THE PSYCHOLOGY OF PERCEIVED VALUE

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THE PSYCHOLOGY OF PERCEIVED VALUE

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This dissertation examines how people assess the value of products, and how this process affects market prices and consumer well-being. I begin by examining how people estimate the economic value of products, specifically the heuristic processes and biases that underlie such estimation.

Chapter 1 shows that subtle changes in product descriptions can render product valuations more experiential or more analytical in nature. In particular, merely making perceptual units (e.g., 12 snack bags) more salient than standardized units (e.g., 12 oz.) in quantity information makes valuations more experiential—even when objective information remains constant. Such experiential processing increases consumers' willingness to pay and, accordingly, retailers charge higher market prices when they sell products described in perceptual units.

Chapter 2 examines how individuals estimate willingness to pay (WTP) in consumer surveys, a question that is central to both practitioners and researchers. I show that the amount that respondents are willing to pay for a product is systematically lower than the actual prices that shoppers would pay in the marketplace. I delineate two distinct heuristic processes that individuals use to assess WTP estimates, preference-based WTP estimation and reference-based WTP estimation. I show that reference-based valuations are closer to market prices.

Chapter 3 investigates the psychological tenets of the valuation of a distinct class of products that are understudied yet important for consumers' well-being: self-made goods. I

document that the feeling of groundedness—a feeling of emotional rootedness—is an important reason why individuals value self-made goods more than equivalent ready-made ones. Individuals who make things themselves experience increased feelings of groundedness, and subsequently feel stronger, safer, and more stable. Conversely, experiencing higher need for groundedness (e.g., when one's foundations are shaken) makes people engage in do-it-yourself (DIY) activities more.

Overall, this dissertation examines both economic and psychological implications of *how* people assess the value of products, and shows that value assessment is essentially heuristic in nature, which renders it susceptible to various contextual factors. How individuals form product valuation has a substantial impact on market prices and consumer well-being.

BIOGRAPHICAL SKETCH

Prior to joining the Ph.D. program at Cornell University, Arnaud completed a Research Master in Marketing (MPhil) at Erasmus University, Rotterdam School of Management (2017), and a Master Degree in Food Science & Management at Agrocampus-Ouest, France (2006). In-between, Arnaud worked as a business journalist for the leading food retail magazine in France, *Linéaires*.

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CHAPTER 1

Experiential and Analytical Price Evaluations:

How Experiential Product Description Affects Prices

Abstract

Quantity can be described using perceptual units (e.g., bags, pieces) or standardized units (e.g., ounces, grams). Merely making perceptual units more salient in quantity description can increase perceived economic value. Even when the objective information and numerosity are kept constant, merely presenting the perceptual unit first (e.g., Lay's Chips 14 snack bags, 14 oz. of chips in snack bags of 1 oz. each) increases willingness to pay compared to presenting the standardized unit first (e.g., Lay's Chips 14 oz., 14 oz. of chips in snack bags of 1 oz. each). This occurs because perceptual units activate more experiential evaluations whereas standardized units activate more analytical evaluations. An archival study shows that retailers charge higher unit prices for products when perceptual units are salient in quantity description. Six preregistered experiments show that even when both units are available, merely increasing the attentional salience of perceptual units increases willingness to pay. The demonstration that the mere salience of experiential information can alter subjective value offers new insights into the psychology of market prices.

"We know not through our intellect but through our experience."
— Maurice Merleau-Ponty

The perceived economic value of a grocery product depends on its price and on the quantity offered at that price. In fact, along with price magnitude, quantity is probably the most critical piece of information that consumers use to assess economic value. Yet, despite substantial variation in the way quantity is described in the marketplace, how the framing of quantity influences perceived economic value and market prices has been largely overlooked in the extant literature. Retailers have considerable leeway in deciding how to describe quantity. Quantity can be described using *standardized units,* such as ounces and grams, that are based on scientifically calibrated measurements and require analytical thinking. Or it can be described using *perceptual units,* such as bags and pieces, that can be assessed based on subjective experience without much analysis. Even when these two types of units are used together, retailers can make the standardized unit more salient in the description by presenting it first (e.g., Lay's Chips 14 oz., 14 oz. of chips in snack bags of 1 oz. each) or they can make the perceptual unit more salient (e.g., Lay's Chips 14 snack bags, 14 oz. of chips in snack bags of 1 oz. each). Does such framing of quantity influence consumers' subjective assessment of the economic value of a product? Does it influence market prices? These questions, which have important practical and theoretical implications, are the focus of this research.

