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When does construction enhance product value?

Investigating the combined effects of object assembly and ownership on valuation

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Abstract

Recent findings have shown that even without the ability to customize a product, individuals pay more for goods that they assembled. In this paper we examine which components of this creation process account for this increase in valuation, and whether it operates equally for owners and non-owners of the self-assembled object. Based on the self-extension theory of ownership, we propose a psychological mechanism by which the assembly process strengthens the self-object association. In three experiments, we find that – although witnessing the assembly process or assembling a similar product can increase participants' evaluation of, and attachment to, a product that they own – a greater and more consistent increase in valuation and attachment arises when owners assemble their product themselves. Seemingly, merely learning about the assembly process plays only a small role in enhancing value; for substantial increases in value, one must actually assemble the product oneself. Contrary to the previous findings on the effects of labour on willingness to pay, we find little effect of product assembly among non-owners of the product. We suggest that self-assembly encourages objects to be incorporated into the self, but that this occurs most effectively when one owns the product.

Keywords: product assembly, ownership, valuation, self-extension, IKEA effect, consumer co-production

Opportunities for consumer involvement in the process of product co-creation have increased in recent years. For example, consumers can now pay to shape and decorate their own piece of pottery at a ceramics café, or can construct objects in a virtual LEGO universe, and can then purchase their creation. Product customization appears to benefit everyone. Mass customization marketing techniques increase firms' efficiency by outsourcing some of their production costs and by fulfilling the demands of a wider range of customers (Firat & Venkatesh 1995; Lovelock & Young 1979). For the buyer, self-manufactured goods offer a better fit to one's personal preferences (Franke, Keinz, & Steger 2009), introduce feeling of pride and achievement (Dahl & Moreau 2007; Mochon, Norton, & Ariely 2012) and become an expression of personal identity (Franke, Schreier, & Kaiser, 2010). These positive outcomes can compensate for the effort spent on customizing a product (Buechel & Janiszewski, 2004), such that those who design their products are often willing to pay more for them than for similar pre-assembled goods (Franke & Piller, 2004; Schreier 2006).

Recent studies have demonstrated that construction, even without the freedom to customize, can increase the amount that potential buyers offer for products – an effect named the IKEA effect (Norton, Mochon & Ariely 2012) or (ironically) the "I-designed-it-myself" effect (Franke, Schreier, & Kaiser 2010). Constructing a product has been shown to increase willingness to pay for simple goods (e.g., LEGO, origami, IKEA storage boxes, t-shirts), both when created by hand or using web-based customization toolkits. It remains unclear, however, *why* object assembly makes goods more desirable. Consequently, the aim of the following work is to establish the conditions under which one's labour is regarded as a cost, and when it has a value enhancing effect.

We propose that the process of object assembly enhances creators' subjective feelings of ownership towards the item. Building on existing theories of psychological ownership, we test the hypothesis that constructed goods become part of one's self, and that the strength of

this bond is positively related to object valuations. In three experiments, we demonstrate that the association between consumers and an assembled good is strongest among those who *both* undertook its assembly *and* now own that product.

Labour and value

Consumers appear to value the fruit of their labour more than products made by others. Norton et al. (2012) found that students were willing to pay more for self-assembled goods (e.g., origami) than for the same good assembled by an expert. Franke, Shreier and Kaiser (2010) also found that participants who designed a t-shirt following precise instructions valued it higher than the same pre-made t-shirt. Some have argued that creation can influence the implicit value of sensory experiences. For example, Troye and Suphellen (2012) showed that cooking one's own meal can alter judgment of its tastiness. Similarly, children who prepare their own meals eat more (including vegetables, van der Horst, Ferrage, & Rytz, 2014) and show higher liking for the food they made (Dohle, Rall, & Siegrist, 2014).

Even without any creative input, object assembly can offer benefits to the assembler. Mochon et al. (2012) suggested that assembled items demonstrate a person's competence, which can be affirmed by purchasing the good. They found that participants who could not solve a difficult math problem suffered from lower feelings of competence and expressed higher willingness to assemble an item (IKEA box) themselves than those whose feelings of competence had not been threatened in this way (Mochon et al., 2012, Study 3). Product creation can also be regarded as a positive experience in itself, given that the task allows for a sufficient level of autonomy, mastery and challenge (Buechel & Janiszewski, 2014); thereby producing positive affect and enhanced feelings of control.

At the same time, there are reasons why product assembly could be regarded as a negative experience. In addition to the time and effort spent on construction, boredom and

frustration can arise when the creation process is too difficult (Trentin, Perin, & Forza, 2014). Additionally, Buechel and Janiszewski (2014) demonstrated that when the creative element of construction is decoupled from the assembly procedure, product valuations decrease (but only when the level of construction effort is high).

In sum, it is not clear what characteristics of the creation process and what psychological processes may lead to higher valuations of self-constructed goods. In the following work, we extend previous efforts and explore the relationship between psychology of ownership status and labour.

Psychological and factual status of ownership

The role of ownership status on valuation is closely linked with one of the best known anomalies in behavioural economics – the endowment effect (Horowitz & McConnell, 2002; Thaler, 1980) – whereby owners demand significantly more in exchange for their possession than non-owners are willing to pay for the same object. This disparity between willingness to accept (WTA) and willingness to pay (WTP) has been shown to occur for a range of consumer products (Kahneman, Knetsch, & Thaler, 1991), public goods (Cummings, Brookshire, & Schulze, 1986) and non-material possessions (Brenner, Rottenstreich, Sood, & Bilgin, 2007; Walasek, Wright, & Rakow, 2014). Numerous explanations have been put forward to explain the WTA-WTP disparity and include loss aversion (Novemsky & Kahneman, 2005), strategic considerations (Plott & Zeiler, 2005; 2007), biased attention allocation (Carmon & Ariely, 2000), emotions (Lerner, Small & Loewenstein, 2004), or avoiding a bad deal (Isoni, 2011; Weaver & Frederick, 2012).

Some researchers have suggested that feelings of possession play an important role in explaining why owners tend to place a value on their belongings which exceeds the market price. Reb and Connolly (2007) propose that two types of ownership, which were confounded

in previous research, need to be differentiated in order to understand this phenomenon: dichotomous *factual* ownership, and *subjective* feelings of possession. The latter represents a continuous scale, "a sense of endowment, rather than a legal entitlement" (p. 108), which may or may not be accompanied by the presence of factual ownership (Reb & Connolly, 2007).

A growing amount of empirical and theoretical work has attempted to describe the processes through which an individual develops a special bond with his/her possessions (Beggan, 1992; Pierce, Kostova, & Dirks, 2003; Walasek, Matthews, & Rakow, 2015). One key theoretical framework that describes this process is self-extension theory (Belk, 1988; Dittmar, 1992; Pierce et al., 2001; 2003), according to which possessions become part of our extended self, ultimately becoming incorporated into our own self-definition. Self-extension theory posits that this process fulfills three basic motivations: effectance (also feelings of efficacy and control), self-identity, and feelings of home (Belk, 1990). Thus, first, our possessions allow us to feel control over our environment (Dittmar, 1992), which is critical to our wellbeing (Krause & Shaw, 2000). Second, possessions are symbols of who we are, facilitating maintenance of a coherent and well-defined self-identity (Pierce & Jussila, 2011). Finally, the innate need to have a place, which is important to our feeling of security and familiarity, can be satisfied through close relationship with our belongings (Pierce et al., 2003). Belk (1988) further proposes three main pathways by which the process of self-extension can occur: by using and controlling an object, by knowing it, and by creating it.

Belk's self-extension framework shares many ideas with the theory of ownership (Pierce et al., 2001; 2003), which also posits that the state of psychological ownership arises from: control, intimate knowledge, and investing the self in the object. Here, the self-object link is important but is not the only component necessary to describe the bond between an individual and his/her possessions. More global *feelings of ownership* represent a mental

state, in which a person perceives an object (material or not material) as his/hers (see Pierce & Jussila, 2011, for a review).

Despite differences between the two frameworks, both suggest that the subjective state of ownership can arise through product assembly. A clear prediction of the self-extension model of ownership is that individuals who created an object value it more highly because *their* labour is invested in *their* product, which becomes a part of their individual selves. Object creation can also influence feelings of ownership more generally. Consistent with the theory of ownership (Pierce & Jussila, 2011), a unique bond should develop between a person and his/her creation.

Based on the pivotal role of creation in the emergence of the subjective state of ownership, and of valuation as a behavioural signature of this relationship (see Shu & Peck, 2011), we propose that:

H1: Through object assembly, an individual develops a subjective state of ownership towards a good. Therefore, constructed objects become closer to one's self, producing a stronger self-object link and elevated feelings of possession.

H2: An elevated state of psychological ownership will result in higher valuation of the assembled goods, relative to the ready-assembled goods.

If object creation influences subjective feelings of ownership by strengthening the self-object link and feelings of ownership, what differential impact might this relationship have on the valuation of owners and non-owners? According to Belk (1988), an object may become part of one's self with or without legal ownership status. Indeed, the same holds for feelings of ownership (Pierce & Jussila, 2011) – a person can feel like an owner of an object that does not formally belongs to her (Reb & Connolly, 2007). In such cases, product assembly may strengthen the self-object association and feelings of ownership among its owners and non-owners, raising valuations of buyers and sellers alike. If, as suggested by

other authors (Franke et al., 2010; Norton et al., 2012), all creators of a consumer product grow more attached to the fruit of their labour, and this relationship determines their valuations, then the size of the gap between the willingness of buyers to pay and the price demanded by sellers (the endowment effect) should remain largely unchanged when both groups have constructed the object.

