

# People Have Systematically Different Ownership Intuitions in Seemingly Simple Cases



Xiuyuan Zhang<sup>1</sup> , Paul Bloom<sup>1,2</sup>, and Julian Jara-Ettinger<sup>1</sup> 

<sup>1</sup>Department of Psychology, Yale University, and <sup>2</sup>Department of Psychology, University of Toronto

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## Abstract

Our understanding of ownership influences how we interact with objects and with each other. Here, we studied people's intuitions about ownership transfer using a set of simple, parametrically varied events. We found that people ( $N = 120$  U.S. adults) had similar intuitions about ownership for some events but sharply opposing intuitions for others (Experiment 1). People ( $N = 120$  U.S. adults) were unaware of these conflicts and overestimated ownership consensus (Experiment 2). Moreover, differences in people's ownership intuitions predicted their intuitions about the acceptability of using, altering, controlling, and destroying the owned object ( $N = 130$  U.S. adults; Experiment 3), even when ownership was not explicitly mentioned ( $N = 130$  U.S. adults; Experiment 4). Subject-level analyses suggest that these disagreements reflect at least two underlying intuitive theories, one in which intentions are central to ownership and another in which physical possession is prioritized.

## Keywords

social cognition, intuitive theories, ownership, theory of mind, open data, open materials, preregistration

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Imagine walking down the street, finding a box that reads “Free Stuff,” and reaching in and taking out a book. Nearly everyone would agree that the book is now yours. But what if someone had dropped the book as they were rushing down the street and you picked it up and put it in your bag? Now, under some people's conception of ownership—although perhaps not everyone's—you are a thief.

The concept of ownership is central to human social life. It appears across cultures (Kanngiesser et al., 2015; Rochat et al., 2014), emerges early in childhood (Blake & Harris, 2011; Rossano et al., 2011; Saylor et al., 2011), and is possibly present even in infancy (Tatone et al., 2019). Its origins trace back to the origins of human societies (Watson, 2005) and might be shared with other nonhuman primates (Brosnan, 2011; although, if so, such understanding is, at best, tenuous; see Kanngiesser et al., 2020).

Reasoning about ownership requires much more than observing a simple connection between owners and what they own. Just as a simple example, consider the objects inside a furnished rental apartment—forks,

chairs, televisions, and so on. These objects can be used by people leasing the apartment, even over the span of months, but these people do not own them. The real owners might live thousands of miles away, with no observable connection between them and their objects.

Reasoning about who owns what, then, requires that people rely on their intuitive theories about the nature of ownership, the powers that it grants to individuals, and how it can be gained, transferred, and lost. Indeed, people have quite a sophisticated understanding of ownership, including how it is created (Levene et al., 2015), mechanisms for inferring who owns what (Beggan & Brown, 1994; Friedman, 2008; Shaw et al., 2012), and an understanding of the privileges that ownership grants (Gelman et al., 2012; Kim & Kalish, 2009; Nancekivell et al., 2019; Pesowski & Friedman, 2018).

In our “Free Stuff” example, most everyone has the same intuition. Perhaps this is the rule. There are at

## Corresponding Author:

Xiuyuan Zhang, Department of Psychology, Yale University  
 Email: [flora.zhang@yale.edu](mailto:flora.zhang@yale.edu)

least two reasons to expect consensus regarding ownership intuitions. First, given that ownership understanding emerges early in development, appears across cultures, and is critical for social interaction, one might expect that it would have universal properties. Second, representations of ownership are useful only to the extent to which they are shared across individuals. (Imagine the problems that would arise if many renters sincerely believed that they now own the furnishings in the apartment.) People usually seem to agree on who owns what. Indeed, although children have different intuitions about ownership, these intuitions converge as we get older (Berti et al., 1982; Blake & Harris, 2009; Cram & Ng, 1989; Kim & Kalish, 2009; Li et al., 2018).

At the same time, however, real-world ownership disputes happen (DeScioli et al., 2017; DeScioli & Karpoff, 2015; Friedman, 2010). These disputes have been recurrent throughout history (Nancekivell et al., 2019), and many societies have formal legal systems to resolve them. Why might these conflicts arise?

One possibility is that these disputes are uncommon relative to the number of everyday social interactions in which ownership is at play—interactions that typically unfold without conflict. If so, these disputes might be edge cases that go beyond what our intuitive theories capture (as an analogy, consider the rare cases in which we experience visual illusions).

Some of these disputes might also reflect differences in event representation. Two people could have two different understandings about what happened in an event (because of a variety of factors, such as knowledge asymmetries, memory failures, motivated reasoning, or outright dishonesty), even though they might agree about who owns what for each event interpretation. For instance, disputes over who owns an object that one person created using another person's materials depend on how people represent the value of the raw materials and the effort put into creating the new object (Beggan & Brown, 1994; Kanngiesser & Hood, 2014).

Alternatively, disputes such as these might reflect a more fundamental difference in people's intuitive theories: People might have systematically different ideas of ownership, even for the same event (e.g., DeScioli et al., 2017; Friedman, 2008; Kanngiesser & Hood, 2014). If this is the case, can these differences emerge even in relatively simple events? Do people have consistent intuitions across events? And are they aware that different people might disagree with their view? Evidence of more fundamental differences in simple events would be striking given the role that ownership plays in everyday life, the need for our intuitions to be aligned for successful social coordination, and the early emerging and universal nature of ownership. To explore this

## Statement of Relevance

Our understanding of ownerships—over objects, places, ideas, and so on—shape our everyday interactions and are central to human societies. Here we show that people have systematically different intuitions about ownership, even in simple unambiguous events. Critically, people's conflicting ownership judgments predict the rights they believe that they have to use, alter, lend, and dispose objects. These results highlight how important differences in how we represent the social world are hiding in plain sight.

possibility, we created a set of simple object-transfer events that manipulated agents' mental states and physical possession and asked participants to judge relative degrees of ownership over an object.

## Open Practices Statement

All experiments were preregistered with AsPredicted. All materials, preregistrations, data, and analysis code for all experiments are available on the OSF at <https://osf.io/r4mvd/>.

