected value (a moderate reference price).

Biased information processing

More general cognitive process theories suggest that buying, choosing, and selling evoke cognitive frames or queries. In a manner akin to confirmatory hypothesis testing, these frames bias the search for, attention to, and recollection of information, which influences valuation [55,60,62–64]. Frames evoked by buying and choosing increase the accessibility of information that suggests keeping or taking the money is preferable to acquiring the good. Frames evoked by selling increase the accessibility of information that suggests keeping the good is preferable to exchanging it for money (Figure 1). Frame-consistent information may also bias valuation by inhibiting the accessibility of frame-inconsistent information [63].

Frame-consistent information is indeed more likely to be initially searched for, recalled, and spontaneously considered [60,63,64]. Buyers of pens and lotteries recall fewer positive and more negative attributes of those goods than do sellers [24,62]. Buyers of basketball tickets spontaneously consider the (low) list price of the ticket and other costs of attending the game, whereas sellers spontaneously consider the benefits of attending [55]. These differences in accessibility predict WTP–WTA gaps [24,55,60,63,64].

Further evidence of biased information processing is provided by the reduction and mitigation of WTP–WTA gaps when buyers and sellers are explicitly prompted to consider frame-inconsistent information. Prompting buyers to consider positive features of goods increases their WTP, and prompting sellers to consider negative features of goods and reasons to take the money reduces their WTA. By contrast, explicitly prompting buyers and sellers to consider frame-consistent information does not increase

WTP–WTA gaps, suggesting that information is spontaneously considered. Prompting buyers to consider negative features of goods and reasons to keep their money does not affect their WTP, and prompting sellers to consider positive features of goods does not affect their WTA [55,62,63].

This evidence is inconsistent with a standard interpretation of loss aversion, which assumes that buyers and sellers consider the same information about a stimulus, and that WTP–WTA gaps are created by differences in the value they attribute to it when framed as a gain and loss