Alternatively, ownership status may lead to contrasting perceptions of the meaning of labour by owners and non-owners. Whether an object becomes part of one's extended self may depend on the degree to which labour is perceived as wasted effort. A person who created an object may not regard it as part of their self when their creation does not belong to them. In this case, the creator may expect a discount on the price of the created object, since s/he has already incurred a personal cost through product assembly. In contrast, a self-assembled item that one owns can be incorporated into one's self-identity, which should then raise its valuation (e.g., expressed in higher reluctance to give up the item). The same relationship may also apply to feelings of ownership. Notably, valuation among owners and non-owners can still increase as a function of other factors (e.g., feelings of competence).

Given these contrasting sets of predictions, it is important to determine how factual ownership status interacts with the assembly process and how they (jointly, or independently) influence product valuation. In the following studies, we therefore examined whether co-creation of a product enhances feelings of ownership towards it, and whether this relationship is moderated by the factual ownership status.

In Studies 1 and 2 we also explore the experience of co-creation in more detail. Pursuing the objective of determining *how* object construction influences product valuation, we manipulated the degree of involvement in the construction process. Therefore, in addition to a product assembly condition and a control condition, we included two conditions in which participants either watched the product being constructed (i.e., no active involvement in its

assembly), or constructed a different product. In doing so, we disaggregate some of the components of the construction process to determine the "active ingredient" that increases valuation. A prediction based on the theories of psychological ownership is that stronger feelings of attachment can only develop to a specific object that a person has assembled. According to these theories, the value-enhancing effect of product co-creation should only apply to goods that an individual has created with his/her own hands. However, assembling any product can give rise to feelings of competence and pride (Mochon et al., 2012). It is therefore possible that co-creation of a different product will lead to higher valuations of the target item. Separately, it has been shown that people place greater value on goods that they know take more effort to produce (Kruger, Wirtz, Van Boven, & Altermatt, 2004; Loewenstein & Issacharoff, 1994). Therefore, watching a product being assembled by someone else could also influence valuation, if observing product assembly helps people to appreciate the effort that this requires. However, neither personal competence nor feeling of possession should be affected by this minimal exposure to the assembly process.

Study 1 - Object assembly and valuation

Method

Sample, One-hundred-and-sixty-eight volunteers (92 female) from the University of Essex participated, and received £6.00 plus a chance to obtain additional money or a valuable good (science kit). This payment also covered participation in two subsequent unrelated studies. Eight participants were replaced due to kit malfunction (n = 3), failure to follow instructions (n = 3) or a high number of errors (n = 2, > 5 errors) during valuation procedure practice trials. The mean age was 26.3 (*SD* = 6.3) years.

Materials, The products were two educational science kits: the "Amazing Flying Disc" and "Amazing Turbo Air" (retailing at UK£5.99, approx. US$10). We alternated the type of kit for successive participants, i.e., the type of kit used as the target product was

counterbalanced. These kits are relatively easy to assemble and once completed, offer some entertainment value (one sends a plastic disc flying through the air, the other makes a polystyrene ball hover mid-air). Computer-based elements of the task were presented using Real Studio.

Design, This experiment had two between-subjects manipulations: (1) ownership (owner vs. non-owners); and (2) assembly experience, with four conditions – a control condition (i.e. no exposure to the product or the assembly process), a watch (product) assembly condition, an assemble similar product condition, and an assemble product condition. This created a 2 (ownership) by 4 (assembly experience) between-subjects design.

Summary of the measures, See Figure 1 for when the measures described here were obtained, and when random assignment to assembly experience conditions and ownership status occurred.

Product valuation, One of our key dependent variables is the valuation of the product by owners and non-owners (measured in all assembly experience conditions). Our valuation protocol used an incentive-compatible method developed by Becker, DeGroot & Marschak (1964), which removes the incentive to "game" the market by stating a low WTP, or a high WTA, that differs from one's true valuation of the item. Both owners and non-owners made a series of binary choices between the science kit and different amounts of money (ranging from £0.00 to £5.00 in £0.25 increments). For owners, choosing the kit meant keeping it; whereas for non-owners, choosing the kit meant acquiring it. The point at which participants switched between preferring money to an object determined their WTA or WTP. Participants who were non-owners did not have to spend their own money. Instead, they acted as 'choosers' opting for the item or an amount of money (over different amounts offered). At the end of the study, a random market price was drawn, determining the outcome for each participant.

To assure good understanding of this protocol, participants read detailed instructions supported with an example (as recommended by Plott & Zeiler, 2005; 2007). They also practiced using this valuation method, providing hypothetical valuations of two practice items (pen, deck of cards) as either an owner or non-owner (as per their allocation).

Psychological state of ownership, For our second key dependent variable in study 1, we used a widely used 3-item "feelings of ownership" scale (Pierce et al., 2003) to assesses the degree to which a person perceives himself/herself as an owner of a particular object (using a 5-point scale).

Other measures, We included a range of additional measures to gain a better understanding of the interplay between object construction, valuation, and psychological ownership. Some researchers suggested that emotions and mood can influence the size of the WTA-WTP disparity (Lerner, Small, & Loewenstein, 2004). We therefore included the Positive and Negative Affect Schedule (PANAS; Crawford & Henry, 2004) to capture the affective state of our participants before and after the activity associated with their assembly experience condition. We also collected attractiveness ratings of the science kits to assess whether the experience of assembling a product changes its appeal to the participants.

In order to gain a deeper insight into the process of value construction, following Johnson et al. (2007), we asked participants to list all the reasons why they personally would want to have the science kit rather than the money, and all the reasons why they would want to have the money rather than the item. Participants typed one reason at a time.

Procedure, A flow chart in Figure 1 describes the timeline of the entire procedure.

INSERT FIGURE 1 HERE

First, all participants answered demographic questions and then completed the PANAS. Then, they were randomly assigned to one of the four assembly experience conditions. Participants in the *control* condition completed an unrelated pen-and-paper questionnaire,

which took approximately 5 minutes. Participants in the *watch assembly* condition watched a video of an individual constructing one of the science kits (whichever type of kit they would later be given/offered). Those in the *assemble similar product* and *assemble product* conditions assembled one of the kits themselves[1]. These participants were given kit-assembly instructions and unlimited time to complete the task (type of kit was counterbalanced). The batteries needed to power the kits were not provided at this stage so that no one could see whether the completed product functioned. On average, participants took 6 minutes to build the kit, after which they summoned the experimenter. Then, questionnaires and science kits were taken away, the experimenter left, and participants continued with the experiment on a computer.

Participants completed a second PANAS scale, and were then informed that in the following stage they would be taking part in a consequential auction. After completing the BDM valuation tutorial, participants summoned the experimenter, who then informed the participant that he/she was now offered, or that he/she now owned, a completed science kit. Ownership status (i.e., whether they owned the to-be-valued item, or not) was revealed to the participants at this point. In the assemble product condition, it was explicitly stated that this was the kit they had made earlier. In the assemble similar product condition, the kit was different from the one that participants had made previously (viz. Turbo-Air or Flying Disc). In the watch assembly condition the offered/given kit was the same type as the one seen in the video, while in the control condition it was determined randomly. In all conditions, the experimenter demonstrated how the kit worked and informed participants that they could obtain the entire set (batteries, kit, box and instructions). Participants were then left to continue with the task on a computer. They completed the reason-listing task and indicated

[1] Unbeknown to the participants, those in the assemble product condition were given the kit for the product that they would later value; whereas participants in the assemble similar product condition were given the kit for the "other" (i.e. *not*-to-be-valued) product.

their valuation and attractiveness rating for the kit, in that order. Finally, participants saw a market price and the ensuing outcome (viz. whether they received the science kit or the money). Participants whose WTA (owners) or WTP (non-owners) were lower than the market price received an amount of money equal to the market price. Those whose valuations were at or above the market price retained/received the science kit. Everyone was paid in full upon completing the study.

Results

Creation, Ownership and Valuation, Figure 2 shows the valuations of owners and non-owners by assembly experience. Since we also counterbalanced the type of kit in our study, we pooled data for both kits together[2], and used a two-way (ownership status by assembly experience) ANOVA to analyze the valuation data.

In a 2 (ownership status) by 4 (assembly experience) ANOVA, the main effect of ownership was significant, with owners of the science kit valuing their possession higher (median = £2.25), than non-owners who indicated bids for the product (median = £1.25), $F(1, 160) = 4.76$, $p = .031$, partial $\eta^2 = .029$. There was no significant main effect of assembly experience ($F < 1$); there was, however, a significant interaction between ownership status and assembly experience, $F(3, 160) = 4.76$, $p = .026$, partial $\eta^2 = .056$. A set of orthogonal comparisons run separately for owners and non-owners revealed that the essential summary of this interaction is that owners who assembled the science kit valued it higher than owners who did not assemble it, watched it being assembled, or assembled a similar product; while, in turn, participants in the assemble other product and watch assembly conditions valued the kit more highly than those in the control condition (see Supplementary Materials). In contrast, among non-owners there was no significant effect of assembly condition. These

[2] With valuation as the dependent variable, the type of kit did not interact with the other two independent variables ($F < 1$).

results are illustrated in figure 2 – the median valuation of owners in the assemble product condition is at least 56% higher than valuation in the other conditions.

