Money on My Mind:

An investigation of the folk classification of money

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Abstract

Little is known about the folk ontology of money. Across four studies, we examined how participants classify two important cases: currency artifacts (bills and coins) and *ad hoc* currency objects, which include artifacts not intended to be currency (e.g. cigarettes) and natural objects (e.g. shells). In all studies, participants reliably categorized shells and cigarettes as money only when they functioned as a currency within the current social system. In contrast, many participants continued to classify currency artifacts as money even when they no longer functioned as currency. Interestingly, responses were bimodal, with participants either fully endorsing or rejecting the classification of defunct currency artifacts as money. When asked to generate properties of money, participants mentioned social (e.g. being a medium of exchange) and physical (e.g. having a serial number) properties, but rated social properties as more important. Participants saw artifacts and social conditions as interacting but placed more weight on social conditions overall. Therefore, data indicated that although participants primarily represented money as a social kind, the intuition that broken or unused artifacts retain their intended kind led people to sometimes classify as money those artifacts that exist in virtue of social conditions.

Keywords: Categorization, concepts, causal reasoning, social cognition, money

1. Introduction

Economic activities like trading, investing, or saving involve the use of many objects with peculiar social powers: paper bills, credit cards, cheques, bank accounts, and contracts, to name just a few. In general, these objects are significant because they confer social powers to individuals who otherwise lack them, such as the right to use certain material and social assets. But they are noteworthy also because their powers have little to do with their physical structure, and much to do with social facts and mechanisms, such as the laws, policies, and reoccurring behaviors that involve these objects.

In spite of the important role they play in our lives, institutional entities like bills and bank accounts are still relatively obscure and under-researched from a psychological perspective. In this paper we seek to provide a fuller picture of how people represent *money*, as a case study into the nature of institutional representations. Although money is only one of many institutional kinds, it is a paradigmatic one, enjoying a special status in the philosophy of social institutions (e.g., Simmel, 1978; Searle, 1995; Guala, 2016; Smit et al., 2016; Frasser & Guzman, 2020; Mäki, 2020): it is, in fact, one of the key institutional kinds that an account of social institutions is expected to address. This special status is well-earned because of money's ubiquity and social significance. Thus, any psychological account of institutions ought to provide an adequate account of how people represent money. As individuals interact with money within larger institutions like markets and states, how do they represent the kind they interact with?

1.1 Philosophical perspectives on money

Money is an institutional kind. Institutions are reoccurring, rule-governed patterns of social behavior, which remain stable by constraining and guiding individuals' actions. For example: we would find it challenging to enter a store in the United States and make purchases with objects other than U.S. currency, even if the objects were independently valuable. But institutions also make new forms of acting possible: we can widely exchange dollar bills for goods and services, even if we do not know the consumption preferences of the seller, and even though the pieces of paper are not independently valuable. This universal medium of exchange enables efficient, widescale, and coordinated economic behavior that would be hard to achieve through other means (e.g. barter).

The status of institutional kinds is controversial. A prominent approach, which is popular among scientists, is to identify these kinds with the functions they fulfil. For example: money is anything that plays the role of medium of exchange, store of value, unit of accounting. Some philosophers are willing to follow this functionalist approach (e.g. Rosenberg, 2016; Guala, 2016), but others argue that fulfilling the appropriate functions is not enough: institutional kinds depend on some sort of public recognition. A particular piece of paper, according to this view, is money in virtue of being conferred or assigned the status of money, or of being recognized as money in a given society at a given time (e.g. Lagerspetz, 1989; Searle, 1995; Celano, 1999; Thomasson, 2003).

An institutional status may be assigned directly or indirectly. As an example of the first kind, consider a situation in which an individual is unanimously considered the captain of the football team. The status may be directly conferred by forming the relevant beliefs, and perhaps by stating them verbally in a public context ("From now on, X will be the captain of our team"). Or it may be mediated by a rule that identifies some property or condition that X must satisfy in order to have that status. For example, it may be generally accepted that the most experienced player is the captain of the team. X then would have that status derivatively, in virtue of the fact that she has the relevant property (Thomasson, 2003; Khalidi, 2015).

1.2. Money in folk classification

These philosophical theories, taken at face value, have testable implications concerning the psychology of money. It might be the case, for example that folk categorization processes reflect mainly functional considerations – that ordinary people consider money whatever fulfills the function of medium of exchange, store of value, and unit of accounting in a given society. Alternatively, the folk might classify something as money only if it has been assigned the status of money. Or it might be that people's taxonomic judgments are driven by the possession of properties that are considered necessary for the fulfilment of the functions of money. Whether any of these accounts is psychologically valid, of course, would be an empirical matter.

Understanding folk classification is interesting for various reasons. If we start from the assumption that science offers a truthful description of the world, then empirically studying the processes that govern folk classification may be helpful in preventing certain systematic errors that people make. This possibility has been taken seriously in the case of folk biology, with research considering how folk classification might hamper philosophical and scientific scholarship (Leslie, 2013) as well as education (Gelman & Rhodes, 2012). The social sciences, however, do not enjoy the same degree of respect as physics or biology. One may therefore argue – as some philosophers do – that current economic theories do not provide a reliable benchmark for the identification of errors concerning money (e.g. Searle 1995).

But exactly the same skepticism may be directed against philosophical theories: how do we know that conferralist accounts, for example, provide an accurate picture of the nature of institutional objects? Philosophers have traditionally made heavy use of intuitions to resolve controversies in metaphysics. Although the role of intuitions has received a great deal of scrutiny over the past two decades (e.g. Alexander and Weinber, 2007; Knobe & Nichols, 2007), in the case of institutional kinds this method can be justified in a principled manner: if the existence of institutional kinds depends on people's classificatory practices, then what the folk take to be the case would indeed be the case. Intuitive judgements, in other words, could provide genuine insights on the nature of institutional entities because our judgments would be *constitutive* of institutional reality (Ruben 1989; Thomassson 2003). Alternatively, the coordinative function of monetary objects might be fulfilled independently of people's awareness: folk theories may in principle diverge significantly from the psychological mechanism that sustain and reproduce institutions (Guala 2016).

We do not intend to solve these thorny meta-theoretical issues here. We would simply like to point out that, regardless of one's philosophical inclinations, the empirical study of folk classification may deliver plenty of information that (directly or indirectly) bears on debates concerning the ontology of money.

1.3. Recent work on the psychology of money

Unfortunately, we know relatively little about how people represent institutional kinds. Studies of artifacts have revealed that their physical properties, affordances, and intended functions play a role in categorization processes (see e.g. Chaigneau et al. 2004, and Margolis & Laurence 2007, for overviews). And there is some evidence that people may classify institutional objects in a way that is broadly analogous to how they classify ordinary artifacts (see Roversi et al., 2013; Villani et al., 2021; and, for theoretical analysis, Tummolini & Castelfranchi, 2006).

However, we also know that people believe that an individual can use dollar bills to purchase goods because of the current social position of dollar bills, rather than their physical structure (Noyes et al., 2018). The theory (or theories) underlying the concept of money may have primarily a coordinative function, rather than a predictive/explanatory function as the concepts we use to describe physical or biological objects. Therefore, people's beliefs about how money works may differ significantly from their beliefs about standard artifacts like hammers.

An important insight that has emerged from contemporary research is that people appear to represent certain categories as reflecting non-obvious causal processes (Bloom, 1998; Keil, 1989; Gelman, 2003; 2013; Malt & Sloman, 2007). Natural kinds provide the best evidence for these intuitive causal theories; in particular, people represent animal categories as possessing internal essences that cause their properties (Gelman, 2003; Medin & Ortony, 1989). For example, after observing an individual squirrel building a nest, one may infer that other squirrels build nests too, based on the assumption that squirrels share a fundamentally similar biology that causes their behavior. From this perspective, categories like *money* or *banker* may appear less intuitively helpful for making sense of the world, as they lack a unique internal or inherent structure. Dollar bills are mere pieces of paper, while a credit card may be a piece of plastic or just a serial number linked to a bank account. Similarly, there is nothing 'deep' about an individual that makes them a banker. Therefore, one may conclude that categories like banker and money are not guided by intuitive theories (Keil, 1989).

However, categories can also be constituted by *external* structures, such as norms, conventions, or other regularities in the social world. Although social structures cannot be directly observed, they can sustain correlated clusters of properties. For example, people may infer that dollar bills can be used to purchase goods from the position they occupy in society rather than from their physical properties (Noyes et al., 2018). When one observes a dollar bill, one cannot see any coordinated social processes; nevertheless, one may use information about physical and social structures to infer various properties of dollar bills, such as their exchange or their store value.

Indeed, we know that people reason about many social categories and category-linked properties in virtue of external social processes: they believe for example that individuals constitute groups when they mutually intend to be a group (Noyes & Dunham, 2017; 2020; Noyes & Keil, 2020). Therefore, an individual is perceived to belong to a group not because she is similar to other members of the group but because she occupies a particular position in the group's stable pattern of social relationships (Rhodes, 2013). When hearing generic statements like "boys play with trucks," people can reason that the category-property relationship obtains because of social-structural processes like cultural constraints on the preferences boys can express, rather than because there is anything inherent or intrinsic about boys (Noyes & Keil, 2019; 2020; Vasilyeva et al., 2018; Vasilyeva & Lombrozo, 2020). Therefore, people may possess intuitive theories of social kinds as well, but ones that locate the causal system externally rather than within individual members.

1.4. Empirical Approach and Rationale

Our first hypothesis was that people categorize objects as money based on their current position within society regardless of their material features or their original intended purpose. For example, according to this hypothesis, participants should categorize cigarettes or shells as money if they came to occupy that position in society, even though shells or cigarettes were not designed for that purpose. This type of category judgment uniquely relies on stable features of the external social structure rather than the structure of the object *per se.* This would accord with previous evidence that participants believe the function of money is determined by its position within external systems of rules, rather than its physical properties (Noyes et al., 2018). This causal relationship differs from how the functions of standard artifacts (like chairs and hammers) work, which depend on physical structure rather than social structure.

