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The influence of collaboration and culture on the IKEA effect: does co-creation alter perceptions of value in British and Indian children?

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Author Note

- All data have been made publicly available at the Open Science Framework and can be accessed at: https://doi.org/10.17605/OSF.IO/KUS8E
- Materials and analysis code for this study are available by emailing the corresponding author.
- This study's design, hypotheses and analysis plan were preregistered; see 10.17605/OSF.IO/T58Z9

Abstract

Creating objects can increase our evaluation of them, even when we compare them to physically identical copies (IKEA effect). Here we evaluate the influence of collaboration on the IKEA effect in two societies – the UK and India. 128 5-to-6-year-old children (48% female, 50% British middle class, 50% Indian middle class) assembled toys in pairs. Half of the children collaborated to assemble a single toy and half assembled their own toy. In both societies, children demonstrated an IKEA effect (η_p^2 = .19), valuing their own creation over an identical copy. This was the case regardless of whether children collaborated or worked independently. In summary, it seems that the IKEA effect is a potent bias that is present in diverse societies and is insensitive to others' contributions in a collaborative environment.

Keywords: IKEA effect, Psychological Ownership, Collaboration, Cross-cultural

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Our valuation of an object is rarely based just on its utilitarian functions. Instead, we are heavily biased by the history we can attach to an object: who made it, who owned it previously, or how we acquired it (Newman & Bloom, 2012; Newman, Diesendruck & Bloom, 2011). The act of creating an object leads the creator to attribute a higher value to that item, compared to a scenario in which they had acquired it by other means. This so called 'IKEA effect' (Norton, Mochon & Ariely, 2012) has been demonstrated in adults from Western and Northern Europe and North America in numerous contexts including customization of design products (Franke, Schreier & Kaiser, 2010), and food production (Dohle, Rall & Siegrist, 2014; Radtke, Liszewska, Horodyska, Boberska, Schenkel, & Luszczynska (2019); Troye & Supphellen, 2012), but also in the construction of utilitarian, non-customizable items (Norton et al, 2012; Mochon, Norton & Ariely, 2012).

Theoretical Accounts of the IKEA Effect

Several researchers have proposed psychological drivers of the IKEA effect. Perhaps the effort we invest in creating something leads us to over-value rewards for our efforts (effort justification account; Norton et al, 2012). Alternatively, the created object may function as a trophy, signalling pride and competence to others (Mochon et al, 2012; Bühren, & Pleßner, 2014; Bühren, & Pleßner, 2020). Recently, developmental work has indicated that neither of these accounts adequately explain the IKEA effect, as evaluations of creations did not differ as a function of the amount of effort invested, or whether the object was prominently displayed to others (Marsh, Kanngiesser & Hood, 2018).

The present study is embedded within a third account which proposes that psychological ownership leads to increased valuation (Walasek, Rakow & Matthews, 2017). North American adults are more likely to attribute ownership to people who have contributed labour to the creation of an object, compared to people who have invested ideas (Burgmer, Forstmann & Stavrova, 2019). Object creation also led British adults to report increased subjective feelings of ownership (Walasek et al, 2017). Similarly, developmental research has shown that British children will transfer ownership rights to the creator of an object (Kanngiesser, Gjersoe & Hood, 2010; Kanngiesser & Hood 2014) and North American children show greater respect for ownership of objects that have been made, compared to objects that have been found (Davoodi, Nelson & Blake, 2018). Thus, it seems that throughout development, creating an object results in strong ownership ties between the creator and the object, in the eyes of both the creator and third parties.

The upshot of increased feelings of ownership is increased valuation. The Endowment Effect is a bias in which adults value items in their possession over identical, unowned items (Kahneman, Knetsch & Thaler, 1990; Thaler, 1980). This bias is also present early in development and by age 5, British and American children are biased by IKEA effects (Marsh et al, 2018; DeJesus, Gelman, Herold & Lumeng, 2019) and Endowment effects (Hood, Weltzien, Marsh & Kanngiesser, 2016; Harbaugh, Krause & Vesterlund, 2002) as both self-created and self-owned items are valued over identical copies. While the underlying mechanisms are still debated, it has been proposed that the Endowment Effect is present in societies which are market integrated (Apicella, Azevedo, Christakis & Fowler, 2014), and is driven by feelings of ownership for items in our possession (Morewedge & Giblin, 2015). Indeed, a study by Sarstedt, Neubert & Barth (2017) provides preliminary evidence in support of this claim by demonstrating for Northern European adults that the value a creator placed on their creation was partially mediated by their self-reported feelings of psychological ownership. However, these effects were based on a correlational design, capitalising on individual differences in the valuation of creations. Further evidence indicates that Endowment Effects can be strengthened through self-construal priming in North American adults (Maddux, Yang, Falk et al, 2010) and British children (Weltzien, Marsh & Hood, 2018).

Collaboration, Collective Ownership and Object Valuation

Psychological ownership appears to be a direct consequence of object creation, making it challenging to tease apart labour and ownership accounts of the IKEA effect experimentally. However, one possible avenue is to investigate the impact of collaboration on the IKEA effect as co-creation should lead to collective ownership claims (Pierce & Jusilla, 2010; Verkuyten & Martinovic, 2017). To date, no empirical work has directly tested the extent to which collaborative versus individual creation has an impact on the value attributed to objects. Additionally, there is, to our knowledge, no research into how cultural context affects the IKEA effect and whether it is subject to cultural variability. We speculate that collaborative efforts may result in a weaker IKEA effect where ownership is shared amongst multiple creators, especially in societies in which autonomy and independence are highly valued (Markus & Kitayama, 1991; Kagitcibasi, 2005). The present study tests this hypothesis in a developmental, cross-cultural sample.

Collaborative as compared to individual activities have an impact on a range of behaviours early in childhood. For example, German preschoolers who engage in cooperative activities as compared to individual activities more often help their partner achieve their goals (Hamann, Warneken, & Tomasello, 2012), they make more attempts to reengage partners that have left a joint activity (Gräfenhain, Behne, Carpenter, & Tomasello, 2009), and are more likely to resist temptations to abandon a collaboration (Kachel & Tomasello, 2019).

Cooperative vs. individual activities also determine how pre-schoolers divide resources. American pre-schoolers show merit-based sharing after individual work (Kanngiesser & Warneken, 2012), but when rewards were obtained through collaboration German pre-schoolers shared them equally (Hamann, Warneken, Greenberg, & Tomasello, 2011; Warneken, Lohse, Melis, & Tomasello, 2011). Sharing also increases after working towards a joint goal (Canadian pre-schoolers; Corbit, 2019) and older children (in rural Canada and rural India) will reject advantageous inequity after collaboration but not after parallel work (Corbit, McAuliffe, Callaghan, Blake, & Warneken, 2017). Thus, young children from Europe and North America (and rural India) are sensitive to experimental manipulations of collaboration, and such activities can promote prosocial tendencies, such as sharing. Little is known, however, about the impact of collaboration on perceived ownership in creative activities.