We propose and show that the description of quantity can systematically alter perceived economic value. When the standardized unit (e.g., 14 oz. of chips) is made more salient in the description by presenting it first, it prompts more analytical evaluations. In contrast, when the perceptual unit (e.g., 14 snack bags of chips) is made more salient, it prompts more experiential evaluations, which usually increase perceived economic value. Even when both units are

provided and the information content is unchanged, merely increasing the salience of perceptual units can increase perceived value.

This research contributes to the nascent literature on how the framing of quantity influences consumer judgments (Chandon and Ordabayeva 2009; Lembregts and Van den Bergh 2019; Ma and Roese 2013) as well as to the broader literature on the effects of experiential framing of information (Hsee and Rottenstreich 2004; Hsee, Rottenstreich, and Xiao 2005) on perceived value. We extend these literatures in two ways. First, we examine the effects of standardized and perceptual units on market prices and perceived economic value. Second, we show that the mere attentional salience of perceptual units can alter perceived economic value. Even when both perceptual and standardized units are used, merely increasing the attentional salience of perceptual units can increase willingness to pay compared to when standardized units are more salient.

CONCEPTUAL FRAMEWORK

While shopping in a grocery store, consumers often have to assess how much they are willing to pay for products. Because most people can make such assessments of economic value spontaneously and effortlessly, the task seems deceptively simple. However, the cognitive process underlying such economic value assessment is quite complex. In order to come up with a price that they are willing to pay, shoppers have to consider how much they like the product, prices of similar products, the quality of the product, as well as the quantity being offered at the listed price. Although quantity judgment is an inherent step in the assessment of economic value, it is usually not a focal judgment. It is only an ephemeral intermediary judgment that is used as one of several inputs to assess economic value. We aim to study how such intermediary quantity judgments influence perceptions of economic value. More specifically, we examine how the use

of standardized versus perceptual units influences subjective value. To this end, we have to first characterize the distinct mental processes activated by these two types of units.

Standardized and Perceptual Units

Standardized units are formal, scientifically-calibrated units of measurement created to precisely communicate magnitudes. The earliest known use of standardized measurement system dates back to 2500 B.C. with the standardized stone weights used in the Indus Valley civilization (Robinson 2007). The use of standardized units became commonplace with the proliferation of retail stores that offered consumers the opportunity to compare products of various sizes and prices. Today in most societies, standardized units are legally mandated. Standardized units of quantity include those of the metric system (e.g., grams, kilograms) and those of the imperial system (e.g., ounces, pounds). Importantly, making sense of standardized units requires some knowledge of the measurement system. When dealing with abstract concepts such as standardized units, the extent to which people are familiar with and able to extract meaning from the concepts can influence their evaluations (e.g., Ratneshwar, Shocker, and Stewart 1987). Consumers will not know how much quantity is in 6 oz. of chips or in 20 grams of pretzels without knowing the definition of ounces and grams. Furthermore, even when they know the meanings of such units, they often will not know whether 6 oz. or 20 grams is small or large. They would need relevant reference points to compare these quantities, and might have to estimate the arithmetic difference between two quantities, prompting them to resort to analytical processing. Even though such analytical evaluation can become easy with practice, the evaluation of standardized units always entails some rule-based reasoning and mental arithmetic.