However, we also conjectured that the original intended purpose of an object could contribute to money category judgments. Although historical, defunct currency objects like Roman coins no longer occupy the position of money in society, their material features cannot be explained without acknowledging their original intended purpose. In this regard, people may persist in categorizing these objects as money. This manner of categorization would be noteworthy because money does not even need to involve currency objects. For example, many communities are becoming increasingly “cashless,” such that money is realized entirely by digital records and not by material objects. Nevertheless, insofar as currency objects do exist, whether currently used or not, their existence and material properties depend on their intended purpose as money.

To test these hypotheses, we devised vignettes that doubly dissociated the current social position of an object from its intended purpose. Objects that were originally created to be money can stop occupying that position in society for several reasons: because of the collapse of the society that sustained them (e.g., Roman coins), because of regime change (e.g., the shift to Confederate States dollars during the Civil War), or because of ordinary currency turnover (e.g., discontinued currency objects in the United States). In Study 1, we examined a hypothetical collapse of American society. This allowed us to test people’s concepts of dollar bills as a defunct currency object. In this scenario, people begin to use shells and cigarettes as mediums of exchange. These objects allow us to isolate the current social position from their intended purpose: shells lack an original purpose (as natural objects) and cigarettes had an alternative original purpose. In Study 2, we examined a regime change involving a novel, fictional society so that we could isolate the intended purpose of a currency object from people's familiarity with its use as money. We expected people to categorize the cigarettes and shells as money when they occupied that position in the community. Of interest was the extent to which people might also categorize defunct currency objects as money.

In Study 3, we asked: what does it mean for an object to occupy the position of money in society? The philosophical literature provides at least two types of perspectives on this question: (1) A community's coordinated behavior with respect to an object (or verifiable object) realizes the social functions of money: being a medium of exchange, store of value, and a unit of account (Guala, 2016). Thus, an object is money if it objectively realizes these social functions regardless of whether people recognize it as money. (2) A community collectively recognizes an object (or verifiable record) as having the social status of money (Searle, 1995; 2010). This status is associated with deontic properties, such as privileges and obligations: e.g., by being recognized as money, an individual is allowed to use the objects to settle debts. Thus, an object is money if people recognize it as having this status.

As a first approximation, both of these accounts agree that money is a social kind – money is not determined by physical structure but by social structure. And these factors may be causally related in complex ways: for example, the fact that a currency has been recognized as legal tender may automatically lead people to infer that it is used for trading purposes. And the fact that a currency has been historically created to be money, may be used to infer that it is still used and recognized as such in a given society. Study 3 was designed to investigate the extent to which people rely on, and prioritize, collective recognition, functional coordinated behavior, or history (intended function) in their category judgments. In principle, these factors are all dissociable: one-cent Euro coins, for example, are recognized as money but rarely function as mediums of exchange in practice. The opposite combination occurs too: because cash is often banned in correctional facilities, cigarettes, postage stamps, and ramen packages have served as ad hoc mediums of exchange. It is possible that members of jail communities recognized those objects as money; but those objects could function as mediums of exchange whether they were recognized as money or not. Moreover, some currencies (like McKinley bills in the USA) have been produced in the past to fulfil money-like functions but have rapidly fallen out of circulation, while others – whether or not they were ever recognized as such – are used in informal transactions or black markets.

To explore how folk classification is affected by these factors, we used objects like one-cent Euro coins, or cigarettes in prison communities, to determine if participants rely more on collective recognition, history, or functional coordinated behavior. Past evidence suggests that people believe that both collective recognition and coordinated behavior make it possible for an individual to use an object to make a purchase (Noyes et al., 2018). One study found that participants relied more on collective recognition than function to determine if individuals constituted a group (Noyes & Keil, 2020); but even here, function partly contributed to judgments about groups. Overall, then, we expected participants to prioritize collective recognition, but we expected that function and history would still contribute to money category judgments.

Finally, we were interested in whether collective recognition and intended purpose act as causally central properties (Ahn, 1998; Ahn, et al., 2000). As we have mentioned, the original intended purpose of an object provides an explanation for why it exists and why it has its material properties. Likewise, the current social position of an object explains certain other properties: for example, a dollar bill is valuable in virtue of its recognized status within society. So, we were interested in the extent to which we could identify an explanatory role of both collective recognition and intended purpose in how people make sense of properties associated with money.

To test this, we had participants generate common properties of money. We then assessed whether these properties were explained by collective recognition or intended purpose. We expected participants to endorse collective recognition as explaining the social-functional properties of money (e.g., being a medium of exchange) and intended purpose as explaining the material properties of money (e.g., depicting Presidents). To make sense of why collective recognition is more important than intended purpose, we also examined the extent to which the properties they accounted for were considered explanatory or contingent (Prasada & Dillingham, 2006; 2009). Properties vary in the extent to which people represent them as properties of the kind *per se* or properties that are contingently associated with the kind. We expected participants to rate the social-functional properties of money as more central than the material properties of money. In turn, we expected collective recognition to account for the more explanatory properties of money (its social-functional properties).

2. Study 1

Our first experiment was designed to elicit judgments about two different cases: First, we were interested in objects that come to occupy the social position of money but that were not originally created for that role: e.g., natural objects like shells, and artifacts like cigarettes. If people categorize these objects as money, it would show that people represent money as a social position. We contrasted these items with defunct currency objects: objects that were originally created to be money but that do not currently occupy that position. There may be a pull to categorize these as money in virtue of their original intended purpose, since their existence cannot be explained through other causal processes (unlike shells and cigarettes). To test this, we created a vignette where American society collapses: before the crisis, people use dollar bills as money; after the crisis, people initially use cigarettes or shells as money, and then they switch to the other object (Figure 1). This allowed us to examine how people categorize defunct dollar bills, cigarettes/shells when they occupy the position of money ('used' objects), and cigarettes/shells when they do not ('unused' objects).

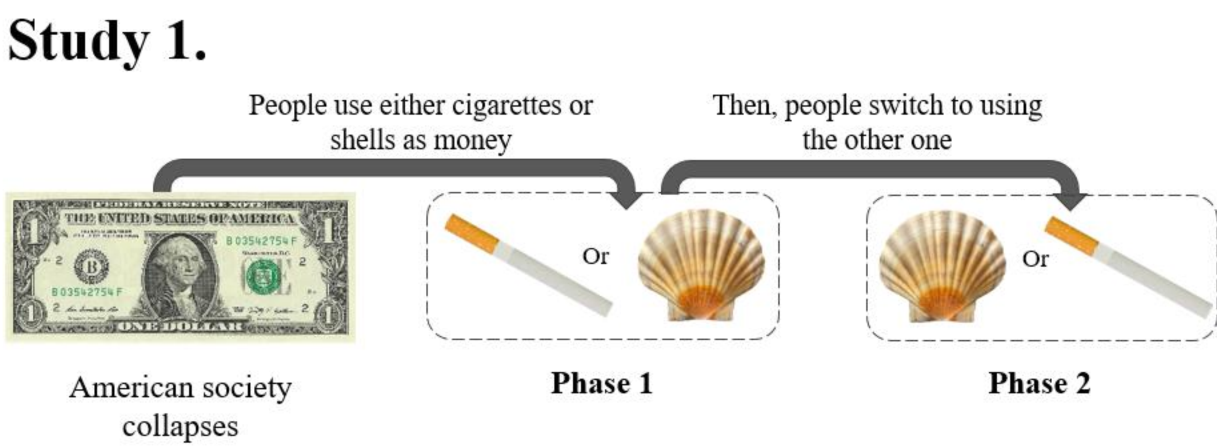

Figure 1. Study 1. The vignette told participants a story about 'post-America', a society where dollar bills are no more in use, and are replaced by either cigarettes or shells as a medium of exchange.

2.1. Method

2.1.1. *Participants and Materials*

We recruited 200 experimental subjects on Amazon Mechanical Turk. Of these, 195 completed the entire survey. For Study 1, we did not collect demographic information. Studies have demonstrated that MTurk samples are more representative than undergraduate samples; they are close to representative for race and gender but skew younger, liberal, and non-religious (Berinsky et al., 2012; Burnham et al., 2018; Huff & Tingley, 2015). This study and all subsequent studies were conducted under Protocol Number 1311013027 approved by Yale's IRB Board. For all studies, we paid Connecticut minimum wage, which was $10.10 at time of testing. We paid participants 0.71$ for the 4-minute task. The full materials (including scripts, images, and structure of questions) are available on Open Science Framework: https://osf.io/6y8gf/.

2.1.2. *Design*

The task was split into two phases, corresponding to before and after a switch in which a non-currency object (cigarettes or shells) was used as a medium of exchange. In each phase, participants received three blocks of questions, presented within-subject in randomized order, corresponding to three objects: (1) *Dollar bills:* defunct dollar bills, (2) *Used:* cigarettes or shells currently acting as a medium of exchange, (3) *Unused*: cigarettes or shells not currently acting as a medium of exchange. In each block, participants expressed their agreement to three statements in randomized order: the test statement (is the object money) and two control statements.

2.1.3. *Procedure*

At the introduction of the task, participants were told they would read a story and answer questions about it. Our basic vignette involved a hypothetical scenario called ‘post-America’:

> *American society has crumbled after a massive viral outbreak. The former government has been decimated. All of the former religious, economic, and legal systems are gone. For*

example, the Federal Reserve Bank and U.S. Treasury no longer exist. Descendants of that society now live among the rubble. We will call this society 'post-America.'

