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Vast similarities in ownership behaviour across species and age ranges have been used to support the notion of an innate basis for ownership reasoning. Using a twin study paradigm, this is the first study to investigate the extent to which genetic and environmental factors contribute to individual differences in ownership reasoning. 65 pairs of adult monozygotic (MZ) twins, and 16 pairs of same-sex dizygotic (DZ) twins completed a 24-item ownership questionnaire, which included items on (1) new ownership and (2) appropriate transfers of ownership. For both of these factors, it was found that MZ correlations were larger than DZ correlations. Univariate model fitting analyses indicated that genetic and non-shared environmental factors could account for all individual variation on the two factors, with shared environmental factors contributing non-significantly; heritabilities ranged from .36-.57 over both factors. The results support the notion that individual differences in ownership reasoning have a significant genetic basis. It is proposed that future research look into the many other facets of ownership reasoning, and to explore their relationship and mediation via genetically influenced traits.

The rules and customs we use to establish ownership are often ascribed to human society (e.g., Bentham, 1914; Ellis, 1985). For successful reproduction and survival, individuals must acquire and maintain possession of certain materials (e.g., food, shelter, mates). Accordingly, many species have devised characteristic ways of responding to possessive behavior, presumably to reduce conflict (e.g., Brosnan, 2011; Stake, 2004). Based on the longstanding importance of property, it is reasonable to suggest that our own ownership reasoning may have evolutionary roots.

The Importance of Ownership

The importance of ownership extends beyond the satisfaction of basic needs, to include a variety of psychological effects. In humans, these include an increase in preference, memory, and value for owned over non-owned objects (Friedman & Neary, 2008; Friedman, 2010). Parallel effects have been evidenced in non-human primates and birds, who have been shown to work harder to maintain an item in their possession than to acquire the same item (i.e., loss aversion, and the endowment effect; Brosnan, 2011; Stake, 2004). On a more general note, property has been suggested as one of the earlier forms of abstract thinking, as it can extend beyond current possession (Fasig 2000; Friedman & Neary, 2008).

In addition to psychological effects, ownership influences behavior. The way we act toward an object depends on whether the object is owned, and by whom. For instance, it would be inappropriate to write in or rip out pages from another individual's journal, unless given permission to do so. Whether learned or innate, a common understanding and respect for ownership regulates much of our behavior toward objects.

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Extending beyond its effects at the individual level, an understanding of ownership is integral to social cooperation. Highlighting this social element, law defines ownership as the relation between people in regards to an object (Stake, 2004). This relation involves mutual assent regarding the boundaries and rights incurred by ownership; without which, social order would be imaginably hard to maintain. Many authors and philosophers have supported this idea, going so far as to claim that society would not exist without the establishment of property (Ellis, 1985). To elaborate, consider a society in which homes, businesses, and even this paper could be claimed by any individual with the desire to do so; with no respect for property, society could crumble. Consequently, the concept and understanding of ownership is an integral part of our society and cooperation as a species.

Despite the importance of ownership in terms of its psychological, behavioural, and social consequences, the origins and influences on our ownership reasoning are unknown. Due to our advanced and highly enforced property regulations, it may seem that our ownership beliefs derive merely from the laws we use to control property behaviour. As such, the origin of ownership reasoning has largely been taken for granted, and has been frequently ascribed to convention alone (e.g., Bentham 1914; Ellis, 1985). Although environment certainly exerts its influence on our beliefs, it would be naïve to conclude that biology does not also play a role. For instance, each of our ownership experiences must be processed within our biological hardwire, which may then lead to unique evaluations, integrations within our individual schemas, and compatibility with our personality traits. The idea that personality traits and attitudes have a heritable contribution has been evidenced in numerous studies (Johnson, Vernon, & Feiler, 2008), but the proposition that our property laws and behaviours are also biologically influenced has yet to be proven. Because ownership has comprised an invaluable component of human cooperation and society, it would be interesting to investigate whether our property behaviours reflect an undetected biological influence.

