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Original Articles

When and how does labour lead to love? The ontogeny and mechanisms of the IKEA effect

Lauren E. Marsh[a,c,*], Patricia Kanngiesser[b], Bruce Hood[a]

[a] School of Experimental Psychology, University of Bristol, Bristol, UK
[b] Faculty of Education and Psychology, Free University Berlin, Berlin, Germany
[c] School of Psychology, University of Nottingham, Nottingham, UK

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ABSTRACT

We elevate our constructions to a special status in our minds. This 'IKEA' effect leads us to believe that our creations are more valuable than items that are identical, but constructed by another. This series of studies utilises a developmental perspective to explore why this bias exists. Study 1 elucidates the ontogeny of the IKEA effect, demonstrating an emerging bias at age 5, corresponding with key developmental milestones in self-concept formation. Study 2 assesses the role of effort, revealing that the IKEA effect is not moderated by the amount of effort invested in the task in 5-to-6-year olds. Finally, Study 3 examines whether feelings of ownership moderate the IKEA effect, finding that ownership alone cannot explain why children value their creations more. Altogether, results from this study series are incompatible with existing theories of the IKEA bias. Instead, we propose a new framework to examine biases in decision making. Perhaps the IKEA effect reflects a link between our creations and our self-concept, emerging at age 5, leading us to value them more positively than others' creations.

1. General introduction

Goods are rarely valued in an objective way: who made an object (Newman & Bloom, 2011), how it was made (Fuchs, Schreier, & Van Osselaer, 2015), or who it was previously owned by (Newman, Diesendruck, & Bloom, 2011) all have a profound influence on an object's perceived value. Consumers also place a higher value on products they constructed themselves compared to identical items they did not construct – a bias termed the 'IKEA effect' (Norton, Mochon, & Ariely, 2012). While this bias seems intuitive in scenarios where customisation of a product is key (e.g., arts and crafts), it also extends to utilitarian goods with no creative customisation, such as kit-furniture (Norton et al., 2012, Exp 1a). Furthermore, consumers continue to value their own, poorly crafted creations over those which have been well crafted by an expert (Norton et al., 2012, Exp 1b). The IKEA effect generalizes to many different creation scenarios, such as food production (Dohle, Rall, & Siegrist, 2014; Troye & Supphellen, 2012) and online customisation of products (Franke, Schreier, & Kaiser, 2010).

Why might such a bias exist? While the IKEA effect is well documented, different explanations have been suggested for the mechanisms underlying this effect. The main accounts include: (1) signal of competence, (2) effort justification, and (3) mere ownership. On the signalling account, participants value their creations because they signal competence, akin to a trophy (Bühren & Pleßner, 2013; Mochon, Norton, & Ariely, 2012). Mochon et al. (2012) demonstrated that feelings of competence mediated participants' willingness to pay for an object that they constructed. On the effort justification account, rather than signalling competence, creations reflect investment of effort (Aronson & Mills, 1959; Norton et al., 2012). A reward for a task is valued more highly when the task required a considerable amount of effort, but valuation is reduced when the task required low effort (Aronson & Mills, 1959). Thus, the increased value of a creation may be reflective of the effort invested. On the mere ownership account, creating an object leads to ownership claims (Kanngiesser, Gjersoe, & Hood, 2010; Kanngiesser & Hood, 2014), and enhances the creators' subjective feelings of ownership for that object (Walasek, Rakow, & Matthews, 2015). A consequence of enhanced ownership is increased valuation. Adults tend to value their own possessions more than equivalent, but unowned items (Kahneman, Knetsch, & Thaler, 1990; Thaler, 1980), possibly due to feelings of psychological ownership (Morewedge & Giblin, 2015). Therefore, a boost in feelings of ownership could drive increased valuations of self-made objects. There is limited evidence for each of these accounts therefore we aim to directly test them, employing a developmental perspective.

* Corresponding author at: School of Psychology, University of Nottingham, Nottingham NG7 2RD, UK.
E-mail address: lauren.marsh@nottingham.ac.uk (L.E. Marsh).

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Here we set out to examine the age at which children start to show an IKEA effect, and probe the different mechanistic accounts at the earliest point in development. We elected to study children aged between 3 and 6 years as previous studies show clear evidence of effort justification at age 6, but not age 4 (Benozio & Diesendruck, 2015) and ownership effects on item valuation in children aged 5 and up (Harbaugh, Krause, & Vesterlund, 2001), but not at younger ages (Hood, Weltzien, Marsh, & Kanngiesser, 2016). Thus, both effort and ownership accounts predict IKEA effects in children aged 5-to-6, but not 3-to-4-years. No previous study has directly examined the developmental trajectory of this bias, although preliminary evidence on children's consumption of self-prepared vegetables suggests that they are in place by age 6 (Van der Horst, Ferrage, & Rytz, 2014), but not younger (Raghoebar, van Kleef, & de Vet, 2017).

In Study 1, we investigate the ontogeny of the IKEA effect to establish the developmental trajectory of the bias. In Study 2 we examine the effort justification account, and finally in Study 3, we examine the mere ownership account of the IKEA effect.

2. Study 1a

In Study 1 we examined whether creating an object influences children's value judgements in a similar way to adults – that is do they value their own creations more than identical copies? When does this bias emerge? Three-to-six-year old children were first asked to indicate the relative worth of a number of items on a smiley scale before creating their own version of one of these items. Following creation, children then evaluated their creation, and the original (identical) item. We examined whether children showed evidence of an IKEA effect, attributing increased value to their creation compared to the identical item. We predicted that children would start to show an IKEA effect from age 5.

2.1. Method

2.1.1. Participants

Thirty-two 3-to-4-year old (16 female, M_{age} = 48.5 months, range = 37–58 months) and 32 5-to-6-year old (18 female, M_{age} = 72.2 months, range = 61–83 months) children took part in Study 1a. An additional ten 3-to-4-year olds and three 5-to-6-year olds were tested but excluded from analysis due to failing the experimental control questions (n = 10) or experimenter error (n = 3). All children were tested in a quiet classroom at a local science museum with their parent/guardian present. The study was approved by the University of Bristol ethics committee and all parents gave written, informed consent prior to the start of the study. This sample size was based on similar studies within our lab (Hood et al., 2016). A post hoc power analysis revealed we had 99% power to detect an effect. Data collection continued until 32 complete datasets were collected for each age group.