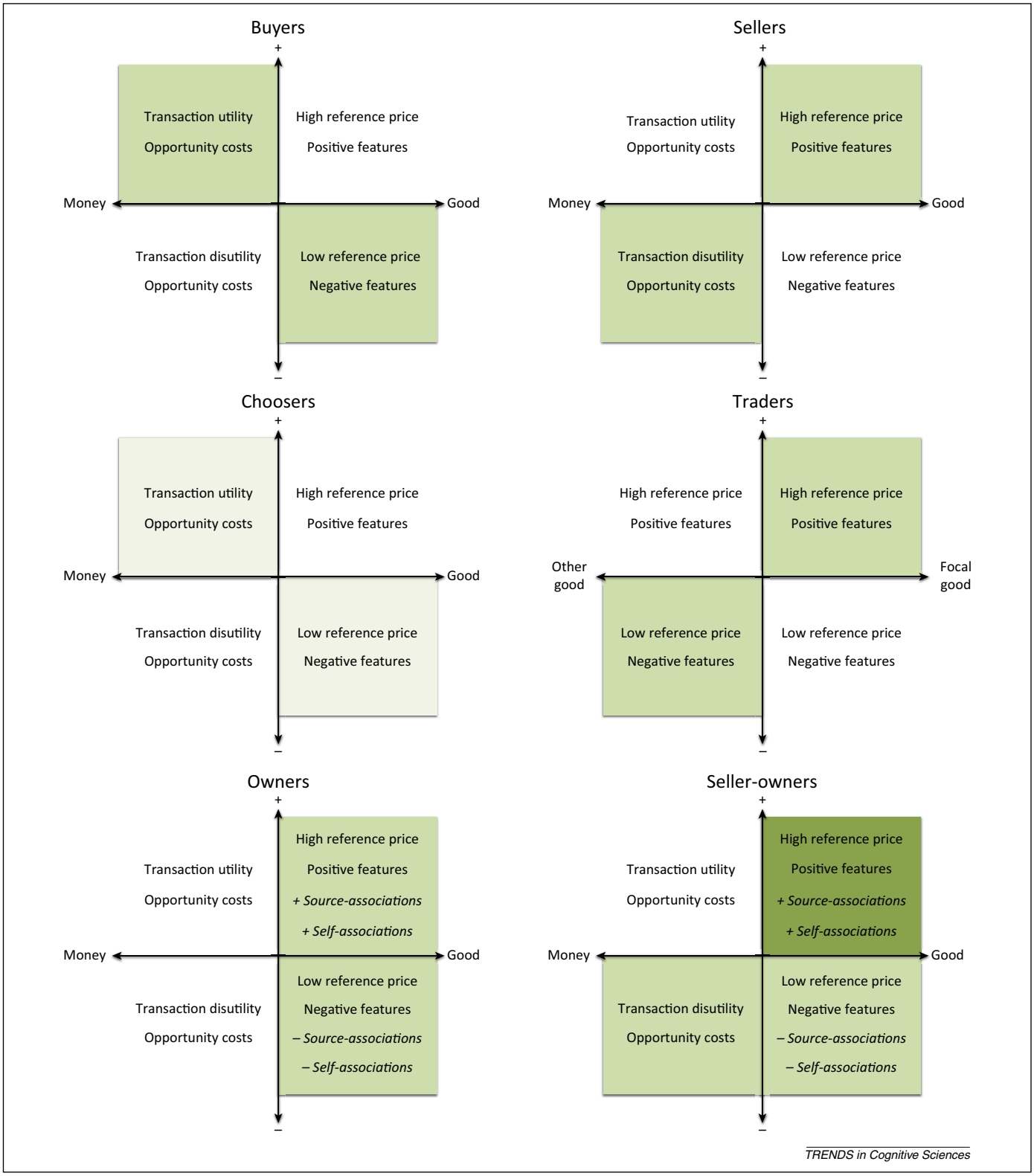

Figure 1. Frame-induced accessibility biases. Exogenous frames (e.g., buying, choosing, selling, trading) and endogenous frames (e.g., owning) increase the accessibility of frame-consistent attributes of a transaction, depicted by shading of quadrants. Frames can act independently, as when buying, choosing, selling, or trading a good one does not own. Frames can also act jointly, as when selling a good one owns (e.g., seller-owners). Ownership adds non-transferrable attributes to the transaction such as positive (+) and negative (−) self- and source-associations.

Box 3. Accessibility and valuation

Greater accessibility of frame-consistent information may bias valuation in two ways, affecting awareness or weighting of information. First, it may change what information people are aware of and ignore at the time of valuation [107,118–121]. Buyers of a home may be more likely to think of its old roof, which sellers may neglect to consider. Second, people may be aware of the same information during valuation but weight that information differently because of differences in its accessibility [122,123]. Buyers and sellers of a home may both be aware of its old roof, but that information may be more accessible to buyers and thus heavily weighted in their valuation. It is difficult to separate these two accessibility effects because they are highly related [96,124]. For example, information that is not accessible is accorded no weight in judgment [96].

Most evidence suggests that accessibility changes the information which buyers and sellers are aware of and ignore, rather than how they weight information. Buyers and sellers better recognize and recall frame-consistent information than they do frame-inconsistent information [62]. Recollection of frame-inconsistent information is sometimes inhibited [63]. Furthermore, making frame-consistent information more accessible does not increase its influence on valuation. Prompting buyers and sellers to consider frame-consistent information does not change WTP-WTA gaps, whereas prompting them to consider frame-inconsistent information reduces WTP-WTA gaps [55,60,62,63]. Biases in attention and sampling behavior also suggest that people attend to and gather more frame-consistent information, and ignore frame-inconsistent information [60]. When buying lotteries, people gaze longer at the lowest payouts. When selling lotteries, people gaze longer at the highest payouts. Moreover, the difference in their gaze duration predicts the size of the WTP-WTA gaps that they exhibit [64].