Unlike standardized units, perceptual units are not based on scientifically-calibrated measurement systems. Perceptual units are units that consumers can have a visual, mental

representation of. People have an intuitive sense of the quantity in two snack bags of chips, in three cookies, or in six chocolates. Such perceptual units prompt experiential evaluations based on prior sensory experiences with the ecological environment—or based on the simulation of such experiences. Perceptual units enable consumers to experientially make sense of quantity using nonverbal, sensory information, without the need for rule-based reasoning or arithmetic processing. For example, while a preschooler who is not proficient in arithmetic can make sense of the quantity in 3 cookies, she will not be able to comprehend the quantity in 3 oz. of cookies. She would intuitively know that 5 cookies are more than 3 cookies, but this intuition might mislead her when she compares "3 cookies of 5 oz. each" with "5 cookies of 3 oz. each." Thus, unlike standardized units, perceptual units offer a direct phenomenological experience of quantity. Though imprecise, this process enables consumers to feel whether the quantity is small or large without resorting to rule-based reasoning or mental arithmetic.

Verbal and Nonverbal Numeric Processing. The notion that standardized units activate verbal processing and perceptual units activate nonverbal processing is consistent with the literature on numerical cognition. Dehaene (2011) and other scholars of numerical cognition (Gibbon, Church, and Meck 1984; Gordon 2004; Pelham, Sumarta, and Myaskovsky 1994; Whalen, Gallistel, and Gelman 1999) have characterized two distinct routes to magnitude judgments—a verbal number system and a nonverbal number system. The verbal number system is language-dependent, unique to humans, and acquired through formal education. People learn to make sense of quantity based on the norms of formal number systems such as the Arabic decimal number system. They also learn to relate numeric quantities using the arithmetic rules of addition, multiplication, and subtraction, and over time learn mental shortcuts to perform these arithmetic processes. In contrast, the nonverbal number system is an adaptive ancient system

common to humans, including infants who have no formal knowledge of numbers, and animals such as dolphins, rats, and monkeys. This nonverbal system is innate, hardwired in the human brain, and largely perceptual. It has evolved from mental processes used to evaluate psychophysical stimuli such as weight, light, and sound. It can be used for approximate magnitude judgments even when numeric or verbal information is not available. Importantly, several researchers have suggested that even when people try to make numeric judgments using the arithmetic rules, the nonverbal representation of magnitude is activated and it biases their judgments (Moyer and Landaeur 1967; Whalen et al.1999).

Related Taxonomies. The taxonomy of perceptual and standardized units shares parts of the nomological network used by other taxonomies in the literature, such as more or less discretized units (Lembregts and Van den Bergh 2019) and more or less countable units (Ma and Roese 2013). These authors have shown that discrete and countable units are more intuitively evaluable than those that are not discrete or countable. We agree with these authors, and extend their conceptualization by proposing that the intuitive evaluability of discrete and countable units often stems from their perceptual nature. The perceptual nature of such units not only increases the intuitive evaluability of units, but it can also trigger more experiential processing of quantity and of adjacent information. Thus, the present set of studies emphasizes the perceptual nature of some units, and shows that this emphasis can yield valuable new insights into the subjective assessment of economic value.[1]

[1] The present set of studies departs from prior research in other important ways, both conceptually and methodologically. Notably, in prior research quantity judgment (or the difference in the quantities of two stimuli) was the focal variable. That is, participants were directly asked to judge changes or differences in quantity. In contrast, in the present research the focal variable is perceived economic value, and we study how ephemeral intermediary quantity evaluations influence perceived economic value. Additionally, we demonstrate that keeping objective information and numerosity constant, the mere salience of perceptual units can increase perceived value.

Perceptual Units and Perceived Economic Value

How do perceptual units increase perceived economic value? As is the case with several robust psychological effects, the effect of perceptual units on subjective value is multiply determined. We will focus on two distinct but convergent mechanisms through which perceptual units can increase perceived value: experiential processing and bias in quantity judgments.