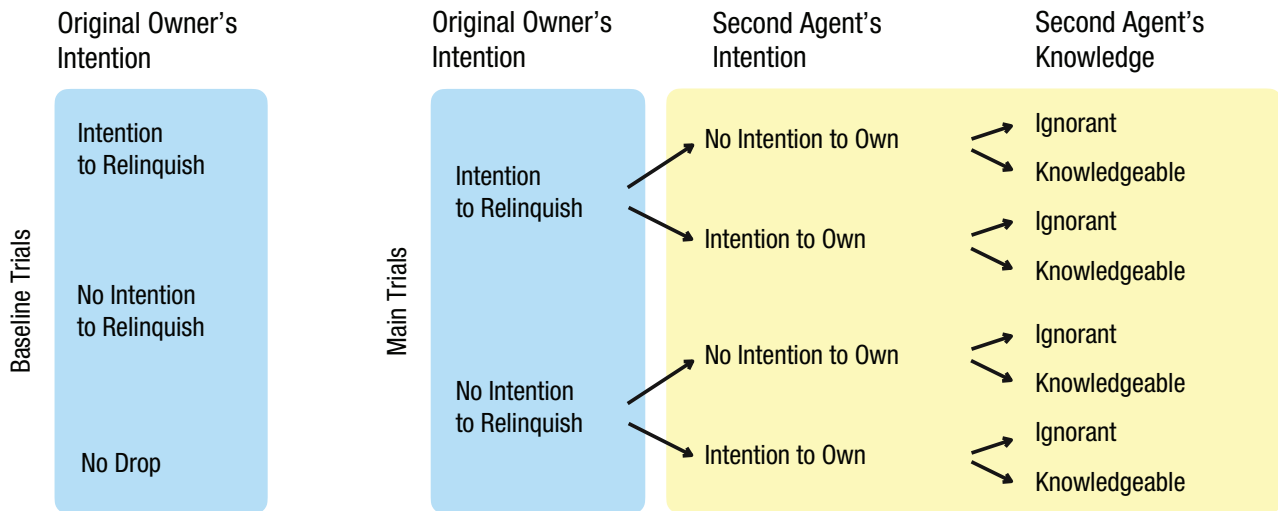
## Experiment 1

Experiment 1 explored people's intuitions of ownership in simple, ordinary, and unambiguous events. Participants watched simple object-transfer events between two agents and were asked how much each agent owned the object.

## Method

**Participants.** A preregistered sample of 120 U.S. adult participants ( $M_{\text{age}} = 32$  years, range = 18–66 years,  $SD = 12$  years) were recruited online through Prolific. We originally intended to run this sample on Amazon Mechanical Turk but switched services because of abnormally low inclusion rates (see the Supplemental Material available online). The sample size was determined on the basis of a pilot result and power analysis (see the Supplemental Material). An additional 53 participants were recruited but were not included in our analysis because of our preregistered inclusion criterion. All experiments reported were approved by the Yale University Institutional Review Board.

**Stimuli.** Stimuli consisted of 11 short videos (ranging from 11 to 22 s long) showing simple stick figures



**Fig. 1.** Schematic of the baseline and main trials. The three single-agent baseline trials included variations in the original owner's intention to relinquish the object (determined by an intentional object drop, an accidental drop, or no drop at all). The eight two-agents main trials manipulated three key dimensions: original owner's intention to relinquish the object (determined by an intentional or accidental object drop), the second agent's intention to own the object (determined by whether they picked the object and took it or not), and the second agent's knowledge of the original owner's intention (determined by the second agent's presence when the original owner dropped the object). The blue background shows variations on the original owner's intention, and the yellow background shows manipulation in the second agent's intention and knowledge states.

walking from one side of the screen to the other (for the trial structure, see Fig. 1). Three of these videos were baseline trials designed to measure how ownership intuitions are affected by how a single agent interacts with an object. In these baseline trials, the original owner (in blue) carrying a green bag emerged from the left side of the screen and walked toward the right side of the screen until disappearing. In the *no-drop baseline*, the agent simply walked across the screen with a bag. In the *accidental baseline*, an object (represented as a brown square) slipped out of the agent's bag in the middle of the screen without the agent noticing. Finally, in the *intentional baseline*, the agent paused in the middle of the screen and intentionally placed the object on the ground and then walked away.

In the eight main trials, the videos were similar to the baseline videos except that a second agent (in yellow) was added. These videos parametrically varied depending on (a) whether the original owner's object fell accidentally or was dropped intentionally, (b) whether the second agent was present when the original owner dropped the object, and (c) whether the second agent took the object or simply walked past it.

Each video was paired with a brief vignette that explained all the key variables: the original owner's intention (e.g., "The blue person accidentally dropped the object") and, in the main trials, the second agent's knowledge state (e.g., "The yellow person knows that the blue person accidentally dropped the object").

**Procedure.** The full script is available in the Supplemental Material. Participants were introduced to the two agents (with no names and differentiable only by their color) and were told that the original owner would always carry a bag with an object. They were told that this agent would sometimes drop an object intentionally, sometimes accidentally, and sometimes not at all. Participants were also told that the original owner always started by owning the object. Finally, participants were told that their task was to decide how much each agent owned the object at the end of each video using two slider bars—one for each agent. To continue the task, participants had to correctly answer (a) which person had the bag of objects and (b) who initially owned the object. If participants provided at least one incorrect response or did not respond, they would stay on the page and a message would show up asking them to check their answers.

During the task phase, participants watched all 11 videos in a randomized order. At the end of each video, participants were asked to respond to the question "How much does the [blue/yellow] person own the object now?" on a scale from 0 (*not at all*) to 100 (*completely*). The question order was randomized across trials. After completing all trials, participants were asked to respond to the question "How valuable do you think the object is?" on a scale from 0 (*not valuable at all*) to 100 (*extremely valuable*). Finally, participants were asked a series of demographic questions (see the Supplemental Material).

## Results

As preregistered, participants who gave a nonzero rating to the second agent on the baseline trials were excluded from the experiment ( $n = 53$ ).

**Baseline trials.** Participants attributed the highest level of ownership to the original owner in the no-drop baseline ( $M = 99.75$ ,  $SD = 2.03$ ), followed by the accidental baseline ( $M = 59.18$ ,  $SD = 40.87$ ); the lowest level of ownership was attributed to the original owner in the intentional baseline ( $M = 22.21$ ,  $SD = 34.69$ ). Both decreases were significant,  $t(119) = 10.83$ ,  $d = 0.99$ ,  $p < .001$ , and  $t(119) = 8.50$ ,  $d = 0.78$ ,  $p < .001$ , by paired  $t$ -tests (for the first and second contrasts, respectively), suggesting that ownership judgments are sensitive to owners' behavior and mental states, even when the owner is alone.

**Main trials.** Figure 2 shows participant judgments in the main trials. Participants had similar intuitions for all trials in which the original owner intentionally dropped the object (Figs. 2a–2d). When the second agent walked away without taking it (Figs. 2a and 2b), most participants thought that the object lacked an owner. By contrast, when the second agent took the object that the original owner intentionally left behind (Figs. 2c and 2d), people's intuitions shifted in a unified way, with participants judging that the object now belonged to the second agent. In each of these cases, the second agent's knowledge of how the object ended up on the floor did not affect people's judgments (cf. Figs. 2a and 2b and Figs. 2c and 2d).