One finding could support either account: WTP-WTA gaps increase with the amount of time that research participants are given before making lottery valuations [64]. This seems contrary to a straightforward awareness account, which might predict that WTP–WTA gaps should decrease when people have more time to consider all payouts. However, if frame-consistent information accumulates with time because it is sampled more often than frame-inconsistent information, an awareness account adhering to a diffusion process model could explain this finding [125]. For example, preferences could accumulate over the course of the valuation process until a threshold is reached and a choice is made (e.g., keep or trade) or the monetary value of a good is determined (e.g., WTA or WTP) [108].

[62]. It is less clear how the greater accessibility of frame-consistent information influences valuation (Box 3), and whether biased information-processing theories are process explanations of loss aversion or alternative theories.

Psychological ownership

Loss and gain frames in the valuation and exchange paradigms are usually confounded with ownership status – buyers are never owners and sellers always own the good. This is problematic because ownership alone, is sufficient to increase the perceived value of a good [65,66]. Ownership even increases the perceived value of beliefs and ideas [67]. Mere ownership effects are driven by psychological rather than factual ownership [28,32]. Merely touching a good, touching an image of a good, or imagining one owns a good engenders a more positive evaluation if that experience creates a feeling of psychological ownership [68–72]. Psychological ownership increases with the amount of time one possesses a good [26,28], for as long as 2 months later [27]. These findings could be attributed to changes in expectations that shift the reference point used to evaluate the good (i.e., loss aversion). Some mere ownership effects, however, are not attributable to loss aversion (Box 4).

There are two explanations of the mere ownership effect: ownership creates new associations with the good and it improves memory for the good through a self-referential memory effect [68,73]. The first explanation proposes that ownership creates a non-transferrable valenced association between the self and the good [74,75]. The good is incorporated into the self-concept of the owner, becoming part of her identity and imbuing it with attributes related to her self-concept [76,77]. Most self-evaluations are positive, and this new association is therefore usually positive [65,70,71,73]. The more positive a person's implicit self-evaluation, the more positive her implicit evaluation of goods she owns [78]. The more self-enhancing a person's culture, the more likely she is to exhibit an endowment effect [40]. When ownership of a good creates a negative association (e.g., serves as a reminder of bad performance), owners do not value the good more favorably than do controls [79].

Self-associations may take the form of an emotional attachment to the good [70,73]. Once an attachment has formed, the potential loss of the good is perceived as a threat to the self [65,80]. Because selling entails a loss of the good, sellers are more affected by perceptions of threat and feelings of anxiety than buyers. Incidental self-threats affect the WTA of sellers but not the WTP of buyers. Performing a self-affirmation reduces the WTA of sellers of a good but does not affect the WTP of buyers [81]. The WTA of sellers with a highly anxious attachment style, who are likely to feel threatened by the loss of the good, is higher than the WTA of sellers with a less anxious attachment style. However, attachment anxiety does not affect the WTP of buyers [82]. Finally, WTP–WTA gaps are reduced when sellers do not have to 'give up' all of the good – selling may be less threatening when they will retain a portion of the good after the sale [83].

A second route by which ownership may increase value is through a self-referential memory effect (SRE) – the better encoding and recollection of stimuli associated with the self-concept [84]. People have better memory for goods that they own than goods that are owned by others, even if that ownership is simply imagined [85–87]. This memory bias is correlated with the activation and deactivation of brain regions involved in self-referential processing while thinking about who owns those goods [68,88].

We suggest that the SRE for owned goods may act as an endogenous framing effect. During a transaction, attributes of a good may be more accessible to its owners than are other attributes of the transaction (Figure 1). Because most goods have more positive than negative features, this accessibility bias should result in owners more positively evaluating their goods than do non-owners [55]. Indeed, people spontaneously recall more positive features of goods that they own relative to those they do not [89]. Suggesting that ownership may increase the accessibility of all attributes of a good, people exhibit a reversal of the endowment effect for bads – entitlements with predominantly negative attributes (e.g., parking tickets). People endowed with bads are more likely to

Box 4. Is ownership necessary for endowment?

Owners of a good evaluate it more positively than do non-owners [65,89]. Even virtually touching or imagining one owns a good is sufficient to create this mere ownership effect [68,72]. It was originally assumed that ownership was a necessary but not a sufficient condition for the endowment effect [2]. Evidence has gradually accumulated suggesting that psychological ownership can create an endowment effect alone. A loss frame is not necessary.