What is Ownership Reasoning?

Given its vast applicability across situations and species, it should come as no surprise that ownership reasoning is multifaceted and includes a range of questions. According to Friedman (2008) these include: (1) what can be owned and by whom?; (2) what privileges are incurred by ownership?; and (3) who owns what? This final question can also be divided into: (a) the ownership of already-owned objects; and (b) the ownership of non-owned objects (Friedman & Neary, 2009). In addition to these, there are also questions concerning appropriate transfers of ownership (e.g., borrowing without permission). For the purpose of this study, we will focus on the question of who owns what in terms of non-owned objects, and on appropriate transfers of ownership.

Ownership Reasoning in Humans

Adults have been shown to use a variety of heuristics when deciding on the owner of a non-owned object. Commonly, a "first possession" heuristic is used, in which ownership is granted to the first person to take physical possession (Friedman, 2008; Friedman & Neary, 2009). In other situations, adults have been shown to favor a person whose actions were "necessary for

possession" (i.e., caused the object to be owned, such as releasing a gem from a cliff; Friedman, 2010). Another more nuanced heuristic parallels attributions of responsibility. In this scenario, the "necessary for possession" heuristic will persist only if the agent's actions were both under their control and intended (e.g., he/she forcibly removed a gem from a cliff, with the intention of getting the gem; Palamar & Friedman, 2012). In general, the decision of who owns what may be based on attempts to retrace the history of the object-in-question (Friedman, Neary, Defeyter, & Malcolm, 2011). Although it is unclear whether these patterns were learned or acquired, parallel heuristics have been observed in young children, which may suggest an innate basis.

From an early age children exert ample attention toward property, and as young as two develop heuristics similar to those found in adulthood. Highlighting the early emergence of property notions, Furby (1980) notes that possession is one of the first concepts expressed by toddlers, and already by 18 months some toddlers are able to distinguish ownership from current possession (Fasig, 2000).

Parallel to the first possession heuristic in adults, children as young as two show a bias to select first possessor as owner of an object in serial possession tasks (i.e., tasks in which one person possesses an object, followed by another person; Friedman 2008; Friedman & Neary 2008). Similarly, in observational studies, children as young as three years old will show less resistance to a "take attempt" (i.e., playmate attempting to take their toy) when the taker had prior possession, even if the current possessor is larger in stature (Hook, 1993). Children as young as three have also been shown to infer ownership in serial possession tasks based on which character controls permission (Neary et al., 2009). Beyond tangible objects, children from the age of six have been shown to use both the first possession heuristic, as well as the control over permission heuristic, in relation to ideas (Shaw, Li, & Olson, 2012). Additionally, children from four years old have been shown to track ownership across exchanges; that is, they understood that owners could lose rights, and that non-owners could gain rights, under certain circumstances (Kim & Kalish, 2009). The early recognition of property speaks to a possible genetic basis for ownership reasoning, however it could still be argued that environment plays the supreme guiding role.

Some scholars maintain that our understanding of ownership is entirely regulated by convention (Bentham, 1914; Ellis, 1985). Although environment likely influences ownership beliefs, the vast similarity in our beliefs across cultures indicates an innate influence as well. For example, Furby (1978) compared kindergartners as well as fifth graders from three different groups, differing by property customs: (1) American, (2) Israeli: non-kibbutz, (3) Israeli: kibbutz. Kibbutz is a communal settlement in which all private property is shunned, thus it offers a natural comparison group to study the effects of convention on ownership beliefs. Across all three groups, similar responses were given when asked the meaning of, and motivation to acquire, personal property. The only differences found were between American and Israeli groups, with no differences between the two Israeli groups. Specifically, the Israeli groups marked the desire to control use over property as a main motivator for ownership. In contrast, the Americans ranked the convenience and

satisfaction of needs as the primary motivator for ownership. Furby (1978) suggested that this difference might be due to a greater concern, in Israeli people, over the control of territory, as this territory is often under threat. Despite this minor difference, the author mentions that all cultures remained "remarkably similar". Thus, in contrast to the belief that convention alone influences our ownership beliefs, the overlapping understanding between cultures suggests a genetic contribution as well.