Societal Variation in Endowment and IKEA Effects

Much of what we know about the IKEA effect comes from studies conducted in North America and, Western and Northern Europe. Therefore, it is difficult to ascertain whether the bias perpetuates broadly across human societies or if it is limited to some societies. This has been identified as a key issue in the field of developmental psychology (Nielsen, Haun, Kärtner & Legare, 2017). There is some cross-cultural evidence that the Endowment Effect varies between Canadian, Chinese and Japanese university students (Maddux, Yang, Falk et al, 2010). Yet, to elicit Endowment effects participants are usually allocated objects and there is no effort involved in obtaining or creating them (IKEA effect), but see Bühren and Pleßner (2020) for conditions where effort and labour are directly compared. Cross-cultural, developmental work on children’s ownership understanding suggests that the investment of effort and labour acts as a strong signal of ownership that is present across a range of diverse societies and socio-economic status (SES) groups from the preschool years (Rochat et al, 2014; Kanngiesser, Itakura, & Hood, 2014). This suggests that the IKEA effect may be less impacted by cultural context than Endowment effects.

The Present Study

Here we examine IKEA effects for individually and collaboratively created objects in children from two distinct societies. Based on the reviewed literature, we hypothesise that children from both UK and India will show a robust IKEA effect for individually created objects (Marsh et al, 2018; Rochat et al, 2014; Kanngiesser, Itakura, & Hood, 2014). However, we speculate that cultural differences may emerge when children are asked to co-create an object. We hypothesised that children from the UK would demonstrate a weaker IKEA effect for a co-created object, compared to an individually created object because children in Western societies tend to be socialised to value autonomy and independence over relatedness (Keller, Borke, Chaudhary, Lamm, & Kleis, 2010; Kagitcibasi, 2005). In contrast, we hypothesised that this dilution of the IKEA effect due to collaboration would not be present in the Indian children due to a greater societal emphasis on relatedness than in urban Western samples (Keller et al, 2010; Kärtner, Crafa, Chaudhary, & Keller, 2016). In Phase 1 of this study, 128 5-to-6-year old children from the UK and India individually completed a shopping task which elicited relative worth judgements for a series of small toys, including a monster finger puppet (as in Marsh et al, 2018). In Phase 2, children were then paired with another child from their class and were randomly assigned to a collaborative or an individual build condition. In the collaborative build condition, children worked together to make a monster finger puppet, identical to the one used in the shopping task. In the individual build condition, children sat next to each other, but made separate monsters. Following the build task, children completed the shopping task again to value the monster they made as well as the identical monster.

Method

Participants

128 5-to-6-year old children were included in this study. 64 British children (mean age = 75 months, Range = 67-85 months, 32 female) were recruited from three primary schools in Bristol. 64 Indian children (mean age = 76 months, Range = 69 – 82 months, 30 female) were recruited from two English-medium primary schools in Pune. Bristol is a medium-sized urban city in the South-West of England, with an estimated population of 460,000 people. Main employing industries include Retail and Health and Social Care. The city is reasonably diverse with 22% non-white British residents. Pune is a large-sized urban city in the West of India, with an estimated population of 4 million residents. Main industries include IT and manufacturing. The sample size was specified in the study pre-registration on the Open Science Framework (OSF, https://doi.org/10.17605/OSF.IO/T58Z9) and was based on previous studies (Marsh et al., 2018).

An additional 25 Indian children completed Phase 1, but not Phase 2 because they did not pass valuation training (n = 11), were absent on the second testing day (n = 8), or it was not possible to match them to a same-sex classmate for Phase 2 (n = 6). An additional 13 British children completed Phase 1 but not Phase 2 because they failed to pass the valuation training (n = 4), they were absent on the second testing day (n = 5), or it was not possible to match them to a same-sex classmate for Phase 2 (n = 4). All parents gave written, informed consent prior to participation. Testing was completed in English in a quiet classroom within the child’s school. Indian children were proficient in speaking English. This study, entitled

"Is the IKEA effect prevalent across cultures", received ethical approval from the ethical review board at the University of Bristol (ID: 31031632882).

Procedure

This study was pre-registered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/T58Z9). The study comprised of two phases, completed on consecutive days. In Phase 1, we tested children individually. First children completed a friendship nomination task where we asked them to name all their friends in their class. Children could nominate as many friends as they liked. The purpose of this was to assess the social network position of children within each class. Next, we trained children in an object evaluation task, as reported in Marsh et al. (2018). After an initial demonstration by the experimenter, children were presented with pairs of items and instructed to assign 10 coins between them, to indicate their relative worth ("How much will you pay for each item?"). Training pairs included two identical mid-value items, a high-value item with a mid-value item, and a mid-value item with a zero-value item (see Figure 1). To pass training, children had to assign more coins to the more valuable item, and an identical number of coins to the identical items. Finally, we used the same procedure to elicit baseline object evaluations for a foam monster (identical to the one built in Phase 2) paired with a mid-value item, and a control object (a plastic figurine) paired with the same mid-value item. Children were instructed to assign all 10 coins for each object pair. A maximum value of 10 coins, and a minimum value of 0 coins could be assigned to any item.

In Phase 2, we tested children in pairs. Dyads were always same-sex, from the same class, and as closely matched on baseline valuations of the foam monsters as possible (mean difference = 1.14 coins). We did not select dyads on the basis of friendship nominations, although we assessed after testing whether children were paired with a friend or not. 23

(36%) Indian children and 22 (34%) British children participated with someone they nominated as a friend. We randomly assigned dyads to one of two between-subjects conditions: collaborative build or individual build. In both build conditions, children sat next to each other and received pieces to make a foam monster (identical to the monster valued at baseline in Phase 1). In the collaborative build condition, we gave each child half of the pieces and instructed them to make one monster together. In the individual build condition, we gave children pieces to make a monster each. The experimenter turned away and pretended to be busy while the children built the monsters. Once finished, each child individually completed post-test evaluations with the experimenter while the other child completed a colouring task with headphones on. We elicited post-test evaluations for the monster they had built, the control object, and the identical monster valued at baseline, using the object evaluation task from Phase 1. In each case, we paired the target item with the same mid-value item used in Phase 1. The experimenter verbally labelled the monsters as ‘this is the one you built’ and ‘this is not the one you built’ so that children could keep track of their creation. We counterbalanced the order of the own-built and identical monster valuations, with the control object always valued second so that children never valued the two monsters sequentially. Finally, to assess monster preference, the built monster and the identical monster were placed side-by-side and we asked children which of the two monsters they liked best and why. Again, the experimenter verbally labelled the monsters for the child to avoid mixing them up. After both children had completed the post-test valuations, they attached their monster to a display on the wall of the classroom. We videotaped both study phases so that it was possible to check the valuation responses and to complete behavioural coding of the interactions between children during the build task.