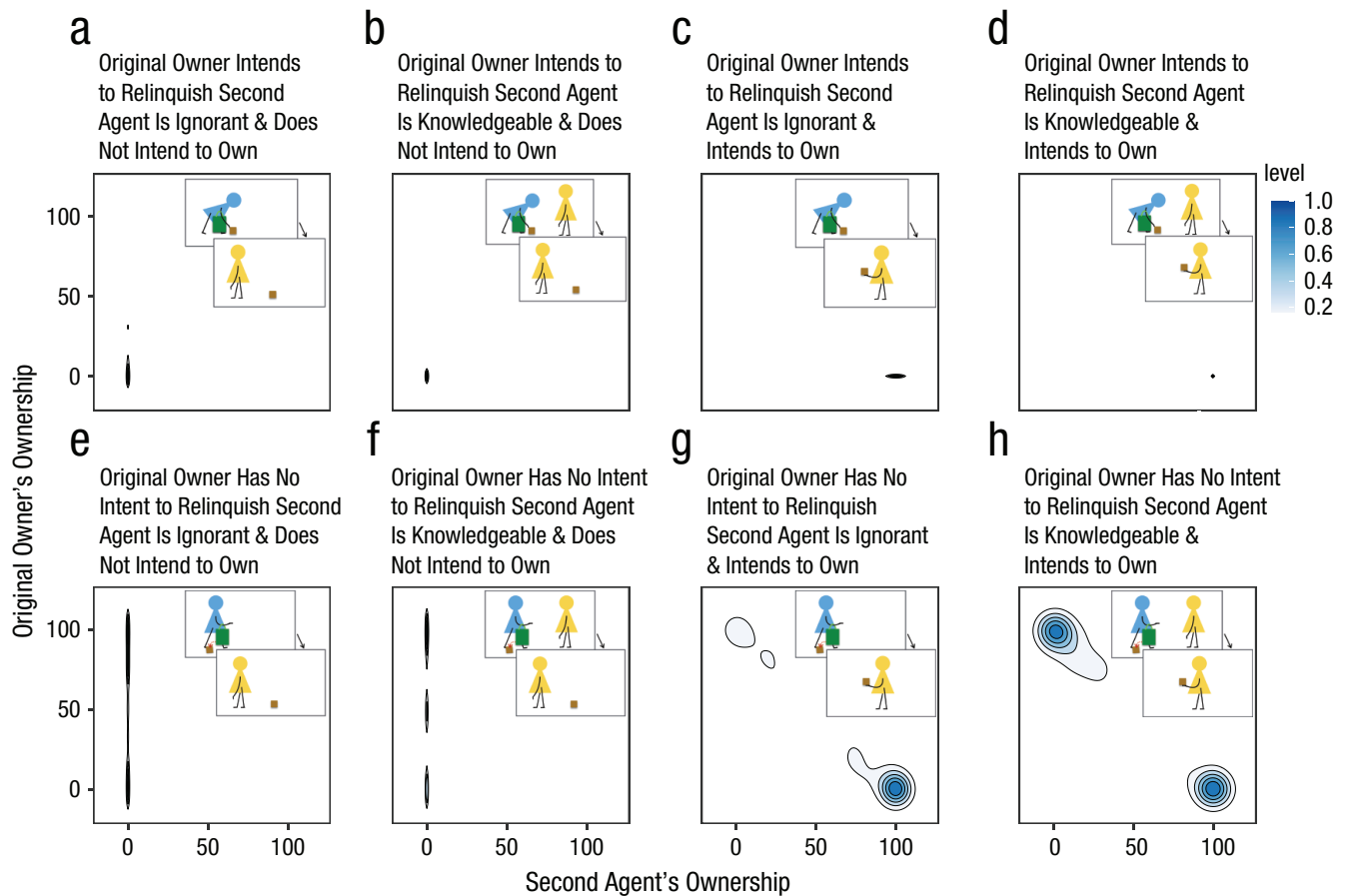
In contrast to the nearly unanimous agreement in events in which the original owner intentionally dropped the object, participant judgments became bimodal when the original owner accidentally dropped the object (Figs. 2e–2h). When the second agent walked away without taking the object that the original owner had accidentally left behind (Figs. 2e and 2f), some participants believed that nobody owned the object, whereas others believed that the original owner retained ownership. And when the second agent took the object, people's intuitions clustered around two extremes: One group of people believed that only the original owner owned the object, whereas the other group believed that only the second agent owned the object. Moreover, the relative proportion of people in each group varied on the basis of the second agent's knowledge. When the second agent did not know how the object ended on the floor (Fig. 2g), 54% of participants believed that the second agent owned the object more than the original owner did. However, when the second agent had seen the object accidentally slip out of the original owner's bag (Fig. 2h), only 41% of participants believed

that the second agent owned the object more than the original owner, a marginal decrease across trials (odds ratio = 1.71,  $p = .052$ ; Fisher's exact test).

**Quantifying people's ownership intuitions.** To formally quantify people's intuitions, we divided the space of ownership judgments into five equal-area regions (through a Voronoi partition; see Fig. 3) that represent the following beliefs: (a) Neither the original owner nor the second agent owns the object (Fig. 3, bottom left), (b) the original owner owns the object more than the second agent does (Fig. 3, top left), (c) both agents somewhat own the object (Fig. 3, middle), (d) the second agent owns the object more than the original owner does (Fig. 3, bottom right), and (e) both agents own the object (Fig. 3, top right). Although the number of possible intuitions could be greater (e.g., one of these theories could turn into two smaller theories), these five intuitions represent a first approximation of five types of beliefs that people might have in each event.

To identify systematic response clusters, we defined a region as reflecting an intuition if the number of participants selecting it was statistically higher than expected by chance (i.e., higher than .2 given five regions of equal area). This analysis confirmed the qualitative patterns found in Figure 2: All trials in which the original owner intentionally left the object behind (Fig. 2, top row) elicited a single intuition cluster, and all trials in which the original owner accidentally dropped the object (Fig. 2, bottom row) elicited two intuition clusters. Consistent with these patterns, only the accidental baseline gave rise to two intuitions, whereas the no-drop baseline and intentional baseline revealed a single intuition (for exact distributions, see the Supplemental Material).

One possibility is that conflicting judgments do not reflect conflicting ownership intuitions but rather different beliefs about the object's value. That is, some participants might have assumed that the object was worthless (e.g., a pocket tissue pack), and they could have reasonably concluded that the original owner would not care about ownership after having accidentally dropped it (essentially retroactively relinquishing ownership). Other participants might have assumed that the object was valuable (e.g., a phone). These participants would then expect the original owner to retain ownership over the object. If this is the case, then people's estimates about the object's value should predict their judgments in the task. For each two-intuition event (including the baseline trial), we ran a logistic regression predicting participant cluster as a function of the reported object value. These regressions revealed no significant effect in any event,  $|b| < .013$ , Bonferroni-corrected  $p > .2$  (see the Supplemental Material). This



**Fig. 2.** Distributions of participants' ownership judgments in Experiment 1. Each plot represents one of the eight main trials, with the original owner's ownership on the  $y$ -axis and the second agent's ownership on the  $x$ -axis. Each figure shows a density plot of participant judgments (data were minimally jittered for visualization purposes because density plots cannot be estimated in the absence of variance; for details, see the OSF repository), the two static images in each panel represent the two key events that happened in each video.

suggests that people's beliefs about the object's value do not explain the striking patterns of disagreement we found in this study.