2.1.2. Materials

Smiley-scale: Following Hood et al. (2016), a five-point smiley-scale consisting of five card faces attached to a board by Velcro ranging in valence from 'very happy' to 'very unhappy' was used to measure relative worth throughout the study. See Fig. 1 for materials and method used in Study 1a.

Object Sets: Three sets of four objects were used for the relative worth task. Each set contained a piece of rubbish (scrap of paper, card, or plastic), a control toy (a small plastic figure), a foam monster (see below), and a highly desirable toy (small plush teddy). One set was used by the experimenter to demonstrate appropriate use of the smiley-scale and the other two were used by the child to assess their baseline preferences of objects prior to the build and hold tasks, respectively.

Monsters: Two identical foam monster kits were used in each of the build and hold tasks. Each monster kit consisted of a coloured foam body shape upon which five additional foam pieces and googly eyes could be stuck for decoration. In the build task, one of the monster kits was pre-constructed by the experimenter and the other was given to the child to complete. In the hold task, both monster kits were pre-constructed by the experimenter. As children completed both the build task and the hold task, different coloured monsters were used for each task, counterbalanced across participants.

2.1.3. Procedure

An overview of the procedure can be found in Fig. 1 and full testing scripts in Supplementary Information. Children were familiarised with the smiley-scale and shown that they could use the faces to indicate relative liking of objects. Following a demonstration of one object set by the experimenter, children were then asked to value a second object set. The position of the control toy and the foam monster constituted the baseline ratings for the difference scores.

Children then experienced two interaction tasks (build or hold) in a counterbalanced order (within-subject design). In the build task, children were shown the monster that they had just rated and were told that they could now make another monster just like it. The experimenter then gave the child the body of the monster and handed them the additional pieces to stick on individually. Children were encouraged to build the monster so it looked the same as the example. In the hold task, children were shown a snakes and ladders board. The experimenter explained that the child should use a second monster (identical to the one they had previously rated) as the counter, rolling the die to move the monster to the 'den' at the top of the board. Throughout both tasks, the experimenter took care to avoid the use of ownership labels for the monsters so that children were not led to believe that they would be able to keep the monster.

Following each interaction task, children were asked to rate how much they liked the monster they had just interacted with (interaction monster), the control object, and the monster they had rated at baseline (identical monster) on the smiley-scale. The control object was always rated second, between the two monster ratings so that the child was never asked to rate two identical monsters sequentially. The order of rating the monsters (interaction, identical) was counterbalanced.

The experimenter then repeated the entire procedure for the second interaction task. The child completed object rankings for set 3, the second interaction task, and finally, the post-interaction ratings.

The full experimental procedure was video-recorded and took approximately 10 min per child. Only after the end of the experiment were children told that they could take home the monster that they created. This was done to avoid inducing increased valuation of objects due to explicit ownership labels (endowment effects, see Hood et al., 2016).

2.1.4. Data coding and preliminary analysis

Object position on the smiley-scale was coded numerically from 1 to 5, with the least happy face scoring 1 and the most happy face scoring 5. Difference scores were calculated for the interaction monster (the monster which was built or held) and the identical monster (used in the baseline ratings). These scores were calculated by subtracting the baseline rating of the monster (prior to the interaction task) from the post-interaction ratings of each monster such that a positive score indicates an increase in valuation over the course of the experiment. We elected to analyse difference scores, rather than raw scores as these are adjusted to account for individual differences in baseline preference for the objects. An analysis of raw scores yielded comparable results to the analysis of difference scores (descriptive statistics and analyses of raw scores are reported in Supplementary Information). Difference scores were analysed using a 2 (task: build, hold) by 2 (object: interaction, identical) mixed ANOVA with age group (3-to-4-years, 5-to-6-years) and gender entered as between subjects factors.

To check that children could be consistent in their use of the scale, and to rule out the possibility that any other aspects of the procedure influenced evaluations, a difference score was also calculated for the control object (baseline ratings of the control object, prior to the

