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Original Article

A Memory Advantage for Property

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Abstract: People's access to resources depends on their status as the owner of particular items. To respect property, people need to remember who owns which objects. We test the hypothesis that people possess enhanced memory for ownership relations compared to unrelated objects. Participants viewed a sequence of 10 person-object pairs before completing a surprise associative memory test in which they matched each person with the previously paired object. We varied the description of the person-object pairs in the instructions. Across three experiments, participants showed better recall when the person was described as the owner of the object compared to being unrelated. Furthermore, memory for property was better than a physical relation (bumping), whereas it did not differ from mental relations (wanting and thinking). These patterns were observed both for memory of items (Experiments 1 and 2) and perceptual details (Experiment 3). We discuss implications for how people remember other people's property.

Keywords: property, ownership, mental states, associative memory

Introduction

The concept of property is a fundamental part of social life. In human societies, an individual's access to valuable resources does not depend only on physical power but also on the person's status as the "owner" of particular objects (Hobbes, 1651; Hume, 1740; Locke, 1689). Human groups determine ownership using intricate property rules that are much more complex than those observed in non-human animals (Brosnan, 2011). However, for people to respect property, they need to remember who owns which items. Individuals are surrounded by numerous objects with different owners. Moreover, people own objects that are physically similar and distinguished only by subtle details such as different people's pens, jackets, bicycles, MacBooks, or Honda Accords. These complexities raise

questions about how people maintain accurate representations of the property relations in their social groups.

Previous studies have found a variety of psychological features that support people's sense of ownership. Research suggests that people show better memory for items they own compared to items owned by other people (Cunningham, Conway, Turk, and van den Bos, 2010; Cunningham, Turk, Macdonald, and Macrae, 2008; van den Bos, Cunningham, Conway, and Turk, 2010). People also value the same object more if they own it than if they do not, termed the *endowment effect* (Kahneman, Knetsch, and Thaler, 1991; Jones and Brosnan, 2008). To determine ownership, people make inferences using rules such as who was first to possess the item (DeScioli and Karpoff, in press; Friedman, 2008; Friedman and Neary, 2008), who invested labor in the item (Hook, 1993; Kanngiesser, Gjersoe, and Hood, 2010), who grants permission to other people to use the item (Neary, Friedman, and Burnstein, 2009), and who was necessary for acquisition of the item (Friedman, 2010). Property transfers such as gift-giving, buying, borrowing, and stealing are also characterized by systematic intuitions in children and adults (Blake and Harris, 2009; Kim and Kalish, 2009; Olson and Shaw, 2011). Similarly, understanding the implications of ownership, such as the owner's right to destroy their property, begins in early childhood (Rossano, Rakoczy, and Tomasello, 2011). Finally, Constable, Kritikos, and Bayliss (2011) found that ownership influences visuomotor processing; participants were more careful when lifting the experimenter's mug, whereas they used more forceful movements to lift their own mug.

Theories about the functions of property can help understand these empirical observations. Researchers have proposed that the concept of property helps to resolve conflicts of interest over resources (Gintis, 2007; Krier, 2009; Stake, 2004). These proposals build on Maynard Smith's (1982) classic evolutionary model of resource disputes, which shows that evolution can favor strategies that compete or acquiesce based on an *uncorrelated asymmetry*: an asymmetry between disputants that is not correlated with physical power. Maynard Smith examined the case of the *bourgeois strategy*, in which individuals compete when they have first possession over a resource and they back down when their counterpart had prior possession. The model shows that by respecting property rules, individuals can coordinate their fighting decisions to avoid costly disputes such as stubborn standoffs, heated arguments, or violence. Individuals who respect property gain an evolutionary advantage over individuals who ignore the rules because they incur less fighting costs (Maynard Smith, 1982). DeScioli and Wilson (2011) found empirical support for Maynard Smith's model in an economic game in which participants disputed over monetized resources. When resources were clumped in patches, creating the potential for costly disputes, participants spontaneously developed a prior-possession rule to resolve conflicts of interest. In contrast, when resources were distributed uniformly and costly disputes were rare, no property convention was observed.