Even in the absence of property laws, similar heuristics are observed across cultures. An example of this comes from East Timor, a country in Southeast Asia that currently has no laws regulating private land ownership. In East Timor, land authority is typically claimed based on narratives of origin and first possession, wherein subsequent settlers argue for property rights based on their relationship with original owners (Fitzpatrick, McWilliam & Barnes, 2012). This tradition is strikingly similar to the first possession heuristic observed in Western cultures, and due to the absence of laws, it cannot be ascribed to convention alone. Thus the meaning of ownership, and the heuristics we use to understand ownership may have an innate rather than a cultural basis. This idea is further corroborated with findings from other species.

Ownership "Reasoning" in Non-Human Species

A genetic etiology of ownership heuristics is suggested by the common strategies employed across species. One such strategy is termed "first in time, first in right", in which members of a species that are first to the property-in-question are more likely to retain the property than those coming later in time. Greater than mere first proximity, physical contact appears to play a pivotal role in settling ownership disputes, similar to the first possession heuristic observed in humans (Stake, 2004). An example of this is provided with wood speckled butterflies, whose fighting lasts 10 times longer when both touch down on vegetation, versus only one. In many other species from damselflies to non-human primates, the first possessor will often win in a property dispute, even against a dominant competitor (Brosnan, 2011; Stake 2004). Furthermore, experimental data show that dominant male baboons will withhold any attempts to take a food item from a subordinate male that possessed the item first (Sigg & Falett, 1985). Given the absence of formal customs, the existence of similar property behaviour over such a diverse range of species speaks to a possible innate mechanism driving ownership behaviour.

Disentangling Genetics and Environment

Due to the similarity in property behaviour across species and age ranges, along with the overwhelming importance of property in survival, it is surprising that the origin of ownership reasoning is unknown. Although speculations have existed for at least a century (e.g., Bentham, 1914), the question is unanswered: Does our ownership reasoning have a genetic influence, or is it merely the product of social convention?

A common method used to parcel out genetic and environmental influences is the twin study. Twin studies can elucidate the role of genetics on individual differences via at least two routes: (1) intra-twin correlations, and (2) model fitting. Intra-twin correlations involve computing the correlations between identical (i.e.,

monozygotic [MZ]) twins, and between fraternal (i.e., dizygotic [DZ]) twins. If the correlation is larger in the MZ twins than the DZ twins, this suggests a genetic influence.

Model fitting estimates the sources of individual variation in a phenotype (P). These sources include: additive genetics (A), common or shared environment (C), and unique or non-shared environment (E). MZ and DZ twins make ideal subjects for model-fitting of this sort because they only differ in terms of A. In summary, twin studies have the ability to estimate the contribution of environment and genetics toward variance on a given trait (see Rijsdijk & Sham, 2002 for a review on twin studies).

Based on common trends from insects and non-human primates, all the way through to children and human adults, it is suspected that ownership reasoning may have a genetic basis. Thus, it is hypothesized that the correlation between twins on an ownership questionnaire will be higher in MZ twins versus DZ twins, and that the A component of our model will explain a significant proportion of the response variance.

Method

Participants

Adult twins were recruited from a previously established twin registry. The original registry recruited twins via newspaper and catalogue ads, and from a TV and movie-casting agency specializing in twins. Data were collected from 65 pairs of identical or monozygotic (MZ) twins (60 female pairs, and five male pairs), and 16 pairs of same-sex fraternal or dizygotic (DZ) twins (15 females pairs, one male pair). Participants ranged between 19 and 82 years (M = 42.94, SD = 14.98). All participants were entered in a draw for a one in ten chance at $100. The majority of participants were either Canadian or American; a small proportion of participants were from Europe or Australia.