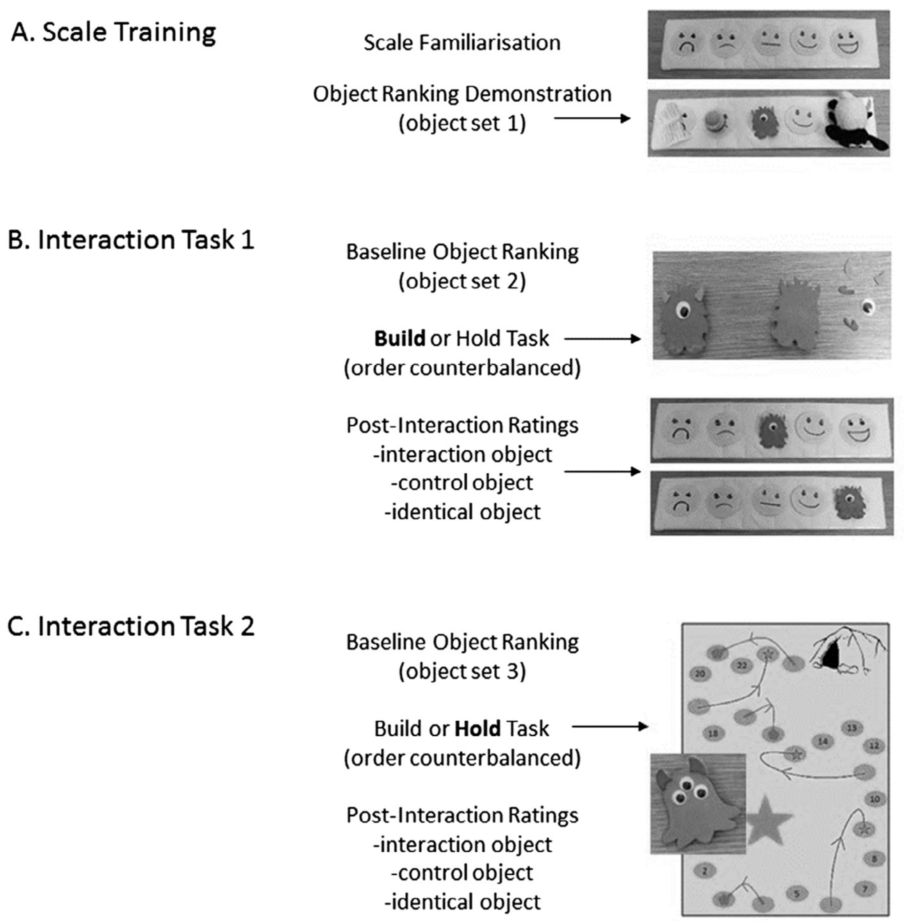

Fig. 1. Materials used in Studies 1a and 1b. Panel A: The smiley scale used for object valuations and the positions used by the experimenter to demonstrate rankings of object set 1. Panel B: Materials used for the build task and the post-interaction ratings. Panel C: Materials used for the hold task.

interaction task minus post-interaction ratings of the control object) and analysed in a separate model. We used a separate model for this analysis because the control object was a different object to the identical monsters, therefore the reasons why the control object might change in value over the course of the experiment (inter-subject variability, mood, etc.) are different from the reasons why the value of the monsters may differ (physical interaction, creation).

The amount of time spent on the build and hold tasks was recorded by the experimenter using a stopwatch and attempts were made to match this within-subject. However, the amount of time spent on the hold task was significantly longer than the build task (M_{build} = 87.0s, M_{hold} = 102.6s, $t(63) = 3.99$, $p < .001$, $d = 0.70$). In order to control for variation in interaction time between the build and hold conditions, the difference in interaction time between conditions was entered as a covariate in all reported analyses.

There were no effects of task order ($F(1,32) < 0.01$, $p = .994$, $\eta_p^2 < 0.01$), valuation order ($F(1,32) = 1.45$, $p = .235$, $\eta_p^2 = 0.03$), or which monster was used ($F(3,32) = 0.60$, $p = .617$, $\eta_p^2 = 0.04$) on difference scores so these variables are collapsed across all analyses and will not be considered further.

2.2. Results

A main effect of task ($F(1,59) = 8.13$, $p = .006$, $\eta_p^2 = 0.12$), in which difference scores increased for both monsters (i.e. the interaction monster and the identical monster) following the build task (M = 0.58, 95% CI = [0.34, 0.81]) more than the hold task (M = 0.12, 95% CI = [−0.12, 0.37]) was found. A significant main effect of object ($F(1,59) = 14.01$, $p < .001$, $\eta_p^2 = 0.19$) also indicated that there was a general effect of physical interaction: difference scores were higher for monsters that children interacted with (M = 0.53, 95% CI = [0.35, 0.72]) than for the identical monsters that they had no interaction with (M = 0.17, 95% CI = [−0.06, 0.39]). Importantly, in evidence of an IKEA effect, a significant interaction between task, object and age group on difference scores was found ($F(1,59) = 5.94$, $p = .018$, $\eta_p^2 = 0.09$). To examine developmental changes, we broke down this interaction by analysing data from each age group separately. There was a significant interaction between task and object in the 5-to-6-year olds ($F(1,29) = 5.28$, $p = .029$, $\eta_p^2 = 0.15$). Specifically, 5-to-6-year olds increased the value of the monster that they built (M = 0.82, 95% CI = [0.53, 1.11]) more than the identical monster that they did not build (M = 0.36, 95% CI = [0.09, 0.64], $t(31) = 2.35$, $p = .025$, $d = 0.49$, Bonferroni corrected), providing clear evidence of an enhancement in value for self-made items in this age group. Furthermore, for 5-to-6-year olds, difference scores did not differ significantly between the monster that they held (M = 0.28, 95% CI = [0.02, 0.53]) and the identical monster (M = 0.21, 95% CI = [-0.10, 0.52], $t(31) = 0.81$, $p = .423$, $d = 0.08$), ruling out the possibility that mere physical interaction with an object increases its value. In contrast, in 3-to-4-year olds the interaction between task and object was not significant ($F(1,29) = 2.72$, $p = .110$, $\eta_p^2 = 0.09$), indicating that 3-to-4-year olds' difference scores did not differ significantly between the monster that they built (M = 0.63, 95% CI = [0.13, 1.12]) and the identical monster (M = 0.50, 95% CI = [0.00, 1.00]), and between the monster that they held (M = 0.41, 95% CI = [−0.05, 0.86]) and the identical monster (M = −0.41, 95% CI = [−0.98, 0.17]). There were no significant main effects of age group ($F(1,59) = 0.91$, $p = .345$, $\eta_p^2 = 0.02$), gender ($F(1,59) = 0.01$, $p = .922$, $\eta_p^2 < 0.01$) or difference in time spent on the interaction task ($F(1,59) = 1.45$, $p = .233$, $\eta_p^2 = 0.02$) on difference scores. The interactions between these variables were all non-significant. Difference scores are reported in Fig. 2.