Subjects were told that people in post-America use peculiar objects to perform money-like functions. Depending on the experimental condition, these objects may be *cigarettes* or *shells* (this was randomized between-subject):

People trade cigarettes [shells] for goods. People reliably expect that others will accept cigarettes [shells] for payment, so people can keep track of the cost of objects in quantities of cigarettes, and can reliably expect cigarettes [shells] to be valuable. People cannot use any other objects this way.

In each block, participants saw an image of one of the objects – a dollar bill, a cigarette, or a shell – followed by three statements that they rated on a 1-6 Likert scale ranging from "Totally disagree" to "Totally Agree":

1. *'This is money'.*
2. *'This counts as money in post-America'*
3. *'This was created for the purpose of being money'.*

We call 1 the *Basic Categorization* statement; 2 is the *Conventional Categorization* statement; and 3 is the *Purpose Categorization* statement. The judgment of interest is only the first one – what subjects consider to *be* money in post-America: dollars, cigarettes, or shells? The second and third statements, instead, are comprehension checks. Subsequently, participants read that the community switched from using shells to cigarettes or cigarettes to shells. Participants then rexamined to the same three blocks of experimental statements again. The total task was very brief and could be completed in approximately four minutes.

2.2. Results and Discussion

Overall, we found the qualitative pattern of results was the same across phase and so we collapsed across phase for these analyses. To analyze results, we used generalized linear models with the cluster bootstrap as implemented in the R package 'ClusterBootstrap' (GLMCB; Deen & de Rooij, 2020). We report bootstrapped standard errors in parentheses. We report bias corrected and accelerated 95% bootstrapped confidence intervals and use those to draw conclusions. To investigate participants' beliefs about each of three object types (dollar bills, used cigarettes/shells, non-used cigarettes/shells), we coded the categorical variable as two contrasts: dollar bills compared to used cigarettes/shells, and used objects cigarettes/shells to unused cigarettes/shells.

First, we examined the control statements.

"Counts as" control: Participants correctly said that defunct dollar bills did not 'count as' money in the social context, M = 1.57 (0.08), 95%CI: [1.42: 1.75], as they rated dollar bills significantly below the midpoint of the scale (3.50). They correctly said that cigarettes and shells 'counted as' money when they were used, M = 5.61 (0.06), 95%CI: [5.47: 5.71], and not when they were unused, M = 1.73 (0.08), 95%CI: [1.58: 1.90]. Dollar bills were rated significantly lower than used cigarettes/shells by b = -4.04 scale points, 95% CI: [-4.28: -3.75]. Used cigarettes/shells were rated significantly higher than unused cigarettes/shells by b = 3.88 scale points, 95% CI [3.61: 4.11].

"Created to be" control: Participants correctly said that defunct dollar bills were originally created to be money, M = 5.12 (0.11), 95%CI: [4.88: 5.31]. They correctly said that cigarettes/shells were not originally created for that purpose whether they were currently used, M = 2.10 (0.12), 95%CI: [1.89: 2.34], or not, M = 1.48 (0.07), 95%CI: [1:35: 1.63]. Dollar bills

were rated significantly higher than used cigarettes/shells by *b* = 3.02 (0.21) scale points, 95% CI: [2.58: 3.41], and cigarettes/shells were rated significantly higher by *b* = 0.62 (0.10) scale points when used then un-used, 95% CI: [0.44: 0.85]. Overall, participants appropriately tracked the intended purpose and current social status of the objects.

Next, we examined the critical test statement (Figure 1). Participants rated defunct dollar bills significantly less as money than used cigarettes/shells: *b* = -0.73 (0.24) scale points, 95% CI: [-1.20: 0.25], and participants rated cigarettes/shells as money significantly more when they were used then unused: *b* = 2.86 (0.15) scale points, 95% CI: [2.57: 3.15]. Overall, however, participants said that dollar bills were money around the midpoint of the scale: *M* = 3.75 (0.15), 95%CI: [3.45: 4.03]. In fact, participants responded in a strongly bimodal fashion, as can be seen in the violin plot in Figure 2, which shows the distribution of responses by the relative width. Indeed, 65.64% of participants gave a one (28.46%) or a six (37.18%) on the scale, which were the most extreme responses. This bimodality is also present, to a lesser extent, in category judgments of used cigarettes/shells; however, participants judged used cigarettes/shells as money significantly higher than the midpoint of the scale: *M* = 4.48 (0.13), 95%CI: [4.23: 4.72]. Indeed, participants who said that dollar bills were money were less likely to say used cigarettes/shells were money and vice versa, as revealed by a significant negative correlation: *phase one*, *r* = -.49, 95%CI: [-0.58: -0.38]; *phase two*, *r* = -.53, 95% CI: [-0.63: -0.41]. But, on closer inspection, these two response strategies were asymmetric: participants who said dollar bills were *not* money (i.e., ratings <3.50), said used cigarettes/shells were money 93.53% of the time. In contrast, participants who said dollar bills were money were bimodal in their judgments about used cigarettes/shells: 57.77% said they were money and 42.27% said they were not. Finally, unused shells/cigarettes were not rated as money, as expected: *M* = 1.62 (0.07), *95%* CI: [1.49: 1.78].

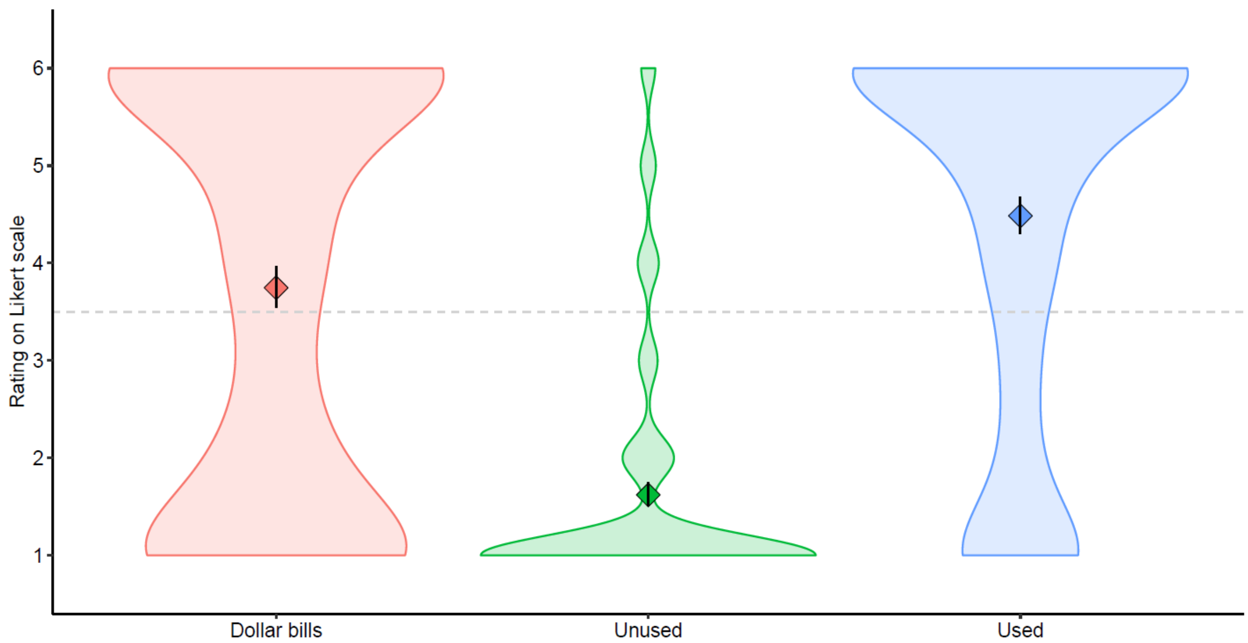

Figure 2. Study 1. Participants' judgments about whether the three objects were money: Defunct dollar bills, cigarettes/shells (unused), and cigarettes/shells when acting as a medium of exchange (used). Error bars are 95% bootstrapped confidence intervals as calculated by ggplot2. Dotted line is midpoint of scale, 3.5.

2.2.1. *Order*

The categorization task may imply that not every object could be money, leading to an artificial bimodal pattern. But, if that were true, then we would not expect any bimodality on the first trial, before participants were aware that they would be categorizing two contrasting cases. However, the data revealed a qualitatively similar pattern regardless of order: when dollar bills were the first experimental trial, 58% of participants gave a 1 (26%) or a 6 (33%); when dollar bills were the second experimental trial, 68% of participants gave a 1 (28%) or a 6 (40%). Even on the first trial, thus, we see substantial bimodality, suggesting that it was not merely an artifact of within-subject task demands.

2.2.2. *Discussion*

Overall, the data show that the majority of participants represent money as corresponding to the current social status an object has in a community. Notice that this study did not investigate the conditions that must be satisfied for something to acquire the status of money. Although we primarily discussed used cigarettes/shells in terms of their function as media of exchange, this study was not designed to distinguish between the collective recognition of cigarettes/shells as money and the current use of them as media of exchange – we resolve this in Study 3. In either case, participants are representing money as embedded in a community's social structure – their collective intentions and behaviors. This representation of money differs from classic essentialist representations, which would locate money-hood within the intrinsic or internal features of an object rather than in the social features of the surrounding context. But this representation of money also differs substantially from many accounts of standard artifacts, where participants tend to prioritize either material features of the object itself (i.e., the causal efficiency of its structure for performing a function; Chaigneau et al., 2004) or its design history (i.e. intended purpose; Bloom, 1996; Matan & Carey, 2001).

Design history, to be sure, did influence some judgments. We found that many participants continued to categorize defunct dollar bills as money; moreover at least half of the participants who categorized defunct dollar bills as money did not categorize used cigarettes/shells as money. Therefore, the intended purpose of an object continued to contribute to how a significant number of participants represented money, and was even the primary or exclusive way that at least some of them represented money. Although we found that participants were tracking the control information, we could not rule out that they were tempted to categorize defunct dollar bills as money because of their familiarity with dollar bills as money, rather than the intended purpose of these objects. Therefore, we conducted a follow-up study using a novel currency object. If participants categorize defunct dollar bills as money because of their prolonged exposure to dollar bills as money, then we should see this response strategy disappear when we use entirely novel currency objects. But, if participants represent defunct dollar bills as money in virtue of their original intended purpose, then we should see this response strategy persist.