Materials and Procedure

After reading a letter of information and consenting to participate, subjects received a mailed or an on-line (via FluidSurvey) booklet, each containing short instructions followed by a 24-vignette survey. The 24 vignettes yielded scores on two factors: (1) new ownership, and (2) borrowing without permission, with each factor containing 12 items. The vignettes were tested in an unpublished pilot study in which the full survey was found to have a Cronbach's alpha of .837, and the new ownership and borrowing factors were found to have reliabilities of α = .852, and α = .942, respectively.

With permission, we borrowed the new ownership stories from a study by Palamer, Le, and Friedman (2012). Each story involved two male characters and a natural un-owned object (e.g., a coconut). The first character or *causal agent* allowed the object to become available (e.g., by kicking a soccer ball at a coconut, thus releasing it from its tree). Once the object became available, the second character or the *possessor* physically took the object (i.e., the coconut) and the two argued about whom rightfully owned the object. We used three base stories and varied each according to a 2 x 2 design, whereby the causal agent had intent or not, and control or not. Following each story was a statement that read "The [object] belongs to the [causal agent's name/possessor's name]". The name used in the statement (i.e., causal agent's or possessor's) was

counterbalanced across questions within each survey. Participants were asked to rate their agreement to each statement on a 7-point scale (1 = *totally disagree* and 7 = *totally agree*). Below is an example of an intent x no control story:

> Isaac is out paddling his rowboat in the bay. He sees a beautiful shell high on top of a rocky sandbar, and decides he wants it. Using one of his paddles, Isaac tries to knock the shell into the water. He misses and instead hits some of the rocks at the base of the sandbar. The rocks tumble into the water, carrying with them the beautiful shell. James is swimming by the sandbar. He sees the shell floating in the water and grabs it. Isaac hurries over, and they begin to argue about who gets to keep it.
>
> The shell belongs to Isaac:
>
> 1 2 3 4 5 6 7

The remaining 12 stories focused on borrowing without permission. In these stories, a borrower wanted to use and then return an item belonging to someone else, for either an important or non-important reason. The owner had either a surplus, or only one of the desired item(s). After each story read a statement, "It is acceptable/unacceptable for [borrower's name] to use [owner's name]'s [item]". The two versions of this statement (i.e., "acceptable" or "unacceptable") were counterbalanced across questions. The 12 stories were created using three different items and a 2 x 2 design crossing importance and surplus. Participants rated their agreement in the same way, using a 7-point scale. Below is an example of a not important x surplus story:

> Leah needs a pair of dress pants because she wants to look nice while she goes out with a friend. Her roommate Mary has several identical pairs, but she is out of town for a few days. Leah decides she will wear one pair of Mary's pants for the day, and then wash and return them.
>
> It is acceptable for Leah to use a pair of Mary's pants: 1 2 3 4 5 6 7

The twins were expected to complete the questionnaire in an hour or less, and this was done on their own time. After completion of the survey, twins read a debriefing form and were given contact information should they have any questions regarding the study.

Data Analysis

All twins rated their responses to each of the 24 items on our questionnaire, and means and standard deviations were obtained for the two factors. Correlations were computed to determine the average DZ correlation and the average MZ correlation for both our ownership and borrowing factors. Reliability statistics were also obtained for both of these factors.

The contributions of genetic and environmental factors on individual differences were estimated using univariate model-fitting, with the software package Mx (Neale et al., 1999). A "full model", which will always provide the best fit to data, estimates the relative contributions of additive genes (A), shared environment (C), and non-shared environment (E) on individual differences. Reduced models can also be fit to see whether one or more of the A, C, and E factors can be dropped without a significant worsening of fit. For example, a CE model can be used to test whether purely environmental factors can account for the data without a significant worsening of fit. In our analyses, we compare the ACE model with reduced model options using

the Akaike information criterion (AIC). The more negative the AIC value, the better choice the model. As mentioned, the ACE model will always provide the best fit, so a more negative AIC value is adjusted based on goodness of fit as well as parsimony.