From the perspective of Maynard Smith's model, property is defined as a particular strategy that uses coordination rules to reduce the costs of disputes. A coordination function can encompass a variety of rules that differ in content and complexity (see also DeScioli and Kurzban, 2013). Perhaps the simplest property rule is based on immediate possession or physical contact between the individual and the object, and the next simplest rule is based on physical proximity. These two rules have been observed in non-human animals (Brosnan, 2011; Kokko, López-Sepulcre, and Morrell, 2006; Stake, 2004). In contrast,

there is limited evidence in non-human species for more abstract property rules that do not require co-presence, such as prior possession or invested labor (Brosnan, 2011). A possible exception is chimpanzees, which appear to recognize working for a reward as establishing ownership (Brosnan, 2011). The idea that property functions as a fighting strategy shows a common thread running from simple possession to the most complex property laws found in human societies (DeScioli and Karpoff, in press). Different property rules found in non-human animals versus humans and in one human culture versus another are all connected as instances of a single underlying strategy for reducing fighting costs.

The present experiments add to previous research by looking at how people remember who owns which objects. If ownership functions to allocate resources, then it is critical for individuals to remember property relations so they can apply ownership conventions. Hence, we test the primary hypothesis that people possess enhanced memory when person-object pairs are characterized by ownership, compared to when the person and object are unrelated. We test this hypothesis both for recall of items, such as remembering John's scissors and Mary's keys (Experiments 1 and 2), and perceptual details, such as remembering John's bicycle as distinct from Mary's bicycle (Experiment 3). Recall for items is required for applying ownership conventions to different types of objects. Recall for perceptual details is required for distinguishing among similar objects. Individuals in a social group often need to distinguish ownership for objects that share the same category and similar appearance such as different people's hammers, baskets, shirts, or wallets.

Memory for associations, such as owner-to-object, as well as for perceptual details, such as distinguishing one bicycle from another, are challenging memory tasks because they require a great deal of specificity in memory (Schacter, Gutchess, and Kensinger, 2009). Although general information often supports the distinction between a familiar item and a novel one, memory for associations and details requires accurate binding together of several pieces of information (e.g., color, orientation, size, owner information) into one representation (Chalfonte and Johnson, 1996; Koutstaal and Schacter, 1997). Thus, finding that ownership benefits these aspects of memory would provide strong support for the salience of ownership information.

Further, we compare memory for property to other physical and mental relations between people and objects. These comparisons can clarify the relative strength of memory for property. Also, they can test alternative ideas about how the mind represents property relations. We select comparison cases based on the fundamental distinction between physical versus mental relations, and between desires and beliefs within mental relations (Dennett, 1989; Frith and Frith, 2003; Hirschfeld and Gelman, 1994; Pinker, 1997; Repacholi and Gopnik, 1997; Spelke and Kinzler, 2007).

For physical relations, we draw on the principle of contact, which is fundamental to understanding inanimate objects even in young infants (Spelke and Kinzler, 2007). Specifically, we look at bumping interactions in which a person contacts an object. We selected bumping rather than terms for contact that could additionally imply mental relations, such as touching or holding, in order to separate physical from mental relations. For mental relations, we select desires and beliefs because they are basic and distinguishable elements of people's understanding of others' minds (Frith and Frith, 2003; Repacholi and Gopnik, 1997).

We take the general empirical approach that theories about shared psychological mechanisms predict similar patterns of cognitive processing such as memory, attention, and

inferences (e.g., DeScioli, Asao, and Kurzban, 2012; Spelke and Kinzler, 2007). It is possible that the human concept of property is built on simpler concepts such as physical contact and proximity. If people represent ownership as a physical relation, then they will show similar memory abilities for ownership and physical relations. Alternatively, the concept of ownership might be more closely related to mental state representations (Frith and Frith, 2003). If ownership is understood as a mental relation, then memory for ownership will be similar to memory for desires and beliefs.¹ We note that these hypotheses are about whether ownership is primarily a physical or mental concept rather than about which cues are used to infer ownership in a particular instance (we expect that cues of ownership span both physical and mental domains).