3. Study 2

We have seen that people continued to categorize defunct dollar bills as money: is this merely because participants are familiar with dollar bills as money (through prolonged exposure, and their current status as money in U.S. society), or are people basing their category judgments on original intended purpose? We resolved this question by investigating a replication of Study 1 using a novel currency object. This allowed us to isolate the contribution of intended purpose to category judgments.

In designing this study we also wanted to check whether the responses were correlated with some individual characteristics of the respondents. For example, the level of education – economics education, in particular – might be correlated with the category judgments elicited in the experiment. A student may have heard during a lecture or read in a book that money is whatever fulfils the function of medium of exchange, store of value, and unit of accounting. It is plausible that such an individual would identify used objects as money in the post-America scenario, while a subject who has not been exposed to economics education would not.

The broad cultural environment in which individual respondents have acquired their concepts of money may provide other explanatory factors. There is evidence, for example, that children who have received a religious education are more likely to have 'essentialist' beliefs about social properties such as ethnicity, race, and gender (e.g. Diesendruck & Haber, 2009). Other studies report a correlation between socio-economic status (which often reflects differences in formal education) and the conceptualization of social class (e.g. Kraus & Keltner, 2013). Finally, categorization seems to be influenced by 'ways of thinking', such as similarity-based or causality-based reasoning, that are correlated with ethnicity (e.g. Norenzayan et al., 2002). To cast the net widely, we collected data about nine demographic variables: Education, Economics education, Political orientation, Age, Gender, Race, Household income, and Childhood income.

3.1. Method

3.1.1. *Participants and Materials*

We apportioned 200 Hits from Amazon Mechanical Turk. 206 people completed the survey. See participant section for Study 1 for details about demographics, IRB, and pay. The full materials (including scripts, images, and structure of questions) are available on Open Science Framework: https://osf.io/6y8gf/. Aspects of the materials were adapted from Noyes et al. (2018). The novel currency object was visually depicted with a Katanga cross, which is an X-shaped iron ingot currency object used in the State of Katanga in the early 20th century. The test questions were identical to Study 1 except the word "money" was referred to with the word "kayan."

3.1.2. *Design*

Participants were presented, within-subject, with two blocks of statements in random order corresponding to the two objects: (1) *Defunct currency object,* a defunct, novel currency object and (2) *Used shells,* natural shells currently acting as a medium of exchange. In each block, participants examined three statements in randomized order: the test statement (Is the object 'kayan') and two control statements.

3.1.4. *Procedure*

At the introduction of the task, participants were told they would read a story and answer questions about it. Participants then read an introduction to a novel island community (called "Vawnsie") and learned about "kayan," which was the novel island community's money:

> *On an island far away there exists a group of people called Vawnsies. Vawnsie society is unlike our society in almost all ways. They speak a different language, have different family structures, and have a variety of cultural and religious practices very unlike our own. On Vawnsie Island there is something called 'Kayan'. On Vawnsie Island, people trade the objects depicted below for goods. People expect that others will accept them for payment. This allows people to keep track of the cost of goods in quantities of these objects. People can expect them to remain valuable. People cannot use any other objects this way.*

This description introduced them to novel currency objects, which were visually depicted. Participants then read a vignette describing a regime change on the island, during which the community stopped using the currency object to trade for goods and services and switched to using natural shells (Figure 3). Participants then examined two blocks of experimental statements. In each block, participants saw an image of one of the objects followed by three statements that they rated on a 1-6 Likert scale ranging from "Totally disagree" to

"Totally Agree." The test statement was: "This is kayan." The control statements were: "This counts as kayan on Vawnsie Island now," and "This was created for the purpose of being kayan."

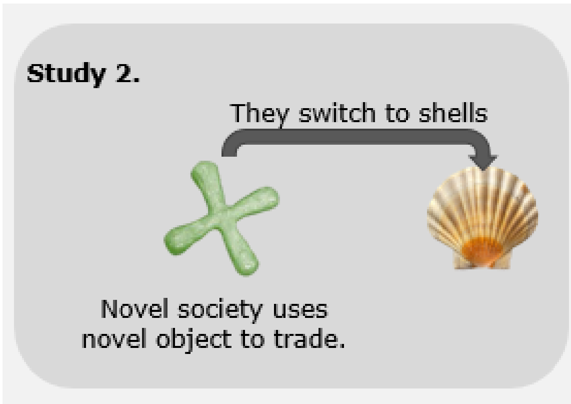

Figure 3. Study 2: the vignette told participants a story about "Vawnsie Island", a society where X-shaped objects were used as "kayan" (money) but are later replaced by shells.

3.2. Results and Discussion

Participants reacted correctly to the control statements: they said that the defunct currency objects did not 'count as' money in the social context, M = 2.71 (.14), 95%CI: [2.44: 3.00], and the correctly said that used shells did, M = 4.97, 95%CI: [4.74: 5.16].[1] The defunct currency objects were rated significantly lower by b= -2.26 (.21) scale points, 95%CI: [-2.63: -1.81]. Participants also correctly said that the defunct currency objects were originally created to be money, M = 4.92 (.09), 95%CI: [4.73: 5.09], and correctly said that the used shells were not, M = 2.49 (0.12), 95%CI: [2.25: 2.75]. The defunct currency objects were rated significantly higher by b = 2.43 (0.17) scale points, 95% CI: [2.07: 2.73]. Taken together, participants appropriately tracked the intended purpose and current social status of the objects.

[1] As in Study 1, we used generalized linear models with the cluster bootstrap as implemented in the R package 'ClusterBootstrap' (GLMCB; Deen & de Rooij, 2020). We report bootstrapped standard errors in parentheses. We also report bias corrected and accelerated 95% bootstrapped confidence intervals and use those to draw conclusions about statistical significance.

Next, we looked at the critical test statement (Figure 2). Participants rated the novel, defunct currency object as money significantly lower than used shells by b = -0.64 (0.24) scale points, 95%CI: [-1.10: -0.15]. As before, participants were overall around the midpoint of the scale in their judgments about defunct dollar bills: M = 3.68 (0.14), 95%CI: [3.39: 3.95], which before reflected an underlying bimodal response strategy (see Figure 4). Also, as before, participants did consistently judge that used shells were money, M = 4.32 (0.13), 95% CI: [4.05: 4.56], reflecting an attenuated bimodal response pattern such that the majority of participants were saying the shells were money. As in Study 1, there was a significant negative correlation between responses to defunct currency objects and used shells, r = -0.51 (.053), 95%CI: [-0.62: -0.41]. Participants who said that defunct currency objects were *not* money, said that used shells were money 92.22% of the time. Participants who said that defunct currency objects were money, were bimodal in judgments about used shells, saying that used shells were money 55.56% of the time and not money 44.44% of the time.

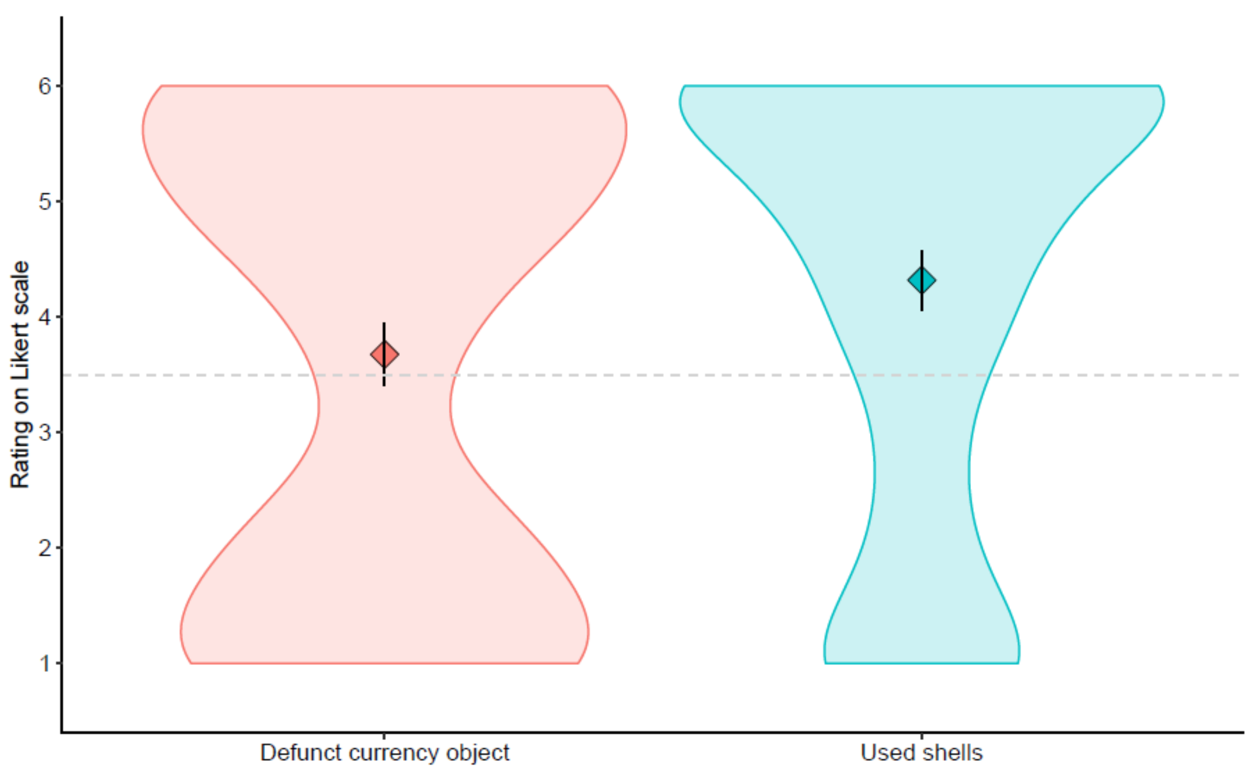

Figure 4. Study 2. Participants judgments' about whether the two objects were money: A novel, defunct currency object and shells currently acting as a medium of exchange. Error bars are 95% bootstrapped confidence intervals as calculated by ggplot2. Dotted line is midpoint of scale, 3.5.