[Figure 1 about here]

Data Coding and Analysis

We coded all responses live and from videotape. There were no discrepancies between live coding and video coding for the valuation responses. ANCOVA analyses were conducted using SPSS and GLMM analyses were conducted using the lme4 package in R.

Valuation of the built object

Difference scores for the valuation of the built monster and the identical monster were calculated by subtracting the baseline monster value from the value assigned to each monster at post-test. Each item could be valued between 0 and 10, so difference scores could range from +10 to -10, with higher values indicating an increase in valuation over the experiment. To analyse difference scores, we used an ANCOVA, with object (built, identical) as a within-subjects factor, and condition (collaborative, individual), society (UK, India) and gender as between-subjects factors. We entered age in months as a covariate.

Valuation of the control object

A difference score was calculated for the control object by subtracting the value of the control object at baseline from the value of the control object at post-test. We used a separate ANCOVA to analyse difference scores for the control object. This was to ensure that children's valuations did not generally change over the course of the experiment as a result of one of the experimental manipulations. Condition (collaborative, individual), society (UK, India) and gender were entered as between-subjects factors and age in months was entered as a covariate.

We pre-registered these analyses on the Open Science Framework (https://doi.org/10.17605/OSF.IO/T58Z9). However, our pre-registration did not account for the nested structure of the data (i.e., children providing data within a dyad are not independent from one another). As such, we ran additional GLMMs which take this into account. These analyses provided comparable results and are reported in Supplementary Information.

Friendship Nominations

As rates of parental consent per class were low in the UK (<30% per class) it was not possible to use friendship ratings to assess the social network position of the children taking part, as originally planned. Instead, we used friendship nominations to determine whether children were paired with someone they consider to be their friend or not. To assess whether being paired with a friend influenced the IKEA effect in each condition and across societies, we conducted an additional ANCOVA.

Monster Preference

Children either picked their own creation (n=81), the identical monster (n=32), or stated that they were the same (n = 15). Monster preference was analysed using a GLMM to assess whether the number of children selecting their own creation varied by society or collaboration condition. A full model including society, collaboration condition, the interaction between society and collaboration condition, participant gender and age was compared to a null model including only gender and age using likelihood ratio tests.

Behavioural Coding

Behavioural coding of the build interaction was completed as a manipulation check, to assess whether children engaged in different interaction styles in collaborative and individual build conditions (Little, Carver & Legare, 2016). The length of time that children engaged in individual activity (partners engaged in individual tasks) vs triadic activity (partners engaged in joint tasks, by looking at or touching the same pieces of a monster) was coded from video. A second coder scored 21% of the videos for reliability purposes. Agreement between coders was 97% for individual activity (kappa = .28), and 93% for triadic interactions (kappa = .68). The kappa value for individual activity is low despite very high rates of agreement, because our coding was heavily skewed as both coders coded some categories particularly frequently and others very rarely (see supplementary information for further details). Time spent in triadic interactions was compared across condition (collaborative, individual) and society (UK, India) using GLMM. The analysis of behaviour during the build task was not pre-registered and is thus exploratory.

All data have been made publicly available at the Open Science Framework and can be accessed at: https://osf.io/kus8e/?view_only=10238c35085d47afb22b3c1b0da5776e. Materials and analysis code for this study are available by emailing the corresponding author.

Results

Valuation of the built object

In evidence of an IKEA effect, children increased the value of the monster that they had built (M = 1.06, 95% CI = [.60, 1.52]) more than an identical monster which they had not built (M = -.27, 95% CI = [-.77, .23], $F(1,119) = 28.23$, $p <.001$, $\eta_p^2 = .19$, Figure 2 and Figures S1&2 for raw data). There was no main effect of condition; children over-valued the monsters regardless of whether they had built a monster individually (M = .25, 95% CI = [-.33, .83]) or collaboratively (M = .54, 95% CI = [-.04, 1.11], $F(1,119) = .47$, $p = .494$, $\eta_p^2 = .004$). There was also no main effect of society on valuations (M_{UK} = .54, 95% CI = [-.04, 1.12], M_{India} = -.24, 95% CI = [-.34, .82], $F(1,119) = .54$, $p = .465$, $\eta_p^2 = .004$). Contrary to our hypotheses, the three-way interaction between condition, society, and object (F(1,119) = .67, p = .414, η_p^2 = .006, BF^{01} = .013), and the two-way interactions between condition and object (F(1,119) = 2.08, p = .152, η_p^2 = .017), and society and object (F(1,119) = 1.57, p = .213, η_p^2 = .013) were not significant. This indicates that the IKEA effect was not modulated by collaboration, and was consistent across the two societies in our study. There was a significant effect of gender (F(1,119) = 4.61, p = .034, η_p^2 = .037), in which females (M = .84, 95% CI = [.25, 1.43]) increased the value of both monsters more than males (M = -.06, 95% CI = [-.63, .52]), but gender did not interact significantly with any other variable (all *F's* < 2.42, all *p's* > .123).

[Figure 2 about here]

Valuation of the control object

Children who collaborated decreased the value of the control object (M = -1.08, 95% CI = [-1.67, -.48]) more than children who completed independent builds (M = -.15, 95% CI = [-.75, .45], F(1,119) = 4.73, p = .03, η_p^2 = .038). There was no significant effect of society (M_{UK} = -.71, 95% CI = [-1.31, -.11], M_{India} = -.52, 95% CI = [-1.12, .08], F(1,119) = .21, p = .652, η_p^2 = .002), and no significant interaction between condition and society (F(1,119) = .298, p = .586, η_p^2 = .002) on control object valuations.

Friendship effects on the valuation of built objects

There was no significant effect of friendship (F(1,111) = .17, p = .683, η_p^2 = .002), and no significant interaction between friendship and other experimental variables on valuation of the monsters (all *F's* < 2.24, all *p's* > .137). Children valued the monsters in the same way, regardless of whether or not they were paired with a friend during the build phase of the task.

Monster Preference

In the individual build condition, 24 (75%) British and 18 (56%) Indian children selected the monster they had created as the preferred option. In the collaborate condition, 20 (63%) British and 19 (59%) Indian children preferred the monster they had built. There was no significant difference between the full and the null model (X^2 (3) = 3.95, p = .267), indicating that society, collaboration, and the interaction term had no explanatory effect on monster preference.