Ownership status and selling are typically confounded because buyers never own the good and sellers always own the good. One direct test removed this confound [66]. In addition to buyers and sellers, an 'owner-buyer' condition was included. Owner-buyers were endowed with a mug and then indicated their WTP for a second identical mug. If gain and loss frames drive the endowment effect, owner-buyers should be WTP as much for this second mug as buyers are WTP for the first mug, and less than sellers are WTA for the first mug. In other words, prospect theory suggests that owner-buyers should adopt ownership of the first mug as their reference point and view the second mug as a gain, exactly as owners of $1 should view later receiving an additional dollar as a gain of $1 relative to their current reference point.

If ownership drives the endowment effect, owner-buyers should be WTP for this second mug as much as sellers (also owners) are WTA for the first mug, and more than buyers are WTP for the first mug. Ownership status drove the endowment effect in this and a second experiment. Owner-buyers were WTP as much for the second mug as sellers were WTA for the first, and both valued the mugs more than did buyers and pair-buyers, a condition controlling for the possible benefits of owning a pair and diminishing marginal utility (Figure I).

Another paper directly compared the relative importance of psychological and legal ownership. Participants in two studies could buy or sell a good after physically possessing it for 15 min, or after having no physical or visual contact with it. Legal ownership (buying or selling) had no effect on WTA/WTP prices. By contrast, participants who physically possessed the good longer valued it more than did participants who had no contact with the good. This was due to the former group feeling greater psychological ownership for the good [28].

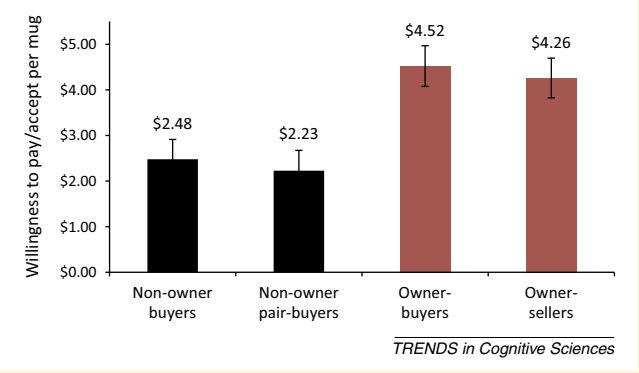

Figure I. Ownership rather than loss aversion appears to drive differences in the valuation paradigm. Buyers who owned a mug (owner-buyers) were WTP more for a second identical mug than buyers who did not own a mug were WTP for one or two of those mugs (non-owner buyers and non-owner pair-buyers). Most important, owner-buyers were WTP as much for that second mug as owner-sellers were WTA for the one mug they owned [66].

exchange them for other bads than would be expected by chance [70,90]. This suggests that the negative attributes of bads are more salient to owners. Moreover, this result contradicts the self-enhancement theory of ownership, which predicts that owners of bads should evaluate bads more positively. Ownership would add a positive attribute to the bad, an association with the self. It is important to note that the reversal of the endowment effect for bads is not predicted by standard loss aversion. A unique possession loss aversion was proposed by the authors to explain this finding [90].

The most direct evidence linking psychological ownership to SRE is that the activation of a brain region involved in self-referential memory (i.e., medial prefrontal cortex; MPFC) while imagining that one owns a good, or upon viewing it afterward, predicts more positive subsequent evaluations of that good [91]. The activation of this region while imagining that someone else owns the good is not related to subsequent evaluations of that good [68]. People also exhibit a larger mere-ownership effect for goods congruent with their self-concept [92], and a larger WTP–WTA gap for goods with identity-relevant attributes such as the logo of their university [80]. Presumably, self-congruence and identity-relevance make attributes easier to encode in relation to the self and easier to remember when valuing the good.

