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How does the perceived value of a medium of exchange depend on its set of possible uses?☆

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ABSTRACT

The normative value of a medium of exchange is derived from the best consumption that it permits. Adding potential uses can increase the normative value of a medium of exchange but not decrease it. In two large preregistered experiments (total $N = 2205$), including one with incentive-compatible measures, we find that the perceived value of a medium of exchange systematically lies below this normative benchmark, such that adding a less-attractive set of potential uses decreases a medium of exchange's perceived value. Moreover, the extent of undervaluation depends on the difference in value between the potential uses, and there is no evidence of undervaluation when preferences among potential uses are articulated in advance. More generally, these findings reveal that the perceived value of a medium of exchange depends not only on the expected value of the best alternative but also on the set of alternatives.

1. Introduction

A medium of exchange is valuable because it may be exchanged for something else that directly or indirectly provides value. Money, gift cards, promotional credit, and arcade tokens are all valuable media of exchange because they eventually enable consumption of something else. The normative value of a medium of exchange is based on the best set of goods and services for which it can be exchanged. Formally, the normative value of a medium of exchange is the difference between the expected utility of the best bundle of goods that can be obtained with that medium and the expected utility of the best bundle of goods that can be obtained without that medium. For example, if the best use of a $10 gift card is a $10 book that would not be purchased otherwise, then the gift card is as valuable as the book, less any transaction costs.

In this paper, we address the titular question: How does the perceived value of a medium of exchange depend on its set of possible uses? In order to isolate the effect of the composition of the set of items, we address this question in cases where each subset of options is salient at the time of choice (to examine effects beyond unawareness or inaccessibility in memory) and where the difference in the scope of the set is relatively small (to examine effects in cases where choice overload is unlikely to account for the effect). We find that adding less-attractive (i.e., less-valuable or less-desirable) uses to a medium of exchange's set of possible uses can reliably decrease the medium's perceived value, holding constant the accessibility of the best use.

We begin by discussing previous research on the perceived value of media of exchange and draw from research on how people average across sets to suggest that adding less-attractive goods to the set of potential uses may reduce a medium of exchange's perceived value. We then describe the results of two preregistered experiments, including one with incentive-compatible measures, testing this relationship. Together, these experiments indicate that making less-attractive options available decreases the perceived value of a medium of exchange.

2. Valuing media of exchange

2.1. Nominal value and forms of media of exchange

Previous research on how consumers value media of exchange has focused on properties of media of exchange themselves, independent from their sets of uses. One stream of research has focused on how the numerosity of a currency and its nominal value influence its perceived

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value. Holding constant real prices and wages, people are sensitive to nominal prices and wages (Fisher, 1928/2011; Shafir, Diamond, & Tversky, 1997). Introducing a medium into a decision leads consumers to focus on the medium, beyond its consequences for ultimate consumption, distorting choice (Hsee, Yu, Zhang, & Zhang, 2003; van Osselaer, Alba, & Manchanda, 2004). As a result, consumers do not sufficiently discount the number of units of a currency by the value of each unit: they treat a larger quantity of a less-valuable currency as more valuable than a smaller quantity of a more-valuable currency with the same total real value (Raghubir & Srivastava, 2002; Wertenbroch, Soman, & Chattopadhyay, 2007). Put simply, nominal value matters.

A second stream of research has examined the effect of the form of a medium on spending decisions. Otherwise-equivalent spending decisions using cash, credit cards, or gift cards lead to differences in valuation, spending, and goals (Soman, 2001, 2003; Prelec & Simester, 2001; Reinholtz, Bartels, & Parker, 2015). Even the same sum in cash is valued differently depending on whether it is presented as multiple bills or a single bill (Mishra, Mishra, & Nayakankuppam, 2006).

In each of the research streams above, the set of possible uses is held constant in order to isolate the effects of numerosity or form on value. Yet underlying each finding is the key assumption that the value of a medium of exchange remains grounded in its potential uses and thus its real value. This literature indicates that whether the exchange rate for a loyalty program is 1 point per dollar or 100 points per dollar matters, but this is not to say that whether a point is worth a snack or a feast is irrelevant. The current research addresses the key question of how the perceived value of a medium is grounded in its potential uses.

When people assess the value of a medium of exchange, accessible options exert a disproportionate effect relative to options that are known but less accessible in memory (Frederick, Novemsky, Wang, Dhar, & Nowlis, 2009; Spiller, 2011). This finding is in line with a large body of research showing that across many judgments and decisions, the accessibility with which information, including particular alternatives, comes to mind influences its likelihood of being used (Feldman & Lynch, 1988; Lynch, Marmorstein, & Weigold, 1988; Johnson, Häubl, & Keinan, 2007; Nedungadi, 1990; Weber et al., 2007). Such accessibility influences the value of media of exchange as well, making consumers more likely to buy a focal option when no attractive outside options come to mind (Frederick et al., 2009; Spiller, 2011).

These latter findings indicate that the value of a medium of exchange is based largely on its accessible uses, but they are silent regarding how multiple accessible uses are integrated together into an overall judgment of value. In particular, from past research it is unclear whether the value judgment uses only the best accessible use or integrates both the best accessible use along with other accessible uses in a possibly non-normative manner.

2.2. Value of choice

Consumers find intrinsic value in having choices. When future preferences are uncertain, rational consumers prefer flexibility (Kreps, 1979). People exhibit reactance in the absence of freedom of choice (Brehm, 1966) and greater intrinsic motivation in the presence of choice (Zuckerman, Porac, Lathin, & Deci, 1978). Mere choice that does not enhance outcomes can be preferred to a lack of such choice (Bown, Read, & Summers, 2003) and consumers are averse to choice sets containing only a single option (Mochon, 2013). Consumers sometimes overvalue keeping options open for the future (Shin & Ariely, 2004; Shu, 2008). Consistent with that value, regret is affected by the set of positive attributes foregone, not just the best option foregone (Sagi & Friedland, 2007; cf. Weiss & Kivetz, 2019).

These findings may suggest that a medium of exchange is perceived to be more valuable than its best use, since in addition to its best use, it also provides choice. Yet often, "instead of hypothetically traveling through the branches of a decision tree… people suspend judgement and remain at the node" (Shafir, 1994, p. 403). When faced with a choice set in general, and a medium in particular, consumers may focus on the assortment itself as an integrated market offering (Chernev, 2006; Hsee et al., 2003; Sood, Rottenstreich, & Brenner, 2004; van Osselaer et al., 2004). If so, they are more likely to evaluate a medium directly as a market offering rather than deriving its value from the decision tree it implies.

2.3. Averaging sets

If consumers evaluate a medium as an integrated market offering rather than deriving its value from the decision tree it implies, they are likely to evaluate it as they do other market offerings: by taking a weighted average of its features.

Across a wide range of domains, people quickly assess and use average values of stimuli. When looking at a set of objects, people rapidly extract a feature's average value from a set of objects, including size from circles (Ariely, 2001; Chong & Treisman, 2003), emotion from faces (Haberman & Whitney, 2007, 2009), animacy from objects (Yamanashi Leib, Kosovicheva, & Whitney, 2016), and price from products (Yamanashi Leib et al., in press); see Whitney and Yamanashi Leib (2018) for a review. When generating summary evaluations by integrating information across a set of inputs, people typically rely on the average value of the set of inputs, including characteristics of people (Anderson, 1965; Nisbett, Zukier, & Lemley, 1981), attractiveness of individuals (Anderson, Lindner, & Lopes, 1973; van Osch, Blanken, Meijs, & van Wolferen, 2015), values of gambles (Lynch, 1979; Shanteau, 1974), and evaluations of discrete experiences (Ariely & Zauberman, 2000, 2003) and career performances (Brusovansky, Vanunu, & Usher, 2019). Given their ubiquity, some argue these varied instantiations of averaging may represent natural assessments attributable to a common mechanism (Ariely, 2001; Kahneman, 2003; Whitney & Yamanashi Leib, 2018; Whitney, Haberman, & Sweeny, 2014).

Judgments of market offerings are as sensitive to such averaging processes as judgments of other objects. These averages apply even when a clear normative benchmark for judgment is the sum rather than the average; such non-normative use of the average is consistent with people's general tendencies to misapply such natural assessments to inappropriate contexts (Kahneman, 2003; Kahneman & Frederick, 2002; Tversky & Kahneman, 1983). When evaluating products as sets of features (Weaver, Garcia, & Schwarz, 2012; Troutman & Shanteau, 1976) and bundles as sets of products (Brough & Chernev, 2012; Chernev & Gal, 2010; Gaeth, Levin, Chakraborty, & Levin, 1991; Yadav, 1994), people use a weighted average of the set to generate a summary evaluation. Counter to the normative standard, this can lead to a "more is less" effect (e.g., Hsee, 1998; List, 2002) such that adding less-extreme favorable information to more-extreme favorable information decreases evaluations. For example, an electronic device bundle (a market offering) that includes a cover (a more-attractive feature) and a free download (a less-attractive feature) is seen as less valuable than that same bundle without the free download (Weaver et al., 2012).