Experiment 1

In Experiment 1, we showed participants a sequence of 10 person-object pairs before administering a surprise associative memory test asking them to match the person's face with the object from the previous pairings. Each person was paired with a different type of object. For example, John was paired with scissors and Mary was paired with keys.

Across experimental conditions, we varied how the person-object pairs were described to participants. To test memory for ownership relations, participants in the property condition were told that each pair showed a person and an object that they own. We compared performance to the unrelated condition in which participants were told that each pair showed a person and an unrelated object. The property hypothesis predicts that participants would show better memory for person-object pairs when the person was described as the owner rather than being unrelated.

In three additional conditions, participants were told that the person bumps into the object, wants the object, or is thinking about the object. The physical-relation hypothesis predicts that ownership relations will show similar recall to physical relations. The mental-relation hypothesis predicts that ownership relations will show similar recall to desire and belief relations.

Materials and Methods

We recruited participants online to complete a short study for payment (\$0.30) using Amazon's Mechanical Turk website (Buhrmester, Kwang, and Gosling, 2011; DeScioli and Kurzban, 2009; Horton, Rand, and Zeckhauser, 2011). We excluded participants who omitted responses or previously participated in a property study, yielding a final sample of $n = 273$ participants (age: $M = 31.1$, $SD = 11.5$ years; 65% female).

Participants read a short paragraph of general instructions stating that they will view a series of 10 person-object pairs (see Figure 1). To draw attention to the photos, participants were asked to write two adjectives for each face and each object before proceeding to the next pair on the next page. After completing 10 person-object pairs,

¹ There are of course more complex possibilities. Property concepts could combine, alternate between, or be separate from both physical and mental concepts. Nonetheless, we motivate a simpler dichotomous approach based on previous research showing a fundamental divide between physical and mental concepts (Pinker, 1997; Spelke and Kinzler, 2007).

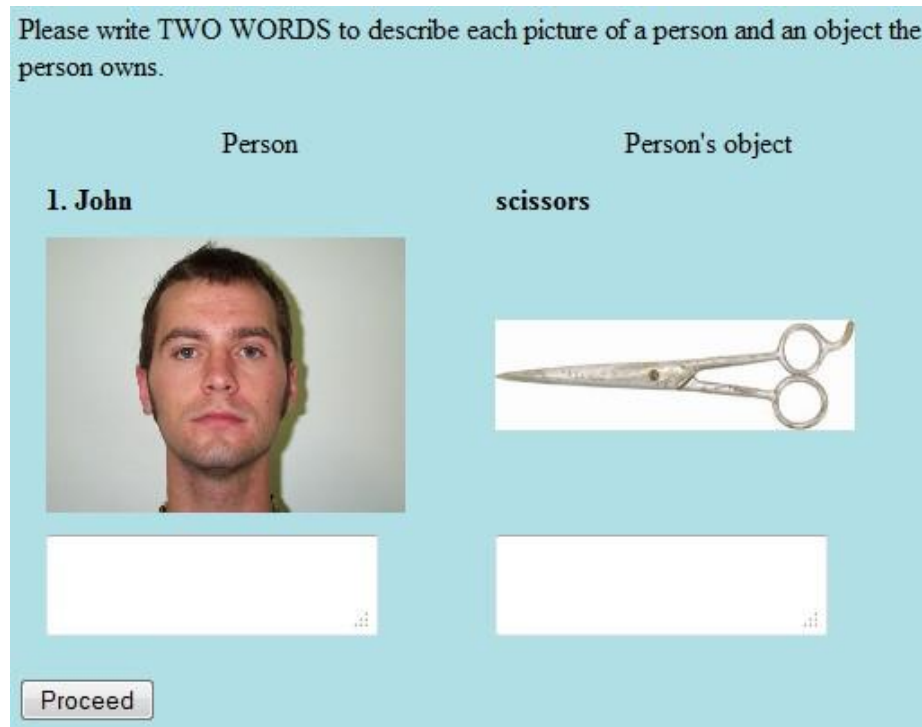
participants were presented with a surprise associative memory test. The 10 face images and names were displayed in a resorted order in the left column and the 10 object images and labels were shown in the right column, independently resorted. Participants read:

In this section, please try to match the people you previously saw with the objects they were paired with in the previous task. It is ok if you do not remember, just make the best guess you can. We are interested in which pairings were the most memorable and your guesses will help us find out even if you do not remember the exact answer.