The currency study thus closely replicated Study 1 despite using a completely novel currency object and a regime change rather than a societal collapse. Once again, the majority of participants represented money as embedded in societal structure. But we also replicated the finding that many participants categorize defunct currency objects as money, suggesting that intended purpose plays an additional or exclusive way of representing money for some participants. The persistence of this effect in a novel context shows that participants were not categorizing the defunct currency objects as money because of their familiarity with the object as money. Instead, many participants believe that intended purpose is sufficient to make an object money. Across both studies, roughly 40% of participants exclusively relied on current social status, 30% relied on current social status and intended purpose, and 25% relied exclusively on intended purpose.

Finally, we looked for correlations between category judgments and nine socio-economic variables: Education, Economics education, Political orientation, Age, Gender, Race, Household income, and Childhood income. As dependent variable, we used the difference score calculated subtracting the dollar bills category judgment from the used object category judgement. Thus, for example, a subject expressing confidence that dollar bills are money in post-America but shells are not, would be associated with a negative difference score; while a subject who is confident that shells are money but dollar bills are not, would have a positive score. None of the variables, however, predicted the propensity to use effective function or conferred status as a classification criterion. For simplicity, we report here only the statistics of the combined model with all the demographic variables: Education level: $b = -0.03$, $SE = 0.22$, $p = 0.903$. Economics education: b

= -0.19, SE = 0.27, p = 0.481. Political Orientation: b = 0.37, SE = 0.21, p = 0.084. Age: b = 0.02, SE = 0.02, p = 0.405. Gender: b = -0.61, SE = 0.49, p = 0.214. Race: b = 0.10, SE = 0.59, p = 0.865. Household income: b = 0.04, SE = 0.18, p = 0.840. Childhood income: b = 0.18, SE = 0.17, p = 0.315. This suggests that judgment variations cannot be explained by individual differences – not by the plausible properties that we have checked in our study, at least.

4. Study 3

In Study 1, objects like cigarettes or shells may be perceived as occupying the position of money because they are collectively recognized as money, but also because they fulfil the effective function of money. Are both of these conditions sufficient for participants to categorize an object as money or do they play different roles in people's concepts of money? To answer this question, we can examine (1) objects that are recognized as money but are not used in practice, and so do not effectively function as mediums of exchange; (2) objects that act as mediums of exchange in society even though they are not recognized as money by the community. In Study 3, we investigated these two cases in a full factorial design that varied the recognition of an object as money, its effective function as a medium of exchange, and (as in the previous studies) its original intended purpose.

4.1. Method

4.1.1. *Participants and Materials*

We apportioned 200 Hits from Amazon Mechanical Turk. 198 people completed the survey. See participant section for Study 1 for details about demographics, IRB, and pay. The full materials (including scripts, images, and structure of questions) are available on Open Science Framework: https://osf.io/6y8gf/.

4.1.2. *Design*

Participants judged whether 8 objects were money: these 8 objects represented every cell in a 2 by 2 by 2 factorial design combining *History* (Originally made to be money or not), *Function* (Currently acting as a medium of exchange or not), and *Recognition* (Collectively recognized to be money or not). All participants received every object in randomized order.

4.1.3. *Procedure*

At the introduction of the task, participants were told they would read eight descriptions of objects and would be asked a single category judgment. Participants received eight blocks in randomized order. In each block, participants first read a brief description of the object they were being asked to consider. The basic template of the description was the same in each block:

- *Historical information*: X were [were not] made for the original purpose of being a mode of payment. They originally counted [did not count] as a mode of payment in American society.
- *Recognition information*: Local norms in America stipulate [do not stipulate] that X are a mode of payment. The government stipulates [does not stipulate] that X are a mode of payment.
- Function information: In practice, X are used [are not used] as a mode of payment. People trade [do not trade] X for goods and services.

For example, in one block subjects read a story about a currency that had once been used as money, but is not currently recognized and is not currently used as such:

500 dollar bills depicting William McKinley were used in the 1930s but became obsolete. Now the bills are only housed in museums. McKinley bills were made for the original purpose of being a mode of payment. McKinley bills originally counted as a mode of payment in 1930s America. Local norms in America do not stipulate that the McKinley bills are a mode of payment. The government does not stipulate that the McKinley bills are a mode of payment. In practice, McKinley bills are not used as a mode of payment in America. People never trade McKinley bills for goods and services.

Participants then read three tightly controlled statements that reinforced whether the currency was originally created to be money or not, was currently acting as a medium of exchange or not, and was currently recognized as a medium of exchange. These statements were presented in randomized block. Participants were then asked: "Are these objects money," which they rated on a 1-6 Likert scale ranging from "Definitely not" to Definitely yes."

4.2. Results and Discussion

First, we analyzed the results using a multi-level model with History, Function, and Recognition as predictors (Figure 5).[2] All three of these factors significantly contributed to money category judgments: there was a significant effect of History, b = 1.14 (.08), 95%CI: [0.99: 1.30], a significant effect of Function, b = 1.22 (.07), 95%CI: [1.09: 1.36], and a

[2] We analyzed the results as in Study 1: we used generalized linear models with the cluster bootstrap as implemented in the R package 'ClusterBootstrap' (GLMCB; Deen & de Rooij, 2020). We report bootstrapped standard errors in parentheses. We also report bias corrected and accelerated 95% bootstrapped confidence intervals and will use those to draw conclusions about statistical significance.

significant effect of Recognition, $b = 2.03$ (.09), 95%CI: [1.85: 2.19]. Therefore, an object was more likely to be categorized as money if it was originally made to be money, was currently used as a medium of exchange, or was collectively recognized as money, relative to an object that had none of these features (e.g., a natural shell on a beach). History and Function affected money category judgments to a similar extent, whereas Recognition had a significantly greater effect (as revealed by the non-overlap of the confidence intervals). Next, we added the interaction terms to the model. The three-way interaction effect was non-significant: $b = .10$ (.20), 95%CI: [-0.30: 0.48]. But each of the two-way interaction terms was significant: History*Function, $b = -0.68$ (0.14), 95%CI: [-0.95: -0.39]; History*Recognition, $b = -0.44$ (.17), 95%CI: [-0.77: -0.12], Function*Recognition, $b = .48$ (.15), 95%CI: [-0.77: -0.20]. Each of these two-way interactions demonstrate (unsurprisingly) that the difference between objects with a single property and the control object (which had none) was larger than the difference between objects with one property and objects with two properties.

Next, we compared the conditions to the midpoint. First, we looked at the singleton conditions where the object had only one of the three properties. Merely being recognized as money was sufficient to be categorized as money: $M = 3.86$ (0.11), 95%CI: [3.64: 4.07]. But, merely being used as a medium of exchange was not, $M = 3.17$ (0.11), 95%CI: [2.96: 3.39]. Nor was being originally created to be money sufficient on its own, $M = 3.07$ (0.13), 95%CI: [2.82: 3.32]. Objects that had two properties were all rated above the midpoint: History-Function: $M = 4.17$ (0.10), 95%CI: [3.96: 4.36]; History-Recognition: $M = 5.09$ (.08), 95%CI: [4.91: 5.25]; Function-Recognition: $M = 5.15$ (.08), 95%CI: [4.98: 5.30]. Therefore, none of the three properties was necessary to be categorized as money. Notably, however, objects recognized as money (History-Recognition, Function-Recognition) were rated higher than objects that were not recognized (History-Function). From the violin plots we can see that a bulk of participants said the History-Function object was partially money (most responses at 4 and 5), whereas the majority participants said the History-Recognition or Function-Recognition objects were fully money (mostly 6 responses). Overall, then, the results demonstrate that collective recognition was the most important factor in participants' category judgments.