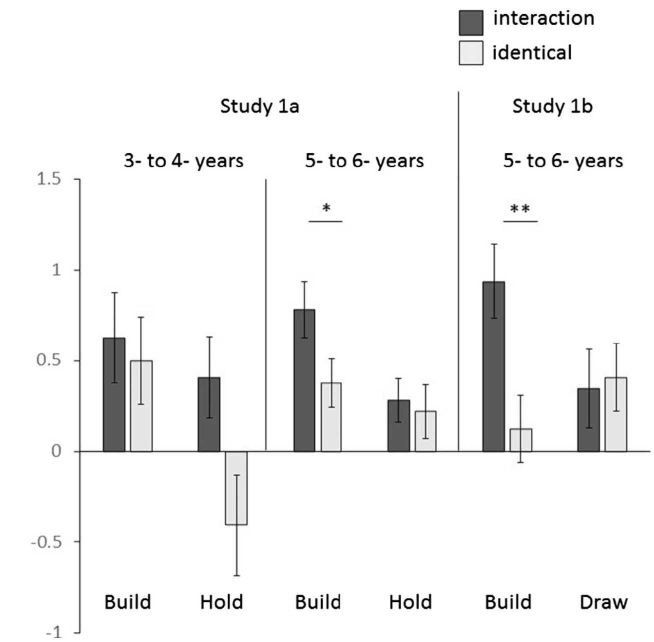

Fig. 2. Difference scores for the interaction monster (dark bars) and the identical monster (light bars) as a function of interaction type and age group. *p < .05, **p < .001, error bars represent ± 1 S.E.M.

To ensure that children made consistent value judgements, and that the interaction tasks did not change the valuation of objects more generally, difference scores for the control object were analysed. This did not differ significantly between age groups ($F(1,60) = 0.11$, $p = .741$, $\eta_p^2 < 0.01$), task ($F(1,60) = 0.11$, $p = .744$, $\eta_p^2 < 0.01$), or gender ($F(1,60) = 1.01$, $p = .319$, $\eta_p^2 = 0.02$) and no interactions between these variables were significant.

Study 1a demonstrated an IKEA effect in 5-to-6-year old children but not in 3-to-4-year olds. Children in the older age group valued the object they built more highly than an identical object that they did not build. Furthermore, as this difference in value was not found in the hold condition, we also demonstrated that the IKEA effect cannot be attributable to physical manipulation or general positive interaction with an object.

3. Study 1b

It is possible that 5-to-6-year olds over-valued their creation because they focused more attention on the object while building it as compared to holding it. To control for effects of perceptual attention, we examined a second group of 5-to-6-year old children using a drawing task as a control condition. In this task, children completed a picture of a monster and then evaluated the monster that they drew (not their drawing). Children also completed a build task, identical to Study 1a.

3.1. Method

3.1.1. Participants

Thirty-two 5-to-6-year old (21 female, $M_{age} = 70.50$ months, range = 60–82 months) children took part in Study 1b. As with Study 1a, all children participated at a local science museum in the presence of their parent or guardian, who gave written, informed consent.

3.1.2. Procedure

The procedure was identical to Study 1a with the exception of the control task. Instead of the hold task, all children participated in a drawing task where they drew a picture of the monster they would later value. For this task, the experimenter produced a second monster, identical to the one that had just been evaluated, and a half-finished picture of the monster. The picture consisted of a coloured outline of the monsters' body with the decorations missing. Children were asked to examine the monster and draw on the decorations that would have been stuck on in the build condition. After completing the drawing, children were then asked to evaluate the monster that they drew a picture of (not their picture), the control toy, and the identical monster which they previously rated at baseline. The build condition was a direct replication of Study 1a.

3.1.3. Data Coding and preliminary analyses

Data were coded as per Study 1a. In this study, there was no significant difference in the amount of time spent on the building and drawing tasks ($M_{build} = 84.3s$, $M_{draw} = 76.6s$, $t(31) = 1.17$, $p = .251$, $d = 0.32$) so this variable is not entered as a covariate in the analysis. There were no significant effects of task order ($F(1,16) = 0.33$, $p = .574$, $\eta_p^2 = 0.02$), valuation order ($F(1,16) = 0.07$, $p = .800$, $\eta_p^2 < 0.01$), or which monster was used ($F(3,16) = 0.57$, $p = .642$, $\eta_p^2 = 0.10$) on difference scores so these variables were collapsed across all analyses and will not be considered further.

3.2. Results

Difference scores as a function of age group and condition are illustrated in Fig. 2. As in Study 1a, we found a main effect of object: value increased significantly for the interaction monsters (M = 0.66, 95% CI = [0.13, 0.68]), compared to the identical monsters (M = 0.26, 95% CI = [−0.06, 0.57], $F(1,30) = 9.31$, $p = .005$, $\eta_p^2 = 0.24$)). However, in this study, children did not show a general task effect as there was no increase in value for objects following the building task compared to the drawing task ($F(1,30) = 0.04$, $p = .836$, $\eta_p^2 < 0.01$).

In evidence of an IKEA effect, a significant task by object interaction ($F(1,30) = 11.47$, $p = .002$, $\eta_p^2 = 0.28$) in which difference scores increased significantly for the built monster (M = 0.94, 95% CI = [0.53, 1.35]), compared to the identical monster (M = 0.13, 95% CI = [-0.25, 0.50], $t(31) = 4.00$, $p < .001$, $d = 0.75$, Bonferroni corrected) was found. No significant increase was found when comparing valuations for the monster that children completed a picture of (M = 0.34, 95% CI = [−0.09, 0.78]) and the identical monster (M = 0.41, 95% CI = [0.03, 0.78], $t(31) = 0.49$, $p = .625$, $d = 0.06$). Difference scores were significantly greater for the built monster compared to the drawn monster ($t(31) = 2.18$, $p = .037$, $d = 0.51$, Bonferroni corrected), indicating that attention alone cannot explain this increase in value following building. This pattern shows a robust replication of the IKEA effect in 5-to-6-year olds. There was no significant main effect of gender on object valuation difference ($F(1,30) = 0.02$, $p = .901$, $\eta_p^2 < 0.01$).

Difference scores of the control object did not vary significantly with task ($F(1,30) = 0.29$, $p = .592$, $\eta_p^2 = 0.01$) or gender ($F(1,30) = 0.88$, $p = .355$, $\eta_p^2 = 0.03$).

Together, findings from Study 1a and 1b indicated that from age 5, children show increased valuation of their own creations, even when compared to identical copies. This IKEA effect was robust to replication and not attributable to positive physical interaction with the created object. The magnitude of the effect was not determined by the amount of time spent making it, and was not driven by increased attention to the created object.