In short, a weighted averaging rule is an effective summary of the processes by which people evaluate market offerings as sets of features. A medium of exchange's set of potential purchases organizes spending and is central to mental accounting (Cheema & Soman, 2006; Brendl, Markman, & Higgins, 1998; Heath & Soll, 1996; Henderson & Peterson, 1992; Kahneman & Tversky, 1984; Reinholtz et al., 2015; Thaler, 1985). Just as with other market offerings, a medium of exchange may be characterized by a set of features, where each feature represents a set of potential purchases: a gift card (a market offering) may be usable at Walmart (a more-attractive feature) and usable at Sam's Club (a less-attractive feature). Because summary evaluations of market offerings are driven by a weighted average of evaluations of individual features, adding less-attractive potential purchases (i.e., less-attractive features) to a medium of exchange can decrease its perceived value.

To our knowledge, prior work has not examined the averaging

principle in the context of choice sets or media of exchange. This theoretical extension must be tested empirically because of key characteristics that differentiate media of exchange from other market offerings. First, as detailed above, consumers find inherent value in choice. Second, features of traditional market offerings are not mutually exclusive in the way that choosing to spend a medium of exchange on one use necessarily forecloses the option to spend it on another. In each of the judgments above regarding market offerings, the value that people attempt to assess is a function of the sum of the components of the set, adjusted for complementarities (Shaddy & Fishbach, 2017; Popkowski Leszczyc and Häubl, 2010). In contrast, the value of a set of potential purchases relevant for a medium of exchange should be a function of the maximum of the components of the set, not the sum. Such a difference in the normative standard may affect the actual valuation process. Third, because media of exchange necessitate a downstream choice, it is possible that consumers may orient their attention to a single end use rather than holistically assess the set (though consumers' tendencies to holistically evaluate bundles and media as ends rather than means suggests this is unlikely; Hsee et al., 2003; Shaddy & Fishbach, 2017; van Osselaer et al., 2004). Nevertheless, if the averaging principle does extend to a medium of exchange's set of potential uses, adding less-attractive uses will decrease a medium's perceived value.

2.4. Valuing choice sets

Given that consumers value market offerings as a weighted average of their features but also value inherent choice, whether weighted averaging applies to the perceived value of media of exchange remains to be examined.[1] Two research streams lend indirect support to the proposal that media of exchange may be valued in accordance with a weighted average of their uses and less than their best use. First, the value of a product assortment is sensitive to the mean, not just maximum, product value. Assortment evaluations decrease as the number of unacceptable products in the assortments increase (Kahn & Lehmann, 1991). At the aggregate level, decreasing the number of less-desirable products available can increase purchase rates, suggesting increased evaluations (Boatwright & Nunes, 2001; Broniarczyk, Hoyer, & McAlister, 1998).

Second, when choice sets and real options are valued as market offerings themselves, their values are sensitive to the values of unchosen alternatives. When valuing choice sets, adding less-attractive options to a set decreases willingness to pay (WTP) for that set, and as the attractiveness of those less-attractive options decreases, so does WTP for the set (Le Lec & Tarroux, in press). Similar processes apply to the perceived value of real options, which grant the right but not the obligation to purchase an asset at a given price. If the asset is worth less than its price, its value is irrelevant: the option holder can avoid a loss by not buying the asset. Just as with media of exchange, the option holder would then face a choice between two alternatives, one more-attractive (do not buy) and one less-attractive (buy an asset that is worth less than its price). The perceived value of an option is affected by the less-attractive alternative's value, even though it is irrelevant (Miller & Shapira, 2004). In each of these cases, the way that people value choice sets is consistent with the use of the weighted averaging rule described previously (though to our knowledge this theoretical link has not previously been established).

2.5. Moderators of undervaluation

If people value a medium of exchange according to a weighted average of its set of uses rather than its derived normative value, this implies two theoretically important moderators.

First, as the value spread among the sets of possible uses grows, valuing the medium as a weighted average of its uses will lead to greater undervaluation (cf. Le Lec & Tarroux, in press). Suppose a medium is valued at the average of its best and other uses. Someone who values the best use at $10 and the other use at $6 would value the medium at $8 and thereby undervalue it by $2. Now consider two counterfactuals: if the consumer valued the best use at $14 and the other use at $6, they would value the medium at $10 and undervalue it by $4. Alternatively, if the consumer valued the best use at $10 but the other use at $2, they would value the medium at $6 and undervalue it by $4 again. As these examples indicate, as the value spread increases, whether due to the value of the best use increasing or the value of the other use decreasing, the gap between the average value and the best value also increases. If the average value drives valuation, undervaluation will increase as the value spread increases.

Second, in line with the prior literature on averaging effects in cases where the normative standard is a sum rather than a maximum, we propose this undervaluation is not the result of intentional, reasoned analysis that persists when its implications are laid bare. As a result, if consumers are encouraged to look ahead to the end of the decision tree, they may be able to appropriately value a medium in accordance with its derived value. Thus, we hypothesize that considering one's preferences among the set of possible uses ought to attenuate the extent of undervaluation, as consumers are capable of deriving the value of the medium from its uses.

3. Overview of experiments

To test the averaging principle, we focus on a key implication: people value a broad-use medium of exchange associated with two sets of uses *less* than a narrow-use medium that is only associated with the more-attractive set. Two experiments reveal that given a sufficiently large value spread between the more-attractive set and the less-attractive set, broad-use media of exchange are valued less than preference-matched narrow-use media of exchange (i.e., narrow-use media of exchange usable on the more-attractive set.) Furthermore, this undervaluation increases as the value spread increases. Experiment 1 tests this in the context of shopping categories at a large multi-category retailer. Experiment 2 tests this with incentive-compatible measures using multi-retailer gift cards. The online supplement contains a replication of experiment 1 and additional experiments from a previous version of this paper. We close with a discussion of how our results align with alternative psychological processes, as well as boundary conditions and potential extensions.

Our experimental design decisions were influenced by five key concerns. First, we must ensure that neither unawareness nor inaccessibility of more-attractive uses accounts for the undervaluation. When uses are inaccessible, they are less likely to be incorporated into a medium of exchange's value (Frederick et al., 2009; Spiller, 2011), so such accessibility must be held constant across conditions to isolate the effect of set composition. To address this concern, we explicitly name the set or sets of potential purchases when participants evaluate the medium.

Second, we must account for heterogeneous preferences. Often it is sufficient to calibrate stimuli based on mean differences across people. In the current case, however, heterogeneous preferences could lead us to infer that the mean value of a medium of exchange is greater than each uses' mean value, even if everyone values the medium less than the best use. To illustrate, suppose coffee-drinkers value coffee at $5 and tea at $1, tea-drinkers value tea at $5 and coffee at $1, and everyone values a voucher for coffee-or-tea at $4. If there are 70% coffee-drinkers and 30% tea-drinkers, the average value of the voucher ($4) is higher than the average value of each drink ($3.80 for coffee, $2.20 for tea), yet everyone undervalues the voucher by $1. To address this

[1] Note that the use of a weighted averaging rule and valuing choice are not necessarily mutually exclusive possibilities. People may use a weighted averaging rule and also make an adjustment for option value.

concern, we identify the more-attractive use separately for each participant.

Third, the measure used to identify the best use must be different than the measure used to value the best use. Otherwise, measurement error could result in undervaluation as a statistical artifact. To illustrate, suppose a person values coffee at $5, tea at $5, and a voucher for their choice at $5. If the drink values are measured with error and used to both identify and value the best use, the expected value of the maximum of coffee or tea (more than $5) will exceed the expected value of the voucher ($5), leading to apparent undervaluation. To address this concern, the measures used to identify the best use are separate from those used to assess its value.

Fourth, we argued above that making preferences among uses accessible immediately prior to valuation reduces undervaluation. Thus, while it is tempting to address the second and third concerns by having participants choose between uses immediately before they value the medium, theory suggests this would be self-defeating. In experiment 1, we assess preferences after a filler task following valuation. In experiment 2, we assess preferences indirectly prior to valuation, using independent ratings to ensure relative preferences are less accessible.

Fifth, concern for statistical power led us to assess value via WTP rather than choice. Although there can be systematic differences (e.g., Amir & Ariely, 2007; Amir, Ariely, & Carmon, 2008; O'Donnell & Evers, 2019; Lichtenstein & Slovic, 1971), we have no reason to expect to find qualitative differences across metrics in the present case.

4. Experiment 1

The primary purpose of experiment 1 was to examine whether broad-use media of exchange are undervalued relative to the value of preference-matched narrow-use media of exchange. The value of preference-matched narrow-use media of exchange also serves as a proxy for the value of the best use, net any mere medium differences (e.g., transaction costs of spending the medium). A secondary purpose was to examine value spread and preference accessibility as potential moderators. We begin by describing the overall method and then discuss the design specifics that enable us to answer our questions via targeted analyses.