INSERT FIGURE 2 HERE

Feelings of ownership, We computed a mean score on the feelings of ownership scale for each participant (α = .95) and used ANOVA to examine the effects of ownership status and assembly experience (figure 3).

INSERT FIGURE 3 HERE

Unsurprisingly, owners reported greater feelings of ownership than non-owners of the science kit, $F(1,160) = 13.28$, $p < .001$, partial $\eta^2 = .077$. Feelings of ownership also varied significantly with the assembly experience, $F(3,160) = 3.53$, $p = .016$, partial $\eta^2 = .062$ but the interaction term was not significant ($F < 1$) (see Table S1 in Supplementary Materials).

Other measures, The pattern of the means for each condition for the attractiveness ratings (see Supplementary Materials, Figure S1) was qualitatively similar to that for valuation: there was a significant main effect of ownership status, $F(1, 160) = 7.10$, $p = .009$, partial $\eta^2 = .042$ (owners rated science kits as more desirable than non-owners); no significant effect of assembly experience ($F < 1$); but a significant two-way interaction, $F(3, 160) = 2.68$, $p = .049$, partial $\eta^2 = .048$. Consistent with the valuation and feelings of ownership data, the mean attractiveness ratings for owners in the assemble product condition were higher than those for participants in any other condition (see Supplementary Materials).

We measured change in affect by subtracting composite PANAS scores before the assembly experience manipulation from those obtained after it, maintaining separate for positive and negative emotions. Each set of scores was subjected to a 2 (ownership) by 4 (assembly experience) ANOVA. The only significant effect was a greater change (increase)

in positive affect experienced by owners of the kit, $F(1, 160) = 4.30$, $p = .040$, partial $\eta^2 = .026$. There was no significant difference in these affect change scores across any combination of the conditions (all remaining *p*s > .1). We therefore conclude that changing mood plays, at most, only a minor role in the observed effects of assembly experience and ownership on valuation and feelings of ownership.

Reason Listing, The processes underlying valuations and attractiveness ratings were explored by analyzing participants' thought listings. Each reason was blind rated for valence (positive vs. negative) and target (science kit vs. money) by two raters who matched on 94% of their judgments. Discrepant ratings were resolved by the first author, or deleted where resolution was not possible[3]. Ratings were re-coded into value-enhancing reasons (positive aspects of the science kit or negative aspects of obtaining money) or value-decreasing reasons (negative aspects of the kit or positive aspects of obtaining money). The number of value-decreasing reasons was then subtracted from the number of value-enhancing statements. An ANOVA with ownership and assembly experience as independent variables revealed that owners of the science kit generated more value-increasing reasons ($\text{mean}_{\text{owners}} = .51$, SD = 2.18) than non-owners ($\text{mean}_{\text{non-owners}} = -.44$, SD = 2.44, $F(1, 160) = 7.16$, $p = .008$, partial $\eta^2 = .043$). This finding is in line with the biased memory search hypothesis of Query Theory (Johnson et al., 2007), according to which owners tend to generate more reasons in favour of owning an object than do non-owners. However, the pattern of reasons does not explain the differences in valuation resulting from the creation manipulation, because neither the assembly experience, $F(3, 160) = 1.32$, $p = .270$, nor the interaction between ownership and creation ($F < 1$) were significant.

Discussion

[3] The results are unchanged if the discrepant ratings are excluded.

Results of the present study indicate that, having successfully built an object, one demands more money to part with it and finds it more attractive. On the other hand, when offered the opportunity to purchase one's creation, the very same object is rated and valued much like those with which one has no contact at all. Our results also show that observing an object identical to the one that you own being assembled by someone else or creating a similar product induces somewhat higher valuations of one's product. Thus, in line with the possibility that observation illustrates the effort involved in construction (cf. Kruger et al., 2004), and that construction of another product represents an investment of labour that can signal competence (cf. Mochon et al., 2012), "partial" experience of product assembly can increase its value – but, importantly, we only detected this effect among owners of the object.

Study 1 employed valuation methods (choice between amounts of money and an item) that have been shown to suppress differences between owners and non-owners (Plott & Zeiler, 2005). Study 2 employed another commonly used incentive-compatible valuation method (open bids) for which WTA and WTP are more likely to differ. This allowed us to explore the robustness of the combined effects of creation and ownership that were observed in Study 1. To enhance our understanding of the role of feelings of ownership, and to provide a better test of the self-extension model of ownership, the reason listing procedure for a detailed measure of the self-object link (association).

For the purpose of comparison with the findings of Norton and colleagues (2012), the target items in Study 2 were small LEGO kits.

Study 2 – Assessing the self-object link

Method

Sample, The participants were 175 volunteers from the University of Essex (122 female), with a mean (SD) age of 22.0 (4.7) years. The experiment was advertised as a 15-

minute computer task with a participation fee of UK£3.00. One participant's data were excluded for failing to follow instructions.

Materials, Two different LEGO Creator® kits were used (retail price ≈ £2.50): a frog and a lizard. The assignment of LEGO kit to each participant was counterbalanced, i.e. each successive participant received either a frog or a lizard.

Design, The design was identical to Experiment 1

Other measures, One new measure was introduced in Study 2: a 6-item "self-object link" scale (0-100 scale of agreement) which assesses the extent to which an object is part of one's self (Ferraro et al., 2011). This measure incorporates questions about an object's role in defining one's self (Sivadas & Venkatesh, 1995) as well as the quality of one's relationship with an object (Escalas, 2004). Previous work has found that this scale captures the connection between a person's identity and an item, predicting the extent of grief associated with losing a cherished possession (Ferraro et al., 2011). This measure allows us to test more directly our prediction that labour leads to a closer link between an object and one's self, the core concept of the self-extension theory of ownership (Belk, 1988). Crucially, this measure is distinct from the "feelings of ownership" scale, which assesses the global sense of attachment towards a product (Pierce & Jussila, 2011). Mood (PANAS score) and the attractiveness of the product were not measured in Study 2.

Procedure,

Figure 4 outlines the timeline and measures of Study 2.

INSERT FIGURE 4 HERE

Participants completed the task individually in separate testing booths. Those assigned to the control condition began by completing a 7-minute computer task (unrelated to this study); the procedure for initial interaction with the good in the remaining conditions was equivalent to Study 1. Participants then summoned the experimenter, who revealed to each

participant that he/she was either an owner or non-owner of a completed LEGO kit, which he/she had the option to sell or buy, respectively. Participants were then left to continue with the remainder the experiment on the computer, with the LEGO kit remaining in the testing booth.

Prior to valuing the LEGO kit, participants completed two practice trials for the incentive-compatible valuation procedure with the random market price selected as per Study 1, but with WTP or WTA stated freely (i.e., in contrast to Study 1, wherein participants chose between specified monetary amounts and the item). Participants then provided their valuation of the LEGO, typing their WTP or WTA for the kit. Next they completed both of the measures of psychological ownership and basic demographic questions. Once a random market price for the LEGO was displayed, the experimenter was alerted and concluded the session by honouring all transactions.

Results

Due to considerable positive skew and heterogeneity of variance, buying and selling prices were log transformed. We also pool the data for the LEGO lizard and LEGO frog (which had been counterbalanced as the target object, and – where relevant – the "similar" object). For clarity of interpretation we report untransformed WTAs and WTPs in descriptive statistics, while performing tests of significance on the transformed scores. One outlier was identified and removed from the analysis (single score 1.5*IQR above the upper quartile).

Figure 5 shows that owners who created LEGO valued it the most. Interestingly, the lowest valuation came from non-owners who could purchase the item they constructed. Consequently, the ratio between median WTA and median WTP is largest for the assemble product condition (6.4), exceeding the ratio in the control (1.9), watching assembly (2.0) and assemble similar product (3.8) conditions.

A 2-by-4 (ownership status by assembly experience) ANOVA revealed a significant main effect of ownership on valuation, $F(1, 165) = 40.34$, $p < .001$, partial $\eta^2 = .196$. Owners demanded more in exchange for their LEGO (median = £2.00) than buyers were willing to pay for it (median = £0.80), demonstrating the endowment effect. However, unlike Study 1, the main effect of assembly experience was not significant ($F < 1$) nor was the two-way interaction, $F(3, 166) = 1.55$, $p = .203$, partial $\eta^2 = .027$.[4]

INSERT FIGURE 5 HERE

Subjective ownership, To gain deeper insight into the reasons for the observed pattern of valuation, we conducted separate 2-by-4 ANOVAs on the two sets of scores measuring the subjective dimension of ownership: feelings of ownership ($\alpha = .90$) and self-object link ($\alpha = .95$). The summary of the results is presented in Table 1.

INSERT TABLE 1 HERE

The results for feelings of ownership replicate those of Study 1: again, owners developed stronger feelings of ownership than non-owners. Also, feelings of ownership differed by assembly experience, being strongest for those who assembled a similar product and (more so) for those who assembled the target product (see Supplementary Materials, Table S1, Figure S2).

With respect to the strength of the self-object link, owners identified with the LEGO more than non-owners. The strength of this association differed by assembly experience, and crucially, there was also a significant interaction between ownership status and assembly experience. Figure 6 illustrates the pattern: the self-object link with the LEGO was strongest among the factual owners who assembled it – in line with the self-extension theory of

[4] Note that a more highly powered analysis using orthogonal comparisons "tuned" to our hypotheses (as per Study 1) revealed that, among owners (only) the difference between the product assembly condition and the other three assembly experience conditions combined was marginally significant ($p = .089$, see the Supplementary Materials). No other comparisons were significant (all ps > .160).

ownership, labour established a strong bond between a person and his/her possession (see Supplementary Materials, Table S1, for details of comparisons between conditions).