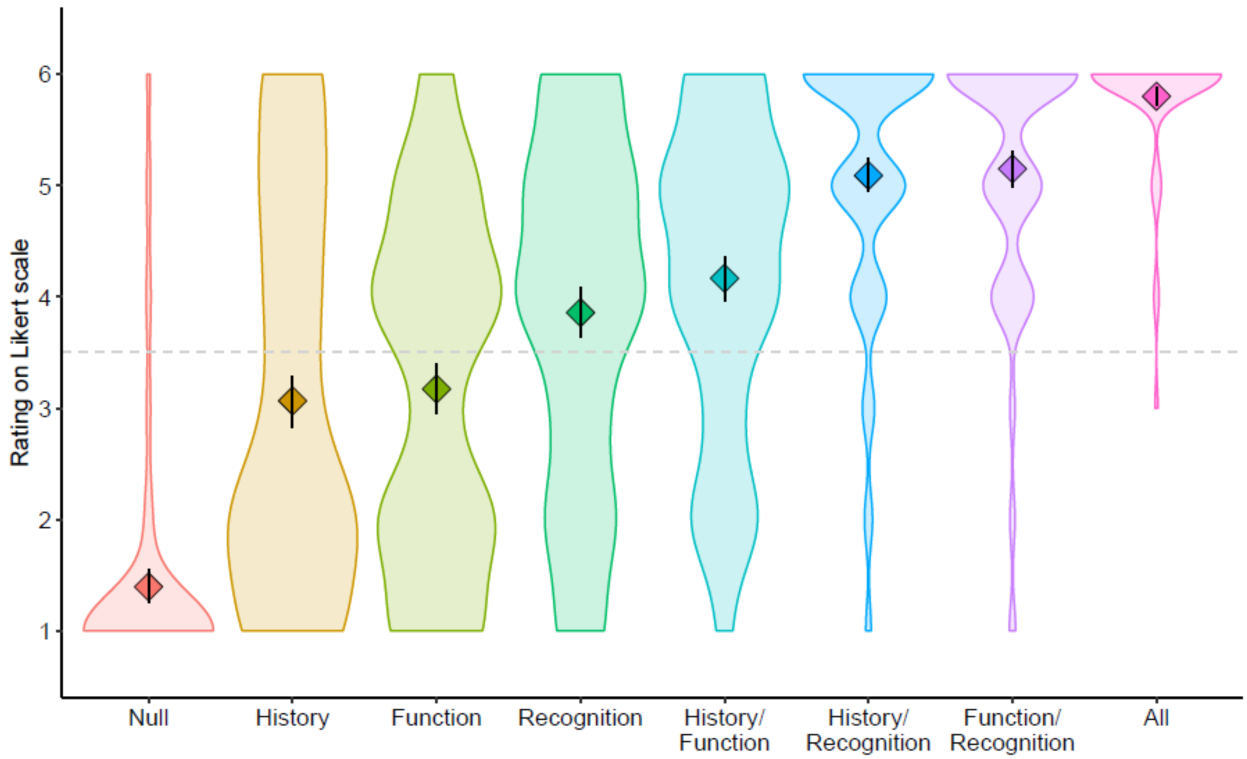

Figure 5. Study 3. Participants judgments' about whether an object was money by whether it was originally created to be money (History), currently used as a medium of exchange (Function), or collectively recognized as money (Recognition). Error bars are 95% bootstrapped confidence intervals as calculated by ggplot2. Dotted line is midpoint of scale, 3.5.

Next, we looked at individual differences. As with Study 1 and 2, there was substantial variation in participants' responses, with some bimodality (particularly for the Function condition). To gain a better understanding of how participants were responding, we used cluster analysis to detect response profiles. Cluster analysis measures the similarity between participants across multiple dimensions (in this case, responses to the eight conditions) in order to detect clustering in that dimensional space. To estimate the optimal number of clusters, we used the optimum average silhouette width, which was calculated using the *pamk* function from R's "fpc" package. This suggested the optimal solution was two clusters of participants, which we visualized in Figure 6. By far, the largest difference between these two samples was their responding to the Function and History-Function trials: Cluster Two (42% of the sample) rated these conditions highly, whereas Cluster One (58% of the sample) rated these conditions relatively low. In particular, Cluster Two responded that acting as a medium of exchange was sufficient to be money, whereas Cluster One responded that it was not (as visible in the violin plots). Otherwise, they were fairly similar. So, it seems that both participant clusters prioritized the current social status of an object relative to intended purpose, which is consistent with Study 1 and 2. But they differed in whether they represented currently social status exclusively in terms of collective recognition or in an undifferentiated way, such that they showed little difference in their reasoning about collective recognition and function. Possibly, some participants think of functional behavior that is not recognized or formally agreed-upon as more accidental, and so as less stably predictive and explanatory. In any case, collective recognition was a far more consistent part of participants concepts of money, whereas function was only important for some participants.

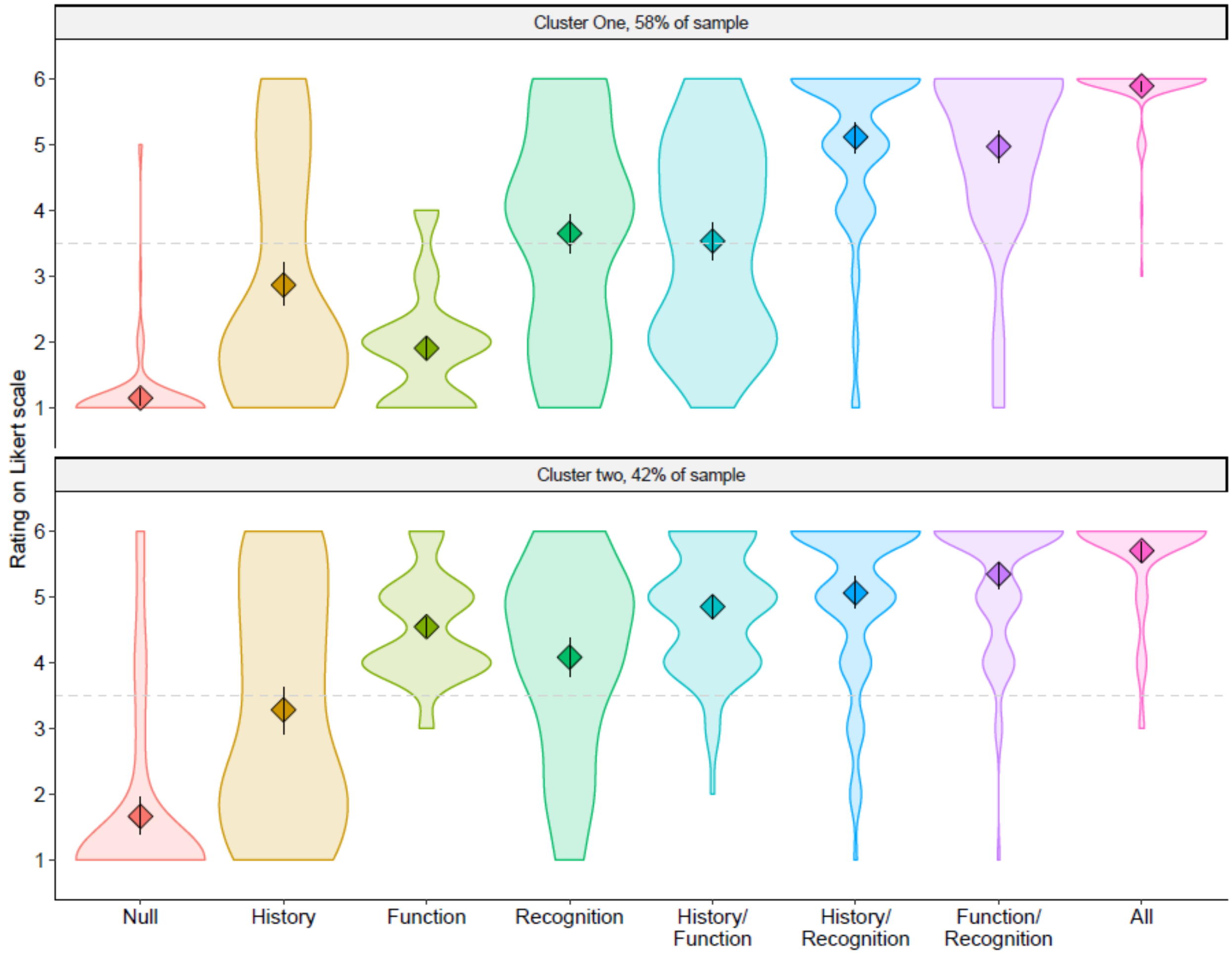

Figure 6. Study 3 divided by two response clusters. Participants judgments' about whether an object was money by whether it was originally created to be money (History), currently used as a medium of exchange (Function), or collectively recognized as money (Recognition). Error bars are 95% bootstrapped confidence intervals as calculated by ggplot2. Dotted line is midpoint of scale, 3.5.

As in Study 1 and 2, intended purpose (History) varied considerably in its importance to individual participants but overall contributed to money category judgments. In comparison to Study 1 and 2, original intended purpose seemed relatively less important in this setting. One major difference is that current social status in this study was divided into function and recognition, which necessarily meant that there was twice as much emphasis on the current role the object had in the community relative to its history. Likewise, this study focused on an object with the most far removed history. The defunct currency object described in the vignette in fact was discontinued in 1934. In contrast, Study 1 relied on current one-dollar bills and Study 2 described the creation of the novel currency object at the beginning of the study and presented participants with an abrupt regime change. So, Study 3 systematically deemphasized the intended purpose of objects relative to current social status, which makes it less surprising that the effect of intended purpose was slightly weaker here. Nevertheless, Study 3 adds additional evidence that original intended purpose influences money category judgments to a nontrivial extent.

One possible explanation of this effect is that institutional objects are classified according to their *disposition* to fulfil a specific function, such as medium of exchange, in a given society. An object that has been used as money in the recent past, then, might be perceived as more "money-like" than an object that has not fulfilled that function for a long time – or not at all – in that specific society. Since our data do not allow to test the dispositional hypothesis, however, we offer this remark as a suggestion for future research.[3]

5. Study 4

In section 1 we have suggested that participants categorize money through causal-explanatory reasoning. For example, participants may categorize defunct currency objects as money because their original intended purpose explains their properties. This hypothesis, however, has not been directly tested so far: does causal-explanatory reasoning actually play a role in people's category judgments? To see whether this account is plausible we investigated the properties people generate for money and how they explain those properties. A first group of participants generated three properties of money. Two additional groups of participants evaluated the twenty most frequently generated properties: they evaluated whether the properties were

[3] We are grateful to a reviewer for suggesting this possible explanation.

explained by the community's current rules / practices and the creators' original intentions. They also evaluated whether the properties were central or not ("principled", in the terminology of Prasada & Dillingham, 2006). Core properties are treated as properties of the kind *per se* (e.g., "dogs have four legs"), whereas associated properties are treated as incidentally generalizing to the kind (e.g., "dogs wear collars"). This study applied the distinction to a set of properties that were specifically generated for the concept of money.

5.1. Method

5.1.1. Participants and Materials

For the property generation task, we apportioned 200 Hits from Amazon Mechanical Turk (195 people completed the survey). For the subsequent property evaluation tasks, we apportioned 200 Hits from Amazon Mechanical Turk for the forced choice version (195 completed the survey) and 200 Hits for the continuous version (188 completed the survey). See participant section for Study 1 for details about demographics, IRB, and pay. The full materials (including scripts, images, and structure of questions) are available on Open Science Framework: https://osf.io/6y8gf/.