Behavioural interactions during the build task

The full model had the best fit to the data (see Figure 3). Children from India engaged in proportionally more triadic interactions than children from the UK (X^2 (2) = 10.59, p = .005). Children also engaged in a higher proportion of triadic interactions in the collaborative condition, compared to those who built the monsters individually (X^2 (2) = 32.49, $p < .001$). These main effects were qualified by an interaction between condition and society (X^2 (1) = 5.79, p = .016). Pairwise Tukey corrected comparisons revealed that Indian children engaged in a higher proportion of triadic interactions in the collaborate condition, compared to children from the UK ($t(25) = 3.08$, p = .024). There was no difference in the proportion of triadic interactions between Indian and British children in the individual build condition ($t(25) = .53$, p = .950).

[Figure 3 about here]

Discussion

This study aimed to assess the strength of the IKEA effect for objects that children built collaboratively vs individually and to examine this bias in children from two different societies. We found robust IKEA effects in all conditions of this study. Contrary to our predictions, collaborative work resulted in children valuing their creations just as highly as creations built individually. In addition, this bias was similarly present in children from the UK and children from India and did not depend on whether the child was paired with a friend for the task. Exploratory analyses revealed variation in behavioural performance of collaborative activities across society and condition. We discuss the implications for each of these findings in the sections below.

Societal Comparisons of Valuation and Collaboration

There was no societal variation in the size of the IKEA effect demonstrating that children in the UK and India alike value their own creations more than identical items created by someone else. As predicted, this study demonstrates that the IKEA effect is robust and replicable across different societies. However, we did expect the collaborative condition to draw out societal differences in this task. Specifically, we predicted that British children would value their individual creations more than the product of collaboration as individual efforts and achievements are regarded more highly. In India we predicted that collaboration would have less influence on the size of the IKEA effect. The lack of societal variation could be another demonstration of the robustness of the IKEA effect as its manipulation has proved elusive in other developmental studies (Marsh et al, 2018).

Alternatively, this null result could reflect a methodological issue with the collaborative condition in which children do not actually engage in collaborative activity in this task. Instead, children could be completing the build in serial, rather than jointly engaging with their partner. To rule out this possibility, a post hoc behavioural coding analysis of children's interactions during the task was conducted. As expected, children engaged in more triadic interaction during the collaborative build condition, compared to the individual build condition. This indicates that the collaboration manipulation was effective in altering behavioural interactions between children. In addition, this analysis revealed societal differences in interaction style during the collaborative build task as Indian children engaged in proportionally more triadic interactions than British children. Previous studies have found differences in children's cooperation styles depending on their parents' level of schooling (Alcalá, et al., 2018; Chavajay & Rogoff, 2002; Correa-Chávez, 2016; Correa-Chávez, et al., 2016) – though children in both of our samples came from urban middle class families. This tentatively suggests that factors other than parental education may also play a role in collaboration styles. However, it is important to note that this analysis was exploratory and based on a limited number of codeable videos which have an unbalanced number in each condition. We therefore believe that these findings are interesting but remain cautious in our interpretations.

The Link Between Collaboration and Value

We hypothesised that collaborative creation of an item would induce collective ownership in the creators, and that this would weaken the IKEA effect. Contrary to predictions, children demonstrated an equally-sized IKEA effect, regardless of whether they collaborated or not. There are three possible explanations for this result. First, the collaboration manipulation may have been ineffective at inducing collaboration. Second, collaboration doesn't induce collective ownership, or third, the product of collaboration is valued equally to an individual creation. Each of these explanations will be discussed below.

With regards to the effectiveness of the collaboration manipulation, the behavioural data contribute to our understanding by showing that our experimental manipulation did have an effect on children's behaviour. As mentioned above, children in the UK and India engaged in more triadic interactions in the collaborative condition, compared to the individual condition.

This indicates that the children in the collaborative condition did treat the task as a shared endeavour, by either helping or watching their partner as they contributed to the build task.

Although not directly tested, we believe that it is equally unlikely that collaboration failed to induce collective ownership in the creators. Previous work has demonstrated that children as young as 3-years-old will share the spoils of collaboration equally, demonstrating collective ownership of their rewards (Warneken et al, 2011). Thus, it seems reasonable that the same might be true in this case.

The final explanation that the product of collaboration is valued as highly as an individual creation, is the most plausible explanation in this case. One previous study has investigated the parameters of collective ownership in young children (Huh & Friedman, 2017). They reported that children aged 3-to-6-years understood that property could be owned by groups, and that group ownership conferred privileged access over non-group members, but also limited rights in comparison to sole ownership. Therefore, a complex understanding of both the benefits and limitations of collective ownership should be possible for the children in the present study. However, it seems that despite this appreciation, collective ownership as a result of collaboration does not limit product valuations. Further confirmatory work is needed to establish this finding and to explore the limits of collaboration and linked value. For example, does collaboration dilute the value of an item with increasing numbers, or does the identity of the collaboration partner affect valuations? With regards to the latter, being paired with a nominated friend had no impact on the value of creations, although other factors such as perceived similarity might have a greater impact. Future work could also assess the extent to which collaboration influences the IKEA effect in adults. These questions are of importance for organisations who might be seeking to promote value linked to ownership and collaboration (i.e. the use of company shares for employees, or the use of community art projects to deter vandalism). Additionally, in our current 'disposable society' there is value in exploring ways to promote the value of objects through creative input, as this might provide a mechanism for promoting sustainable product use (i.e. reusable personalised coffee cups) or other sustainable behaviours linked to psychological ownership (Preston & Gelman, 2020).

To conclude, constructing an item leads to a potent preferential bias towards it (the IKEA effect) which is present early in development. This work is the first to demonstrate that this preferential bias can be the result of individual or collaborative activity, and has been identified in two different socio-cultural contexts.