4.1. Overall method[2]

Participants. 1202 participants (495 women, 701 men, 6 other or unknown) recruited from Amazon Mechanical Turk completed this experiment in exchange for a small payment.[3]

Stimuli. The medium of exchange used in this study was $20 of promotional credit that could be used in select categories at Amazon.com. There were 12 categories in total.[4] For each participant, the 12 categories (and their associated credits) were shuffled into four triplets, which we label *set A*, *set B*, *control*, and *filler*. WTP for credits in set A and set B served as key dependent measures. Measures of control credits were only used as covariates and to separate key measures. Measures of filler credits were only used to separate key measures.

All credits in this experiment were either *narrow-use* credits or *broad-use* credits. Narrow-use credits could be spent within a single specified category. Broad-use credits could be spent in either of two specified categories. The two categories associated with a particular broad-use credit were always drawn from the same triplet (i.e., set A, set B, control, or filler). Thus, three narrow-use credits and three broad-use credits could be drawn from each triplet.

WTP and choice measures. Participants first read a brief set of instructions describing Amazon promotional credits and how to interpret WTP prompts. Over 9 screens, they then completed a structured set of 15 WTP judgments and 12 binary choices. At the end of the study, participants completed three measures of choice certainty (one for each set A choice), and reported gender and age. The full ordering of WTP and choice measures is given in Table 1, with each type of measure and analysis described next. Despite the complex design, participants' tasks were relatively simple: complete a set of choices and WTP judgments. The full rationale underlying the complete structure of measures is described in Appendix A.

Open-ended WTP prompts read: "What is the most (in dollars) that you would be willing to pay for the Amazon credit below?" followed by a $20 credit usable in one or two categories. The 15 WTP judgments included 8 measures for set A credits (all 3 narrow-use, all 3 broad-use, and 2 randomly drawn with replacement), 1 measure for a set B credit (randomly drawn); 3 measures for control credits (all 3 narrow-use), and 3 measures for filler credits (all 3 narrow-use). Per our preregistration, all WTP measures were winsorized to $21 ($1 above face value, affecting 1.6% of responses) and mean WTP for narrow-use control credits (after winsorizing) was used as a covariate in all analyses.

Choice prompts read: "For which of the two categories below would you prefer to have $20 of Amazon Credit to spend?" followed by two categories drawn from the same triplet. The 12 choice prompts included all three pairwise choices among the three categories within a triplet, for each of the four triplets, so each category appeared in two choices. These choices permit identification of preference rankings within each triplet. We label the category chosen twice "H" (*h*ighest ranked), the category chosen once "M" (*m*iddle ranked), and the category chosen zero times "L" (*l*owest ranked). Per our preregistration, participants who made intransitive choices for set A or set B choices (49 out of 1202 participants) were excluded from all analyses.

The full set of measures was structured to permit three specific analyses. The first analysis, preregistered in detail given the many potential researcher degrees of freedom, assesses undervaluation of broad-use credits. The second analysis assesses whether undervaluation is moderated by value spread. The third analysis assesses whether undervaluation is moderated by preference accessibility. The first two analyses use set A credits (blocks 2, 4a, 4b); the third uses set B credits (blocks 6, 7, 9) such that it is effectively a separate sub-experiment, conducted with the same participants. Additional analyses are reported in the online supplement.

4.2. Analysis 1: Are broad-use credits valued less than their best uses? Yes

Design (Blocks 1, 2, 4a). Participants were randomly assigned to one of two conditions in block 2: *narrow-use* or *broad-use*. In the narrow-use condition, participants reported WTP for one focal narrow-use set A credit. In the broad-use condition, participants reported WTP for one focal broad-use set A credit.

Choices in block 4a were used to classify set A credits. Narrow-use credits were classified as H (spendable on the highest-ranked category H), M (spendable on the middle-ranked category M), or L (spendable on the lowest-ranked category L). Broad-use credits were classified as HM (spendable on category H or M), HL (spendable on category H or L), or ML (spendable on category M or L).[5] The value of the best use of the

[2] Experiment 1 was preregistered at https://aspredicted.org/84f3a.pdf. Materials, data, and preregistrations for both experiments 1 and 2 are available with the online supplement at https://osf.io/srg45.

[3] An additional 57 participants started the survey before dropping out. Only 11 dropouts made it far enough to be assigned to a condition, minimizing the potential for differential attrition.

[4] The categories were: Athletic Clothing, Beverages, Camping Gear, Cookware, Digital Music, Frozen Foods, Garden, Movies, Organization, Snack Foods, Team Fan Shop, and Video Games.

[5] There is no evidence that block 2 credit affected block 4a choice share. Of choices that posed a previously-seen category against a novel category, the previously-seen category was chosen 49.7% of the time (vs. 50%: $t(1201) = -0.28$, $p > .7$). This did not depend on whether the previously-seen category

Table 1
Experiment 1 structure of measures for analyses 1, 2, and 3.

Block 1[1,2,3]	**Block 5**
Control WTP (Narrow 1)	*Randomized Narrow (N) or Broad (B)*
Control WTP (Narrow 2)	Set A WTP (N) Set A WTP (B)
Control WTP (Narrow 3)	
	Block 6[3]
Block 2[1,2]	*Randomized Set B or Control*
Randomized Narrow (N) or Broad (B)	Set B Choice 1 Control Choice 1
Set A WTP (N) Set A WTP (B)	Set B Choice 2 Control Choice 2
	Set B Choice 3 Control Choice 3
Block 3	
Filler WTP (Narrow 1)	**Block 7**[3]
Filler WTP (Narrow 2)	*Randomized Narrow (N) or Broad (B)*
Filler WTP (Narrow 3)	Set B WTP (N) Set B WTP (B)
Block 4a[1,2]	**Block 8**
Set A Choice 1	Filler Choice 1
Set A Choice 2	Filler Choice 2
Set A Choice 3	Filler Choice 3
Block 4b[2]	
Set A WTP (Narrow 1)	**Block 9**[3]
Set A WTP (Narrow 2)	*Counterbalanced with Block 6*
Set A WTP (Narrow 3)	Control Choice 1 Set B Choice 1
Block 4c	Control Choice 2 Set B Choice 2
Set A WTP (Broad 1)	Control Choice 3 Set B Choice 3
Set A WTP (Broad 2)	
Set A WTP (Broad 3)	

Note. Each row within a block represents one measure. Superscripts indicate the analyses (1, 2, or 3) for which a block's measures were used. Blocks without superscripts (3, 4c, 5, and 8) were not used in any of the primary analyses; see Appendix A for details. Blocks 3 and 8 were merely filler measures. Results of Blocks 4c and 5 are discussed in the online supplement. Blocks 4a-4c all appeared on the same screen.

HM credit (net of transaction cost) can be estimated using the value of the H credit. The value of the best use of the HL credit can also be estimated using the value of the H credit. The value of the best use of the ML credit can be estimated using the value of the M credit.

Results. Participants valued broad-use credits less than preference-matched narrow-use credits. We regressed focal WTP (block 2) on credit type (H, M, L, HM, HL, or ML, represented via five orthogonal contrast codes), controlling for mean control WTP (block 1). The contrast of interest compared the broad-use credits (HM, HL, ML) against the preference-matched narrow-use credits (H, H, and M, respectively). On average, broad-use credits were valued $0.60 less than their best uses (SE = 0.28, $F(1, 1146) = 4.48$, $p = .035$). Each of the individual matched comparisons was directionally negative (HL vs. H: -$0.90; HM vs. H: -$0.37; ML vs. M: -$0.59), though only the HL vs. H comparison was statistically significant ($t(387) = -2.28$, $p = .023$). Because it relies on considerably more data, the combined contrast is more precisely estimated than the individual comparisons. Thus, for the remaining results, we focus on the combined contrast. Results are depicted in Fig. 1 and means are given in Table 2.

Note that this analysis does not simply compare the average of H, M, and L narrow-use credits (M = $9.24, SD = $5.38) against the average of HM, HL, and ML broad-use credits (M = $10.32, SD = $5.03; $t(1151) = 3.50$, $p < .001$). On average, broad-use credits are valued more than narrow-use credits because of better preference fit (e.g., participants are better off with HL than with L.) Once one accounts for preference fit, broad-use credits are valued less.

(*footnote continued*)
was as part of a narrow-use credit (50.4%) or a broad-use credit (48.9%; $t(1200) = -0.63$, $p > .5$).

4.3. Analysis 2: Does undervaluation increase with value spread? Yes

Design (Blocks 1, 2, 4a, 4b). If consumers value a credit according to a weighted average of the values of its uses, then holding the weights approximately constant, undervaluation will increase as the difference between the best use's value and the average value increases. This difference is greater when the best use's value is greater (holding constant the other use's value) and when the other use's value is lower (holding constant the best use's value).