INSERT FIGURE 6 HERE

Discussion

In Study 2 we observed an endowment effect: on average, owners demanded more to relinquish their LEGO than non-owners were willing to pay for it. Unlike Study 1, we found no significant evidence that product assembly influenced people's valuations of the product, or that ownership and product creation increase WTA among owner-creators. However, while acknowledging the lack of significant interaction, we note that (consistent with Study 1) the owners-creators did set their price higher than the valuations of participants in other conditions. Moreover, when subjective ownership was assessed by a measure of the self-object link, we did find a significant interaction between ownership and creation, with owner-creators having a stronger self-object link than owners who did not engage in constructive labour. Together, these findings offer partial support for hypotheses H1 and H2, showing that the enhancing effect of labour on valuations and self-object link applies only to owners. In other words, the stronger association between one's self and one's belonging develops if one has created one's possession. People who can purchase their creation (but who do not factually own it) do not appear to form such association with the product.

Study 3 – Probing the self-object link

The main purpose of Study 3 is to test possible alternative explanations of the interaction between factual ownership status and assembly experience. Although the findings of Study 2 indicate that product assembly influences the association between an object its owners, these findings could be explained via a number of mechanisms.

Furthermore, some differences between our results and those reported in the previous work of Norton et al., (2012) and Franke et al., (2010) motivates a further test of the effect of

product creation on valuation. In Study 3, the design was simplified and cell-sizes were enlarged to increase the statistical power to detect any ownership-by-creation interactions. We therefore compared owners to non-owners, and creators to non-creators, but retained only the assemble product and watch assembly (now as control) conditions for the assembly experience factor.

Method

Sample, One-hundred volunteers from the University of Warwick (87 female), with a mean (SD) age of 22.4 (2.6) years, participated. Participants received at least £3.00 for 30 minutes of their time.

Materials, The objects used were Woodcraft® Construction Kits of a butterfly (RRP ≈£3.99). Each kit consists of 15 wooden pieces, and a completed model measures 27cm x 33cm x 17cm. This particular model was chosen (over a bi-plane, T-rex, violin, etc.) on the basis of a preliminary online survey, which indicated little sex difference in the desirability of the kit.

Design, Study 3 had a 2-by-2 design, with ownership (owners vs. non-owners) and assembly experience (watch assembly vs. assemble product) as between-subjects factors.

Other measures, One possibility is that the pattern of results observed in Studies 1 and 2 is due to emotional responses towards the object that are not picked up by generic mood measures such as the PANAS. Because *specific* emotions have been demonstrated to influence both buying and selling prices (Lerner et al., 2004; Zhang & Fishbach, 2005) we included a 10-item measure of object emotional attachment (Thomson, MacInnis, & Park, 2005), which assesses the affective responses towards a specific material good (on a 7-point scale).

We also devised a measure evaluating participants' perception of the construction process itself. Participants who assembled the butterfly rated their agreement on a 5-point

scale with eight statements describing their experience of enjoyment, achievement and difficulty while assembling the kit. Participants in the watch assembly condition were asked to imagine how they would feel if they had the opportunity to assemble the kit (see Appendix 1 for details).

In Study 3, we also probed the nature of the self-object link by exploring individual differences in the tendency to use possessions as self-extensions (Ferraro et al., 2011; 9-item scale). We expected individuals with a higher propensity on this measure to develop stronger self-object links when assembling a product. Motivated by our previous findings, we also predicted that this effect would be particularly strong among owners.

In order to further test predictions of the self-extension theory of ownership, we assessed participants' willingness-to-purchase a set of items that could be used to enhance the attractiveness of the target good, expecting greater willingness if they also perceive this good to be part of their selves (for similar predictions, see Baer & Brown, 2012; Mochon et al., 2012). We presented participants with a picture of a clear gloss varnish and a brush, which were described as a bundle that could be used to "add a nice glaze look to the Woodcraft butterfly". Participants were asked how much, hypothetically, they would be willing to pay for these items, assuming that they end up keeping/acquiring the butterfly at the end of the study.

Procedure,

Figure 7 outlines the procedure of the Study 3.

INSERT FIGURE 7 HERE

Before the study (at least one day before arriving at the lab), all participants completed an online survey comprising a self-extension tendency scale and basic demographic questions.

The lab session (completed on computers in individual testing cubicles) began with a 20-item PANAS scale, followed by the manipulation of the assembly experience. In the watch assembly condition, participants watched a 5-minute long video of the butterfly kit being constructed; after which they were presented with a pre-assembled butterfly. In the assemble product condition, participants assembled the butterfly using the instructions in the booklet provided (with no time limit). Next, as per Study 2, participants were informed that they either own or do not own the kit. Owners were then told that they would have the opportunity sell their kit, and, accordingly, non-owners were informed of the opportunity to buy the kit, later in the experiment. They were then instructed to learn about the auction mechanism for selling or buying the kit.

After specifying his/her WTA or WTP, each participant completed the "feelings of ownership", the "self-object link", and the "attractiveness" scales that were used in the previous two experiments, plus the "emotional attachment" scale. The order of these scales was randomized. These were followed by a measure of enjoyment and achievement associated with the construction process itself. To answer these questions, participants in the *watch assembly* condition were asked to imagine how they would feel if they had the opportunity to assemble the kit.

Then, after completing a second PANAS, participants typed their valuation of the varnish kit and alerted the experimenter who concluded all transactions based on the random market price.

Results

Creation, Ownership and Valuation, Figure 8 summarizes the valuations of owners and non-owners in each assembly experience condition.

INSERT FIGURE 8 HERE

Due to positive skew in valuation, the significance tests were conducted on the log-transformed values (though for clarity of exposition, untransformed descriptive statistics are reported). Overall, we observed an endowment effect, with owners' WTA (median = £3.00) exceeding non-owners' WTP (median = £1.50), $F(1, 136) = 19.16$, $p < .001$, partial $\eta^2 = .123$. However, the difference between owners and non-owners occurred only in the assemble product condition (Figure 8). Also, those who assembled the product valued it higher (median = £2.00) than those who watched a video of the construction process (median = £2.00), $F(1, 136) = 5.16$, $p = .025$, partial $\eta^2 = .037$. However, consistent with Study 1, the value-enhancing effect of constructing a butterfly occurred among owners, but not non-owners: the interaction term was significant, $F(1, 136) = 10.33$, $p = .002$, partial $\eta^2 = .071$. Thus, replicating the results of the previous two studies, we found that participants who construct *and* own the product value it the most. Indeed, the effect of assembly experience was significant for owners ($F(1,68) = 14.94$, $p < .001$, partial $\eta^2 = .180$), but not non-owners ($F(1,68) = .45$, $p = .505$, partial $\eta^2 = .007$).

Figure 9 summarizes participants' (hypothetical) valuations of the brush/varnish bundle (again, due to positive skew, data were log transformed for statistical analysis). The pattern closely resembles the valuations of the butterfly – participants who owned a butterfly were willing to pay more for products that could be used to improve it than were those who did not own the butterfly, $F(1, 136) = 12.16$, $p < .001$, partial $\eta^2 = .082$. Neither the main effect of assembly experience ($F(1, 136) = 2.73$, $p = .101$, partial $\eta^2 = .020$) nor the interaction term were significant ($F(1, 136) = 3.15$, $p = .078$, partial $\eta^2 = .023$) but the pattern of valuation clearly mirrors product valuation from all three studies.

INSERT FIGURE 9 HERE

Subjective Ownership and Affect, The effect of ownership and creation on constructs related to subjective feelings of ownership was investigated in a series of 2-by-2 ANOVAs. The results for all scales are reported in Table 2 (descriptive statistics for each measure are reported in Table S2 in Supplementary Materials).

INSERT TABLE 2 HERE

In contrast with Study 2, the interaction term for self-object link was not significant. However, figure 10 reveals a pattern similar to that in Study 2: the strongest self-object link developed among those who both owned and constructed the product[5].

INSERT FIGURE 10 HERE

Self-object Link and Self-Extension Tendency, In order to further explore the self-extension theory account, we performed a hierarchical regression with the self-object link as the criterion variable (Table 3). Our primary prediction was that people who tend to incorporate material objects into their self-identity will also develop a closer self-object association with the butterfly kit. Our second prediction was that this effect would be stronger among owners than non-owners. To test these predictions, we first controlled for the effect of ownership status, assembly experience, and their interaction; then added self-extension tendency (α = .92) as a further predictor; and finally included the interaction term between ownership status and the self-extension tendency.

Model 2 reveals that self-extension tendency is positively correlated with the degree to which participants perceived the butterfly to be part of their self. The interaction between ownership status and the self-extension tendency was not significant (Model 3).

[5] We used mediation analysis to test the hypothesis that subjective ownership (i.e., self-object link or feelings of ownership) mediates the relationship between valuation and the product of assembly experience and ownership status. The indirect effect was not significant in these analyses. These results are reported in the Supplementary Materials.

INSERT TABLE 3 HERE

Discussion

Once again we found that enhanced valuation occurs only among those who both created and own an item. Despite the lack of the significant interaction for measures of the self-object association (both the questionnaire-based measure and hypothetical valuations of the gloss and brush), we note that pattern of our data closely resembles valuation. These findings are only partially consistent with the findings of Study 1 and 2.