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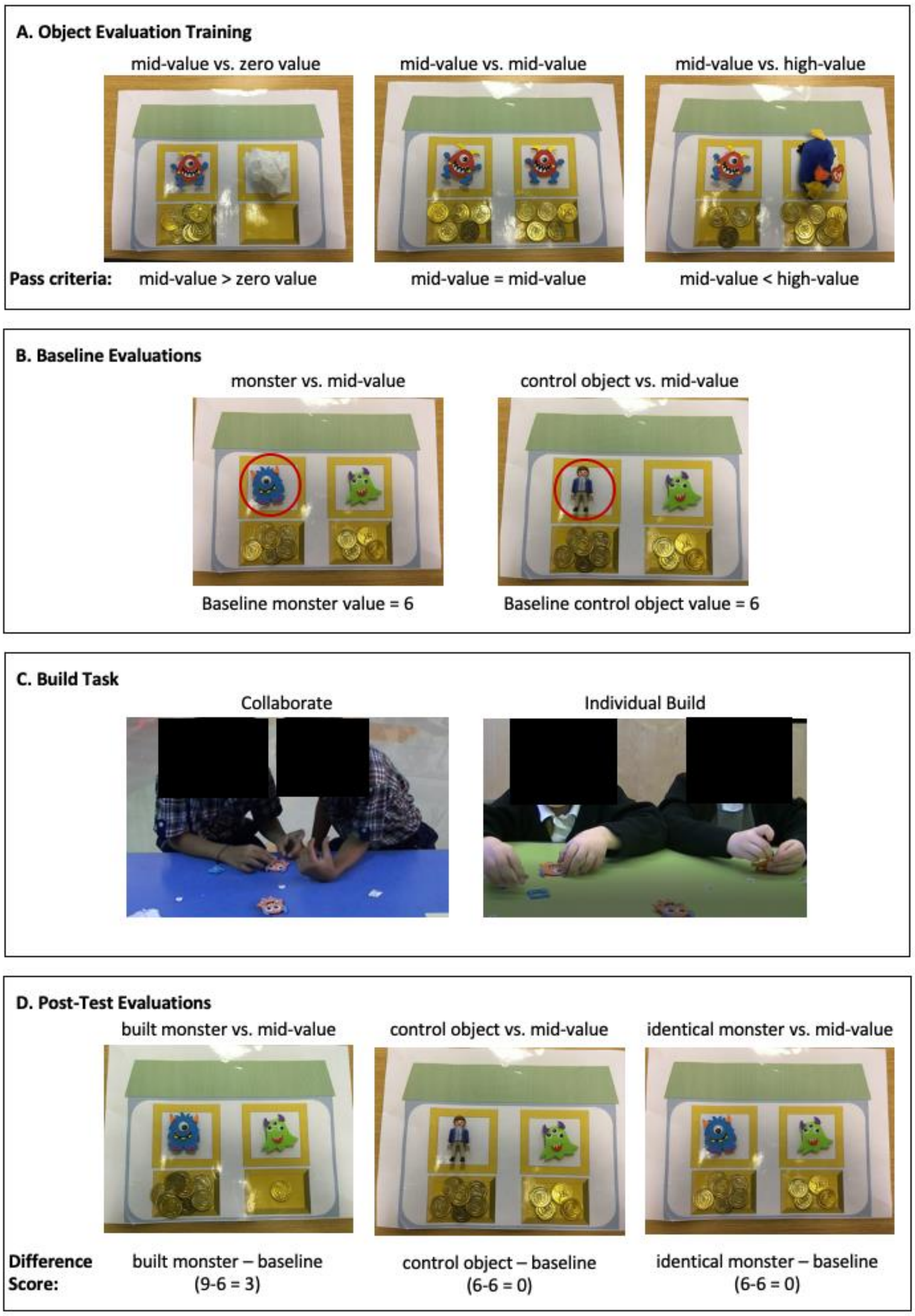

Figure 1: Panel A depicts the training trials and pass criteria that children needed to attain to be included in the study. Panel B shows how we elicited baseline valuations. The red circle indicates the item of interest. Panel C shows different interactions elicited by the

collaborative and individual build conditions. Panel D shows how post-test evaluations were elicited and gives an example difference score calculation.

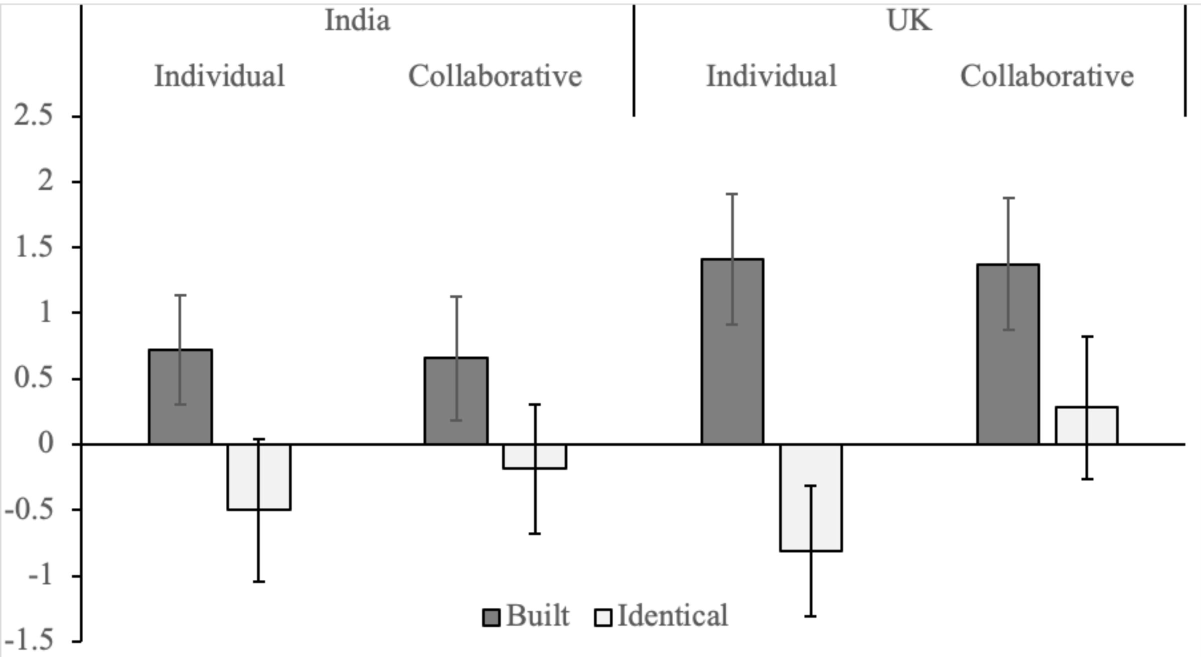

Figure 2. Value change of the own-built monster (dark bars) and the identical monster (light bars) as a function of collaboration condition and society. Error bars represent +/- 1 S.E.M.