To test this implication, we regressed focal WTP (from block 2) on a set of dummy variables representing the 6 types of credits (H, M, L, HM, HL, ML) and WTP for H, M, and L component use values (from block 4b) nested within type of credit, controlling for mean-centered control WTP (from block 1) to reduce error. This allows us to estimate the relationship between (a) WTP for each of the three component use values (H, M, L, as measured in block 4b) and (b) WTP for each of the six focal credits (as measured in block 2), for a total of 18 slopes.

Results. The coefficients on best-use values were smaller for broad-use credits (H as best use for HM: 0.56; H for HL: 0.65; M for ML: 0.57) than for preference-matched narrow-use credits (H for H: 0.86; M for M: 0.83; $F(1, 1128) = 18.67$, $p < .001$): broad-use credit value varies less with best-use value than preference-matched narrow-use credit value does. In contrast, the coefficients on other-use values were larger for broad-use credits (M as other use for HM: 0.24; L for HL: 0.06; L for ML: 0.23) than for preference-matched narrow-use credits (M for H: −0.00; L for H: −0.02; L for M: 0.06; $F(1, 1128) = 13.63$, $p < .001$): broad-use credit value varies more with other-use value than preference-matched broad-use credit value does. Thus, the value spread between the best use and the other use mattered more for narrow-use credits than for broad-use credits ($F(1, 1128) = 20.76$, $p < .001$). See Fig. 2.

Put another way, because the value spread matters more for narrow-use credits than for broad-use credits, undervaluation of broad-use credits depends on the value spread between the best use and the other use. Holding constant WTP for the other use, as value spread increases by $1, undervaluation increases by $0.24 ($F(1, 1128) = 18.67$, $p < .001$). Holding constant WTP for the best use, as value spread increases by $1, undervaluation increases by $0.18 ($F(1, 1128) = 13.63$, $p < .001$; these are the same interactions as above). See Fig. 3.

4.4. Analysis 3: Does undervaluation persist when preferences between uses are accessible? No

Design (Blocks 1, 6, 7, 9). Participants were assigned to one of four conditions as part of a 2 (Credit: broad-use, narrow-use) × 2 (Preference accessibility: high, low) design. This randomization, regarding set B credits, was independent of that for set A credits discussed above.

In the *narrow-use* condition, participants reported WTP for one focal narrow-use set B credit in block 7. In the *broad-use* condition, participants reported WTP for one focal broad-use set B credit in block 7. Using the set B choices, the narrow-use credits were classified as H, M, or L, and the broad-use credits were classified as HM, HL, or ML.[6]

In the *high preference accessibility* condition, participants' preferences between the sets of possible uses were made accessible at the time of valuation. Participants made all three set B choices in block 6, meaning

[6] As with set A, we examined whether set B choices were affected by type of credit presented. We regressed proportion of choices of exposed categories over non-exposed categories on contrast codes for order of presentation, breadth of credit, and their interaction. Participants chose exposed categories half of the time (50.1%; $t(1198) = 0.07$, $p > .9$ vs. 50%). Participants were slightly less likely to choose exposed categories after seeing them than before (47.7% vs. 52.5%; $t(1198) = 2.08$, $p = .038$), but there was neither a main effect of type of credit ($t(1198) = -0.10$, $p > .9$) nor an interaction ($t(1198) = 0.07$, $p > .9$).

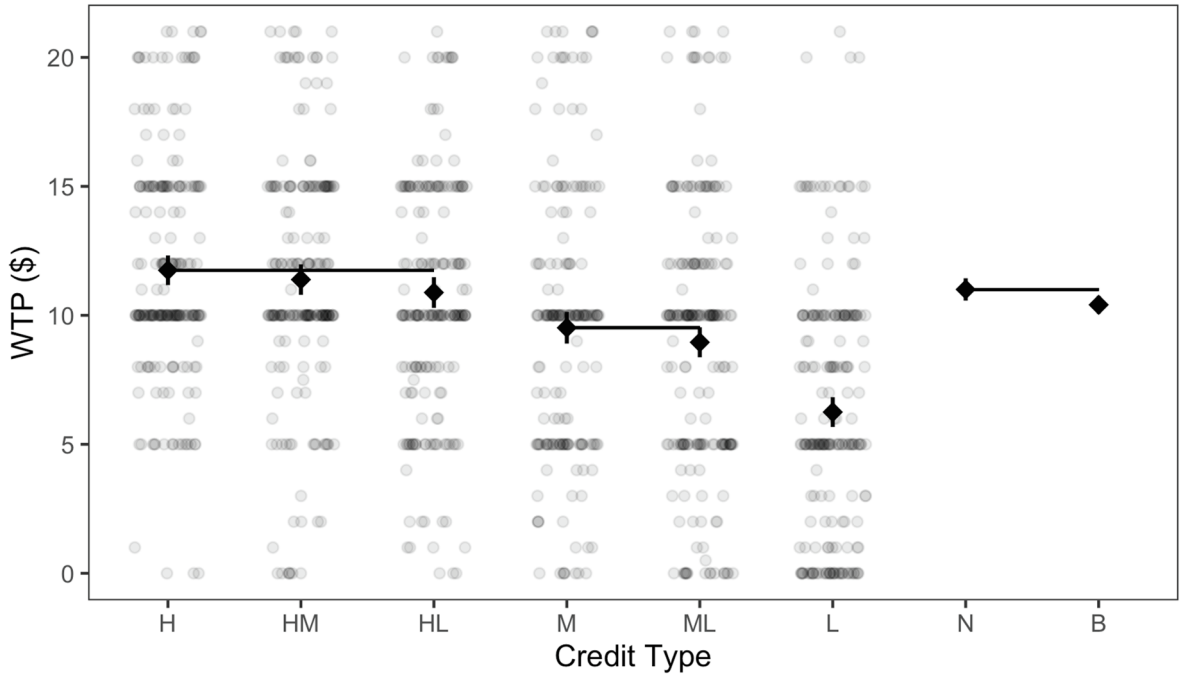

Fig. 1. WTP as a function of credit type in experiment 1 (analysis 1). Light points represent individual observations; dark points represent adjusted means. Error bars represent 95% confidence intervals. B represents broad-use mean (HM, HL, ML); N represents preference-matched narrow-use mean (H, H, M). Lines represent estimated values of preference-matched narrow-use media (H for HM, HL; M for ML; N for B).

Table 2
Experiment 1 means and standard deviations (analysis 1).

Medium of Exchange	N	Mean	SD
Narrow-Use[a]			
H	202	11.77	4.40
M	176	9.57	5.35
L	200	6.40	4.94
Broad-Use			
HM	190	11.34	4.85
HL	188	10.55	4.65
ML	197	9.10	5.31

[a] The differences in within-condition cell sizes (e.g., H vs. M vs. L) are not statistically significant (narrow-use: $\chi^2(2) = 2.17$, $p = .337$; broad-use: $\chi^2(2) = 0.23$, $p = .890$).

they had to access their preferences immediately *before* they made WTP judgments. In the *low preference accessibility* condition, participants' preferences between the sets of possible uses were not made accessible at the time of valuation. Participants made all three set B choices later, in block 9, meaning that they did not have to access their preferences until *after* they made WTP judgments. Whichever block (6 or 9) did not contain the set B choices contained all three control choices instead, as indicated in Table 1. Thus, all participants provided the same measures, just in different orders.

Results. Preference accessibility eliminated undervaluation. We regressed WTP for the focal set B credit on control WTP, a full set of five orthogonal contrasts representing type of credit including the key contrast comparing broad-use credits against preference-matched narrow-use credits, a contrast representing preference accessibility, and the interactions among the full set of contrasts representing credit type and the contrast representing preference accessibility.

Preference accessibility significantly moderated the effect of breadth of use ($F(1, 1140) = 6.52$, $p = .011$). Just as with set A, when preference accessibility was low, broad-use credits (adjusted mean = \$10.35) were undervalued relative to their best use as assessed via the narrow-use credits (adjusted mean = \$11.14; b = -\$0.79, SE = 0.40, $F(1, 1140) = 3.94$, $p = .047$); there was not sufficient power to detect whether this effect differed across credit type. However, this undervaluation was eliminated and directionally reversed when preference accessibility was high (adjusted means = \$11.49 vs. \$10.86; b = \$0.64, SE = 0.39, $F(1, 1140) = 2.64$, $p = .105$). Preference accessibility increased the value of the broad-use medium (b = \$1.15, SE = 0.34, $F(1, 1140) = 11.25$, $p < .001$) but did not affect the value of the narrow-use medium (b = -\$0.29, SE = 0.44, $F(1, 1140) = 0.41$, $p > .5$). Results are depicted in Fig. 4.

4.5. Discussion

In experiment 1, we found that participants valued broad-use credits less than their best uses, as assessed by the value of preference-matched narrow-use credits. The mean between-subject undervaluation (\$0.60) was substantial, representing 17% of the difference between mean WTP for the best option (\$11.03) and mean WTP for the other option (\$7.46). As implied by use of a weighted average, undervaluation is more extreme when the value spread between the best option and the other option is larger. When preferences between the sets of uses are made accessible just prior to valuation, such that participants are encouraged to hypothetically travel the decision tree, undervaluation is eliminated because the broad-use credit was judged to be more valuable. Additional analyses, including analysis of within-subject undervaluation, are available in the online supplement.