5.1.2. *Design*

A first group of participants generated properties about money (and completed a replication of Study 1). Two groups of participants subsequently evaluated the 20 most frequent of those properties on either forced-choice or continuous measures. *Property generation + replication*: participants first generated three properties of money and then they did a shortened form of Study 1. Participants received three blocks of questions, presented within subject in randomized order, corresponding to three objects: (1) *Dollar bills:* defunct dollar bills, (2) *Used:* cigarettes or shells currently acting as a medium of exchange, (3) *Unused*: cigarettes or shells not currently acting as a medium of exchange. *Property Evaluation:* participants received two blocks presented within subject in randomized order: a block where they selected (forced choice) or rated (continuous) explanations of the 20 properties, and a block where they selected (forced choice) or rated (continuous) whether the property was central or not.

5.1.3. ***Procedure***

Property generation + replication: the procedure was the same as Study 1, except (1) after reading the study introduction but before reading the vignette about the collapse of American society, participants were asked to enter three properties of money into three textboxes. (2) There was no second phase, and so participants did not see a switch from shells to cigarettes or cigarettes to shells. *Property Evaluation:* participants were told they would evaluate 20 properties of money. They then received the explanation block and core-property block. In the explanation block, participants saw 20 trials where a picture of a dollar bill was presented with a statement about a single property: e.g., “This is a medium of exchange.” In the forced choice version, they were asked “Why” with three options “Because of the community’s current rules and practices,” “Because its creators decided to make it that way,” “Because of something else.” In the continuous version, they evaluated the first two explanations on a 1-6 Likert scale ranging from “Completely disagree” to “Completely agree.” In the core property block, participants again saw a picture of a dollar bill with a statement about a single property. They were then asked to evaluate whether the property was a central one. They read (for example): “This is durable because it’s money: money, by virtue of being the kind of thing it is, is durable.” In the forced choice version, they selected true or false. In the continuous version, they rated the statement on a 1-6 Likert scale ranging from “Completely disagree” to “Completely agree.”

5.1.4. *Coding of properties*

For many properties, the entries were exactly the same. For example, many participants wrote in the single word “green.” But, for other cases we pooled together entries that were highly related: for example, “you buy things with it,” “medium of exchange,” “tradeable” were counted as a single property “medium of exchange.” We decided to move the 20 most frequently generated properties into the property evaluation task: this set contained every property generated at least five times and encompassed 80% of the total entries.

5.2. Results and Discussion

5.2.1. Replication of Study 1

Overall, we found a qualitatively similar pattern of results as Study 1 (Figure 7). Participants rated defunct dollar bills, M = 3.84 (1.44), 95%CI: [3.54:4.11], and used cigarettes/shells, M = 4.88 (.11), 95%CI: [4.62: 5.08], as money significantly higher than the midpoint of the scale. They rated defunct dollar bills as money significantly lower than used cigarettes/shells by b = -1.04 (.22) scale points, 95%CI: [-1.47: -0.60]. We found a similar bimodal response pattern on category judgments of defunct dollar bill, which was significantly negatively related to judgments of used cigarettes/shells, r = -.44 (.05), 95%CI: [-0.53: -0.33]. Participants who said defunct dollar bills were *not* money said used cigarettes/shells were 98.7% of the time. Participants who said defunct dollar bills were money said cigarettes/shells were

73.50%. Therefore, roughly 45% of participants said both were money, roughly 40% said only used cigarettes/shells were, and only 16% said only defunct dollar bills were. Overall, then, we replicated the results of Study 1 – particularly the importance of current social status to money – but fewer participants relied exclusively on intended purpose and more participants relied on both intended purpose and current social status.

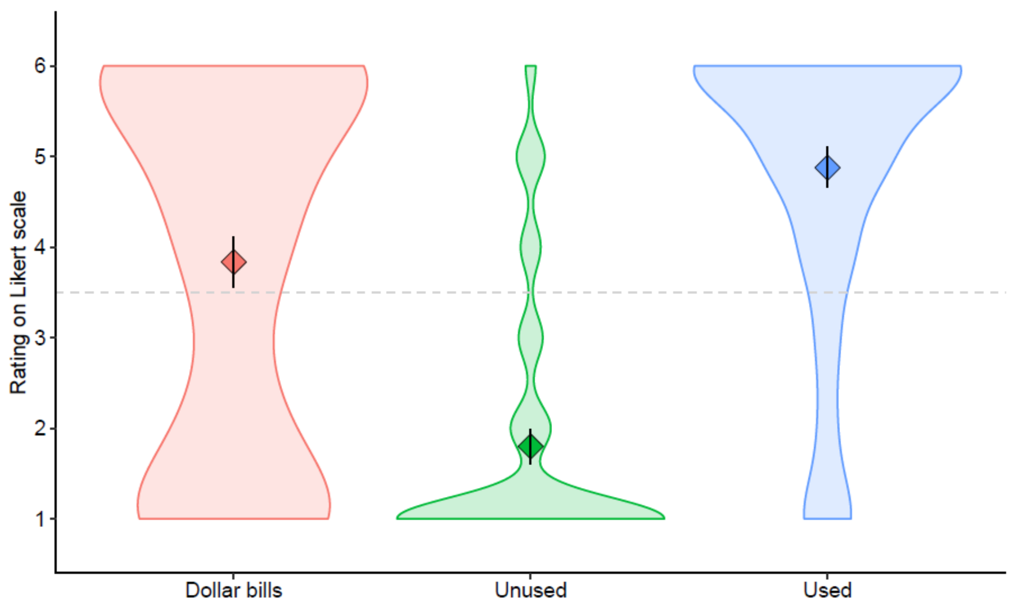

Figure 7. Study 4: replication of Study 1. Participants' judgments about whether the three objects were money: defunct dollar bills, cigarettes/shells (unused), and cigarettes/shells when acting as a medium of exchange (used). Error bars are 95% bootstrapped confidence intervals as calculated by ggplot2. Dotted line is midpoint of scale, 3.5.

5.2.2. Properties

Next, we examined the relationship between explanations and centrality by property. For these models, the property is the unit of analysis (N=20), with values reflecting the average rating from participants. Because explanation and core-property ratings were not within-subject, we relied on GLM with normal, non-clustered bootstrap. First, we looked at the forced choice version of the task. In a model with current rules/practices as predictor and centrality as outcome, we found a significant positive relationship: b = 0.43 (.07), 95%CI: [0.25: 0.54]. In a model with the creator's original intentions as predictor and centrality as outcome, we found no significant relationship, *b* = -0.28 (0.12), 95%CI: [-0.47: 0.04]. Second, we looked at the continuous version of the task. In a model with current rules/practices as predictor and core-property (centrality) as outcome, we found a significant positive relationship: *b* = 0.68 (0.12), 95%CI: [0.41: 0.87]. In a model with creator's original intentions as predictor and centrality as outcome, we found no significant relationship: *b* = 0.27 (33), 95%CI: [-0.54: 0.68]. Therefore, *the community's rules/practices explain more core properties, whereas the creator's original intentions do not.*

Using the forced choice and continuous rating of the two explanations, we looked at how the twenty properties clustered. The properties belonged to three clusters: One cluster was the social-functional properties: Serving as a medium of exchange, being valuable, being divisible, being useful, being a unit of account, being necessary, being in limited supply, and having stable value. These properties were best explained by the community's current rules/practices on the forced choice (*M* = 67.88% vs. 25.37%) but were rated high on both on the continuous measures (*M* = 4.78 vs. 4.63). A second cluster was material properties: being made of paper, being green, being easy to carry, being durable, having ink, being tangible, depicting Presidents, being soft/flexible, having uniform appearance, being rectangular, and having a serial number. These properties were best explained by the creator's original intentions on the forced choice (*M* = 76.36 vs. 17.18%) and the continuous measure (*M* = 5.07 vs. 3.78). A final cluster was the lone property "dirty." We found that social-functional properties were rated as significantly more central than material properties, *b* = 0.21 (0.04), 95%CI: [0.12: 0.28].

Table 1.

Frequency and ratings of the 20 most frequently generated properties.

		Forced Choice				Continuous		
Property	**Count**	*Rules/practices*	*Creator*	*Other*	***Centrality***	*Rules/practices*	*Creator*	***Centrality***
Exchange	75	0.69	0.28	0.03	0.96	5.03	5.00	3.46
Paper	68	0.14	0.83	0.03	0.66	3.71	4.99	2.20
Valuable	55	0.77	0.21	0.02	0.94	4.87	4.69	3.03
Green	54	0.14	0.80	0.06	0.61	3.38	5.07	1.87
Easy to carry	37	0.16	0.80	0.03	0.77	3.89	5.07	2.91
Durable	26	0.22	0.67	0.11	0.54	3.83	4.72	2.07
Divisibility	16	0.44	0.43	0.14	0.83	4.45	4.88	2.68
Ink	15	0.15	0.83	0.02	0.63	3.61	5.12	2.36
Tangible	14	0.17	0.63	0.20	0.72	4.03	5.09	2.85
Depicts President	14	0.21	0.71	0.08	0.67	3.99	5.23	2.51
Use	12	0.78	0.19	0.03	0.94	5.05	4.77	3.35
Soft, flexible	11	0.11	0.83	0.06	0.60	3.52	5.05	1.94
Dirty	11	0.23	0.13	0.64	0.48	3.73	2.66	1.82
Unit of account	10	0.70	0.26	0.03	0.92	4.94	4.48	3.00
Necessary	10	0.82	0.14	0.05	0.87	4.92	4.83	2.89
Uniform	9	0.20	0.76	0.05	0.69	3.56	5.25	2.21
Rectangular	9	0.10	0.86	0.03	0.57	3.93	5.03	2.26
Limited supply	8	0.52	0.34	0.14	0.78	4.49	4.32	2.49
Has a serial number.	6	0.29	0.68	0.03	0.75	4.13	5.12	2.73
Stable	5	0.71	0.18	0.10	0.69	4.48	4.06	1.75

Note. Properties are coded according to three empirically derived clusters: social-functional properties in dark shade, material properties in light shade. The property 'dirty' is an outlier.