Finally, WTP–WTA gaps are larger for people from Western cultures than for people from Eastern cultures, and when individualistic rather than collectivistic self-concepts are primed [40]. These effects of cultural identity might correspond to cultural differences in MPFC activation during processing of self-referential information. More MPFC activation is exhibited when Western and individualistic constructs are salient than when Eastern and collectivistic constructs are salient [93,94].

Mere ownership effects may be due to both positive self-associations and endogenous framing effects arising from SRE. In addition to MPFC activation, tentative fMRI evidence suggests that ownership effects are associated with activity in at least one other, somewhat overlapping, network of brain regions that exhibits increased activity when people experience self-threat [95]. Ownership may increase the valuation of a good both by adding non-transferrable positive attributes to the good (e.g., self- and source-associations) and, as we suggest, by making attributes of the good more accessible than are other attributes of the transaction (Figure 1).

Attribute sampling bias

We suggest that biased information-processing accounts of WTP–WTA gaps in the valuation paradigm [55,58,60,62–64] can be extended to explain all three major instantiations of the endowment effect: WTP–WTA gaps, reluctance to trade in the exchange paradigm, and mere ownership effects. We propose an integrative attribute sampling bias theory that explains how all three forms of the endowment effect might arise from biases in the accessibility of value-relevant attributes. By attributes, we refer to value-relevant qualities and properties such as the positive or negative features of goods, transaction utility, the cost of new or used alternatives, opportunity costs, and non-transferrable associations.

More specifically, we suggest that exogenous and endogenous framing effects increase the accessibility of frame-consistent attributes during valuation in a manner akin to confirmatory hypothesis testing ([96–98], Figure 2).

When attributes suggesting that one should buy or keep the good are more accessible, the good should increase in value. When attributes suggesting one should sell or not acquire the good are more accessible, the good should decrease in value [96,99,100].

Exogenous frames such as buying, choosing, selling, trading, and legal ownership and endogenous frames evoked by psychological ownership, can bias attribute accessibility by determining the focal alternative at the time of judgment. When making a comparison or evaluation, attributes of the focal alternative are most accessible and heavily weighted [101]. For goods, the most positive attributes of the focal alternative are most accessible and heavily weighted [102]. If only one alternative is being evaluated (e.g., a good), it is the focal alternative. If more than one alternative is evaluated (e.g., a good and money, or two goods), the alternative maintaining the status quo is the focal alternative [12,103]. Goals and appraisal tendencies resulting from intense emotions may also operate as endogenous frames. Rather than determine which is the focal alternative, they may bias attention toward goal or appraisal-consistent attributes [28,66,104]. Incidental sadness, for example, which may evoke an implicit goal to change one's circumstances [105], reverses the WTP–WTA gap [70,106].

Attributes of the endowed good should thus be most accessible to owners, particularly its most positive attributes. As demonstrated in tests of biased information processing [55,60,62–64], buying and selling should increase the accessibility of attributes supporting the status quo – keeping one's money or the good. We suggest that in exchange paradigms, framing effects similarly bias attention to attributes supporting the status quo – keeping the endowed good. Multiple frames can act together, as when selling or trading a good one owns. It is important to note that all experiments testing attentional biases of buying, choosing, and selling have confounded these roles with ownership status. The attentional effects of buying or choosing in the presence of ownership, and selling (or trading) in the absence of ownership, have yet to be tested and are therefore potentially attributable to ownership status with respect to the good (Figure 1).

Choosers who feel psychological ownership for a good should exhibit the same accessibility biases as owners. It is less clear which attributes should be most accessible to choosers who do not feel psychological ownership for the good. Suggesting that choosers should adopt the same frame as buyers, acquiring a good is a clear departure from the status quo, whereas acquiring a small amount of money is unlikely to substantively change the wealth of the chooser [20]. Choosers do exhibit accessibility biases similar to those exhibited by buyers [63]. Some have even recommended that comparing choosers and sellers is a similar but cleaner test of the endowment effect than comparing buyers and sellers [106]. It worth noting, however, that choosers may exhibit an accessibility bias only by virtue of being compared to sellers (Box 5).