Results

With all possible scores ranging from 12 – 84 per factor, the participants showed considerable variation for the "ownership" factor (M = 52.90, SD = 14.66), and for the "borrowing" factor (M = 40.48, SD = 19.13). It should be noted that each factors was looked at individually, and the total score was not considered because there was virtually no correlation between factors (r = .027).

Table 1 summarizes the genetic analyses and includes: Cronbach's alpha for each factor, intra-twin correlations for MZ pairs and for DZ pairs, the parameter estimates for additive genetics, common environment, and non-shared environment (a^2, c^2, e^2) within each model, and the AIC to compare the full ACE model with reduced model options. Both the full ACE model and the reduced AE models are included in Table 1.

As can be seen in Table 1, MZ correlations are larger than DZ correlations on both factors, indicating that genetic contributions are present. Model-fitting analyses, also presented in Table 1, reveal that the best quality model for both factors includes the additive genetic (a^2), and non-shared environmental (e^2) factors, with heritabilities ranging from .36 - .57. According to the AIC, the AE model provides the best-fitting model for both factors, on grounds of parsimony (Table 1). Thus, for both factors, non-shared environment and additive genetics accounted for the greatest amount of variance, with shared environment contributing non-significantly.

Discussion

The origins of our ownership reasoning have been long contested, with many authors arguing for a purely conventional origin (e.g., Bentham 1914; Ellis, 1985), and others acknowledging the possibility of a genetic influence (e.g., Stake, 2004; Brosnan, 2011). In the first attempt to empirically resolve this issue, we postulated that genetics would play a significant role in accounting for individual differences in ownership reasoning.

The Effects of Genetics Ownership Reasoning

In support of our hypotheses we found that for both new ownership and borrowing without permission factors, genetics accounted for a significant proportion of response variance. This is consistent with the view that our ownership reasoning has an innate basis, which has been postulated by a number of authors (e.g., Stake, 2004; Brosnan, 2011; Nancekivell, Vondervoort, & Friedman, 2013).

In prior studies, researchers had posed an innate source of ownership reasoning based on observed similarities across species, or between age ranges, as well as the early emergence and central importance of property from such a young age (e.g., Bakeman, & Brownlee, 1982, Stake, 2004; Brosnan, 2011; Nancekivell, Vondervoort, & Friedman, 2013). However, these authors had generally limited their discussion to the establishment and respect for new ownership. In recognition of this, we had incorporated questions of this sort and these comprised our first factor of "ownership". It

Table 1
Internal Reliability and Genetic Analyses on Ownership and Borrowing Factors

		Correlations (r)			Parameter estimates (95% CI)			
Factor	α	MZ	DZ	Model	a^2	c^2	e^2	AIC
Ownership	.905	.58	.39	ACE	.37 (.00-.59)	.04 (.00-.53)	.59 (.41-.81)	-5.04
				AE	.41 (.19-.59)		.59 (.41-.80)	-7.04
Borrowing	.949	.72	.56	ACE	.36 (.00-.71)	.20 (.00-.65)	.44 (.29-.64)	-5.30
				AE	.57 (.37-.71)		.43 (.29-.63)	-7.10

Note. MZ = monozygotic twins; DZ = dizygotic twins; A (a^2) = additive genetic variance; C (c^2) = shared environmental variance; E (e^2) = non-shared environmental variance; AIC = Akaike information criterion.

is reasonable that new ownership reasoning in particular may have an innate basis because the requirement of keeping track of ownership transfers is minimized, thus easing its emergence at early ages and in species without complex cognitive capacities. In addition, new ownership judgments can be developed in numerous species through the use of a simple first possession heuristic. Due to the observable characteristics of possession, this heuristic may proceed without any formal conventions or language, promoting its evolutionary development.