Participants answered which face was previously paired with which object by selecting the object label from a drop-down menu next to each face. Chance performance on this task is 10%, or 1 out of 10 correct.

Across conditions, we varied (between-subjects) one sentence in the initial instructions and the headings shown over the person and object photos. In the property condition ($n = 56$), the instructions described the pairs as “a person and an object that the person owns.” In the unrelated condition ($n = 57$), the pairs were described as “a person and an unrelated object.” In the bumping condition ($n = 52$), the pairs were described as “a person and an object they bumped into.” In the wanting condition ($n = 54$), the pairs were described as “a person and an object they want.” In the thinking condition ($n = 54$), the pairs were described as “a person and an object they are thinking about.” The headings above the person and object were “Person” and then either “Person’s object,” “Unrelated object,” “Object person bumped into,” “Object person wants,” or “Object person is thinking about” in each condition, respectively.

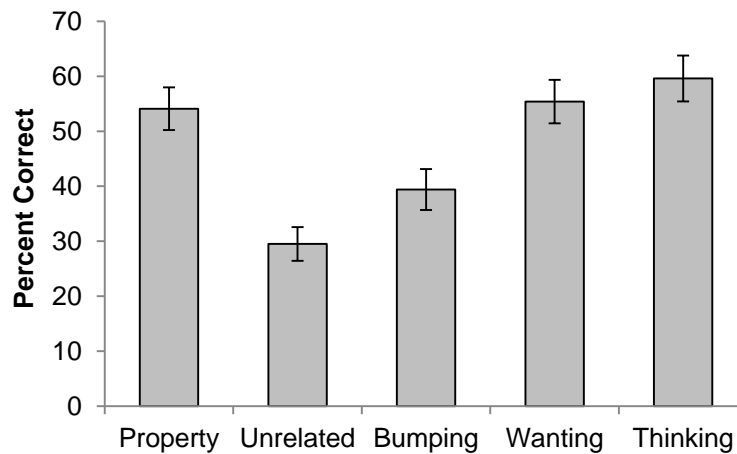
Figure 1. Stimuli showing a person-object pair from the property condition (Experiment 1)



Results and Discussion

Figure 2 shows the results of Experiment 1. Overall, we found a significant effect of condition on memory performance, $F(4, 268) = 11.51$, $p < .001$. To test the main hypothesis, we compared the property and unrelated conditions. In the unrelated condition, participants accurately recalled $M = 2.95$, $SD = 2.31$ of the 10 person-object pairs. In the property condition, participants accurately recalled $M = 5.41$, $SD = 2.90$ pairs. Consistent with the property hypothesis, recall in the property condition was significantly greater than in the unrelated condition, $t(111) = 4.99$, $p < .001$, $d = 0.94$.

Figure 2. Mean (*SE*) percent correct on memory task in Experiment 1



We next compared property to bumping, wanting, and thinking. We found that memory for property was greater than bumping ($M = 3.94$, $SD = 2.69$), $t(106) = 2.73$, $p < .01$, $d = 0.53$. In contrast, property did not statistically differ from wanting ($M = 5.96$, $SD = 3.06$) or thinking ($M = 5.54$, $SD = 2.90$), all $ps > .05$.

These findings support the hypothesis that people have enhanced memory for person-object pairs characterized by ownership rather than being unrelated. Moreover, the data comparing property to bumping, wanting, and thinking provide evidence that recall for property relations is better than physical relations and is similar to mental relations.