General Discussion

The findings presented here extend previous work concerned with the role of labour in the valuation of consumer products. Across three large experiments (total n = 476) owners who created their possession demand more money in exchange for it than participants who valued a pre-assembled product. Our findings imply that this effect is primarily driven by the effort expended in constructing *that* item: neither simply watching the product being assembled nor creating a similar product led to substantially higher selling prices among owners. Finally, consistent with the self-extension (Belk, 1988) and feelings of ownership (Pierce et al., 2003) accounts, we found that the effect of creation on value occurs in tandem with the development of an object-item association. Owner-constructors showed a stronger self-object link than other participants, but did not show markedly stronger emotional responses towards the item, higher perceived attractiveness, or elevated possession-attachment or mood.

These data refine and extend previous studies of the role of creation in product valuation. Object creation reliably led to higher valuation, but crucially, only *owners* regarded their creation as more valuable than pre-assembled goods, asking much more money in return for their good than buyers were willing to pay. We explain these results in terms of

the self-extension view of subjective state of ownership (Belk, 1988). Non-owners may regard their work as a spent resource rather than as a way to enhance their relationship with an object, while owner-constructors perceive their possession as part of their self, and therefore do not want to give it up.

The lack of value-enhancing effect of labour on non-owners' WTP is surprising and at odds with some previous work (e.g., Norton et al., 2012). According to the predictions of the self-extension theory, some self-object association should develop among those who do not own a good (with an associated rise in valuation). While we suggest that this relationship is more likely to develop for goods that are actually owned by a person, we do not disregard the possibility that under certain conditions a strong self-object link develops among non-owners who assemble a product. For example, other products (e.g., more valuable, or more functional than small science, LEGO or craft kits) may be more conducive to inducing strong self-object associations, or other ways of describing the state of (objective) non-ownership to the participant may allow greater room for (subjective) feelings of ownership to develop. For instance, because we manipulated ownership status in our studies, our instructions to non-owners necessarily made it clear that WTP evaluations were WTP for something that they *did not own but could obtain* – an emphasis that may not be present in studies that only elicit WTP (Norton et al., 2012). Such differences in experimental design may explain why our findings differ from those previous studies that did detect value-enhancing effects of product assembly among non-owners. Interpreting our findings in light of that previous research, the essential summary of our work is that the increased product valuations that can accrue from product assembly are greater in owners than in non-owners. We believe this to be an important extension to previous work; and, importantly, our data shed light on why this effect occurs.

From our studies, it appears that *not* being an owner discourages people from letting material objects become a representation of their identity. One possibility is that this is a protective strategy; the psychological needs for control, belonging, and identity that our possessions can fulfill are unlikely to be met by investing our sense of self in an object over which we have no control and which we may not be able to keep (Walasek et al., 2015). That is, creating a product will strengthen the self-object link, and also lead to a higher valuation, but only when it is "safe" to do so.

An alternative explanation is that, in the absence of customization, labour will decrease WTP for goods where the entertainment value lies in the construction process itself. In other words, one would expect that if part of the product's consumption utility rests in the ability to construct it, buyers will be less inclined to purchase the good that they have already assembled, thereby offsetting any value enhancement that comes from increased feelings of ownership. It is easy to see how this explanation could apply to consumer goods like a science kit or LEGO, which are usually purchased–in large part–for the fun of assembling them. The interpretation of one's own spent labour can be very different between owners and non-owners of a product. Whereas owners may perceive the product made by them as a symbol of their identity, non-owners see it purely as a partially-consumed good (see Norton et al., 2012 for a similar argument).

We found that watching assembly or constructing a similar product can influence valuations and the self-object link among owners, though these effects were found less often and were smaller than the equivalent effects of (complete) product assembly. While we never detected these effects among non-owners, it is possible that such experiences will enhance WTP under certain conditions. For example, if one watches a product being assembled by one's child, the (sentimental) value of that good is likely to be much higher. Such effects

could be even explained by the self-object link, as people develop strong attachment to goods that act as stores of important memories in their lives (Belk, 1988).

What are the methodological limitations of our work? First, we only manipulated ownership *after* the assembly experience, and therefore it is possible that the process of product assembly has a very different effect on a good's perceived value when the ownership status is already established. If, for example, participants who assemble a product form an expectation that they will own it at the end of the study, then informing them about their non-owner status could be rather upsetting. This in turn, could reverse the IKEA effect, and explain why product assembly did not have any value-enhancing properties in our work. Future studies will need to determine whether participants' assumed ownership status can influence the relationship between labor and valuation. Second, we were only able to explore simple consumer goods in the context of a short laboratory experiments. It is plausible that the self-object association is much stronger for people who created their long-term cherished possessions. Quantifying the value-enhancing effect of labour in the context of personal possessions offers one interesting avenue for future work. The current findings may inform marketing practices regarding product-return policies for self-assembled goods. Even with products that do not allow for any customization, product creation should reduce the tendency to return goods. Given that customers tend to assess products' quality based on the features of the returns policy (Kim & Wansink, 2012), it may be advantageous for firms to signal quality by stating a "lax" returns policy for customer-assembled goods, safe in the knowledge that few customers will return their self-assembled item. Notably, however, IKEA itself does not seem to exploit the "IKEA effect" in this way, as their terms and conditions disallow returns once products are opened and assembled.

The current findings should stimulate further research into the psychological consequences of creation, construction and co-production. Future research could use the

existing literature on customization to identify moderators of the IKEA (or "I designed-it-myself") effect. For example, Simonson (2005) proposed that the benefits of customization depend partly on whether an individual has stable, and readily accessible, preferences. Indeed, Franke, Keinz and Steger (2009) showed that individuals who have a better insight into their own preferences are more likely to purchase an object they designed. One might expect an inverse relationship in the case of constrained creation, where the ability for preference fit is held constant: individuals with imprecise preferences may particularly enjoy constructive labour, in which they do not have to make choices about the final shape of the product.

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Appendix 1

The following scale was devised to assess the level of enjoyment and achievement felt by the participants after constructing the wooden kit in Study 3. Participants who did not assemble the kit were simply asked to imagine that they did and answer the questions accordingly. The name of the kit in questions was replaced with the kit that participants either assembled themselves, or watched being assembled in a video. Participants indicated their responses on a 5-item scale, anchored with 1- strongly disagree and 5- strongly agree.

Using the scale below, please indicate how much do you agree with each of the following statements.

1. I found the experience of putting the Woodcraft Butterfly together frustrating (rev).
2. I feel proud about assembling the Woodcraft Butterfly.
3. Constructing the Woodcraft Butterfly was tedious (rev).
4. Assembling the Woodcraft Butterfly was annoying (rev).
5. I enjoyed constructing the Woodcraft Butterfly.
6. Creating the Woodcraft Butterfly was boring (rev).
7. It was fun to create the Woodcraft Butterfly.
8. I perceive assembling the Woodcraft Butterfly as an achievement.

Table 1. Summary of the analysis for two measures of psychological ownership: feelings of ownership and the self-object link.

		F	df	*p*	partial η^2
Feelings of ownership (Pierce et al., 2001)	Ownership	31.07	1, 166	< .001	.166
	Assembly experience	3.77	3, 166	.009	.068
	Ownership * Assembly experience	1.98	3, 166	.101	.037
Self-object link (Ferraro et al., 2011)	Ownership	9.81	1, 166	.002	.056
	Assembly experience	3.05	3, 166	.030	.052
	Ownership * Assembly experience	3.43	3, 166	.019	.058

Table 2. Summary of the analysis of the measures associated with the product assembly and ownership status.

		α	$F(1,136)$	p	partial η^2
Feelings of ownership (Pierce et al., 2001)	Ownership	.88	14.35	< .001	.095
	Assembly experience		16.74	< .001	.059
	Ownership * Assembly experience		< 1	.976	<.001
Self-object link (Ferraro et al., 2011)	Ownership	.94	8.73	.004	.060
	Assembly experience		4.00	.048	.028
	Ownership * Assembly experience		2.83	.095	.020
PANAS (negative)	Ownership	.86	4.65	.033	.033
	Assembly experience		1.01	.317	.007
	Ownership * Assembly experience		< 1	.441	.004
PANAS (positive)	Ownership	.88	< 1	.468	.004
	Assembly experience		2.95	.088	.021
	Ownership * Assembly experience		1.19	.274	.009
Attractiveness	Ownership	NA	< 1	.961	<.001
	Assembly experience		4.12	.045	.029
	Ownership * Assembly experience		< 1	.460	.004
Construction enjoyment	Ownership	.87	2.03	.157	.015
	Assembly experience		35.02	< .001	.205
	Ownership * Assembly experience		1.05	.308	.008
Emotional attachment	Ownership	.95	1.82	.180	.013
	Assembly experience		2.91	.090	.021
	Ownership * Assembly experience		< 1	.424	.005

Table 3. Regression models showing the effect of the self-extension tendency on the relationship between ownership status and assembly experience on the strength of the self-object link (criterion variable).

Predictor	Model 1		Model 2		Model 3	
	β	*p*-value	β	*p*-value	β	*p*-value
Ownership status	.162	.048	.177	.026	.177	.028
Assembly experience	.240	.004	.201	.013	.201	.013
Ownership * Assembly experience	.137	.095	.154	.052	.154	.054
Self-extension tendency	--	--	.252	.002	.252	.002
Ownership status * Self-extension tendency	--	--	--	--	<.001	.996
R-sq for model	.320 $F(3, 136) = 5.18$, $p = .002$		.405 $F(4, 135) = 6.62$, $p < .001$		.405 $F(5, 134) = 5.25$, $p < .001$	
ΔR-sq for step	.102 $F(3, 136) = 5.18$, $p = .002$		.061 $F(1, 135) = 9.92$, $p = .002$		.001 $F(1, 134) < .01$, $p = .996$	

Figure captions:

Figure 1. Flow chart of the procedure in Study 1.