4. Study 2

Having established the ontogeny of the IKEA effect, we then investigate the mechanisms underlying it. Specifically, Study 2 assesses whether the IKEA effect can be attributed to effort justification (Aronson & Mills, 1959; Benozio & Diesendruck, 2015; Festinger, 1957). Effort justification refers to the bias to over-value a reward that has been given in recompense for completing an effortful task

(Aronson & Mills, 1959). If effort justification is the mechanism through which the IKEA effect operates, then children who invest high effort in the task (i.e. building a whole monster), will show a larger IKEA effect than those investing low effort (i.e. finishing a half-completed monster). Crucially for effort justification theory, children will also extend this pattern of valuation to situations in which they are evaluating objects which act as referents for their effort (i.e. a reward received for their effort). This reward condition provides an additional test of effort justification because it dissociates the value of invested effort from the value of the product that has been created.

4.1. Method

4.1.1. Participants

128 5-to-6-year old children (65 female, $M_{age} = 71.7$ months, range = 60–83 months) took part in Study 2. As with Study 1, all children participated at a local science museum in the presence of their parent or guardian, who gave written, informed consent. Ten additional children were tested but excluded from analysis due to failing control questions.

4.1.2. Design

A 2 × 2 between subjects design was employed to evaluate the relative effects of effort (high vs low) and means of acquisition (build vs reward) on value judgements. In high effort conditions, children were given all the pieces to build a complete monster (10 pieces to attach) whereas in low effort conditions, children were given a half completed monster and given 5 pieces to attach. Means of acquisition was also manipulated between subjects; children either evaluated the monster that they built themselves, or they evaluated a different monster which had been given to them as a reward for their effort.

4.1.3. Procedure

As children in this study were all 5-to-6-years old, we opted to use a more sophisticated, monetary-like system to elicit relative worth valuations (similar to that used by Hood & Bloom, 2008). Children were given ten gold coins and asked to distribute these coins between pairs of objects to indicate their relative worth. This has two advantages over the method used in Study 1. Firstly, it yields a more varied response profile (0–10, as opposed to 1–5 previously) and second, using coins links the valuations directly to object worth, rather than liking. It also allows us to test the validity of the IKEA effect using a different value-elicitation method. The full script used to explain the shopping task is included in Supplementary Information. Children who allocated appropriate distributions for high and low desirable toys, and demonstrated equivalence for identical toys were deemed to be consistent shoppers. Inconsistent shoppers were excluded from analysis (n = 10). Baseline valuations for a foam monster (identical to the one to be constructed in the build condition / given to the child in the reward condition) and the control object (as in Study 1) were then elicited by pairing them with a reference object in a counterbalanced order (see Fig. 3).

Children were randomly assigned to one of the four building conditions. In each condition, children were given the pieces to make the monster with the instruction "I have all the pieces so that you can make a monster just like this one." In the high effort conditions, the pieces were all detached whereas in the low effort conditions, half of the pieces were already completed. In the build conditions, children were then told "When it is finished you can keep it and take it home with you", whereas in the reward condition, children were told "When it is finished I am going to give you a reward for making it". Once complete, this instruction was re-emphasised, and in the reward condition, the child's creation was taken away and they were given a different monster as a reward to keep and take home. In all conditions in this study, ownership was equated as children were explicitly told they could keep their monster and take it home with them.

Following the build task, children were asked to make relative worth judgments for three items, paired with the reference object; the child's own monster, the control toy, and the identical monster. Valuation order for the two monsters was counterbalanced but the control object was always valued between the two monsters so that children never valued identical items sequentially. The reference object was the same for the baseline valuations and all three post-build valuations. Finally, the child was asked to line up their monster next to the identical monster and asked which one they liked best.

4.1.4. Data coding

The analysis protocol used in Study 2 was pre-registered with the open science framework and can be found here: https://osf.io/pbmvr/register/565fb3678c5e4a66b5582f67. A difference score was calculated for the child's own monster, the identical monster, and the control toy by subtracting the number of coins allocated to the item at baseline from the number of coins allocated to the item following the build task. This score could range from −10 to +10, with positive numbers indicating an increased valuation over the course of the experiment and 0 indicating no change. Difference scores for the monsters were then analysed using a two (acquisition: build, reward) by two (effort: low, high) by two (object: own, identical) mixed ANCOVA with gender entered as a between subjects factor and age in months entered as a covariate.

To assess for any changes in value judgements across the experiment that are unrelated to the IKEA effect, the difference score for the control toy was analysed in a separate univariate ANCOVA with acquisition (build, reward), effort (low, high), and gender entered as between-subjects factors and age in months entered as a covariate.

4.2. Results

Mean difference scores, as a function of effort and acquisition, are presented in Fig. 4. Children increased the value of their own monster (M = 1.09, 95% CI = [0.65, 1.52]) over the course of the experiment more than they increased the value of the identical monster (M = −0.03, 95% CI = [−0.39, 0.32], $F(1,119) = 25.55$, $p < .001$, $\eta_p^2 = 0.18$). This indicates that children displayed an ownership bias, across all conditions of the experiment. Additionally, there was a non-significant trend towards an effect of acquisition ($F(1,119) = 3.12$, $p = .080$, $\eta_p^2 = 0.03$) in which children increased their valuation of the monsters more when they were evaluating a monster that they built (M = 0.82, 95% CI = [0.40, 1.24]), compared to a monster that they were given as a reward (M = 0.23, 95% CI = [−0.15, 0.62]), regardless of whether they were evaluating their own monster or the identical one. However, there was no effect of the amount of effort they invested in the build task on value-change (high: M = 0.30, 95% CI = [−0.05, 0.64], low: M = 0.76, 95% CI = [0.30, 1.21], $F(1,119) = 1.88$, $p = .173$, $\eta_p^2 = 0.016$). All other effects and interactions were non-significant. This indicates that the amount of effort invested in a task is not reflected by increased valuation.