Although many authors proceeded from heuristics on new ownership to postulate a genetic origin of our ownership reasoning, it is unclear whether they had intended to include all aspects of ownership, or only new ownership. At least one author, Stake (2004), had reasoned that our "property instinct" involved other facets such as what to do with property. Similarly, other authors had proposed an innate basis for our ownership reasoning, without specifying any subsets to which that would be confined (e.g., Bakeman, & Brownlee, 1982). Thus, although new ownership was emphasized in the literature, we chose to include a "borrowing" factor as well, which was based on pilot study analyses of our ownership questionnaire. Interestingly, this factor also showed a significant genetic influence on response variance. Although, due to the complexity of borrowing without permission, it is harder to ground this factor within evolutionarily stable behaviours across species and age ranges, and its development seems more reliant on human language and convention. Nonetheless, the genetic influence on response variation was similar across factors.

Moving on from concepts of ownership, the heritabilities that we found for our two factors are very similar to those that have been found for most personality traits, and for a number of attitudes (Olson, Vernon, Harris, & Jang, 2001; Johnson et al., 2008). For instance, an accumulation of behavioural genetic studies over the past 50

years had indicated an average heritability coefficient of 0.48 for personality traits, which is quite close to the heritabilities we found, ranging from 0.36 – 0.57. Although genetics consistently contribute toward attitudes and traits, it is important to note that not all constructs are similarly influenced by heritability. For instance, in their study of attitudes, Olsen et al., (2001) found attitude domains (e.g., treatment of criminals, and intellectual pursuits) to be entirely attributable to environment alone.

The Effects of Environment on Ownership Reasoning

Up to this point, our study has emphasized the genetic contributions toward ownership reasoning. That being said, our results have also indicated a significant contribution of non-shared environment toward variance in ownership reasoning. For instance, estimates on the contribution of non-shared environment toward ownership reasoning range from .43 - .59, indicating that half of the variation in reasoning can be ascribed to environmental sources. This is not surprising, as many behavioural genetic studies have highlighted the importance of non-shared environment (e.g., Plomin & Rende, 1991; Olsen et al., 2001). In contrast, the contribution of shared environment toward ownership reasoning is negligible, with estimates ranging from .04 - .20. This result is similarly unsurprising, as most studies in behavioural genetic research have found only a weak contribution for shared environment on traits and attitudes (e.g., Plomin & Rende, 1991; Olsen et al., 2001; Johnson et al., 2008). Researches have not yet explained the reason for the meager contribution of shared environment, despite the consistency of this finding among studies.

The Nature of Ownership Reasoning

In recognition that both environmental and genetic factors contribute to ownership reasoning, it is worthwhile to consider how these components might affect phenotypic variation. For instance, it is unlikely that there are any direct genotype-phenotype relationships. In contrast, authors have speculated that there exists an innate predisposition to learn social rules, especially those relating to property (Bakeman, & Brownlee, 1982). It is unclear whether this idea would hold for all aspects of ownership reasoning however, as there seem to be almost universal heuristics governing property behaviour, at least in regards to new ownership. Similarly, if humans were born with an innate disposition to readily acquire ownership behaviour, then you would expect to find a greater proportion of response variation attributable to environmental factors, and more cross-cultural variation. Another possibility is that we are biologically prepared to recognize possession through first physical contact, and that our behaviour and opinions toward transfers of ownership and property disputes vary depending on a number of mediating factors, which can include a multitude of traits and attitudes. The idea that we have a biological mechanism to recognize physical possession was advanced by Stake (2004), who highlighted the existence of mirror neurons in primates that fire when viewing another primate grasping an object. Stake purported that these mirror neurons could assist in recognizing and remembering a first possessor. However, it is unlikely that recognition of physical possession would play a role in all facets of ownership reasoning.