Figure 2. Median valuation by ownership status and assembly experience (Study 1)

Figure 3. Mean feelings of ownership by assembly experience and ownership status (Study 1). Error bars: ± 2 standard errors.

Figure 4. Flow chart of the procedure in Study 2.

Figure 5. Median valuation by ownership and assembly experience (Study 2).

Figure 6. Mean self-object link assembly experience and ownership status (Study 2).

Figure 7. Flow chart of the procedure in Study 3.

Figure 8. Median valuation of an assembled butterfly by ownership and watch assembly experience (Study 3).

Figure 9. Median willingness to pay for the varnish and a brush by condition (Study 3)

Figure 10. Mean self-object link across by assembly experience and ownership (Study 3) Error bars: ± 2 standard errors.

Figure (1)

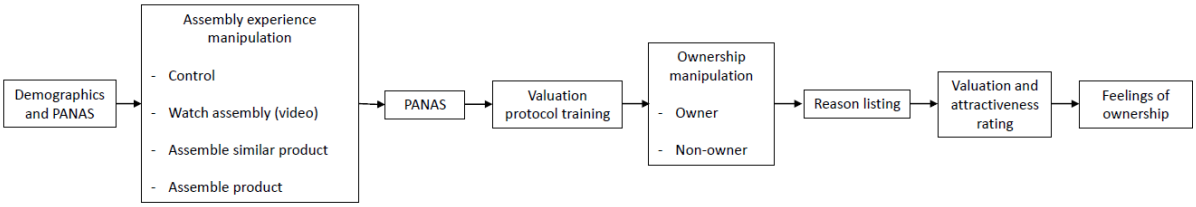

Demographics and PANAS
Assembly experience manipulation
- Control
- Watch assembly (video)
- Assemble similar product
- Assemble product
PANAS
Valuation protocol training
Ownership manipulation
- Owner
- Non-owner
Reason listing
Valuation and attractiveness rating
Feelings of ownership

Figure (2)

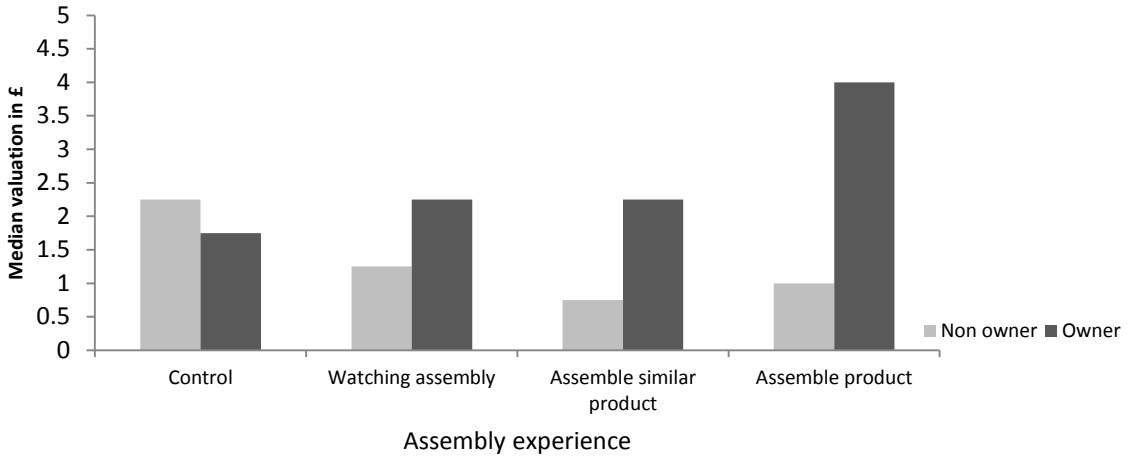

5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Median valuation in £
Control
Watching assembly
Assemble similar product
Assemble product
Non owner
Owner
Assembly experience

Figure (3)

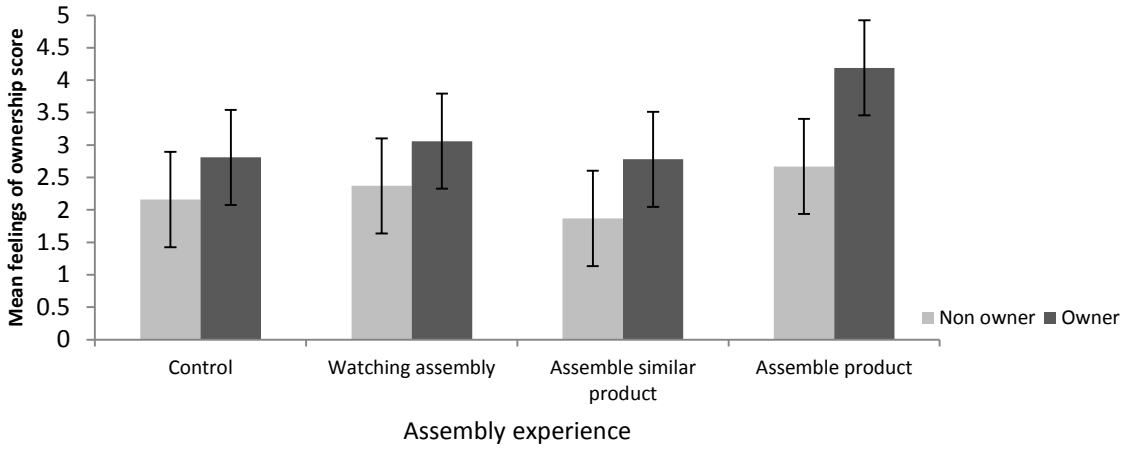

Mean feelings of ownership score
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Control
Watching assembly
Assemble similar product
Assemble product
Assembly experience
Non owner
Owner

Figure (4)

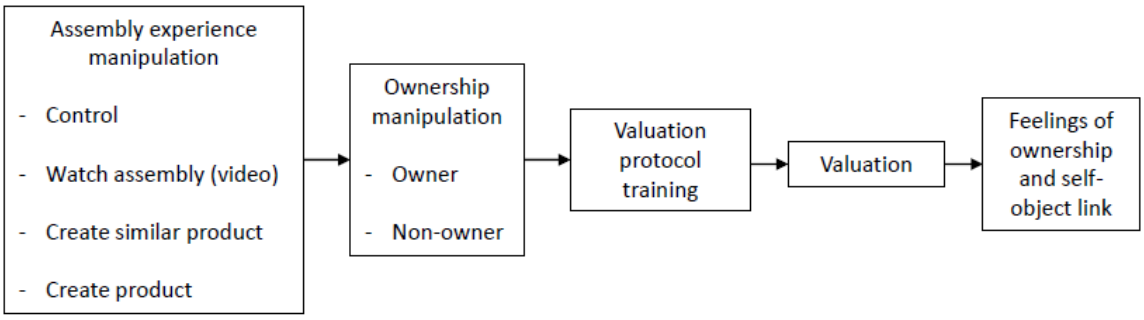

Assembly experience manipulation
- Control
- Watch assembly (video)
- Create similar product
- Create product
Ownership manipulation
- Owner
- Non-owner
Valuation protocol training
Valuation
Feelings of ownership and self-object link

Figure (5)

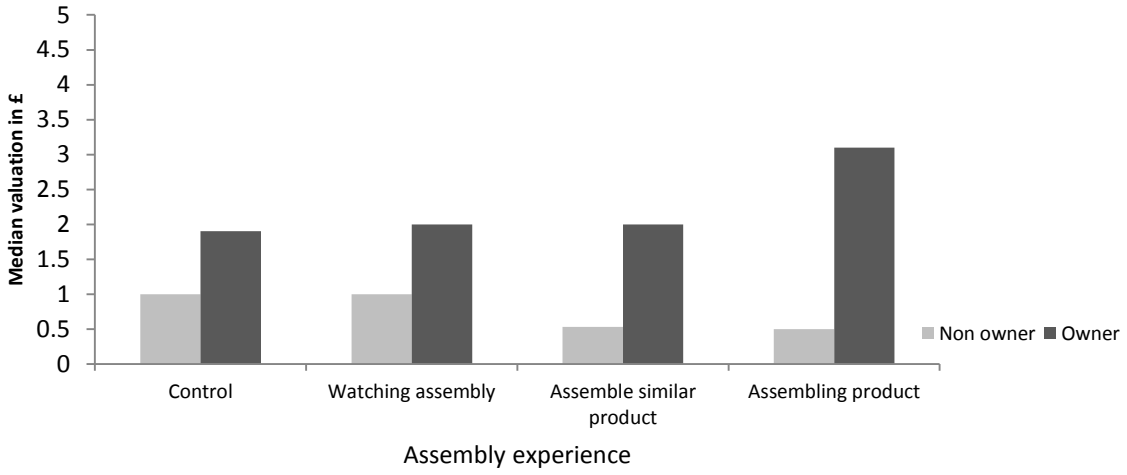

Median valuation in £
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Control
Watching assembly
Assemble similar product
Assembling product
Non owner
Owner
Assembly experience

Figure (6)