Difference scores for the control toy did not change as a function of effort ($F(1,119) = 0.11$, $p = .746$, $\eta_p^2 = 0.001$), acquisition ($F(1,119) = 0.54$, $p = .464$, $\eta_p^2 = 0.005$), gender ($F(1,119) = 0.04$, $p = .848$, $\eta_p^2 < 0.001$), or age ($F(1,119) < 0.01$, $p = .999$, $\eta_p^2 < 0.001$). This indicates that general valuations of objects did not change systematically over the course of the experiment.

The majority (80%) of children selected their own monster when asked which they liked best. This did not vary as a function of effort ($\chi^2 = 0.416$, $df = 2$, $p = .812$) or means of acquisition ($\chi^2 = 0.377$, $df = 2$, $p = .828$).

Study 2 demonstrated that 5-to-6-year olds valued their own items more than identical items, regardless of the amount of effort needed to attain them. Additionally, there was a trending, but non-significant effect of acquisition in which children had a tendency to increase the

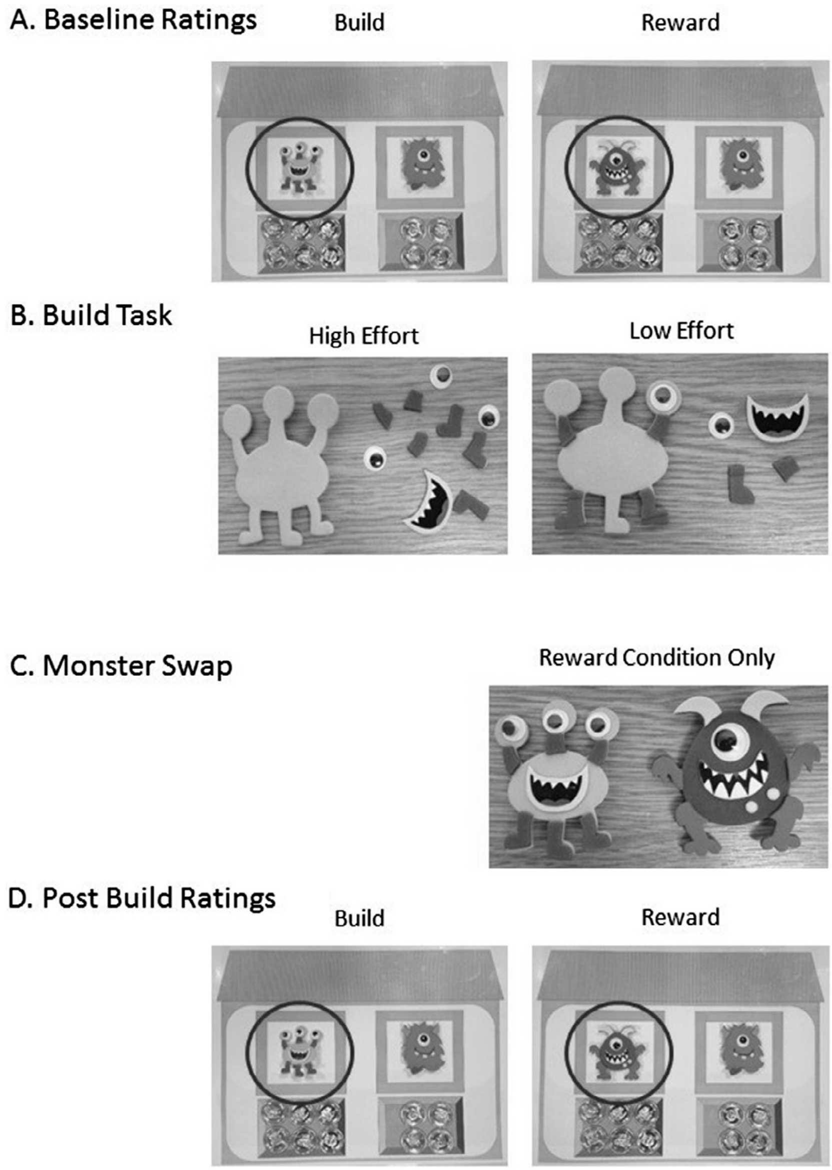

Fig. 3. Materials and procedure used in Study 2. Prior to baseline ratings, participants were trained to allocate more coins to the item that they thought was more valuable. Panel A: The shop materials used in the baseline ratings of the monster. The circle indicates the item used in the build or reward task. The monster not circled was the reference object, used for comparison at baseline and post build. Panel B: Materials used in high and low effort conditions. Panel C: After building, children in the reward condition swapped the monster they made for a different monster, given to them as reward. Panel D: Children re-evaluated their monster (circled), a control toy (not pictured), and an identical monster (circled in Panel A).

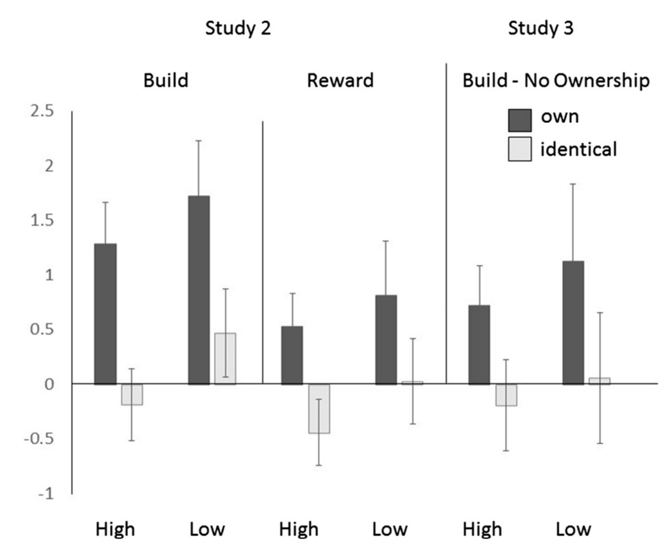

Fig. 4. Difference scores for children's own (dark bars) and identical (light bars) monsters as a function of effort and means of acquisition in Study 2 and 3. Error bars represent ± 1 S.E.M.

value of the built items more than the reward items. Together these findings indicate that effort alone does not drive the IKEA effect, as predicted by the effort justification hypothesis. Instead it seems that valuing the actual built object is necessary to drive the effect. We additionally report no moderation of the IKEA effect by the amount of effort needed to complete the monster. Children in high effort conditions increased the value of their creations to the same degree as children in low effort conditions. This lack of difference provides further support that effort justification does not account for the IKEA effect as children do not seem to consider their invested effort when making value judgements. It is possible that children were not sensitive to the high and low effort condition because this was a between-subjects manipulation, although we believe this is unlikely as children frequently asked why their monster had already been started in the low effort condition, indicating that they were sensitive to the experimental manipulation.