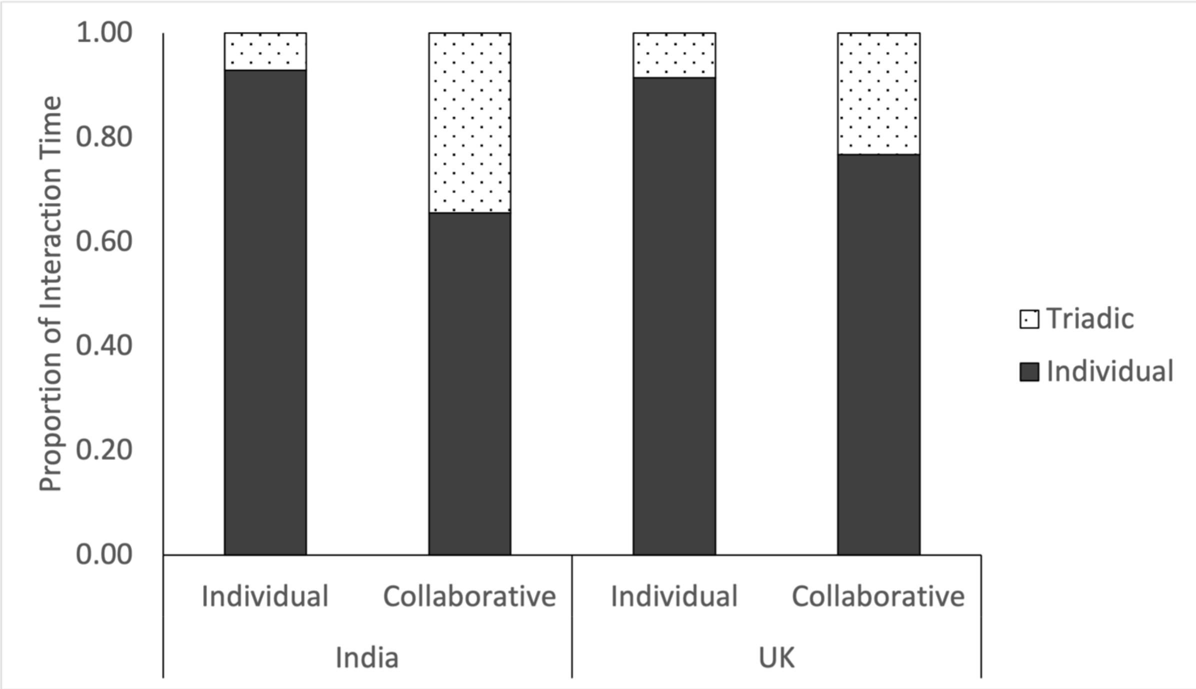

Figure 3: Proportion of time spent engaged in individual (dark bars) and triadic (light bars) interactions as a function of collaboration condition and society.

Supplementary Information for

The influence of collaboration and culture on the IKEA effect: does co-creation alter perceptions of value in British and Indian children?

Testing Script

Training phase (individual testing, day 1):

"We are going to play a shopping game today. Can you see my shop here? There are two windows in my shop. I am going to put some different things in the shop windows and then we can use these coins to show each other how much we think the things are worth."

"First of all, can you count out the coins and tell me how many there are?" [E gives the coins to the child to count, correct the child if they count wrong].

"That's right, there are 10 coins. Now I'll put some things in the shop windows and I'll start by showing you how much I think they are worth. When I have had a few turns it will be your turn and you can show me." [E brings out 2 identical toys]

"First of all I have these two things for the shop. Can you see they are exactly the same so I think they should be worth the same amount of coins? I think they are worth 5 counters each" [E places the two identical monsters in the shop windows and 5 counters in front of one toy and 5 counters in front of the other toy]. "Can you see – because they are just the same, I've given them the same amount of coins".

"Now if I change the things in the shop window, I have these two things – a monster and a monkey. I like this one the best, it's really nice. Because I like this one most, it should be worth more coins. I think it is worth 7 coins. I think this one is only worth 3." [E distributes coins between the two non-identical toys]. "Do you see – because I like this one best, I've given it more coins".

"Last of all, I have these two things for the shop window – a monster and a piece of card. Hmmm…this is just a piece of rubbish – it's not really worth anything. So this time, I think the monster is worth all 10 coins, and the card isn't worth any." [E places all 10 counters in front of the desirable toy and none in front of the rubbish].

"Now, do you think you could tell me how much you think some different things are worth?" [E puts pairs of items in the shop windows and waits for the child to distribute the coins between each pair]

"How many coins do you think these things are worth?"

These item pairs were:

Training pairs (order counterbalanced):

- two identical red monsters (not used in the rest of the experiment)
- one red monster and a small cuddly toy (obviously nicer and more valuable than the monster)
- one red monster and a piece of rubbish

Baseline ratings:

"How much do you think these two things are worth?"

Baseline ratings (order counterbalanced):

- a blue monster (to be used in the build task) and a green monster (labelled as the mid-value item in the manuscript for clarity)
- the control object (small plastic figure) and a green monster

Building Phase (paired testing, day 2):

Collaboration instructions: “I have the pieces so that together you can make a monster just like this one [E holds up the blue monster from the baseline rating task]. Here is the body. You can have these pieces and you can have these pieces. When you are finished you can stick the monster on the wall with the other ones here.”

Individual build instructions: “I have the pieces so that you can each make a monster just like this one. You can have these pieces and you can have these pieces. When you are finished you can stick the monster on the wall with the other ones here.”

[E holds up the build monster, starts the timer and gives the child the body of the monster. In the collaboration condition, children will be given half the pieces each in the own build condition, children will be given all the pieces to make their own monster. E then turns her back and pretends to be busy until the build task is complete].

“Great is that finished now?” [E stops the timer and tidies away spare materials]

[E asks one child to wait on the other side of the table with some headphones on whilst the other child does the shop game behind a screen.]

Post-interaction ratings:

“Now, do you remember the shopping game we played yesterday? Can you tell me how many coins you think these things are worth?”

[E places pairs of objects into the shop and hands the child the coins.]

“The [first/last] pair of items for the shop are the blue monster that you [built / did not build] and the green monster. How much do you think these things are worth?”

“Next in the shop we have this plastic man and the green monster. How much do you think these things are worth?”

Post-Interaction pairs (order of built and identical monsters counterbalanced)

- Blue built monster and green monster (mid-value item)
- Control object and green monster
- Blue identical monster and green monster

Monster Preference Task:

E places own built and identical monsters in the shop windows and asks two questions

"This is the monster that you built, and this is the monster that you did not build. Which one do you like best?"

"Why?"

Details of Behavioral Coding

We first identified videos that could be used for behavioural coding. We excluded videos, in which the majority of the time one or more of the following criteria applied: (a) children's eyes were cut-off and gaze direction could not be judged, (b) the experimenter was constantly interacting with children (speaking, handing pieces), and (c) one or both children were often absent in the frame or distracted. In total, there remained 34 codeable videos (Pune: 15 videos, 11 in the collaborative condition and four in the individual condition; UK: 19 videos, eight in the collaborative condition and 11 in the individual condition).