In a replication of experiment 1, we examined these same questions with a slight variation on the original design; see experiment S1 in the online supplement. We replicated the key undervaluation main effect and observed marginally significant evidence of moderation by value spread. Differential selection effects in our test of moderation by preference accessibility impaired our ability to draw causal interpretations of the effect of preference accessibility. Plausibly as a result of that differential selection, the interaction was not statistically significant, but we replicated our experiment 1 findings of undervaluation for low preference accessibility and no undervaluation for high preference accessibility.

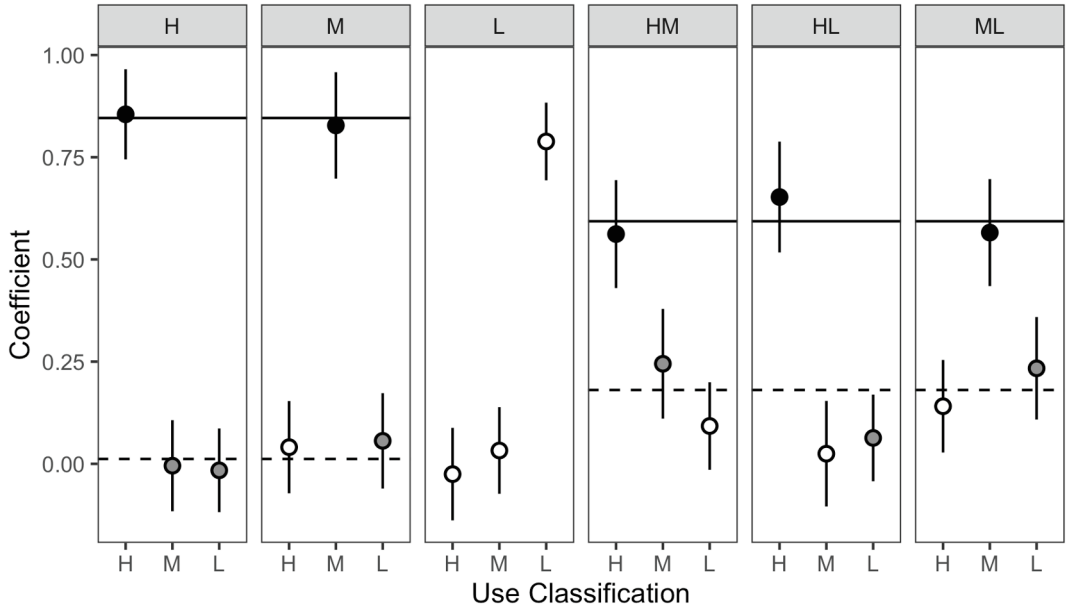

Fig. 2. Coefficients and 95% confidence intervals on value of each component use (H, M, L, as measured in block 4b) for each focal credit type (H, M, L, HM, HL, ML, as measured in block 2) in experiment 1 (analysis 2). The three left panels represent narrow-use focal credits; the three right panels represent broad-use focal credits. Best uses are filled in black. Solid lines represent average best-use coefficients estimated separately for narrow-use and broad-use focal credits. Other uses are filled in gray (for narrow-use focal credits, these are other uses for the matched broad-use credits). Dashed lines represent average other-use coefficients estimated separately for narrow-use and broad-use focal credits. Coefficients that represent neither best uses nor other uses for broad-use credits nor preference-matched narrow-use credits are filled in white.

5. Experiment 2

Experiment 2 was designed to replicate the undervaluation effect from experiment 1 with three key changes. First, we used a new type of media of exchange (gift cards usable at multiple retailers) to examine whether the effect generalizes. Second, we assessed WTP using an incentive-compatible mechanism. That was not possible in experiment 1 given that those credits were not available for sale at the time of the study. Third, the primary analysis in experiment 2 neither selected nor classified stimuli based on any post-manipulation information. Although we did not observe differential selection that could account for the primary results in experiment 1, the approach in experiment 2 ensures that differential selection cannot drive the results.

Using only pre-manipulation information to determine the best use requires balancing two concerns. First, we must accurately identify which use is preferred to allow us to test for undervaluation in a context in which we expect to observe undervaluation. Second, we must not highlight participants' preferences, as preference accessibility reduces undervaluation. To balance these two considerations, we use an indirect measure of preference prior to the manipulation and only analyze

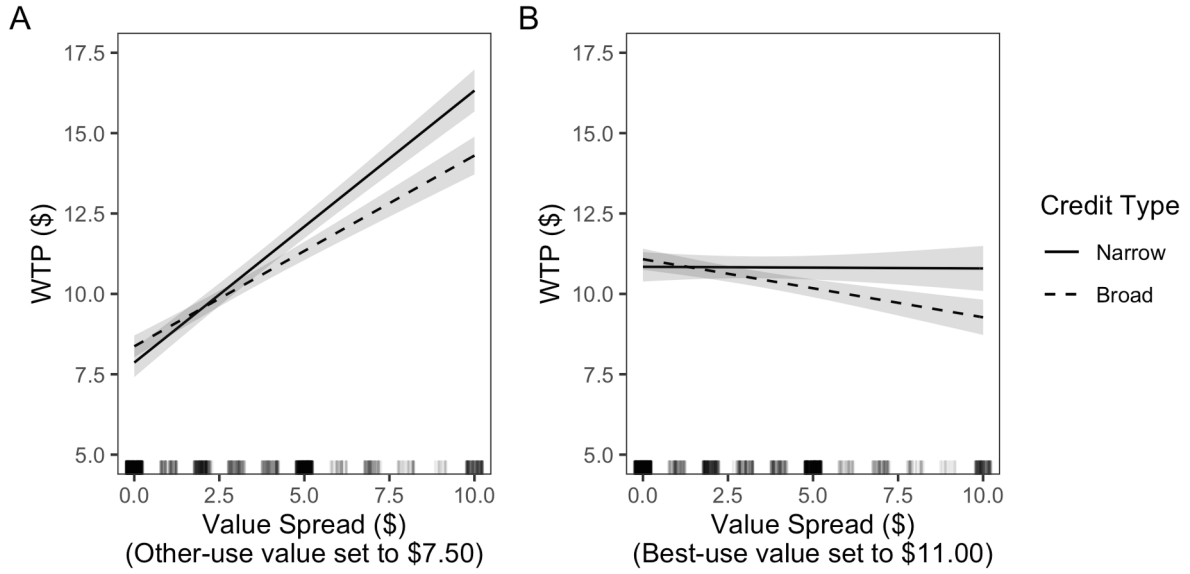

Fig. 3. Undervaluation as a function of value spread in experiment 1 (analysis 2). Dashed lines depict estimated values of broad-use credits. Solid lines depict estimated values of preference-matched narrow-use credits. Panel A holds value of other use constant at $7.50, approximately its mean. Panel B holds value of best use constant at $11.00, approximately its mean. Both panels hold control WTP constant at its mean. Hash marks along the x-axis indicate the distribution of value spread. Observations with value spreads less than $0 or greater than $10 (approximately 10% of the sample) are included in the analysis but are outside the range of the plot.

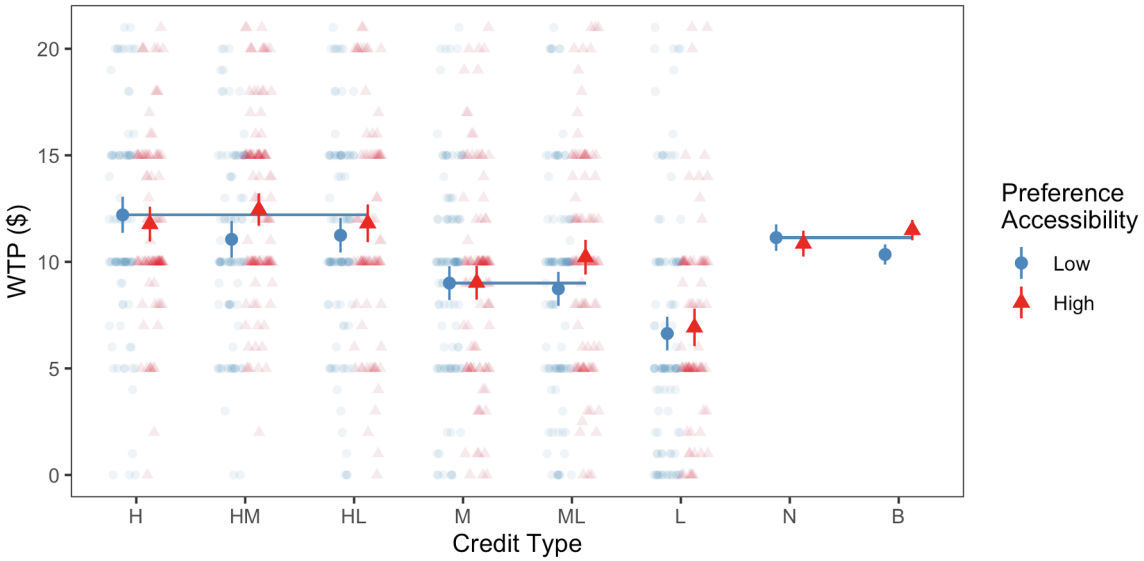

Fig. 4. WTP as a function of credit type and preference accessibility in experiment 1 (analysis 3). Light points represent individual observations; dark points represent adjusted means. Error bars represent 95% confidence intervals. B represents broad-use mean (HM, HL, ML); N represents preference-matched narrow-use mean (H, H, M). Lines represent estimated values of preference-matched narrow-use media in the low preference accessibility condition (H for HM and HL; M for ML; N for B).

cases with a sufficiently strong implied preference.