Although authors generally refer to ownership reasoning as if it were a single

and uniform factor (e.g., "property instinct" from Stake, 2004), the two factors that we measured showed virtually no correlation. This raises the question of whether ownership reasoning is properly conceptualized as a number of independent facets, or whether its facets are essentially interdependent. We did not cover all aspects of ownership reasoning, so it is also possible that there are independent as well as interdependent facets of ownership reasoning, which could potentially reveal a factor structure in time. It is reasonable to suggest that other variables, such as personality traits or attitudes, could mediate the response patterns observed within and between ownership facets.

It is worth considering whether the ownership factors we measured represent a portion of some ownership personality trait constellation, whether the factors are proxies for some sort of possessive or social attitudes, or whether they represent some trait-attitude combination, or something entirely different. If our factors do not represent their own trait or attitude category, then there are likely personality traits and/or attitudes that mediate ownership responses. Alternatively, ownership response patterns may mediate attitudes and/or traits. Each of these questions could be investigated in future studies to more thoroughly understand the nature of ownership reasoning.

Limitations of Our Study

Our study focused on only two facets of ownership reasoning, yet there are many more aspects that were not incorporated (e.g., borrowing with permission, what can be owned, sanctions for the violation of property rights, etc.). Additionally, we chose our factors based on past research, as well as from factor and correlation analyses from a lengthier version of our ownership questionnaire. However, due to a lack of research, it is unclear whether these factors are temporally reliable, or whether they are valid and/or complete subdivisions of ownership reasoning. Future research is needed to develop a more comprehensive measure of all ownership reasoning facets. This can assist in understanding their interdependence, and eventually their relationships to participant qualities.

In addition to our questionnaire only covering a portion of all ownership facets, the method of self-report has inherent issues. For instance, it is possible that there was a social desirability bias, especially in regard to our borrowing without permission factor. Borrowing without permission is generally not well received, so participants may have felt compelled to respond accordingly. However, participants were able to complete questionnaires at home on their own time, without any supervision, and with guaranteed anonymity, so this is not a pressing concern. Another problem with self-report is that responses may not coincide with actual behaviour. Regardless, our focus was on ownership reasoning for this study, and less so on ownership behaviour, so this question is not particularly relevant.

Other limiting factors of our study are related to our participant qualities. For one, we only had 16 pairs of DZ twins, which was not ideal; we hope to continue collecting data to resolve this issue. Another concern is that most of our participants were female, and so our population may not generalize to males. Additionally, without many male participants, it was not possible to detect gender effects on our ownership reasoning factors. In this regard, past research has shown that women may be more open to

sharing, which could presumably affect response patterns to the borrowing without permission factor (i.e., to be more permissive; Rudmin, 1990). Further, research has shown male ownership behaviour to relate to competition and dominance whereas in women, ownership behaviour has been more closely related to personal achievements and social attachments (Rudmin, 1990). With this in mind, it is possible that males may have a more uniform adherence to heuristics such as the first possession heuristic, in which there appears to be an observable "winner" in the situation. Support for this idea comes from the observance that male baboons would not attempt to take a food can from a subordinate male baboon, if the subordinate baboon had first possession of the food can. In contrast, female baboons did not show this pattern (Sigg & Falett, 1985). It is possible that heuristics for new ownership could be more strictly adhered to in males since evolutionarily, males would be typically exposed to more competition for resources, and thus benefit more from a disposition to reduce property disputes (such as adoption of a first possession heuristic).

Finally, twin studies adopt assumptions that are occasionally of concern to critics. Assumptions include the independence of genetics and environment, as well as an assumed equal amount of shared environment between MZ twins and DZ twins. Independence of genetics and environment most commonly includes concerns of assortative mating, genetic-environment interaction, and genetic-environment correlation. Each of these issues can be investigated more thoroughly if necessary, though they are not of particular concern for our current study.