## Experiment 2

People's conflicting ownership intuitions in Experiment 1 raise a question: Are people aware of these disagreements? Experiment 2 replicated our findings and probed people's expectations of consensus.

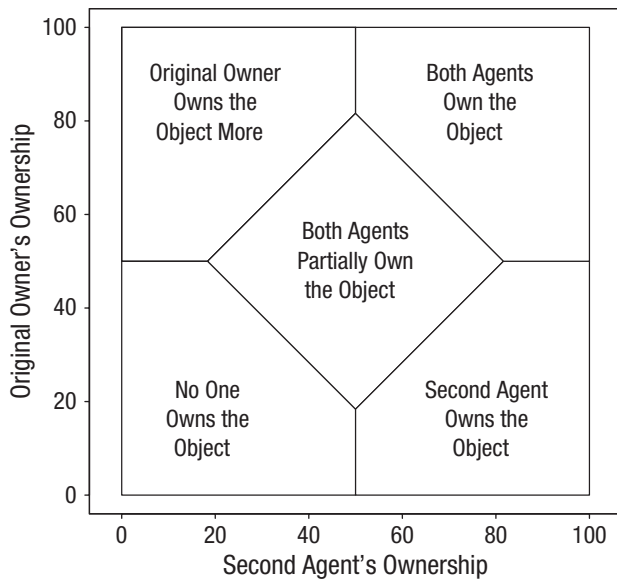
### Method

**Participants.** A preregistered sample of 120 U.S. adult participants ( $M_{\text{age}} = 35.9$  years, range = 18–76 years,  $SD = 14.6$  years) were recruited online through Prolific, the same sample size as Experiment 1. We aimed to replicate results from Experiment 1 to ensure the experiment was appropriately powered. We also planned to assess

participants' judgments as to how many people shared their own intuitions. An additional 31 participants were recruited but not included in our analysis on the basis of the same preregistered inclusion criterion as Experiment 1.

**Stimuli.** The same videos and vignettes were used as Experiment 1.

**Procedure.** The procedure was identical to Experiment 1 except that participants were told that they would also have to estimate what percentage of people would share their intuitions. In addition, to avoid potential confusion about the second agent's ownership rating when only one agent appeared in the video, we instructed participants that the second agent does not own the object at all if they do not appear in the video. For each trial, after watching the video and entering two ownership ratings, participants were asked "What percentage of people do you think would have similar intuitions as you?" on a



**Fig. 3.** Visualization of five possible ownership intuitions represented on a two-dimensional space, with the second agent's ownership on the  $x$ -axis and the original owner's ownership on the  $y$ -axis. The judgment space is divided into five equal regions, as shown here using a Voronoi partition.

scale from 0 (*no one*) to 100 (*everyone*). Finally, participants were asked a series of demographic questions (see the Supplemental Material).

## Results

**Experiment 1 replication.** As preregistered, participants who gave nonzero ownership ratings for the second agent in the baseline trials were excluded from the experiment ( $n = 31$ ). Replicating the Experiment 1 baseline results, significantly higher ownership ratings were given to the original owner in the no-drop baseline ( $M = 98.33$ ,  $SD = 12.86$ ) compared with the accidental baseline ( $M = 61.45$ ,  $SD = 40.04$ ),  $t(119) = 9.27$ ,  $d = 0.85$ ,  $p < .001$ , and significantly higher ownership ratings were given to the original owner in the accidental baseline compared with the intentional baseline ( $M = 19.92$ ,  $SD = 32.85$ ),  $t(119) = 10.91$ ,  $d = 1.0$ ,  $p < .001$ .

Categorizing people's judgments into our five belief categories (Fig. 3) produced an exact replication of Experiment 1 (for details, see the Supplemental Material): Participants' reported object value had no predictive power on any trial,  $|b| < .012$ , and Bonferroni-corrected  $p > .9$  for all cases using logistic regressions. This further suggests that people's judgments reflected different intuitions about ownership rather than differences in perceived object value.

Additionally, this experiment once again showed that, when the second agent took the object in the accidental-drop condition, the relative proportion of people in each of the two clusters appeared to vary on

the basis of whether the second agent knew about the accidental drop (i.e., the events shown in Figs. 2g and 2h). When the second agent was unaware, the percentage of participants who rated the second agent as owning the object more than the original owner increased from 49% to 61%, but this increase was again marginally significant (odds ratio = 1.60,  $p = .09$ ; Fisher's exact test). However, combining the results from both experiments did reveal a significant difference (see the Supplemental Material), suggesting that some participants were further sensitive to the second agent's knowledge. We return to this point later.

**Consensus ratings.** We next examined people's beliefs about consensus across baseline and main trials. A linear mixed-effects model revealed that participants expected a significantly lower proportion of people to share their intuitions on the events that gave rise to two belief clusters ( $b_{\text{cluster number}} = -0.1$  and  $p < .001$  controlling for subject-level effects; see the Supplemental Material). At the same time, people's predicted agreement decreased only from an average of 85.8% (on events with consensus) to an average of 75.7% (on events with conflicting intuitions), in which the actual agreement dropped from 76.1% to 45.8%. This suggests that participants knew which events were more likely to elicit conflicting intuitions, but they severely underestimated the magnitude of the conflict.

To test this possibility further, we compared participants' expected agreement against the true agreement (defined as the proportion of participants choosing the same region in the Voronoi partition as the participant; see Fig. 3) through a linear mixed-effect regression (with random intercepts and slopes by participant and with random intercepts and slopes by trial; for details, see the Supplemental Material). This analysis confirmed that people expected higher agreement on trials in which people agreed more ( $b = 0.32$ ,  $p < .001$ ), but every 1% increase in assumed agreement was related to only a 0.32% increase in true agreement. This was reflected in the mean judgments as well: The expected mean agreement was .81 ( $SD = .19$ ), whereas the true mean agreement was .62 ( $SD = .27$ ),  $t(1319) = 25.85$ ,  $d = 0.71$ ,  $p < .001$ .

Together, these results confirm that, as mundane and common as ownership judgments are in our day-to-day life, there does not appear to be a unified set of intuitions that are stable across people. Moreover, people falsely believe that consensus is much higher than it really is, suggesting that they are largely unaware of the disagreements among each other.