5. Study 3

Next, we tested whether the IKEA effect is due to a mere ownership effect. Although ownership labels were never explicitly used in Study 1, the investment of labour is perceived as a signal of ownership from a young age (Kanngiesser et al., 2010) and children in Study 1 may have assumed ownership over their creation without it being explicitly stated. In Study 2, ownership was equated across all conditions as children were told that they could keep the item they evaluated. Consequently, children valued their own items more than identical items in all conditions. Perhaps this increase in value can be attributed to a mere ownership effect. In Study 3, we explicitly told children that they cannot keep the items they made. If the IKEA effect is driven by mere ownership effects, children will only increase the value of their creations more than an identical item if they think they can keep it. However, if the IKEA effect is an independent bias, then children will continue to over-value their creations, even if they cannot keep them. In Study 3 we also included a comparison of high and low effort conditions to be consistent with Study 2.

5.1. Method

5.1.1. Participants

Sixty-four 5-to-6-year old children (41 female, $M_{age} = 70.1$ months, range = 60–83 months) took part in Study 3. All children participated at a local science museum in the presence of their parent or guardian, who gave written, informed consent. Eight additional children were tested but excluded from analysis due to failing control questions.

5.1.2. Procedure

The procedure was identical to the valuation and build conditions in Study 2 with the exception of the instruction prior to the build task. This time, children were explicitly told that they could not keep the monster. The experimenter gestured to a picture on the wall, with multiple monsters stuck to it, saying "When it is finished, you can put it on the wall with all the other children's monsters". As with Study 2, children either completed the whole monster (high effort) or the last half of a monster (low effort) before re-evaluating the monster they made, the control toy, and the identical monster.

5.1.3. Data Coding

Data were coded as per Study 2 and analysed using a two (effort: high, low) by two (object: own, identical) ANCOVA, with gender entered as a between subjects variable and age in months entered as a covariate.

5.2. Results

Children increased the value of monster they created ($M = 0.92$, 95% CI = [0.13, 1.71]) over the course of the experiment, significantly more than they increased the value of the identical monster ($M = -0.06$, 95% CI = [-0.07, 0.66], $F(1,59) = 7.57$, $p = .008$, $\eta_p^2 = 0.11$) indicating the presence of an IKEA effect (see Fig. 4). As with Study 2, there was no effect of the amount of effort needed to complete the monster on value change scores ($F(1,59) = 0.15$, $p = .699$, $\eta_p^2 < 0.01$), with children increasing the value of their monsters equally in both high and low effort conditions (high effort: $M = 0.27$, 95% CI = [-0.30, 0.83], low effort: $M = 0.59$, 95% CI = [-0.33, 1.52]). There were no other significant effects or interactions (all F's < 2.54, all p's > 0.116).

The control object did not change in value as a function of effort ($F(1,59) = 0.41$, $p = .526$, $\eta_p^2 < 0.01$), gender ($F(1,59) = 0.02$, $p = .880$, $\eta_p^2 < 0.01$), or age ($F(1,59) = 0.19$, $p = .667$, $\eta_p^2 < 0.01$). The majority (83%) of children selected the monster they created when asked which they liked best. This did not vary as a function of effort ($\chi^2 = 0.416$, $df = 1$, $p = .519$).

To directly examine whether removing explicit ownership labels attenuated the IKEA effect, a cross-experiment analysis was conducted to compare the IKEA effect when ownership was explicitly stated (build condition, Study 2) and when it was explicitly removed (Study 3). A mixed 2 (object: own, identical) by 2 (effort: high, low) by two (ownership: stated, removed) ANCOVA was conducted on the value-change scores, with gender entered as between subjects factor and age entered as a covariate. A main effect of object ($F(1,119) = 21.09$, $p < .001$, $\eta_p^2 = 0.15$), in which self-built monsters were valued more highly than the identical monsters, indicated the presence of an IKEA effect. There was no effect of ownership ($F(1,119) = 1.45$, $p = .231$, $\eta_p^2 = 0.01$) and no interaction between ownership and object ($F(1,119) = 0.87$, $p = .353$, $\eta_p^2 = 0.01$), suggesting that removing ownership labels does not moderate the IKEA effect. All other effects and interactions were non-significant (all F's < 1.26, all p's > 0.265). Therefore, Study 3 demonstrates that the IKEA effect is still present when children are told that they cannot keep their creation, thus ruling out mere ownership effects as a potential driver of the bias.

6. General discussion

Across three studies we demonstrate that 5-to-6-year olds value their own creation, preferring items that they have made to other, identical items which have been constructed by someone else. This is akin to an adult IKEA effect (Bühren & Pleßner, 2013; Mochon et al., 2012; Norton et al., 2012; Walasek et al., 2015). The increased valuation appears directly attributable to the building process: 5-to-6-year olds valued their built object more than an object they simply interacted with or drew a picture of (Study 1). Within this study, we also demonstrate that increased valuation of own creations only emerges in the developmental period between 4 and 5 years. This is the same developmental period in which effort justification (Benozio & Diesendruck, 2015) and endowment effects (Hood et al., 2016) emerge.