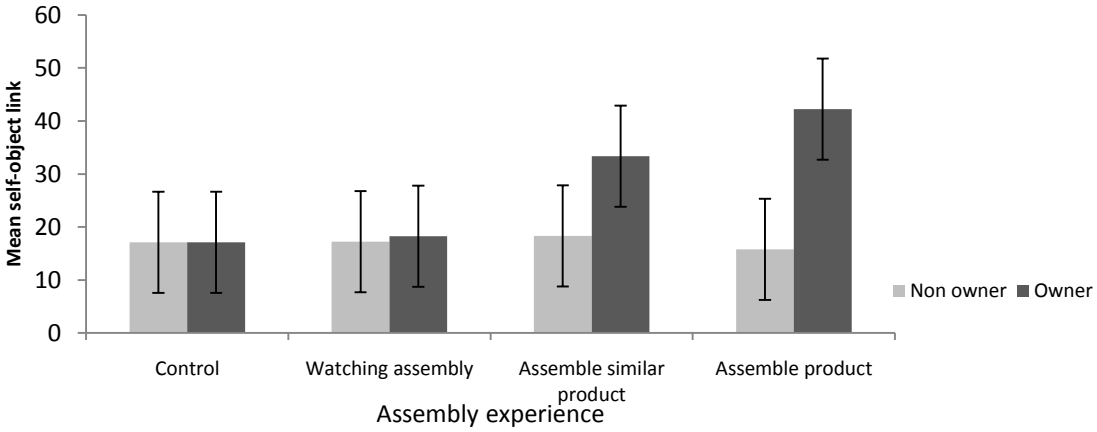

60
50
40
30
20
10
0
Mean self-object link
Control
Watching assembly
Assemble similar product
Assemble product
Assembly experience
Non owner
Owner

Figure (7)

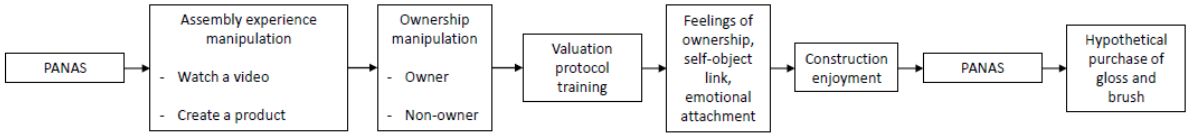

PANAS
Assembly experience manipulation
- Watch a video
- Create a product
Ownership manipulation
- Owner
- Non-owner
Valuation protocol training
Feelings of ownership, self-object link, emotional attachment
Construction enjoyment
PANAS
Hypothetical purchase of gloss and brush

Figure (8)

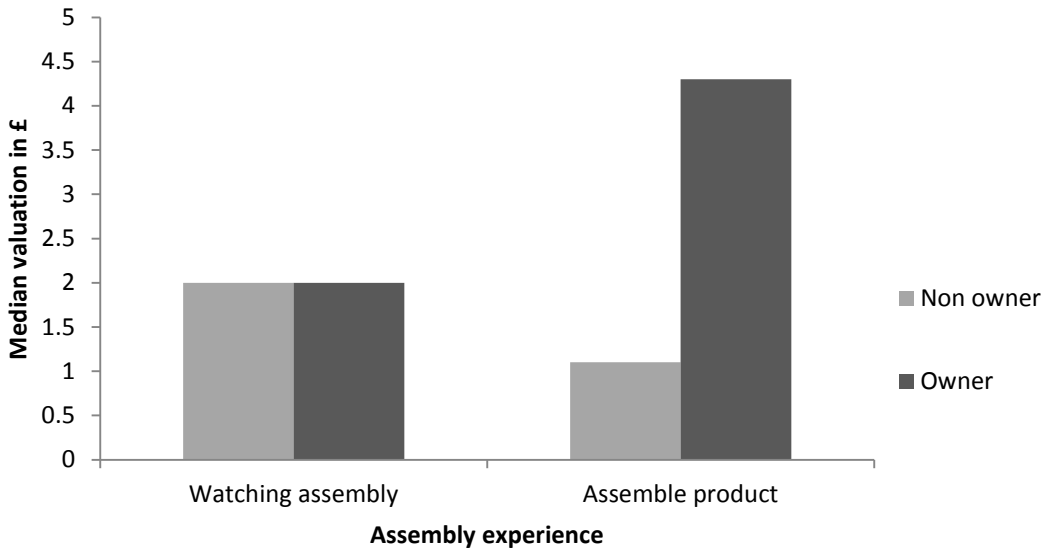

5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Median valuation in £
Watching assembly
Assemble product
Assembly experience
Non owner
Owner

Figure (9)

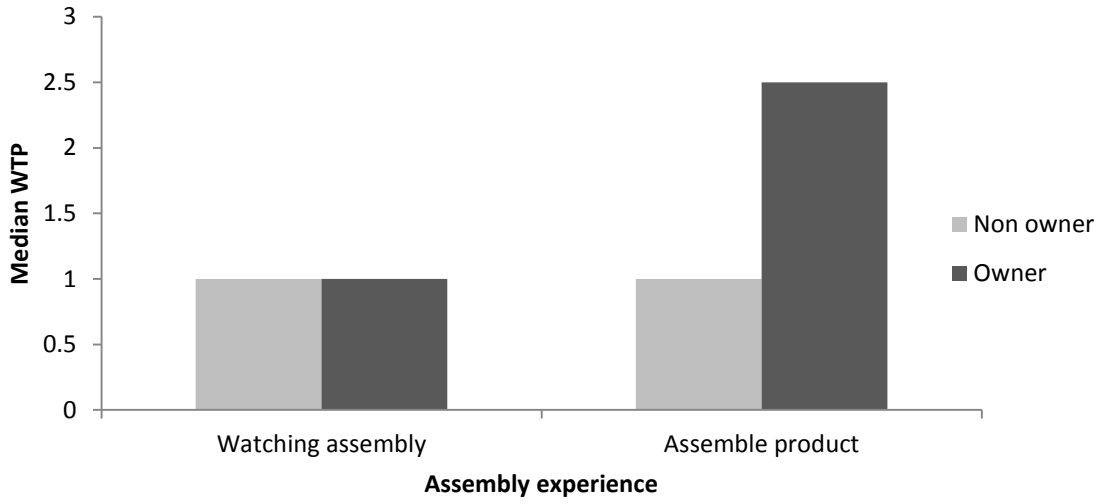
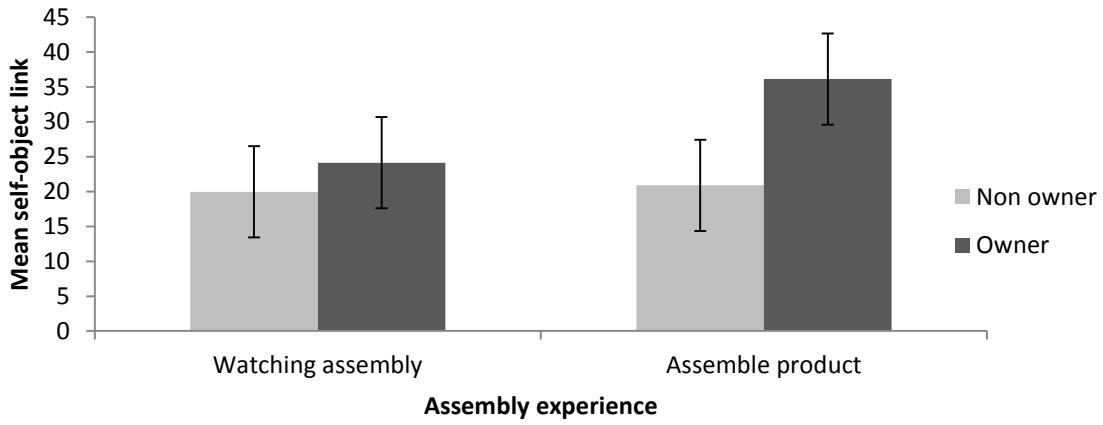

3
2.5
2
1.5
1
0.5
0
Median WTP
Non owner
Owner
Watching assembly
Assemble product
Assembly experience

Figure (10)


45
40
35
30
25
20
15
10
5
0
Mean self-object link
Watching assembly
Assemble product
Assembly experience
Non owner
Owner

Supplementary Materials

Orthogonal comparisons unpacking the effect of assembly experience in Studies 1 and 2.

Studies 1 and 2 each had four assembly experience conditions (to support a detailed examination of the different components of product assembly). To better understand the effect of assembly experience, and – in particular – any interaction with ownership status, we undertook a series of comparisons between assembly experience conditions that followed on from each 4-by-2 (assembly experience by ownership) ANOVA that had been conducted on a main dependent variable in Studies 1 and 2 (Table S1). Separate analyses of the effect of assembly experience were conducted for owners and non-owners, using the relevant value MS_{error} from each of those one-way ANOVAs. Each analysis partitioned the effect of assembly experience into three orthogonal contrasts (i.e., nested comparisons). The first contrast compared the assemble product condition against all other conditions; and therefore compared the condition with all the 'ingredients' of product assembly against those having only some, or none, of those ingredients. The second contrast compared the watch assembly and assemble other product conditions (as a pair, together) against the control condition; thereby comparing the two conditions with some exposure to product assembly against the only condition with no exposure to assembly. The third contrast compared the watch assembly and assemble product conditions; therefore examining whether the there was any difference between the two conditions that had been paired together in the second contrast. This set of three contrasts is in line with the rationale for our experimental design, and provides a more powerful and more readily interpretable analysis of our data than an analysis of each of the six possible pairwise comparisons between each assembly experience condition.