## Experiment 3

One concern is that differences in ownership judgments reflect only pragmatic differences in how people

interpreted the meaning of “own.” For instance, some participants might construe the word as akin to “possess,” and the differences are linguistic, not conceptual. If people are reporting true beliefs about ownership, their judgments should predict the rights that are associated with ownership (see Kim & Kalish, 2009; Nancekivell & Friedman, 2014; Rossano et al., 2011). These include the rights to use, alter, dispose, and control others’ use of the object.

## Method

**Participants.** A preregistered sample of 130 U.S. adult participants ( $M_{\text{age}} = 38.4$  years, range = 19–75 years,  $SD = 13.3$  years) were recruited online through Prolific. This sample size was determined on the basis of a pilot result and power analysis (see the Supplemental Material). An additional 37 participants were recruited but were not included in our analysis because of the same preregistered inclusion criterion as Experiment 1.

**Stimuli.** Stimuli consisted of a subset of seven short videos from Experiments 1 and 2: All three baseline trials (which served as inclusion criteria) and the four events in which the second agent took the object (because our interest was now on whether people reporting ownership transfer were also transferring rights over the object; see Figs. 2c, 2d, 2g, and 2h).

**Procedure.** Participants received the same introduction from Experiment 2 except that we replaced the introduction about estimating ownership agreement with one about evaluating some statements (for the script, see the Supplemental Material). In the main task, participants first watched the four main trial videos in a randomized order. After watching each video, participants were asked to enter their two ownership ratings (as in Experiments 1 and 2). After submitting the trial’s ownership ratings, participants were asked whether they agreed with each of the following statements (with each targeting a different right associated with ownership; the yellow person refers to the second agent):

1. *Use*: “Is it okay for the yellow person to take the object home?”
2. *Alteration*: “Is it okay for the yellow person to paint the object?”
3. *Control others’ use*: “Is it okay for the yellow person to lend the object to a friend?”
4. *Disposal*: “Is it okay for the yellow person to destroy the object?”

Each question was paired with a set of “yes” and “no” binary choices. After evaluating the four statements,

participants were instructed to briefly describe the reason for their responses in a corresponding text box.

After completing the four main trials, participants were presented with the three baseline trials in a randomized order. These trials requested participants to enter only ownership judgments and did not ask about the consequences of ownership (because these baselines were used for inclusion criteria and did not include a second agent that ownership could be transferred to). Finally, participants answered a series of demographic questions (see the Supplemental Material).

## Results

On the basis of the preregistered criteria, participants who provided nonzero ownership ratings for the second agent in the baseline trials were excluded from further analysis ( $n = 37$ ). If participants’ ownership judgments reflect true ownership beliefs, the amount of ownership that they give to the second agent should predict the rights they will have over the object. To test this, we ran a mixed-effects logistic regression predicting the yellow agent’s permissibility judgments (yes/no) as a function of ownership attributed to the yellow agent (controlling for action types and subject-level effects; see the Supplemental Material). Regression results revealed that the more ownership participants gave the second agent the more likely they were to judge the second agent’s action as permissible ( $b = 0.19$ ,  $p < 0.0001$ ; see Fig. 4a; for full results, see the Supplemental Material). This suggests that differences in participants’ ownership judgments go beyond different interpretations of the ownership rating questions. Instead, people’s ownership ratings were consistent with their evaluations of owner-specific rights.

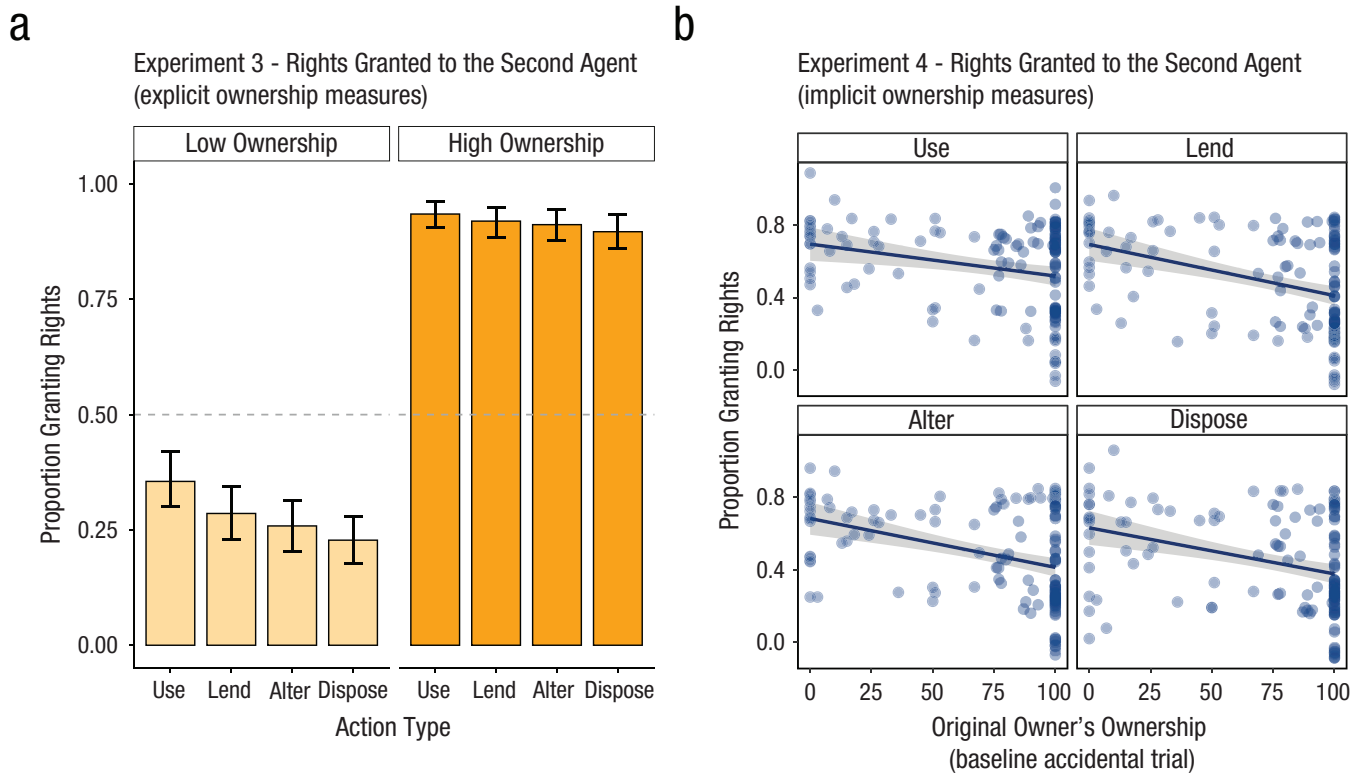
## Experiment 4

One concern with Experiment 3 is that the intuitions about object rights arose because participants were first asked to explicitly rate ownership. If so, people would not ascribe these rights if they had not been prompted by the experiment to think of these transfers as ownership shifts. To explore this possibility, participants in Experiment 4 were asked to rate the permissibility of the owner-specific actions without asking for ownership ratings.