5.1. Method[7]

Participants and design. We recruited participants from AMT (N = 1,003; 454 women, 544 men, 5 other or unknown) for this study in exchange for a small payment.[8] After enrolling in the study, participants were informed about an opportunity to win a gift card and/or additional payment as described below. Participants were assigned to one of two conditions: *narrow-use* gift card or *broad-use* gift card.

Stimuli and procedure. Prior to any manipulation, participants rated 15 retailers (5 control and 2 from each of 5 focal pairs) regarding how much they would like to have a $25 gift card to use at that retailer, using sliders ranging from 0 ("not at all") to 100 ("a great deal"). For each of the 5 matched pairs of retailers, we defined the *best-use* gift card separately for each participant as the gift card usable at the retailer that participant rated higher and the *other-use* gift card separately for each participant as the gift card usable at the retailer that participant rated lower.[9]

Participants then read instructions similar to those in experiment 1. To ensure WTP judgments would be incentive-compatible, we used a lottery form of the Becker-DeGroot-Marschak mechanism (Becker, DeGroot, & Marschak, 1964). Participants read that we would select 10 participants as winners, and for each winner one WTP measure would have real consequences. We would randomly draw a price and give the winner (a) an additional $25 if the price exceeded WTP, or (b) the gift card and $25 less the price if WTP equaled or exceeded the price. The instructions included comprehension check questions with feedback to enhance understanding, and they explicitly stated that this approach implies participants are best-off reporting their true WTP. Finally, the instructions noted that some gift cards could be used at either of two separate retailers and assessed that participants understood the implications of such a gift card using a comprehension check with feedback.

Participants then completed three sets of measures in addition to the 0–100 ratings made earlier. First, all participants reported WTP for the five $25 control gift cards (T.J.Maxx, Old Navy, Olive Garden, Sears, Uber) included in the initial rating task.

Second, participants reported WTP for five focal $25 gift cards, one from each of five pairs included in the initial evaluation task (Walmart, Sam's Club; Nike, Converse; Pottery Barn, Williams Sonoma; Bed Bath & Beyond, World Market; Bubba Gump Shrimp Co., Morton's Steakhouse). In the *narrow-use* condition, we elicited WTP for the participant's best-use gift card from each pair. In the *broad-use* condition, we elicited WTP for a gift card that could be used at either retailer from the pair. In each pair, gift cards for the two retailers are interchangeable due to common corporate ownership.

Third, participants made five pairwise choices, one from between each pair of matched gift cards. These were used to validate our indirect preference measure. Finally, participants completed a second comprehension check regarding broad-use gift cards and reported gender and age. After the study concluded, ten winners were selected and sent electronic gift cards and/or payments, depending on the price drawn and their reported WTP.

5.2. Results

Comprehension check, outliers, and variable calculations. 95% of participants passed the comprehension check at the end of the study. As preregistered, all ten WTP measures were winsorized to $26 ($1 above face value), affecting less than 1% of all measures. The five control WTP measures were averaged for use as a covariate.

Prior to collecting data, we decided to only include focal gift cards from pairs for which participants reported at least a 10-point value spread during the initial 0–100 rating task regarding how much they would like to have a gift card from that retailer. A cutoff that was too low would lead to a smaller average effect size and therefore reduce power. A cutoff that was too high would lead to a reduced sample size and therefore reduce power. The 10-point cutoff sought to balance these objectives.[10] For each participant, we calculated average WTP

[7] Experiment 2 was preregistered at https://aspredicted.org/ym3sf.pdf.

[8] An additional 58 participants began the study but dropped out. Only 4 participants who dropped out stayed in long enough to be assigned to a condition, minimizing the potential for differential attrition.

[9] If two gift cards were rated the same, the one that was rated higher by more people in a pretest was treated as the best use. This was immaterial for our primary analyses, given the inclusion criteria described below.

[10] We defined a cutoff of 10 points in our preregistration to ensure we did not base the cutoff on favorable results. The key result is statistically significant in the expected direction using any cutoff between 1 and 80. A cutoff of 0 includes

across focal gift cards with at least a 10-point value spread; 39 participants had no such gift cards and were dropped from analysis. The participant-level average WTP measure is our key measure for analysis. Note this criterion applies equally to both conditions and only uses pre-manipulation information.[11]

Undervaluation. We regressed the participant-level mean focal WTP on a dummy for broad-use gift card, including mean control WTP as a covariate. Replicating experiment 1, the estimated mean value of the broad-use gift card (adjusted mean = $12.07) was lower than the estimated mean value of the narrow-use gift card (adjusted mean = $12.83, $t(961) = -3.15$, $p = .002$). The online supplement includes a number of robustness checks.[12]

This measure of undervaluation (−$0.76) is influenced by our use of an imperfect proxy to determine which use is the best use. Across all choices where the value spread was at least 10 point, the best use was chosen 86% of the time, but the other use was chosen 14% of the time. If we restrict analysis to gift cards for which participants later chose the best use (as in experiment 1), the undervaluation is more extreme (−$1.04, $t(934) = -4.22$, $p < .001$).[13] If we restrict analysis to gift cards for which participants chose the other use, the relative valuation is directionally reversed (+$0.73, $t(297) = 1.30$, $p = .20$). This non-significant reversal likely reflects some combination of (a) pure noise, (b) measurement error leading to a non-diagnostic comparison of the broad-use gift card against the other-use (rather than best-use) gift card, and (c) the presence of option value.

Moderation by value spread. As noted in our preregistration, our primary analysis approach is not suitable to test for moderation by value spread. It eliminates all within-subject variability and further restricts the useful variation in value spread by excluding all pairs with a small value spread, thereby substantially lowering power. By analyzing our data at the gift-card-by-participant level ($N = 5$ gift cards × 1003 participants = 5015 observations), using all observations, and including clustered standard errors, we can test for moderation by value spread. Specifically, we regress focal WTP on a broad-use dummy, value spread, the interaction of value spread and the broad-use dummy, and control for mean control WTP, the value of either the other use or the best use (depending on the analysis), and the interaction of the value of the other use or the best use (depending on the analysis) and the broad-use dummy.

Replicating experiment 1, we find that, controlling for the value of the other use, as value spread increases by 10 points, undervaluation increases by $0.20 ($t(5008) = -3.49$, $p < .001$). Controlling for the value of the best use, as value spread increases by 10 points, undervaluation increases by $0.13 ($t(5008) = -1.97$, $p = .049$). See Fig. 5.

5.3. Discussion

We replicate the main effect observed in experiment 1: people are willing to pay less for a gift card when they know that it may be used at either a more-attractive or a less-attractive retailer than they are when they only know that it may be used at a more-attractive retailer. Extending experiment 1, this result holds with a new set of stimuli when measured using an incentive-compatible mechanism.

Importantly, the effect holds when selection and classification of observations depends only on pre-manipulation information. While there is no evidence to suggest that differential selection drove the effects in experiment 1, experiment 2 relied only on random assignment given the population of interest: gift card pairs where there is a sufficiently large value spread for the best use over the other use, as assessed prior to the manipulation.

The finding in experiment 2 also points to a broader application of how the averaging principle extends outside the laboratory. The gift cards that were presented as narrow-use gift cards are actually broad-use gift cards: a gift card that can be used at Walmart can also be used at Sam's Club, whether that use is salient or not. Many participants were likely not aware of that fact, and for those who were aware of it, that association was likely not accessible at the time of valuation. Whereas media of exchange like those in experiment 1 representing proper subsets of other media of exchange may be less frequently encountered, media of exchange for which the known or accessible scope varies are quite common. Such media may be undervalued when less-attractive uses are highly salient.

6. General discussion

We find that the perceived value of a medium of exchange depends on the set of uses available, not just the best use. Adding a less-attractive set of uses of sufficiently lower value decreases the perceived value of a medium of exchange. Experiment 2 indicates this holds even if the less-attractive set of uses is always available but is made known and salient. Below, we consider boundary conditions, how these results align with different theoretical accounts, and describe opportunities and extensions this work permits.