Table S1. Studies 1 and 2: Further examination of the effects of assembly experience on valuation and the self-object link (significant contrast effects are shown in bold-face type; positive *t*-values denote that the condition/set named first in the column header has higher mean than the other condition/sets in that comparison).

Study (S)	Orthogonal comparisons between conditions for **owners**			Orthogonal comparisons between conditions or **non-owners**		
Dependent variable	assemble product vs. [all other conditions]	[watch assembly, assemble other product] vs. control	watch assembly vs. assemble other product	assemble product vs. [all other conditions]	[watch assembly, assemble other product] vs. control	watch assembly vs. assemble other product
S1 *Valuation*	***t*(80) = 2.81, *p* = .006**	***t*(80) = 2.36, *p* = .021**	*t*(80) = -.58, *p* = .561	*t*(80) = 1.26, *p* = .213	*t*(80) = -.99, *p* = .321	*t*(80) = .31, *p* = .761
S1 *Feelings of ownership*	***t*(80) = 2.88, *p* = .005**	***t*(80) = 2.64, *p* = .010**	*t*(80) = -.52, *p* = .608	*t*(80) = 1.37, *p* = .175	*t*(80) = -1.32, *p* = .190	*t*(80) = -1.03, *p* = .307
S1 *Attractiveness*	***t*(80) = 2.12, *p* = .005**	*t*(80) = 1.66, *p* = .101	*t*(80) = -.14, *p* = .891	*t*(80) = -1.28, *p* = .204	*t*(80) = -.87, *p* = .389	*t*(80) = .61, *p* = .497
S2 *Valuation*	*t*(81) = 1.72, *p* = .089	*t*(81) = 1.42, *p* = .160	*t*(81) = -.72, *p* = .471	*t*(85) = -.96, *p* = .341	*t*(85) = 1.16, *p* = .250	*t*(85) = .81, *p* = .423
S2 *Feelings of ownership*	***t*(81) = 2.90, *p* = .005**	***t*(81) = 2.39, *p* = .019**	***t*(81) = -2.17, *p* = .033**	*t*(85) = 1.27, *p* = .208	*t*(85) = -1.31, *p* = .194	*t*(85) = .22, *p* = .830
S2 *Self-object link*	***t*(81) = 3.02, *p* = .003**	***t*(81) = 2.41, *p* = .018**	*t*(81) = -1.92, *p* = .059	*t*(85) = -.38, *p* = .709	*t*(85) = .40, *p* = .691	*t*(85) = -.20, *p* = .845

Viewing Table S1 in the round (i.e. from a 'meta-analytic standpoint') the essential summary of the effect of assembly experience is as follows. We always failed to detect significant effects of assembly experience among non-owners. In contrast, among owners, we almost always detected significant effects of assembly experience; with larger (and more consistent) differences between conditions as participants' 'involvement' in the act of assembly increased (relative to the control condition). Thus, owners' evaluations of, and measures of their connection to, their product

were consistently higher in the assemble product condition than in the other conditions (first contrast). These evaluations and measures of connection were sometimes higher among owners in the watch assembly and assemble other product conditions when compared against those for the control condition (second contrast). However, only once did we detect a significant difference in these evaluations or ratings between those who simply watched a video of the assembly and those who assembled a similar product (third contrast).

Table S2. Descriptive statistics (means and standard deviations) of measures of feelings of ownership, self-object link, PANAS (negative), PANAS (positive), attractiveness, construction enjoyment, and emotional attachment.

Assembly experience	Feelings of ownership	
	Owner	Non owner
Control	2.26 (.99)	1.66 (.72)
Create product	2.90 (1.00)	2.30 (1.00)
	Self-object link	
Control	24.14 (18.65)	19.97 (17.90)
Create product	36.16 (23.49)	20.99 (16.70)
	PANAS (negative)	
Control	2.94 (5.95)	.40 (4.15)
Create product	3.14 (6.05)	1.94 (4.03)
	PANAS (positive)	
Control	.91 (6.40)	2.91 (5.62)
Create product	.23 (6.00)	-.17 (7.76)
	Attractiveness	
Control	3.54 (1.62)	3.34 (1.51)
Create product	3.91 (1.69)	4.14 (1.99)
	Construction enjoyment	
Control	3.80 (.57)	3.56 (.72)

Create product	4.28 (.46)	4.24 (.53)

	Emotional attachment	
Control	3.25 (1.32)	2.75 (1.36)
Create product	3.46 (1.44)	3.34 (1.39)

Note. Positive values indicate higher scores of the measured construct. Higher scores on PANAS (negative) indicate that participants felt less negative at the end of the experiment than at the beginning. For PANAS (positive), higher scores indicate that participants felt more positive at the beginning of the procedure.

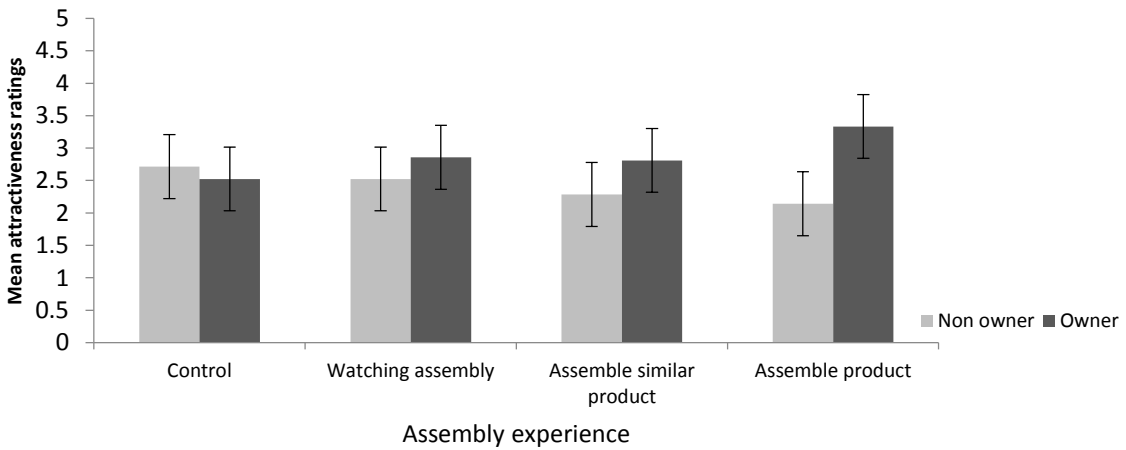


Figure S1. Study 1 Means for attractiveness by assembly experience and ownership conditions with +/- 2 SE shown as error bars

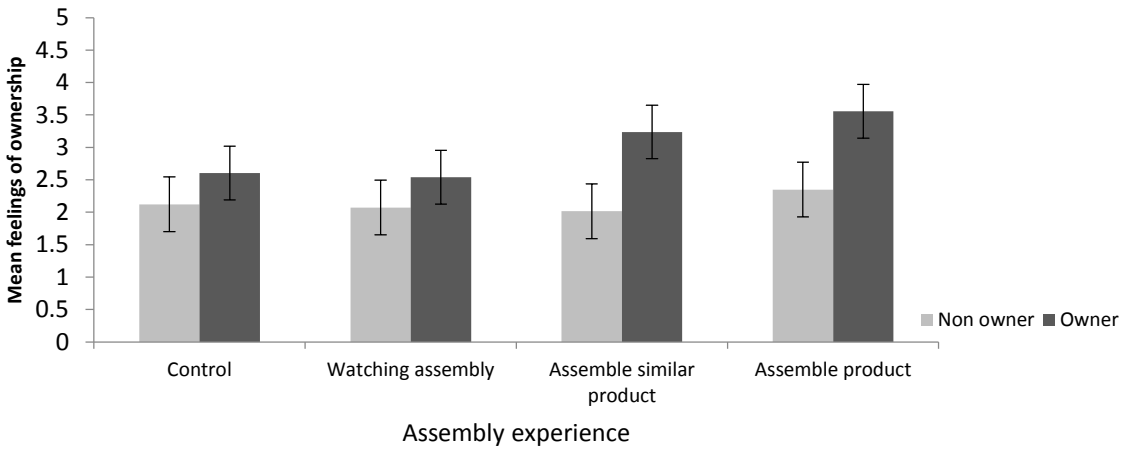


Figure S2. Study 2 Means for feelings of ownership by assembly experience and ownership conditions with +/- 2 SE shown as error bars

Mediation analysis – Study 3

In interpreting our results, we suggest that owners who assemble a product develop stronger self-object association and, in turn, are less willing to part with their possession. In other words, we propose that the psychological state of ownership may mediate the relationship between object valuation and the interaction term of ownership status and assembly experience. We tested such mediation models with both feelings of ownership and the self-object link as potential mediators. Using the PROCESS macro developed by Hayes (2009; model 8), we used the product of ownership status (recoded so that -1 = owner and 1 = non owner) and assembly experience as our independent variable (recoded so that -1 = watching assembly and 1 = assemble product), our two categorical variables (ownership status and assembly experience) as covariates, and the log of product valuation as the dependent variable. We computed the indirect effect with 10,000 bootstrapped samples. In the model where the

strength of the self-object association is our mediator we found no statistically significant indirect effect, with 95% confidence intervals including zero, *95% CIs* [-.005, .092]. We found the same result after replacing our mediator with feelings of ownership (*95% CIs* [-.042, .037]).

References

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs, 76(4)*, 408-420.