## Method

**Participants.** A preregistered sample of 130 U.S. adult participants ( $M_{\text{age}} = 40.4$  years, range = 20–73 years,  $SD = 13.2$  years) were recruited online through Prolific. This sample size was identical to Experiment 3 given the similarity of the planned analysis. An additional 96

## Is it Okay for the Second Agent to Take the Object Home/Paint the Object/Destroy the Object/Lend the Object to a Friend?



**Fig. 4.** (a) Proportion of participants granting ownership rights to the second agent by action types and ownership groups in Experiment 3. Participants' ownership ratings for the second agent in the main trials (explicit measures of ownership) were categorized into two groups using median split: low ownership and high ownership (including the median). The dashed gray line shows the chance-level proportion. Error bars indicate 95% bootstrapped confidence intervals. (b) Proportion of participants granting ownership rights to the second agent by action types in Experiment 4. Because no ownership rating was collected for the main trials, the original owner's ownership from the baseline accidental trial was used as an implicit measure of ownership. Data were minimally jittered on the  $y$ -axis for visualization purposes (for details, see the OSF repository).

participants were recruited but not included in our analysis because of the same preregistered inclusion criterion as Experiment 1 (for an analysis including the full sample, see the Supplemental Material).

**Stimuli.** The same videos and vignettes were used as Experiment 3.

**Procedure.** Participants were provided an identical introduction as Experiment 3 except that we removed any mention about making ownership judgments (for the script, see the Supplemental Material). As in Experiment 3, participants first watched the four main trials in a randomized order. After watching each video, participants were asked to evaluate the permissibility of four owner-specific actions and provided a written explanation for their judgments. After completing these four trials, participants were told that they would be making ownership judgments for the remaining trials (using the

same introduction about ownership ratings from Experiment 3). Participants then completed ownership judgments for the three baseline trials in a randomized order. Finally, participants answered a series of demographic questions at the end of the experiment (see the Supplemental Material).

## Results

On the basis of the preregistered criteria, participants who provided nonzero ownership ratings for the second agent in the baseline trials were excluded from further analysis ( $n = 96$ ). Including all participants in the analyses provided the same overall results (for this analysis and an extended discussion, see the Supplemental Material).

The results of Experiments 1 and 2 suggest that the primary discrepancy across participants' intuitions is already revealed in the accidental-drop baseline

trial—in which one group of participants rate that the agent continues owning the object and another group of participant rates that the agent has now lost total ownership over the object. This ownership judgment therefore helps us identify which ownership beliefs a participant holds despite not having prompted their ownership judgments directly in our key trials of interest (which were critically provided before this baseline trial). To test whether ownership intuitions predict the rights they give to agents in our main trials (despite not having been prompted to think about ownership at any point in this stage), we ran a mixed-effects logistic regression that was structurally equivalent to the one from Experiment 3 except that we used the ownership judgment in this baseline trial as the independent variable (controlling again for action types and subject-level effects; see the Supplemental Material). This analysis revealed that the less ownership that participants gave to the original agent in the baseline trial the more that they transferred ownership rights to the second agent in our key trials ( $b = -0.01$ ,  $p < .0001$ ; Fig. 4b; for full regression results, see the Supplemental Material).

As part of the exploratory analysis, two coders blind to the hypothesis categorized participants' written responses in Experiments 3 and 4 into eight nonexclusive categories (the categories were preregistered). The eight categories included whether participants mentioned agents' mental-state information, the physical possession of the object, and descriptions outside the vignettes and videos or additional object information. We found that 61.3% of participants mentioned mental-state information and 44.4% mentioned physical possession of the object when explaining their judgments (for the full procedure and analyses, see the Supplemental Material).

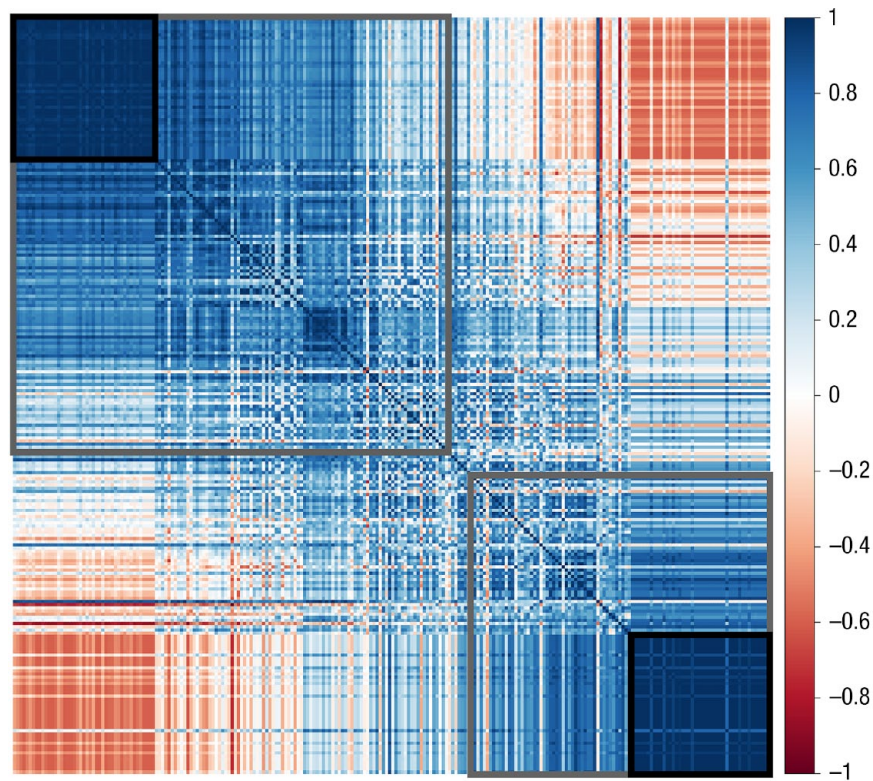
### Quantifying Naive Theories of Ownership

Having found that people show different intuitions about ownership (Experiments 1 and 2) with consequences about the rights agents have over the object (Experiments 3 and 4), we next sought to explore how many different sets of intuitions were reflected in participant judgments. Although each event revealed at most two clusters of judgments, a much larger set of patterns of intuitions could underlie this pattern (e.g., if one trial reveals clusters A and B and another trial reveals clusters C and D, this could reflect as many as four patterns of beliefs: AC, AD, BC, and BD). To evaluate this possibility, we analyzed participants' full pattern of responses for intrapersonal consistency. We first computed pairwise correlations across participants (combining data from Experiments 1 and 2 and using

the trials that elicited conflicting intuitions). As Figure 5 shows, this analysis revealed two qualitative clusters. The first cluster (Fig. 5, top left gray square) appeared to focus on the original owner's intention. These participants believed that the original owner retained object ownership after they dropped it accidentally, independent of whether the second agent took it or not (but critically agreed that the original owner lost ownership over the object when they intentionally left it behind). The second cluster (Fig. 5, bottom right gray square) appeared to focus on physical possession. These participants consistently believed that no one owned the object after the original owner dropped it accidentally and that the second agent gained ownership when they picked it up (independent of whether the second agent knew that the object was dropped accidentally; for a breakdown of ownership intuitions by cluster using the Voronoi diagram, see the Supplemental Material).