Boundary conditions and moderators. The undervaluation we observed is replicable under a relatively well-defined set of conditions. Given a sufficiently large value spread among the set of salient possible alternatives, and given that preferences among those alternatives are not highly accessible at the time of valuation, we reliably find that a broad-use medium of exchange is valued less than a narrow-use medium of exchange spendable on its more-attractive set of uses. While this leaves some open questions (e.g., what defines a sufficiently large value spread when there are more than two subsets of alternatives? when are preferences spontaneously highly accessible?), the results of two preregistered analyses in large experiments enhances our confidence in the replicability of these results.

Two key theoretically-motivated moderators help to define these boundaries. First, when there is a larger value spread between the sets of possible uses, there is more undervaluation. This result follows directly from the predictions of valuing media according to a weighted average and is inconsistent with any alternative account that rests

(*footnote continued*)
cases where participants do not value one use more than the other: we do not expect undervaluation in such cases. For cutoffs above 80, there are few usable observations (e.g., for a cutoff of 81, only 242 out of 1,003 participants had even a single usable responses). We detail results using additional thresholds in the online supplement.

[11] In the complete dataset, participants who were later assigned to the broad-use condition had slightly higher ratings of both the best use ($M_{Broad} = 52.7$, $M_{Narrow} = 49.4$, $t(1001) = 2.43$, $p = .015$) and the other use ($M_{Broad} = 28.6$, $M_{Narrow} = 25.8$, $t(1001) = 1.92$, $p = .055$). These tests represent Type I errors, as random assignment occurred after condition assignment and there was nearly no post-manipulation attrition (4 participants dropped and 1,003 completed the study). Averaging across ratings with sufficiently large value spreads (i.e., using the data the analyses ultimately rely on) revealed no difference in ratings of best uses ($M_{Broad} = 66.4$, $M_{Narrow} = 65.3$, $t(962) = 0.85$, $p = .396$), and a small difference in ratings of other uses ($M_{Broad} = 24.8$, $M_{Narrow} = 21.7$, $t(962) = 2.44$, $p = .015$). Including either or both of these measures as covariates in our analyses has neither a substantive nor statistical influence on our results. See the online supplement for details.

[12] If we consider only responses with *less than* a 10-point value spread, which we preregistered we would exclude, we observe that the broad-use medium is valued significantly more than the narrow-use medium ($0.63, $t(927) = 2.39$, $p = .017$). This is likely a combination of: (a) the fact that option value may outweigh undervaluation for small value spreads, and (b) effects of misclassification, such that the average of the narrow-use gift card is artificially low because it contains a larger proportion of misclassified other uses, not just best uses.

[13] Note that degrees of freedom do not track choice percentages. Choice percentages are across all choices with sufficiently large differences in ratings. Most participants had at least one choice with a sufficiently large difference in ratings where they chose the more-attractive option, so this analysis loses relatively few participant-level observations. The observations that remain are based on fewer gift cards.

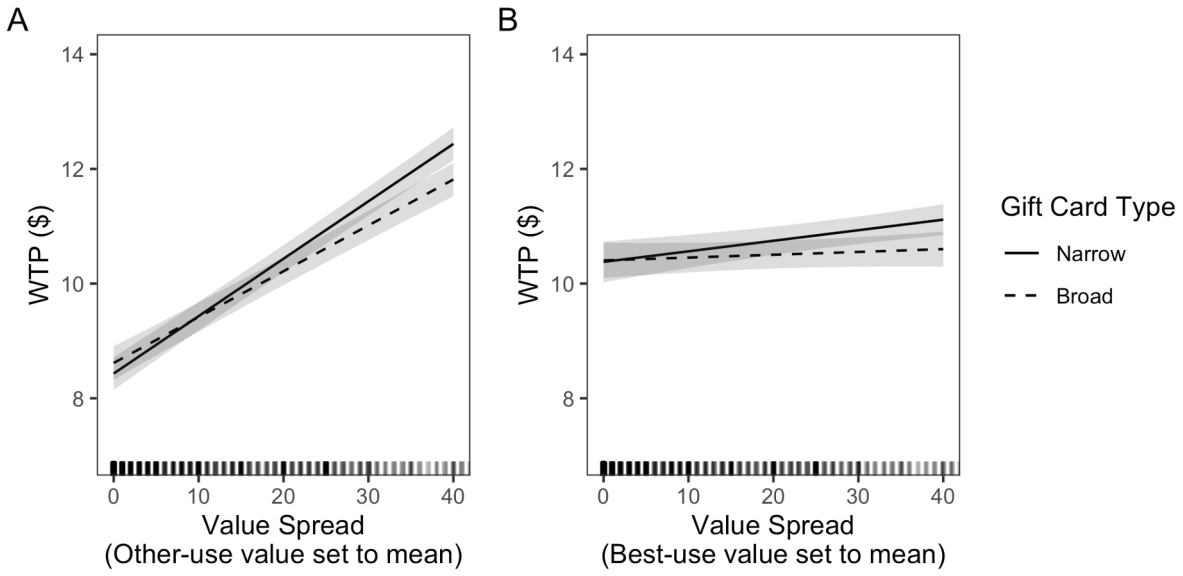

Fig. 5. Undervaluation as a function of value spread in experiment 2. Dashed lines depict estimated values of broad-use gift cards. Solid lines depict estimated values of preference-matched narrow-use gift cards. Panel A holds value of other use constant at its mean. Panel B holds value of best use constant at its mean. Both panels hold control WTP constant at its mean. Hash marks along the x-axis indicate the distribution of value spread. Observations with value spreads greater than 41 (23% of the sample) are included in the analysis but are outside the range of the plot.

solely on number of alternatives or choice difficulty. If the result were driven by mere number of alternatives, there would not be any interaction (whereas we find an interaction) and there would be undervaluation for small value spreads (whereas we find none). If the result were driven by choice difficulty, undervaluation would be smaller for media of exchange with larger value spreads, which presumably enable easier choices (whereas we find it is larger for such media).

Second, there is evidence that undervaluation is reduced when preferences are accessible. In experiment 1, we observed statistically significant undervaluation when preference accessibility was not heightened and statistically significant reduction (or possibly reversal) when preferences were highly accessible. These results suggest undervaluation is unlikely to hold in the presence of highly accessible preferences between the possible uses.

We find replicable evidence that media of exchange are valued in accordance with a weighted average of their uses. In these experiments, even the narrow-use media still permitted considerable choice. In cases where a narrow-use medium severely restricts choice (e.g., a coupon exchangeable for a single product), there are likely two competing factors influencing the value of a broad-use medium: it enables choice, thereby increasing its value, but it also incorporates less-attractive uses, thereby decreasing its value. Whether a broad-use medium of exchange is valued more or less than its matched narrow-use counterpart will depend on the relative influences of those two factors. The presence of the averaging principle does not imply the absence of valuing flexibility. Indeed, we do not contend averaging is the sole mechanism at play, but rather an important contributor that has thusfar been overlooked.

Alternative potential processes. These moderators and other aspects of our experimental designs help to rule out other candidate processes. First, one candidate explanation is that a medium of exchange is valued less than its best use because of transaction costs of using the medium rather than merely receiving the best use. However, given that all of our comparisons are against narrow-use media of exchange that involve the same transaction costs, this cannot account for the effect. Second, comparative loss aversion (Brenner, Rottenstreich, & Sood, 1999) would suggest that making choices can highlight downsides of individual options, possibly depressing the value of a medium. Yet we see that choosing between options prior to valuation *increases* the value of the broad-use medium rather than decreasing it. Third, considering dissimilar products can decrease purchase likelihood more than considering similar products because it can decrease the perceived importance of focal goals (Friedman, Savary, & Dhar, 2018; Karmarkar, 2017). Yet we see that the effect persists in experiment 1 set B (as long as preference accessibility is low) after many other dissimilar products have been considered, which ought to decrease the perceived importance of focal goals across the board; furthermore, the uses in experiment 2 are more similar to one another.

Fourth, consumers may wish to avoid making choices due to conflict (Tversky & Shafir, 1992b) and media of exchange require such choices. Yet both narrow-use and broad-use media of exchange require making choices. Moreover, undervaluation was smaller when component options were more similar in value; if the results were driven by conflict-induced choice aversion, undervaluation should be greatest when conflict is highest (i.e., for smaller value spreads). Fifth, less-favorable evaluations of one object can influence evaluations of another (Popkowski Leszczyc, Pracejus, & Shen, 2008; Rozin & Royzman, 2001). Yet we find that after rating a broad-use medium, participants later rate the more-attractive narrow-use medium as more valuable than they previously rated the broad-use medium ($0.37, se = 0.12, $t(1147) = 3.18$, $p = .001$; see online supplement for details). This would not be the case if the undervaluation were driven by the less-attractive use tainting the value of the more-attractive use. Sixth, considering an undesirable promotion or useless feature can decrease choice share by providing a reason not to choose (Simonson, Carmon, & O'Curry, 1994). Yet this ought to be attenuated for WTP judgments, and results are similar if we only analyze cases where consumers positively valued the less-attractive set of uses, although these tests have considerably reduced power due both to fewer observations and smaller value spreads (where less-attractive WTP > $0 in experiment 1: HL vs. H: b = -$0.59, SE = 0.40, $t(332) = -1.46$, $p = .146$; HM vs. H: b = −$0.05, SE = 0.39, $t(371) = -0.14$, $p > .8$; ML vs. M: b = −$0.50, SE = 0.43, $t(323) = -1.16$, $p = .248$; where less-attractive rating > 0 in experiment 2: b = −$0.68, SE = 0.27, $t(835) = -2.55$, $p = .011$; where less-attractive WTP > $0 in experiment S1 in the online supplement: b = -$1.45, SE = 0.41, $t(260) = -3.53$, $p < .001$). The results are inconsistent with the processes above, but consistent with use of a weighted averaging rule.