We then coded the overall length of the building interaction, starting when all pieces of the monster were on the table and the experimenter left the frame and ending when the task was completed. The main behaviour of interest was whether children engaged in individual or triadic interactions (Little et al., 2016). We used the following coding scheme to score the duration of children's engagement (only durations >1sec were scored; see Table S1):

- Individual engagement: Engagement was coded as (a) *physical individual engagement* when one child was in physical contact with the monster or parts of it or as (b) *visual individual engagement* when one child looked at the monster or parts of it. There was no engagement from the other child.
- Triadic engagement: Engagement was coded as (a) *physical-physical triadic engagement* when both children were in physical contact with the *same* monster or the *same* parts of the monster, as (b) *physical-visual triadic engagement* when one child was in physical contact with the monster or parts of the monster and the other child observed looked at the same monster or monster parts, and as (c) *visual-visual triadic engagement* when both children looked at the same monster or parts of the monster, there was no physical contact between the monster and either of the children.

Behaviours could occur in parallel. For example, both children could be simultaneously engaged in individual-physical with their own monster, or one child could be holding on to her own monster while attending to what her partner did with the partner's monster (this would be scored as physical individual and visual-physical triadic). We coded video segments as take-out's (e.g. not to be included in analyses) when the experimenter briefly interacted with the children or when children's eyes, heads or hands were not visible or they were distracted. A second coder scored seven videos (21%) for reliability purposes (three videos from India, 4 videos from the UK; 4 collaborative, 3 individual). Agreement between coders was 97% for individual interactions (kappa = .28), and 93% for triadic interactions (kappa = .68). The kappa value for individual interactions is low despite very high rates of agreement, because our coding was heavily skewed as both coders coded physical individual engagement very frequently (175/180 and 178/180 codes, respectively) and visual individual engagement almost never (1/180 codes).

The proportion of time that children engaged in individual vs. triadic interactions was compared across condition and society. These data were analysed with GLMMs, using the lme4 package in R. We constructed a full model by assessing whether condition, society, gender, and the interaction between condition and society predicted the proportion of triadic engagement. Within this model, we included a random intercept for each dyad. We compared this to a null model, containing only gender and the random intercept, and a reduced model in which we only removed the interaction term.

Table S1: Details of behavioural coding scheme applied to video data.

Maincode	Subcode	Subsubcode	Description
phase (duration)	start		Start of relevant phase: all pieces of the monster are on the table and experimenter finished interacting with the children.
	stop		End of relevant phase: when one child leaves the frame and task (gluing all the pieces to the monsters body) is completed; when experimenter asks if the children are finished and they agree; when it is verbally expressed that the task is finished.
take-out’s (duration)	experimenter		Whenever experimenter interacts with the children, this is coded as experimenter interaction, none of the other codes apply; whenever the experimenter speaks to the children (not the children to the experimenter); whenever the experimenter places hands in front of the child as they help; Start: when the experimenter first moves/enters the frame; Stop: when the experimenter finishes moving out of view again. Only code if the duration of the event is >1 sec.
	not-codable		Children and their eyes/heads and hands are not clearly visible; they are clearly distracted by things other than the experiment; if this happens too often, the whole video is considered non-codable. Only code if the duration of the event is >1 sec.

engagement (duration)	individual	physical	One child is in physical contact with the monster or parts of it (child doesn't have to look at the monster/monster-parts); *no* engagement from the other child. Only code if the duration of the event is >1 sec.
		visual	One child looks at the monster or parts of it, *no* engagement from the other child. If eyes are a little bit obscured, but the segment is still codable, go off of 'head turn'. Only code if the duration of the event is >1 sec.
	triadic	physical-physical	*Both* children are in physical contact with the *same* monster or the *same* parts of the monster (children don't have to look at the monster/monster-parts). Only code if the duration of the event is >1 sec.
		physical-visual	*Only one* child is in physical contact with the monster or parts of the monster and the other child observes/looks (but without physical contact to the monster or parts of the monster that the other child is interacting with). If eyes are a little bit obscured, but the segment is still codable, use 'head turn'. Only code if the duration of the event is >1 sec.
		visual-visual	*Both* children look at the monster or parts of the monster, there is *no physical contact* to the monster from any of the children. If eyes are a little bit obscured, but the segment is still codable, use 'head turn'. Only code if the duration of the event is >1 sec.

Additional Analyses

The pre-registered analyses did not account for the nested structure of the dataset. As participants completed the build task in pairs, their data cannot be considered to be fully independent. Thus, an additional GLMM analysis was run to take this potential confound into account.

A full model of children's difference scores included predictors of condition (collaborative, individual), society (UK, India) and object (built, identical), the two- and three-way interactions of these variables, gender, and child age in months. Random intercepts for child ID and dyad ID were included to account for the nested structure of the data. A random slope was added to allow for variation in the valuation of each object by dyad. This full model was compared to a null model which included only control predictors (gender, age, random intercepts, and random slope) with a likelihood ratio test. To assess for the contribution of the interaction terms, two reduced models were constructed, one without the three-way interaction, and one without the two-way interactions. These reduced models were compared to the full model using likelihood ratio tests.

Results

The full model outperformed the null model ($X^2 = 31.44$, $df = 7$, $p < .001$), but was not significantly better than the reduced model without the three-way interaction ($X^2 = .59$, $df = 1$, $p = .442$), or the reduced model without the two-way interactions ($X^2 = 4.14$, $df = 3$, $p = .247$). Therefore, a model with only main effects was the best fit to the data. Subsequent likelihood ratio tests determined that object was a significant predictor of valuation (*LRC* = 25.78, $p < .001$) but condition (*LRC* = .42, $p = .519$) and society (*LRC* = .51, $p = .473$) were not. There was a trending, but non-significant effect of gender on valuations (*LRC* = 3.19, $p = .07$).

Table S2: Model comparisons. Bold indicates the model with the best fit to the data.

Model	**AIC**	**BIC**	***p***
Null (Age, Gender, Child ID, Dyad ID, Object|Dyad)	1235.37	1260.18	
Full (Null + Condition, Society, Object, Condition*Society, Condition*Object, Society*Object, Condition*Society*Object)	1217.92	1267.54	<.001 vs Null
Reduced1 (Full minus Condition*Society*Object)	1216.51	1262.60	.442 vs Full
Reduced2 (Null + Condition, Society, Object)	**1214.65**	**1250.11**	**.247 vs Reduced1**

Table S3: Model summary for the most successful model (Reduced 2).