Experiment 2

In Experiment 2, we repeated the previous experiment with two methodological changes. First, the previous manipulation was subtle (a single sentence and heading). We aimed to strengthen the manipulation by asking participants to additionally write one sentence about each person-object relation. Second, after viewing the person-object pairs, participants counted backwards for 30 seconds prior to the surprise memory test. This was designed to reduce recency effects, which could add noise to the recall measures. Experiment 2 serves as a replication of Experiment 1 and also tests whether these modified methods will distinguish property from beliefs and desires.

Materials and Methods

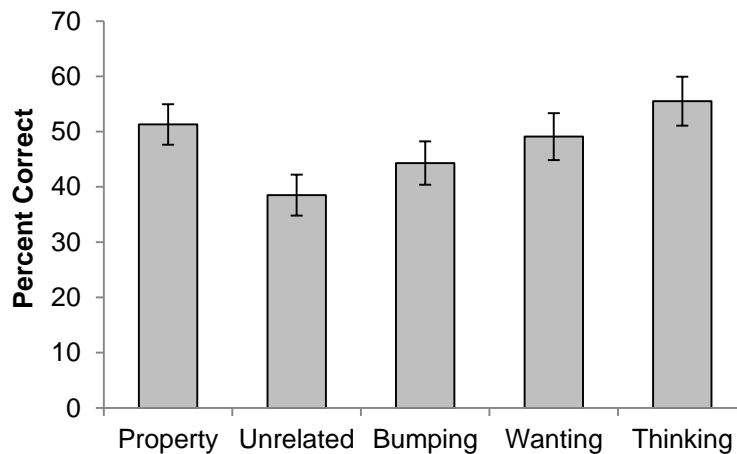
We recruited participants online to complete a short study for payment (\$0.35) using Amazon's Mechanical Turk website. We excluded participants who omitted responses or previously participated in a property study, yielding a final sample of $n = 236$ participants (age: $M = 31.3$, $SD = 11.2$ years; 55% female).

The procedures and conditions were the same as Experiment 1, with two exceptions. First, in addition to writing adjectives for each photo, participants were also asked to write one sentence about the person-object relationship in a specified format: "John owns the scissors," "John is unrelated to the scissors," etc. Second, after viewing the 10 person-object pairs, participants entered a brief retention interval of 30 seconds during which they were instructed to count backwards from 100 by sevens. They typed these numbers into a textbox on their screen. Following the retention interval, participants were presented with a surprise memory test.

Results and Discussion

Overall, we found a significant effect of condition on memory performance, $F(4, 231) = 2.45$, $p < .05$ (see Figure 3). We compared property and unrelated conditions to test the main hypothesis. In the unrelated condition, participants accurately recalled $M = 3.85$, $SD = 2.51$ of the 10 person-object pairs. In the property condition, participants accurately recalled $M = 5.13$, $SD = 2.67$ pairs. Recall in the property condition was significantly greater than in the unrelated condition, $t(97) = 2.45$, $p < .05$, $d = 0.49$ (all reported p values are for two-tail tests).

Figure 3. Mean (SE) percent correct on memory task in Experiment 2



Compared to a physical relation, the difference between property and bumping ($M = 4.43$, $SD = 2.69$) showed a trend in the predicted direction that was not statistically significant, $t(98) = 1.30$, $p = .19$, $d = 0.26$. Compared to mental relations, property did not statistically differ from wanting ($M = 4.91$, $SD = 2.88$) or thinking ($M = 5.55$, $SD = 2.94$), all $ps > .05$.

In sum, these findings largely replicated the pattern observed in Experiment 1, with the exception of a non-significant trend for the property-bumping difference. Recall for

property was better than for unrelated objects, replicating the main result from Experiment 1. Also, memory for property did not differ from wanting and thinking, as observed in Experiment 1. The absence of a property-bumping difference gives mixed evidence across Experiments 1 and 2 for the physical-relation hypothesis.

Experiment 3

In Experiment 3, we examine participants' memory for the details of an object. In the previous two experiments, each person was paired with a different type of object. Thus, participants could associate people with broad classes of objects such as scissors or keys. In Experiment 3, we assessed memory for perceptual details of objects by matching each person with a different exemplar of the same type of object (bicycle). For example, John is matched with one style of bicycle (red color, drop handlebars, etc.) and Mary is matched with another style of bicycle (white color, flat handlebars, etc.). This allows us to test whether people use the details of an object to remember ownership relations.