This pattern suggests that participant judgments emerge from a minimum of two different theories: a mental-state focused one (henceforth *mentalistic*) that prioritizes the original owner's intention and a physical one (henceforth *possession*) that prioritizes physical possession (Table 1). Although this divide might represent a simplified categorization of participants' intuitions (e.g., participants could rely on more nuanced ownership rules on specific trials), we started by examining responses using these broad categories. To test this formally, each participant was scored on the basis of the percentage of trials in which their answers matched the mentalistic theory and the percentage of trials in which their answers matched the possession theory (including only the trials in which the two theories make different predictions; see Table 1 and the Supplemental Material). As Figure 6a shows, all participants showed either full or partial agreement with these two theories. This is significantly different from the pattern expected by chance, which predicts that most participant judgments should agree with neither theory (see Fig. 6b;  $p < .0001$  by Monte Carlo simulations; see the Supplemental Material).

Having found that people's answers were highly consistent with the mentalistic and possession theories (and more so than expected by chance), we next tested whether these judgments reflected two opposing theories or a continuum between two extremes. Figure 6c shows the proportion of participants falling at each possible point in the continuum (focused on participants whose answers were always consistent with either the mentalistic or possession theories): 57% of these participants fell on the extremes (i.e., 28.2% reflecting the mentalistic intuitions and 28.8% reflecting the physical possession intuitions), meaning that participants were more likely to reflect a single theory rather than



**Fig. 5.** Subject-level correlation matrix. Each point represents a correlation between two participants using their ratings from the five trials that revealed two intuitive theories (four main trials and one baseline trial). Participants appear in the same order from left to right and top to bottom (with the inverted diagonal showing self-correlations within the same participant). Using the percentages of responses falling into the mentalistic or possession theory (Table 1), we highlight the following four regions in the matrix: The top left gray square includes participants (57%) who prioritized mentalistic over physical possession information when making ownership judgments; the smaller, top left black square highlights participants (19%) who relied on mentalistic information in all trials; the bottom right gray square shows participants (40%) who prioritized physical possession over mentalistic information; and the bottom right black square highlights participants (18%) who relied on physical possession information in all trials.

expressing a combination of both. This distribution was significantly different than the distribution expected by chance (Fig. 6d),  $\chi^2(5, N = 156) = 100.83$ , Cramer's  $V = .57$ ,  $p < .001$ . The remaining 43% of these participants showed an intermediate pattern of responses (Fig. 6c), suggesting that there is at least a third group with intuitions that cannot be cleanly characterized as purely prioritizing mentalistic information or physical possession.

## General Discussion

Our work suggests that, even in simple unambiguous object-transfer events, people have systematically different intuitions about ownership. Although people shared similar intuitions for events in which an agent intentionally left an object behind—judging that the object had no owner after being dropped and that it

gained a new owner after getting picked up—people showed sharp disagreements when the agent accidentally dropped the object. This pattern emerged not only when people were asked about ownership but also when they were asked about rights that coincide with ownership, such as the right to alter or destroy an object. In these events, some people thought that the owner's intentions were critical (having a mentalistic-leaning theory), whereas others prioritized physical possession (having a physical-leaning theory).

Our work also revealed a third group of people whose judgments revealed more flexibility in terms of what information to prioritize (participants in Fig. 6c who are not at either extreme). There are several possible explanations behind this group's judgments. One possibility is that there are truly only two different intuitive theories (at least in the United States), and these participants were transitioning from using one

**Table 1.** Trials in Which the Mentalistic and Possession Theories Make Conflicting Predictions

Trial	Mentalistic theory	Possession theory
The original owner has no intent to relinquish	The original owner owns	No one owns
The original owner has no intent to relinquish; the second agent is ignorant and has no intent to own	The original owner owns	No one owns
The original owner has no intent to relinquish; the second agent is aware and has no intent to own	The original owner owns	No one owns
The original owner has no intent to relinquish; the second agent is ignorant and intends to own	The original owner owns	The second agent owns
The original owner has no intent to relinquish; the second agent is aware and intends to own	The original owner owns	The second agent owns

Note: In all five trials, the original owner accidentally dropped the object (and had no intention to relinquish ownership). The first column shows the trial descriptions, the second column shows the mentalistic theory's predictions (in which people prioritize the owner's original intentions), and the third column shows the possession theory's predictions (in which people prioritize physical possession).

principle to the other (e.g., people who believe in the possession theory but were beginning to appreciate the role of the owner's original intentions). Alternatively, these differences might suggest that intuitive theories of ownership are even more nuanced. For instance, some participants care more about the object history and who the first owner is (consistent with the *first-possession* bias; see Friedman, 2008) and weigh the final possessor's ownership differently on the basis of their knowledge state.<sup>1</sup> Our Experiments 1 and 2 showed initial evidence that people in the mentalistic theory group are internally divided in their intuitions: Some participants appeared to be more sensitive to the recipient's mental states (in particular whether they knew the object had been accidentally dropped). Although this effect was not significant in either individual experiment, combining the data does show a significant effect (see the Supplemental Material). In more complex settings, people's intuitions might be divided further—for instance, when they know the objective or sentimental value of the object (e.g., people might disagree on how much an agent's personal feelings toward an object affect ownership) or the likelihood that a found object could be returned to its original owner (e.g., people might disagree on how long one must wait before someone who lost the object loses their ownership rights over it).