From a broader perspective, these findings are one instantiation of *non-consequential reasoning*, such that people do not reason through

distal choices resulting from proximal decision nodes. (Shafir, 1994; Shafir & Tversky, 1992; Tversky & Shafir, 1992a). Typically, these nodes reflect *chance*. In the present case, the node may represent uncertainty regarding one's future decisions. Once preferences are accessible, one has resolved that uncertainty and selected a branch of the decision tree and so the undervaluation is reduced.

6.1. Opportunities and extensions

To ensure that (a) there was a proper comparison value for each medium for every individual, (b) inaccessibility did not contribute to the effect, and (c) participants did not experience choice overload (Iyengar & Lepper, 2000), we focused on media of exchange with two sets of uses, where both sets were salient at the time of valuation. While these media are quite generalizable, they are not money. Yet principles derived from these studies may apply to more general media like money. These results suggest that the myriad uses of money could be a barrier to spending in a way that maximizes our own desired outcomes. If less-attractive options devalue our media of exchange, the door is open to financial misallocations of our money: if we value money less than its best use, we may spend it on market offerings that are more valuable than money's perceived value but less valuable than the value of the money's best use.

One opportunity this analysis presents is the potential to develop decision support systems (e.g., budgeting tools) that help people focus on potential purchases that are truly personally valuable and take out of consideration potential purchases that are not. Such systems could present only the items people truly want (e.g., a vacation or a new car) and encourage consumers to focus only on tradeoffs involving these items, pushing to the background other less-desirable possible ways to spend money. Goal-based saving used by many consumer-facing digital finance tools may be one avenue to such success (cf. Colby & Chapman, 2013).

We used a simplified paradigm to examine how consumers integrate multiple uses of a single medium of exchange. In extending these results to decision support systems or the broader cases of money, it is important to consider some of the limitations of this paradigm and how properties of other media of exchange compare.

Beyond two sets of uses. Many media of exchange commonly used by consumers do not have sets of uses that are neatly divided into one or two sets. Two primary complications arise in such cases: first, there are more than two sets of uses to be considered, and second, these multiple uses may have prices of very different magnitudes.

First, the undervaluation of a medium will depend on the distribution of uses for which that medium may be exchanged, as well as their memory accessibility or contextual salience. The number of uses that lie below the reservation utility frequently outnumber the number of uses that lie above it. The influence of these uses is likely moderated by the accessibility of the different uses, where what comes to mind is likely to be a combination of value and frequency (Bear, Bensinger, Jara-Ettinger, Knobe, & Cushman, 2020). More generally, consumers may represent the set of uses of a medium as a unitary set or as a combination of multiple discrete sets. The approach consumers take may influence the way that consumers average across its set of uses (see "multiple levels of media" below).

Regarding the second complication, for one-for-one exchanges, the averaging principle is clear. Such exchanges are prevalent in and of themselves (e.g., movie vouchers; drink tickets). In other cases, such as in the case of money, it is not clear whether one sandwich, two gallons of gas, and 0.02% of a new car will be averaged together in the same way. While the stimuli used in the current investigation are not limited to unit exchanges, they do not include the full range of expenses as in the broader case of money. Further explorations should examine the extent to which consumers are sensitive both to the attractiveness of the purchase as well as the proportion of that purchase it represents (cf. Gourville, 1998).

Valuation context. In these studies, the value of a medium was always assessed in terms of willingness to pay to obtain the medium. Just as important is its perceived value when spent. When less-attractive uses are highly accessible, but one's relative preference is not, we find people are willing to pay less for a medium. If this same process determines value at the time of use, this suggests that when less-attractive uses are highly accessible, the medium will be undervalued at the time of use, thereby increasing willingness to spend on less-attractive uses.

Multiple levels of media. The media of exchange considered in these experiments were usable on categories of uses, which themselves depend on summary evaluations. As Hsee et al. (2003) noted, many objects serve as media of exchange from one perspective but as end goals from another. When multiple media of exchange are at play, an average of averages need not be equal to an average of items. Much as Shah and Oppenheimer (2011) find that cue integration depends on grouping, and Sood and colleagues (2004) find that deriving an end choice prior to choice is different from a direct evaluation of a set, averaging across a set of averages rather than averaging across items will lead to a different value.

Cumulative effects. The present studies help to inform how people come to understand the value of money. People often fail to consider alternative uses of their money when making purchases (Frederick et al., 2009). Yet even in that absence, they do not mindlessly spend down to their last dollar. The value is likely derived from prior spending occasions. The current results suggest that, since value can be negatively affected by the availability of less-attractive alternatives, consumers may be more willing to part with their money for purchases that fall below the implied reservation utility. Such experiences reinforce the salient associations between those less-attractive uses and the resource itself, thus reinforcing the devaluation of the medium. This potential for long-lasting dynamics of resource valuation over time deserves further study.

Conclusion. Previous research has indicated that people are sensitive to irrelevant properties of media of exchange that are wholly disconnected from their end uses. We partially unveil the nature of how the value of media of exchange is grounded in those end uses. In particular, our findings that a weighted average value taken across the set of uses rather than just the best use is a key determinant of a medium of exchange's perceived value can help us better understand how people value their gift cards, money, and other media of exchange. This informs us as to what kinds of mistakes people might make when making such tradeoffs, and can help choice architects design ways to help people better spend their money in accordance with their own preferences.

Appendix A

The intricate structure of Experiment 1 was necessary to pursue multiple objectives simultaneously while observing multiple constraints. Not all of these are apparent in the description of the three key analyses, so we describe them here.

The overall experiment can be broken down into two separate experiments using the same participants: blocks 1 through 5 are used for the first sub-experiment (analyses 1 and 2) and blocks 1 and 6 through 9 are used for the second sub-experiment (analysis 3).

Block 1 measured WTP for control credits to be used as a covariate in both sub-experiments. These measures were necessary to reduce error variance by better accounting for between-subject differences in WTP.

Block 2 measured the key dependent variable for the first sub-experiment, used in analyses 1 and 2.

Block 3 measured WTP for filler credits. We preregistered that these measures were irrelevant for analysis purposes. These measures simply enabled us to separate the key dependent variable (in block 2) from the choices used to classify the key medium (in block 4a) and the values used to assess moderation by value spread (in block 4b) to reduce the

extent of carryover effects.

Blocks 4a, 4b, and 4c measured choices, WTP for narrow-use credits, and WTP for broad-use credits, respectively, for the set A credits used in our first sub-experiment. The choices enabled us to classify each credit as H, M, or L for analyses 1 and 2. The narrow-use WTP measures enabled us to test for moderation by value spread in analysis 2. Together, the narrow-use and broad-use WTP measures enabled us to test for within-subject undervaluation, reported in the online supplement. Based on the potential for preference accessibility to moderate the undervaluation, it was necessary to assess each of these measures after the key dependent variable. Because the choices were necessary for both analyses 1 and 2, we measured choice in block 4a before narrow-use WTP in block 4b (which was used only in analysis 2) and narrow-use WTP before broad-use WTP in block 4c (which was used in neither analysis 1 nor 2).

Block 5 provided an opportunity to measure whether participants exhibited undervaluation after making choices and reporting WTP for both narrow-use and broad-use credits. This analysis is reported in the online supplement.

Blocks 6 through 9 (along with block 1) comprised the second sub-experiment. Block 6 was necessary to manipulate preference accessibility and, for those in the high preference accessibility condition, to classify credit type (analogous to block 4a). To ensure a proper control (e.g., reduce differential fatigue effects, reduce differential carryover from block 5, etc.), the control condition included the same number of choices, but from the control triplet. The content of those choices was irrelevant. We chose to use control choices from the control triplet rather than the filler triplet to enable consistent labeling.

Block 7 measured the key dependent variable for the set B credit used in the second sub-experiment (analogous to block 2).

Block 8 served only as a filler to reduce the extent of carryover effects (analogous to block 3).

Block 9 was necessary to classify type of credit for participants in the low preference accessibility condition (analogous to block 4a). The control choices were included in the high preference accessibility condition merely to equate duration across experimental conditions.

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