Experiment 3 provides a more demanding test of the efficacy of ownership in memory. Remembering item details requires more elaborated memory traces than memory for items in general. Previous work indicates that making ownership-related judgments about oneself or an intimate close other enhances memory for both items and their perceptual details (Hamami, Serbun, and Gutchess, 2011; Serbun, Shih, and Gutchess, 2011). We test whether objects owned by unknown individuals also show enhancements for both item and details.

Participants viewed a sequence of 10 person-bike pairs before receiving a surprise memory test asking them to match the person's face with the bike from the previous pairing. As in the previous studies, we varied whether the pairs were described as property, unrelated, bumping, wanting, or thinking. The property hypothesis predicts that participants will show greater recall for details when the pairing is described as property compared to unrelated. The physical-relation and mental-relation hypotheses predict that recall performance for ownership will be similar to performance for physical and mental relations, respectively.

Materials and Methods

We recruited participants online to complete a short study for payment (\$0.35) using Amazon's Mechanical Turk. We excluded participants who omitted responses or previously participated in a property study, yielding a final sample of $n = 258$ participants (age: $M = 33.3$, $SD = 12.5$ years; 56% female).

The procedures and conditions were the same as Experiment 2, with one exception: Each object was a different bicycle. On the memory test, the 10 bikes were presented alongside an assigned number and participants were asked to match the faces to the number of the bike the face was previously paired with.

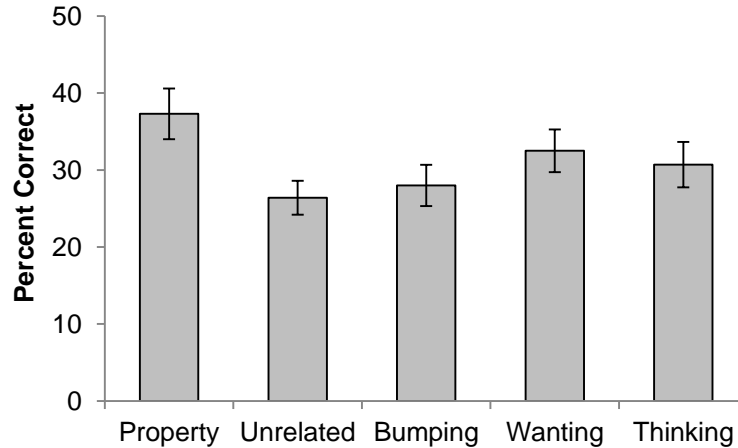
Results and Discussion

Overall, we found a significant effect of condition on memory performance, $F(4, 253) = 2.44$, $p < .05$ (see Figure 4). As expected, the results generally indicate that

remembering details is more difficult than remembering items. Percent correct ranged from 25–40% across conditions in Experiment 3, compared to 30–60% in Experiments 1 and 2.

We compared property and unrelated conditions to test the main hypothesis. In the unrelated condition, participants accurately recalled $M = 2.64$, $SD = 1.63$ of the 10 person-bike pairs. In the property condition, participants accurately recalled $M = 3.73$, $SD = 2.55$ person-object pairs. Recall in the property condition was significantly greater than the unrelated condition, $t(113) = 2.70$, $p = .01$, $d = 0.42$.

Figure 4. Mean (SE) percent correct on memory task in Experiment 3



We also found that memory for property was greater than bumping ($M = 2.80$, $SD = 1.80$), $t(103) = 2.09$, $p < .05$, $d = 0.42$. In contrast, property did not statistically differ from wanting ($M = 3.25$, $SD = 2.00$) or thinking ($M = 3.07$, $SD = 2.00$), all $ps > .05$.

In sum, Experiment 3 found the same pattern for people's recall of object details that was observed for recall of items in Experiments 1 and 2. Memory for property was better than for unrelated and bumping, and did not differ from the mental states of wanting and thinking.