These results carry interesting information on how participants represent money. Foremost, these data confirm our premise that money has a *dual structure* combining the functional role it serves within a community and the material features of the currency objects that instantiate that role. Participants rated social-functional properties as more characteristic of money than material properties, which helps to show that *money as a kind is primarily understood as a social-functional kind* rather than a kind of physical object. These social-functional properties were best explained by the community's *current rules and practices*; indeed, the more participants said a property was 'core' the more they said it was explained by the community's current rules and practices. But, as these data also make clear, *material* *properties* are often brought to mind when people think about money. Indeed, participants generated material properties 37.70% more often than social-functional properties. Material properties were explained by the *creator's original intentions*.

Together, these data help to explain why participants always privileged current social status in their category judgments of money but why intended purpose also contributed to money category judgments for many people. Both a community's current rules/practices and the creator's original intentions help make sense of the properties people bring to mind when thinking about money, and so both play a role in how people categorize money. But, despite the explanatory relevance of the creator's original intentions, the community's current rules and practices better explain the social-functional properties of money, which are more fundamental to its kindhood.

6. General Discussion

The experiments discussed in this paper begin to shed light on the way in which people conceptualize money. Across four studies, we found that participants represent money through two major clusters of properties: social-functional properties (e.g., value) and material properties (e.g., depicting Presidents). Participants judged that social-functional properties were more conceptually significant than material properties; the social-functional properties are core to money as a kind, rather than merely statistically associated with money. Nevertheless, the material properties of money often came to mind. Participants judged that social-functional properties were explained by the current social position of the object, whereas material properties were best explained by the kind of object they were intended to be by their creator. The current social position an object occupies explains its social functional properties and so is causally central to money's core properties; nevertheless, defunct currency objects persist as a kind of borderline case because the reason they exist and have their material properties is because they were created to be money. Overall, our results suggest that people represent money as involving non-obvious causal processes, and that these causal processes guide their category judgments.

The first two studies indicate that people categorize objects as money when they currently occupy that position in society. But objects that were originally created to occupy that position (i.e., defunct currency objects) were still money to some participants. Between the two, social position was consistently important to most participants in all designs, and therefore the best description of people's representations of money is as a position in society that objects can occupy rather than a special kind of physical object. In contrast, we found a bimodal pattern of responding with defunct currency objects: participants either strongly agreed or disagreed that defunct currency objects were money. We think this reflects the conflicting intuitions that defunct currency objects are not money (since they do not currently occupy that position in society) but also have to be money (since they exist because they were made to be money).

These findings complement and help to extend past accounts of money. Prior work found that people believe that acting with currency objects (i.e., purchasing goods with dollar bills) depends on the current position those objects occupy in society, whereas acting with standard artifacts depends on the physical structure of the object (Noyes et al., 2018). Consistent with this, we found that category judgments of money reflect social structure more than physical structure, such that an object can be entirely money or not money depending on its current position in society. Slightly qualifying this finding, however, the material properties associated with currency objects contribute to how people represent money, and so the intended purpose of objects contribute to money somewhat independently of current social position. This opens up the possibility of some overlap in how people think of money and standard artifacts. Though, as we argue below, we think this overlap reflects a unique causal structure for the conceptualization of money.

6.1. ***Connections to theories of artifacts***

There may be ways of broadening theories of artifacts to encompass institutional objects like money. This broadening would require isolating the conceptual overlap between institutional objects and standard artifacts from the unique causal structures of these domains. Artifact category judgments involve physical affordances, current use, and their original intended purpose (see Chaigneau et al., 2004 for overview). We believe that all three of these properties have analogs with money once transformed to account for the distinctly social (rather than physical) structure of money.

Physical affordances seem ill-suited for understanding money. A physically identical object can be entirely money or entirely not money depending on the current position it occupies in society (as the case of shells and cigarettes demonstrates). And of course, a medium of exchange can practically have no concrete instantiation – as the move toward digital forms of exchange (exemplified by Bitcoin) has made clear. But money is possibly understood through its *social affordances*, which refer to the way institutions make possible new forms of acting (Noyes, et al., 2020). This could explain why collective recognition was so important to participants' category judgments in Study 3: even though an object was not currently functioning as a medium of exchange, participants said it was money if people recognized it as money. Participants may have reasoned that such recognition made it possible for individuals to use an object to purchase goods, even though they were not doing so in practice. Our results thus contribute to recent theoretical and experimental research on the semantics of social objects, and in particular to the debate on their abstract vs concrete properties (Pexman et al., 2023). A more general theory of affordances could consider not only the relationship between physical objects and people's bodies (Gallagher & Crisafi, 2009; Petracca & Gallagher, 2020) but also the relationship between people and objects in social contexts. In general, people may represent object kinds through stable possibilities of action.

Intended purpose makes an important contribution to how people categorize standard artifacts (Bloom, 1996; Matan & Carey, 2001). [4] We found that intended purpose was not sufficient for people to categorize artifacts as money. Nevertheless, intended purpose clearly made an important contribution to category judgments about money, and therefore it may be important to both institutional objects and standard artifacts. However, this overlap has to be qualified by money's unique causal structure. When people represent the intended purpose of a standard artifact, they tend to have in mind individual creators, and often inventors and designers with substantial intellectual involvement in the object. Currency objects in contrast cannot be created by individuals. An individual that makes a dollar bill has made a counterfeit. The creation of dollar bills is restricted to socially recognized manufacturers (the Bureau of Engraving and Printing, the European Central Bank, etc.). Also, people may not have in mind intellectual involvement like invention and design; the creative act of making an object is less important than the act of making an object that fulfills certain agreed-upon rules. Therefore, we think that to encompass institutional objects like money, intentional theories of artifacts would need to be modified substantially.

[4] Notice that Matan & Carey (2001) used a forced choice paradigm, rather than a rating scale.

The reason intended purpose contributes to category judgments in both domains may be that intended purpose explains why they were created in the first place. Even though defunct currency objects, like broken cleaning brooms, lack the right affordances and effective function, their existence cannot be explained any other way. Moreover, the fact that they have been used as money in the past may induce people to perceive them as objects with the potential or disposition to become money, should the appropriate conditions be instantiated again. These features arguably make defunct currency objects at the very least a kind of borderline or honorary member of the artifacts category.

Finally, current use may contribute to category judgments of both standard artifacts and institutional objects. As before, in the case of institutional objects current use would need to be modified, however. A private individual can use a rock to hammer a nail. But for an individual to use a shell to purchase goods, the entire community needs to coordinate their use of the object (Noyes et al., 2018). This broader sense of current use did contribute to how people categorize money: we saw this in Study 3, where people were more likely to categorize an object as money if the community was currently using it as a medium of exchange. However, as with standard artifacts, current use does not appear to be a primary driver of money category judgments.

In conclusion then, we think that (1) Institutional objects cannot be readily accounted for by theories of standard artifacts (Noyes et al., 2018), and so institutional objects need to be studied in their own right. (2) Nevertheless, studying institutional objects may promote a deeper understanding of how people represent standard artifacts, and how people represent objects in general. People may have general priorities in how they represent objects (they may ask: *Can I use this to Φ? Why was this made? For what purpose?*) that interact with the specific causal structure of the objects. Systematically comparing institutional objects with standard artifacts might help isolate these conceptual priorities.

6.2. Looking ahead: Cashless transactions

An interesting topic for future research is how people represent cashless transactions. Our description of people's representation of money predicts that if a community shifted entirely to cashless transactions, participants would categorize those cashless transactions as money (or perhaps the verifiable, digital records involved in those transactions as money) but that many participants would continue to categorize the defunct currency object as money too. Further, people's experiences with currency objects may alter their concepts of money: for example, people in advanced economies that have become cashless, particularly those who have spent their entire adult lives in such societies, may represent money differently than those who have or have had regular exposure to physical currency objects. An even more fundamental question is whether the ability to represent money in abstraction from currency objects (as we find here) is conceptually necessary for transitioning to a cashless society; this question could possibly be answered by sampling subjects at different time points during cognitive development (along the lines of Noyes et al., 2018).

Perhaps participants in our sample were particularly open to representing money as the current social position of an object (rather than as an object) because the United States is substantially cashless and people have participated in cashless transactions. Participants in other cultures who have not been exposed to cashless transactions may reveal different responses. Our hypothesis based on existing data is that people will represent money as a current social position without exposure to cashless transactions. Elementary-school children understand that institutional artifacts are depend on the community's rules and practices (Noyes et al., 2018), and we believe it is this causal understanding that guides people to categorize as money objects occupying that position in society. We think this causal insight does not depend on exposure to cashless transactions. Nevertheless, this remains an empirical question.

6.3. Conclusion

This is the first large study to systematically investigate how participants categorize money. We found that participants primarily represented money as a social institution, and thus categorized objects as money when they occupied the relevant position in society. We also found that participants often brought to mind material properties of currency objects when thinking about money. For many participants, defunct currency objects remained money even when they no longer occupied that position in society, which led to a bimodal pattern of responding to defunct currency objects. Therefore, when institutions lead to the creation of new physical objects that would not exist otherwise, these institutional products may take on prominence in how participants represent the institution, and these products may still be understood in virtue of the institution even when they no longer occupy that position in society. Even so, our findings add further support for unique cognitive signatures of institutional concepts and the need to study institutions as a distinct domain of ordinary concepts. Institutions are a significant part of people's daily lives across societies, and studying institutions can provide insight into general priorities in people's concepts.

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