Conclusions

Individual differences in ownership reasoning were shown to reflect not only environmental, but also genetic factors. However, our study only covered a small portion of ownership reasoning, and the effects of gender on ownership reasoning have yet to be examined. Future research is warranted to understand the connection between ownership facets, and their mediation via personality traits, attitudes, and biological factors. In any case, this study addressed a long posed question concerning the origin of our ownership behaviour, and it opens the door for further research regarding different ownership facets and mediating factors that influencing our ownership beliefs.

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References

Bakeman, R., & Brownlee, J. R. (1982). Social rules governing object conflicts in toddlers and preschoolers. In K. J. Rubin & H. S. Ross (Eds.), *Peer relationships and social skills in childhood* (pp. 99–110). New York: Springer-Verlag.

Bentham, J. (1914). Of property. *In The theory of legislation, vol. 1. Principles of the civil code. Part I* pp.145-147. Oxford University Press.

Brosnan, S. F. (2011). Property in nonhuman primates. *New Directions for Child and Adolescent Development, 132*, 9-22.

Ellis, L. (1985). On the rudiments of possessions and property. *Social Science Information, 24*, 113-143.

Fasig, L. G. (2000). Toddlers' understanding of ownership: Implications for Self-Concept development. *Social Development, 9*, 370-382.

Fitzpatrick, D., McWilliam, A., & Barnes, S. (2012). Property and Social Resilience in Times of Conflict: Land, Custom and Law in East Timor. Ashgate Pub. Chicago

Friedman, O. (2010). Necessary for possession: How people reason about the acquisition of ownership. *Personality and Social Psychology Bulletin, 36*, 1161–1169.

Friedman, O., & Neary, K. R. (2008). Determining who owns what: Do children infer ownership from first possession? *Cognition, 107*, 829-849.

Furby, L. (1978). Possession in humans: An exploratory study of its meaning and motivation. *Social Behavior and Personality: an international journal, 6*, 49-65.

Furby, L. (1980). The origins and early development of possessive behavior. *Political Psychology*, 30-42.

Hook, J. (1993). Judgments about the right to property from preschool to adulthood. Law and *Human Behavior, 17*, 135–146.

Johnson, A. M., Vernon, P. A., & Feiler, A. R. (2008). Behavioral genetic studies of personality: An introduction and review of the results of 50+ years of research. *The SAGE handbook of personality theory and assessment, 1*, 145-173.

Kim, S., & Kalish, C. W. (2009). Children's ascriptions of property rights with changes of ownership. *Cognitive Development, 24*, 322-336.

Nancekivell, S. E., Vondervoort, J. W., & Friedman, O. (2013). Young Children's Understanding of Ownership. *Child Development Perspectives, 7*, 243-247.

Olson, J. M., Vernon, P. A., Harris, J. A., & Jang, K. L. (2001). The heritability of attitudes: A study of twins. *Journal of Personality and Social Psychology, 8*, 845-860.

Palamar, M., Le, D., & Friedman, O. (2012). Acquiring ownership and the attribution of responsibility. *Cognition, 124*, 201-208.

Plomin, R., & Rende, R. (1991). Human behavioral genetics. *Annual Review of Psychology, 42*, 161-190.

Rijsdijk, F. V., & Sham, P. C. (2002). Analytic approaches to twin data using structural equation models. *Briefings in Bioinformatics, 3*, 119-133.

Rudmin, F. W. (1990). German and Canadian data on motivations for ownership: Was Pythagoras right?. *Advances in consumer research, 17*.

Schlatter, R.B., 1973. Private Property: history of an Idea. Russell & Russell, New York.

Shaw, A., Li, V., & Olson, K. R. (2012). Children apply principles of physical ownership to ideas. *Cognitive science, 36*, 1383-1403. Chicago

Sigg, H., & Falett, J. (1985). Experiments on

respect of possession and property in hamadryas baboons. *Animal Behaviour, 33*, 978-984.

Stake, J. E. (2004). The property 'instinct'. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences, 359*,1763-1774.