General Discussion

In three experiments, we found that memory for person-object pairs was improved when the person was described as the owner of the object compared to being unrelated to the object. We observed this effect on two different memory tasks: one assessing memory for items (Experiments 1 and 2) and another assessing memory for perceptual details (Experiment 3). These observations illuminate how people distinguish who owns which items as well as how they discriminate among similar possessions such as one person's bicycle versus another person's bicycle.

These experiments also provide suggestive evidence about how people represent property. In Experiments 1 and 3, we found greater recall performance for property than for a basic physical relation of bumping, contradicting the physical-relation hypothesis that ownership is processed and encoded similar to physical relations; however, this property-bumping difference was a non-significant trend in Experiment 2, providing mixed evidence overall for the physical-relation hypothesis. For mental relations, memory for property did

not differ from wanting or thinking. These observations support the idea that property is conceptualized as a mental relation.

However, there are alternative interpretations of the results for mental and physical relations. First, mental relations such as wanting and thinking might be cues for (current or future) ownership. Participants might have inferred ownership from people's mental states of wanting and thinking, particularly because participants had little other information about the people and objects. In this case, similar memory occurred not because ownership is a mental state concept but because cues about mental states activated property concepts. Second, the results might be affected by the presentation of the stimuli as static images rather than dynamic events, which could interfere with the processing of physical relations more than mental relations. Third, bumping and thinking might differ in other relevant respects such as bumping potentially being perceived as more transitory than thinking. Although the present evidence is suggestive, additional tests using different cognitive tasks are needed to determine whether property is represented as a mental relation.

Our results add to previous investigations describing cognitive abilities in adults, children, and non-human primates that support the sense of ownership (e.g., Brosnan, 2011; Cunningham et al., 2010; DeScioli and Wilson, 2011; Friedman and Neary, 2008; Olson and Shaw, 2011). The present experiments show a cognitive ability to remember other people's property. This ability can support the functions of ownership by helping people remember who owns which items. By tracking ownership status, people can use ownership to allocate valuable resources while saving the costs of lengthy debates, hostile arguments, and possibly violence (Gintis, 2007; Krier, 2009; Maynard Smith, 1982; Stake, 2004).

Previous research has shown that people remember objects they own better than objects owned by someone else (Cunningham et al., 2008, 2010; van den Bos et al., 2010). This finding is consistent with theories of property because individuals need to remember which objects they own in order to recognize their privileged access to these items. However, people also need to remember other people's property in order to avoid provoking an owner's hostility. Consistent with this idea, our results show a memory advantage for other people's property.

Previous research has also found improved memory for items and details when participants made ownership-related judgments (Hamami et al., 2011; Serbun et al., 2011). Specifically, participants decided whether they would buy an item, whether a close other would buy an item, and whether an unknown (but familiar) person would buy an item. Recall of the item and its details was better when participants decided about themselves and a close other, compared to an unknown person. The present experiments build on this previous work by comparing property to non-property relations. The results reveal improved memory for unknown individuals' property when compared to unrelated pairs and physical relations.

An important limitation of the current studies is that, like many experiments in cognitive psychology, the task is stylized and abstract compared to natural environments. Participants were presented with strangers associated with objects in rapid succession. In naturalistic settings, people usually have the benefit of background knowledge about familiar people and richer interactions with objects. This suggests that in natural situations there might be greater differentiation in memory among ownership, unrelated, physical, and mental associations.

Property is a core element of human social life and is also the foundation of economic institutions (Demsetz, 1967; Ellickson, 1991; Kimbrough, 2011; Kimbrough, Smith, and Wilson, 2008, 2010; North, 1981; Ostrom, 1990). The concept of ownership can be understood as part of a strategy for reducing the costs of disputes over access to resources—a strategy that is present in non-human animal species but especially elaborated in humans (Brosnan, 2011; DeScioli and Karpoff, in press; Gintis, 2007; Krier, 2009; Maynard Smith, 1982; Stake, 2004). Successful performance of ownership strategies requires cognitive abilities for acquiring and organizing relevant information to accurately track ownership. Future research can continue to investigate ownership strategies to uncover the psychological abilities that support people's respect for property.

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