Attribute sampling bias could be used as a process account of loss aversion in the context of the endowment effect. Similar to 'decision-by-sampling' and 'value construction' [11,107], however, it ascribes differences in the subjective value of gains and losses to an interaction of constraints of attention and memory with features of the environment. It does not rely on a different weighting function for gains and losses, as does traditional loss aversion. Attribute sampling bias posits that accessibility changes which attributes are considered rather than how attributes are weighted (Figure 2). When evaluating complex goods with many attributes, frames should determine which attributes one is aware of and which are ignored. When evaluating very simple goods such as lotteries, people may be aware of all attributes of a good, but attend more to frame-consistent attributes (e.g., more often resample frame-consistent attributes in a dynamic decision process [108]).

Attribute sampling bias explains findings and makes novel predictions that loss aversion does not. It explains how mere ownership acts as an endogenous framing manipulation, increasing the value of goods whether buying or selling them [28,66], which is not predicted by biased information sampling theories of WTP–WTA gaps. It explains how self-associations, source-associations, and culture moderate WTP–WTA gaps [40,79,80,92], and suggests how goals and incidental emotions might reverse them [70,105,106,109]. It can explain why performing a self-affirmation mitigates WTP–WTA gaps [81]: by making irrelevant attributes of the self salient, performing a self-affirmation may inhibit or block the recollection of attributes of a good associated with the self [110].

Attribute sampling bias predicts that because attributes of the good are most accessible to owners and owner-sellers, the magnitude of the endowment effect should increase as the positive attributes of a good increase in extremity or valence. Conversely, as the negative attributes of a bad increase in extremity or valence, there should be a greater reversal of the endowment effect. Indeed, a reversal for bads in the exchange paradigm has been documented. People are more likely to exchange a bad with which they have been endowed for a different bad [70,90]. This predic-

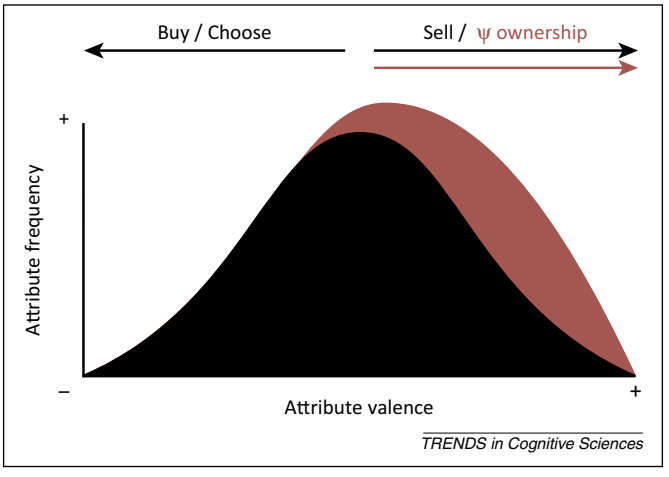

Figure 2. Attribute sampling biases in valuation. The valuation of a good may be determined by the sample of its attributes accessible at the time of judgment. Frames such as buying, choosing, selling, and psychological (Ψ) ownership (depicted by arrows), that increase the sampling of frame-consistent attributes, could induce bias in valuation by changing the average value of the attributes sampled. Note that ownership may both act as a frame and create non-transferrable attributes (usually positive self- or source-associations) that can be sampled from the distribution, depicted by its extension in red.