With respect to the mechanisms underlying the IKEA effect, Study 2 provides two strands of evidence that question an effort justification account. First, the amount of effort required to build the object was not reflected in valuations of the child's creation. It is possible that children were insensitive to the effort manipulation between subjects. Alternatively, as the effort invested in this task was fun, perhaps they did not equate increased building with increased effort. Second, we demonstrated a trend in which children valued their created monsters (build condition) more than a reward they received for an equally effortful creation (reward condition). This finding provides preliminary evidence that increased valuation seems to be directly linked to the product of the effort and does not readily extend to a reward item which acts as a referent for effort. Thus, it is unlikely that the IKEA effect can be explained by an effort justification mechanism alone as proposed by Norton et al. (2012). While it is possible that investing effort to create a product is a necessary component of the IKEA effect, it is not the amount of effort or the effort itself which is valued. Instead it seems that there is something special about the created item which makes it more valuable. The importance of evaluating the created object, rather than a reward is mirrored in studies of ownership whereby children are sensitive to the uniqueness of owned objects (Gelman & Davidson, 2016), and consider possessions to be non-fungible, even for exchanges with identical items (McEwan, Pesowski, & Friedman, 2016). Thus, the act of exchanging monsters in the reward conditions could be responsible for the observed reduction in value of rewards.

Mere ownership effects provide an alternative explanation for the IKEA effect: perhaps children over-value all items which they conceive of as theirs. Results from Study 3 provide preliminary evidence against this claim as children still displayed a bias for their created items, compared to identical items, despite the lack of explicit ownership labels. Indeed, there was no moderation of the IKEA effect when comparing conditions in which children were told they could take their creation home (Study 2) and conditions in which children were told that it was to remain in the museum (Study 3). While it is possible that children still experience feelings of ownership for their creation, even when told that they cannot take it home, we argue that denying children the opportunity to keep their object removes access, control and possession of it. These are all core components of ownership and therefore, we would expect this manipulation to moderate the IKEA effect if the bias is truly driven by mere ownership effects. An extension of this work could manipulate whether the builder was the original owner of the materials, although as ownership transfer readily occurs from owners of materials to builders following the investment of labour (Kanngiesser et al., 2010), it is very difficult to disentangle object creation from ownership in a pure manner.

While the current set of studies does not directly test the signalling account of the IKEA effect, results from Study 3 are also inconsistent with this theory. The signalling account (or trophy effect; Bühren and Pleβner, 2013; Mochon et al., 2012) predicts that own creations increase in value because they signal competence to others. If this is the case then the IKEA effect should have been greater when the creation is displayed prominently. In Study 3, when children are told they can put their creation on the wall, rather than keeping it, the IKEA effect remains the same. Thus, a trophy effect is an unlikely mechanism, although a caveat of this conclusion is that Study 3 removes ownership at the same time as introducing a signalling element. It is possible that mere ownership and trophy effects work in combination to produce a similar effect. A confirmatory test of this theory is still needed.

So what can explain the ontogeny of the IKEA effect? It seems that 3-to-4-year olds' evaluation of objects is based on the visual similarity of objects, rather than the object's history, such as who owns it or who created it. This is in contrast to the 5-to-6-year olds in our study for whom object history is influential when evaluating items. However, we do not believe that this is because 3-to-4-year olds in our sample failed to track the creative history of objects. Previous work has shown that children as young as 2-years aptly track object-ownership, being able to name the owners of common items (Fasig, 2000; Friedman, Neary, Defeyter, & Malcolm, 2011; Nancekivell & Friedman, 2014), and stating preferences for items assigned to them (Gelman, Manczak, & Noles, 2012). Furthermore, it has been demonstrated that creative history of an object is salient in this age group: 2-to-3-year olds selectively protest when someone else claims the child's creations as theirs (Kanngiesser & Hood, 2014) and 3-to-4-year olds will transfer ownership of a newly created object to the creator (Kanngiesser et al., 2010).

It seems that no single, previously proposed theory can neatly explain the pattern of results reported in the current set of studies. Of course it is possible that investing effort, perceiving ownership, and feeling competent all contribute in part to the increase in valuation of self-created items. An alternative explanation could be that shifts in self-related processing might be driving the change in self-created object valuation. Perhaps when a product is created, a special link between this item and the creators' self-identity is forged. This link results in the object becoming an extension of the creators' self-identity, which is valued over-and-above an identical item created by someone else (Walasek et al., 2015).

The concept of self-extension into objects is not a new one. Originally outlined in James (1890), and further articulated by Belk (1988), we use our possessions to signal our self-identity. The IKEA effect we observed may be a manifestation of this same self-extension. Like the endowment effect, which leads to increased valuation of possessions, the IKEA effect may also reflect a positive self-image extended to the things that we create (Gawronski, Bodenhausen, & Becker, 2007). Such interpretations are supported by studies that show that individuals with independent self-construal show stronger endowment effects than those with interdependent self-construal. Moreover, manipulating self-construal produces corresponding changes in the endowment effect both in adults (Maddux et al., 2010) and children (Hood et al., 2016). It seems plausible that our creations are also linked with our concept of self-identity in the same way that our possessions are, and thus increase in value in the same way. Preliminary evidence in favour of self-related processing driving the IKEA effect comes from a cross cultural study in which individuals with independent self-construals show a stronger IKEA effect than those with interdependent self-construals (Atakan, Bagozzi, & Yoon, 2014). To date, there is limited evidence with which to evaluate an extended-self account of the IKEA effect, however we posit that this will be a useful framework for extending current enquiries.

To conclude, this series of studies is the first to examine the mechanisms underlying the IKEA effect from a developmental perspective. We clearly elucidate the ontogeny of the IKEA bias, emerging between age 4 and 5 years. We provide evidence that from age 5 our creations are elevated to a special status in our minds, not just because they reflect an investment of time and effort, nor because they signify the privileged access we have over our possessions. Instead, it seems plausible that they become part of who we are, a tangible manifestation of self.

Author contributions

L.M. study design, data collection, analysis and writing first draft of the manuscript

P.K. conception of idea, study design, review and edits of the manuscript

B.H. conception of idea, review and edits of the manuscript

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Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.cognition.2017.10.012.

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