	Liklihood Ratio	***p***
Condition (collaborate, individual)	.42	.519
Society (UK, India)	.51	.473
Object (built, identical)	25.78	<.001
Age	3.19	.074
Gender	.66	.416

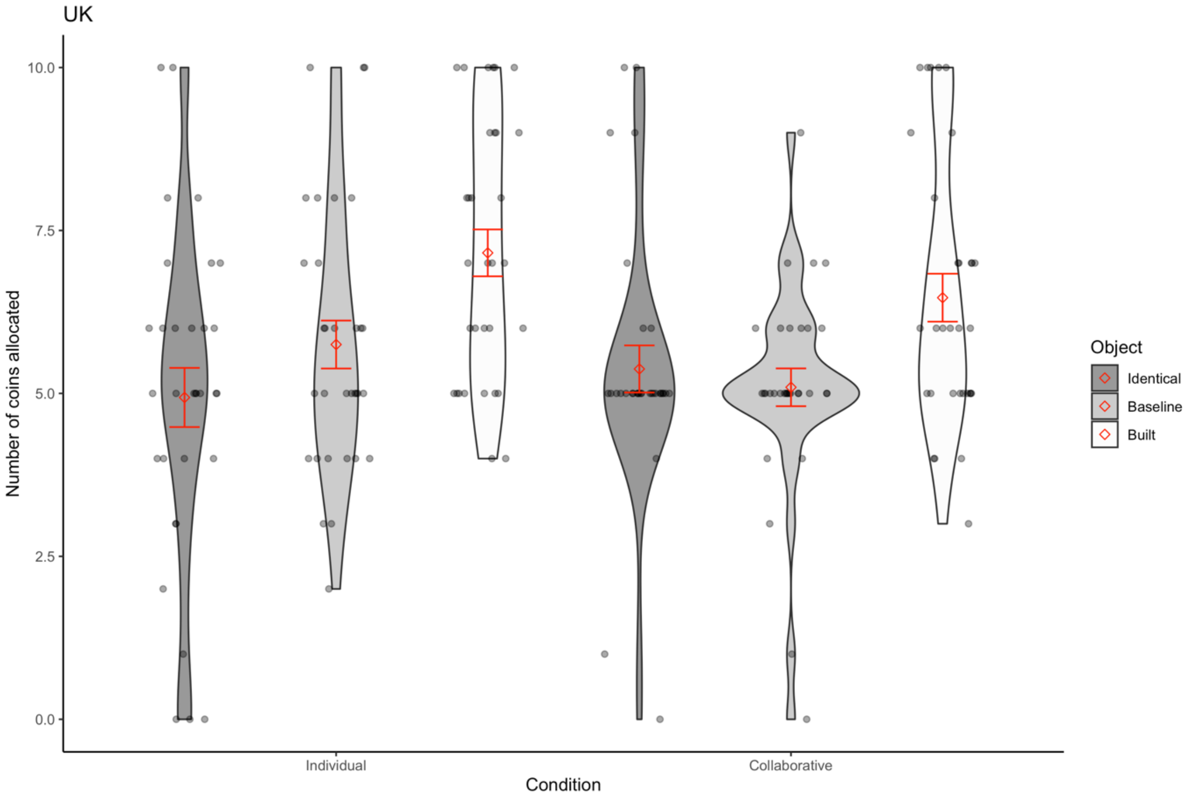

Figure S1: Raw coin allocation data from UK children at baseline (mid-grey), for the identical object (dark-grey) and the built object (light-grey) as a function of collaboration condition Errorbars represent +/-1 S.E.M.

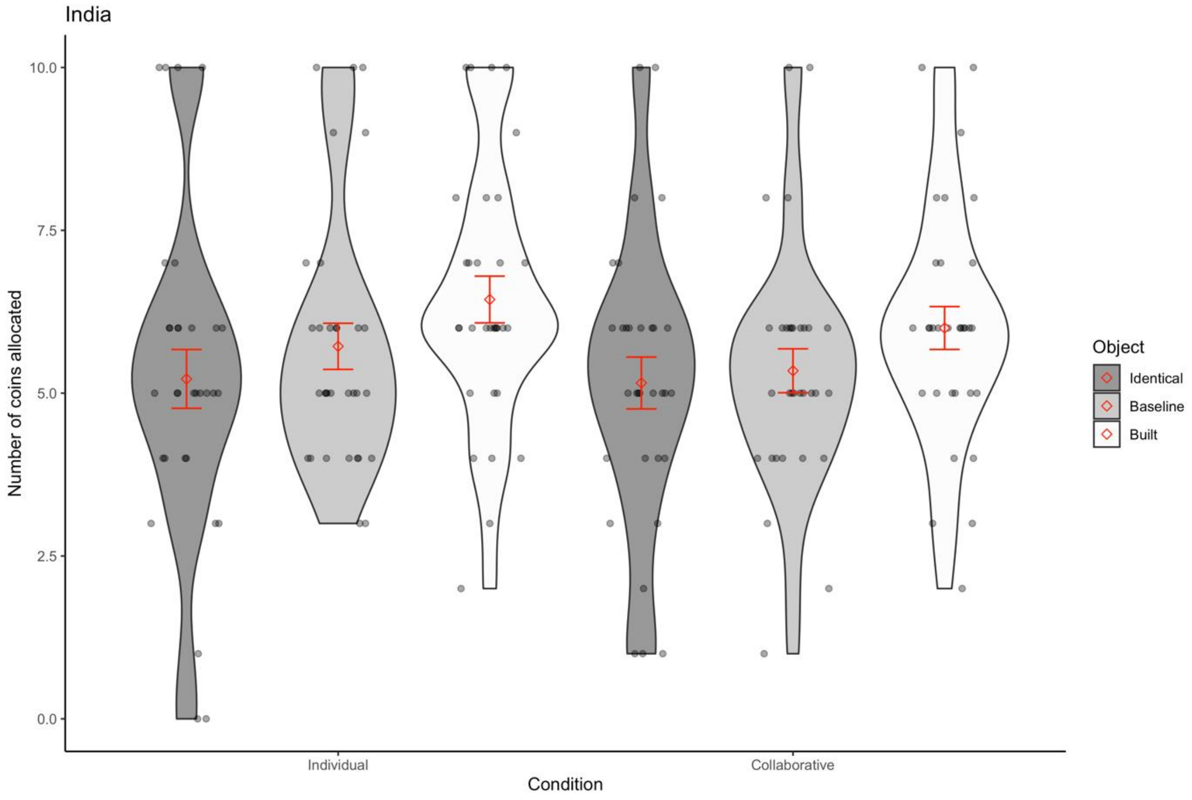

Figure S2: Raw coin allocation data from Indian children at baseline (mid-grey), for the identical object (dark-grey) and the built object (light-grey) as a function of collaboration condition Errorbars represent +/-1 S.E.M.