Box 5. Outstanding questions

- Can a loss frame, in the absence of psychological ownership, induce the endowment effect?
- In the context of the endowment effect, should biased information-processing theories be interpreted as accounts of the cognitive processes underlying loss aversion, or as alternatives to loss aversion?
- Decision-by-sampling theory attributes loss aversion to people more frequently encountering small losses and large gains in their everyday lives, which biases the comparison standards they recall from memory when evaluating new losses and gains [107]. Might loss aversion in the valuation paradigm be explained by a similar interaction between environmental factors (e.g., the greater prevalence of high rather than low reference prices [58]) and accessibility biases in memory?
- Are choosers susceptible to the same accessibility biases as buyers (Figure 1), or do they appear to be biased only by virtue of being compared to sellers? Some direct comparisons find that choosers value goods in a manner more akin to buyers than sellers [20]. Other comparisons find that choosers ascribe greater value to goods than do buyers, and ascribe less value to goods than do sellers [23]. Given the widespread substitution of choosers for buyers [70,106], this question affects a considerable amount of published work.
- If acquisition decisions are usually made from the perspective of a buyer who does not anticipate an endowment effect, do most goods provide unexpected surplus utility [51,52]?
- The endowment effect is characterized as a bias creating inefficiencies in markets. It is typically studied in experimental markets in which one potential buyer is matched with one potential seller; each is given one opportunity to buy or sell the good. Depending on the structure of the market, and on the heterogeneity in perceived value of the good, might the endowment effect sometimes be beneficial to sellers and sometimes to buyers? When the value of a good is extremely heterogeneous, sellers possessing a rare good might benefit from their high valuation because they might not sell it until they find a buyer willing to pay their high WTA. Conversely, buyers may benefit from their low valuation because they might not buy the good until they find a seller willing to accept their low WTP.
- Selling is one of many methods of disposal. Do selling frames make different attributes of a transaction more accessible than do other methods of disposal such as recycling, donating, trading, or throwing away?

tion diverges from query theory [63], which suggests that sellers focus on value-increasing aspects of the good or bad in question. They should therefore exhibit an endowment effect for both bads and goods. Attribute sampling bias also diverges from self-enhancement (attachment) theories of mere ownership effects [65], which would predict that ownership increases the value of both goods and bads by adding an additional positive attribute (an association with the self).

A second prediction is that the magnitude of the endowment effect should vary with the range of attribute values associated with the good. If the endowment effect occurs because people sample different attributes of the good with different values (Figure 2), in cases where there is a greater difference in the value of the attributes that they can sample, there should then be a greater chance of observing an endowment effect. For example, WTP–WTA gaps should be larger for a lottery with a broader range of possible outcomes (e.g., \$0, \$100; 0.90, 0.10) than a lottery with a narrower range of possible outcomes that has the same expected value (e.g., \$0, \$20; 0.50, 0.50). Ownership effects should similarly be larger for 'enriched' goods with very positive and negative attributes than for 'impoverished' goods with a larger concentration of average attributes [111].

Two findings indirectly support this prediction. First, reference prices create WTP–WTA gaps when they are high or low, when buyers and sellers are likely to sample different reference prices [58]. Second, WTP–WTA gaps are greater for goods with more vaguely defined attributes, such as public goods and safety regulations (e.g., 'clean air'), than goods with more clearly defined attributes, such as private goods (e.g., mugs) and lotteries [5]. Presumably, the less clearly defined the attributes of a good, the greater the chance that buyers and sellers may sample attributes that differ in value [102]. Indeed, there is no WTP–WTA gap for the most common single-attribute good, money [20,112,113].

Third, our theory suggests self-referential memory effects create an endogenous framing effect by increasing the accessibility of attributes of owned goods. Moderators of this SRE such as private self-consciousness [114] should thus moderate the size of the endowment effect for goods and its reversal for bads.

Concluding remarks

The findings we review suggest that the endowment effect can no longer solely be attributed to a traditional loss aversion account. Different elicitation methods and psychological ownership lead people to consider different information when valuing a good, and not to weight the same information differently. We propose an integrative process account that specifies how biased information-processing theories of WTP–WTA gaps can be extended to explain reluctance to trade and mere ownership effects. Direct evidence supporting our integrative account includes the biases in attention and memory exhibited by buyers, sellers, choosers, traders, and owners, the correlation between these biases and the size of the endowment effect, the mitigation of the endowment effect when people are directed to consider frame-inconsistent information [24,55,58–60,62–64,89], and the reversal of the endowment effect for bads [90]. We hope that connecting these instantiations of the endowment effect through a common cognitive process fosters a better understanding of the basis of the effect, and the construction of value. Perhaps it may even provide new insights into the processes underlying loss aversion.

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