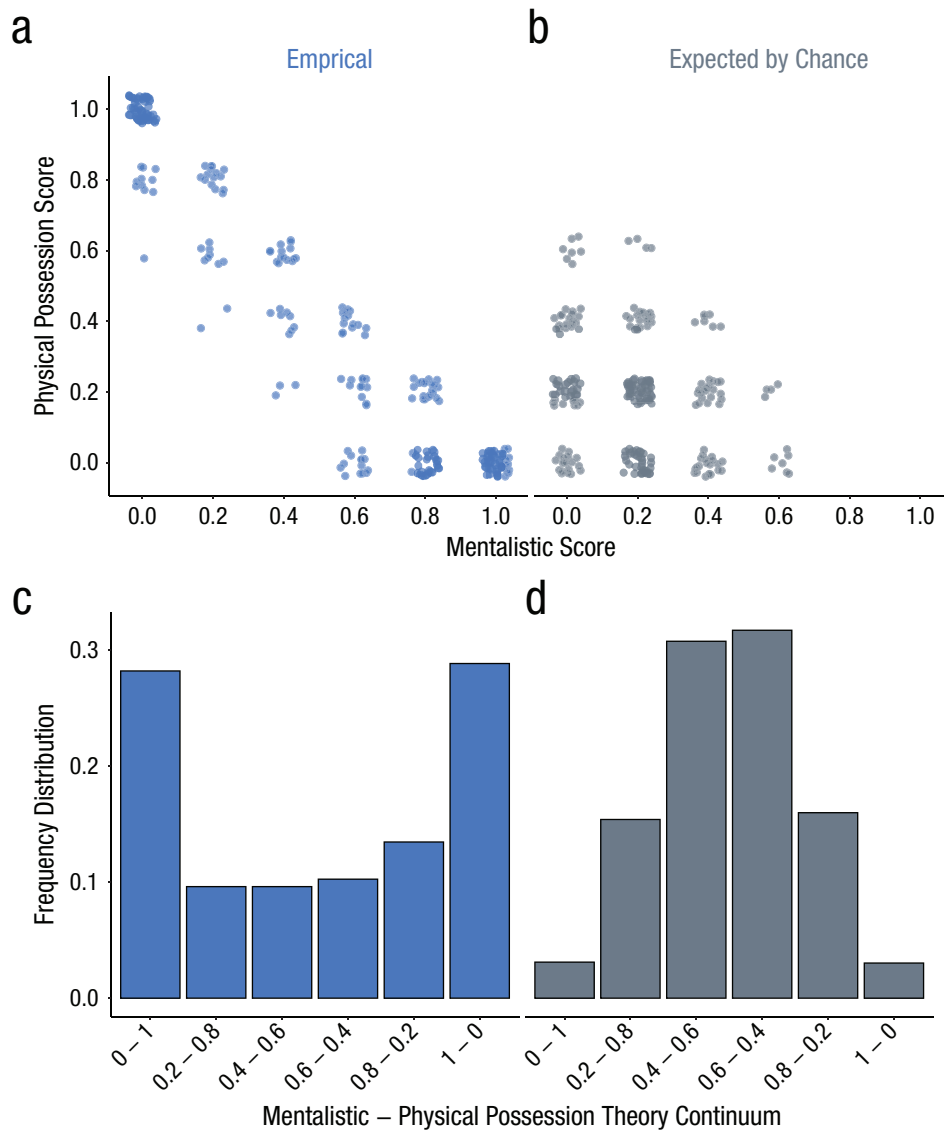
Our results therefore suggest that people have different intuitions about ownership in simple transfer events, but they do not imply that all intuitions can be neatly captured as a division between mentalistic- and possession-oriented theories. These are questions that we hope to explore in future work.

Experiment 2 further revealed that people are partially aware that some events are more contentious than others. Although it is possible that some inflated sense of consensus might arise from providing an ownership

judgment prior to the consensus rating, we found that people severely underestimated the magnitude of the underlying disagreements. This raises a question: Should the differences in people's intuitive theories of ownership not be obvious given the disputes that they could cause in the real world?

Perhaps identifying these differences in real life might not be so simple. As we suggested earlier, perhaps such explicit disputes are rare. Furthermore, in everyday life, people might use the same cues to infer ownership, such as someone's physical possession of the object, interactions with the object, or verbal claim to ownership (e.g., if participants in our experiment saw only the second agent with the object, with no information about what happened before, they would all likely agree that the second agent owned it; Beggan & Brown, 1994; Friedman, 2008; Shaw et al., 2012). This might lead to shared representations about who owns what at any given time despite different theories of how ownership is acquired and transferred.

Although our study documented a sharp discrepancy in people's intuitive theories of ownership, it did not reveal what caused this difference. All of our participants were from the United States (recruited using the online platform Prolific), suggesting that fine-grained experiences (not captured in country-level cultural differences) give rise to different intuitions. Interestingly, none of the demographic information that we collected—political orientation, community income level (as determined by zip code), and general geographical location within the United States—was able to successfully explain these differences (see the Supplemental Material). This raises the possibility that people's experiences of how ownership is acquired and lost could be closely related to how others in their own community, or perhaps even others in their immediate family, interact with objects.



**Fig. 6.** (a) Participants' consistency with the possession and mentalistic theories. Each point represents a participant, the *x*-axis shows the proportion of judgments consistent with the mentalistic theory (e.g., 1.0 means that all trials were consistent with the mentalistic theory), and the *y*-axis shows the proportion of judgments consistent with the possession theory. Proportions were calculated using trials in which the two theories make conflicting predictions, as shown in Table 1. (b) Distribution of ownership judgments expected by chance if participants were responding randomly (see the Supplemental Material available online). (c) Proportion of participants showing different theory mixtures (including only participants who always responded in accordance to one of the two theories). The *x*-axis indicates the proportion of mentalistic responses and proportion of physical responses separated by a dash (such that the leftmost side represents full physical judgments and the rightmost side represents full mentalistic judgments). (d) Distribution expected by chance.

A second explanation for individual differences remains. Intuitively, most ownership transfer events that we witness are ones in which one agent willingly transfers ownership to another agent. In these cases, mental-state information and physical possession correlate with one another. Therefore, different people might derive different conclusions about what dimensions licensed the ownership transfer, with some participants focusing on the physical transfer of objects and others focusing

on the agents' mental states. This account would help explain why both intuitive theories give converging answers to all events when an agent intends to relinquish ownership but diverge when an agent did not intend to relinquish ownership.

We close by returning to a point made earlier, which is the counterintuitive nature of these findings. Indeed, when we first began piloting these studies, we had no expectation that individual differences would arise for

the simple scenarios that we were using. The fact that they do raises a more general question: Will we also find this in other domains? There is a tacit assumption by cognitive scientists that, at least when it comes to simple cases, people share the same underlying theories about domains such as naive physics and theory of mind. Perhaps this is so, but the existence of conflicting intuitive theories in the domain of ownership suggests that this remains an open question.

## Transparency

*Action Editor:* Leah Somerville

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*Author Contributions*

**Xiuyuan Zhang:** Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Software; Validation; Visualization; Writing – original draft; Writing – review & editing.

**Paul Bloom:** Conceptualization; Methodology; Project administration; Writing – review & editing.

**Julian Jara-Ettinger:** Conceptualization; Funding acquisition; Methodology; Project administration; Resources; Supervision; Validation; Visualization; Writing – review & editing.

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## ORCID iDs

Xiuyuan Zhang  <https://orcid.org/0009-0009-9402-2545>

Julian Jara-Ettinger  <https://orcid.org/0000-0002-6167-1647>

## Supplemental Material

Additional supporting information can be found at <http://journals.sagepub.com/doi/suppl/10.1177/09567976241240424>

## Note

1. We thank an anonymous reviewer for this observation.

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