Perceptual Units Activate Experiential Processing. It is generally agreed in the judgment and decision-making literature that people can respond to the same information in more experiential or more analytical manner (Epstein 1994; Hsee and Rottenstreich 2004; Hsee et al. 2005; Inbar, Cone, and Gilovich 2010; Paivio 1990; Sokolova and Krishna 2016). Importantly, this literature has clearly linked the perceptual, nonverbal system with a more experiential mode of processing. For instance, the influential Dual Coding Theory (Paivio 1990; 1991) suggests that everyday stimuli are processed via two distinct but interconnected systems that form the basis of human cognition: a nonverbal system that relies on sensorimotor imagery to process information in a more experiential manner, and a verbal system that relies on propositional logic and reasoning to process information in a more analytical manner. In a similar vein, Epstein's (1994) Cognitive-Experiential Self Theory distinguishes between a primarily nonverbal system that is intuitive, experiential, and preconscious, and a verbal system that is rational, analytical, and conscious. A common theme in these dual-system theories is that the nonverbal, perceptual system is inherently experiential, while the verbal, symbolic system is inherently analytical. In addition, whether individuals rely more on experiential processing or analytical processing in decision making largely depends on contextual cues such as stimuli characteristics (Inbar et al. 2010). In the context of this research, we propose that standardized units (e.g., ounces, grams)

beget value assessments based on analytical processing, while perceptual units (e.g., bags, pieces) beget value assessments based on experiential processing.

How does more experiential evaluation affect perceived value? We propose that in many cases (although not always) experiential evaluations activated by perceptual units will increase willingness to pay. It has indeed been extensively documented that experiential processing can improve evaluative judgments by directing attention to the sensory aspects and the desirability of the consumption (e.g., Adaval and Wyer 1998; Bushong et al. 2010; Keller and McGill 1994; McGill and Anand 1989; Shiv and Huber 2000). For instance, Adaval and Wyer (1998) showed that preference for a vacation plan was greater when participants were instructed to imagine themselves having the experience. Likewise, Bushong et al. (2010) found that situations that facilitated experiential processing, such as the physical proximity to a product, increased willingness to pay by up to a whopping 60%. In the context of this research, we expect that perceptual units will facilitate experiential processing, which in turn should make consumers more likely to consider experiential aspects, such as how much they enjoy consuming the product, or how desirable or tasty the product is. Consistent with the works reviewed above, focusing on desirability or consumption enjoyment will yield more favorable evaluative judgments than focusing on analytical information such as pack size and price per ounce. Thus, we expect the use of perceptual units to increase willingness to pay.

Perceptual Units Bias Quantity Judgments. There is another convergent mechanism through which we expect perceptual units to inflate perceived economic value—by inflating perceived quantity. Consistent with past research on consumer behavior (Lembregts and Van den Bergh 2019; Ma and Roese 2013) and numerical cognition (Bagchi and Davis 2016; Pelham et al. 1994), we propose that perceptual units can bias perceived quantity.

By activating nonverbal numeric representations, perceptual units can prompt people to focus their attention on the numerosity of the quantity information, ignoring the size of the units. Such cognitive simplification can make the quantity information seem more evaluable, which in turn can increase its perceived magnitude (Hsee et al. 2005). Consistent with this account, Lembregts and Van den Bergh (2019) showed that differences in quantity between two stimuli appear larger when those quantities are described using more discrete (or perceptual) units. In a similar vein, Ma and Roese (2013) showed that individuals were more dissatisfied with receiving a smaller (vs. larger) reward when the difference between the two rewards was expressed in more countable (or perceptual) units. It follows that such bias in quantity judgment may also manifest even when people are assessing a product's economic value. That is, to the extent that perceived economic value depends on perceived quantity, using perceptual units to describe quantity should increase perceived economic value.

In summary, compared to standardized units, perceptual units prompt more experiential processing and it also biases quantity judgments, both of which increase subjective value.

The Role of Attentional Salience

An important aspect of our theorizing, and perhaps the one that has the most intriguing implication for managers and public policy analysts, is that the mere attentional salience of perceptual units can influence perceived value. That is, even when both perceptual and standardized units are provided in the quantity description, merely presenting the perceptual unit before the standardized unit (e.g., 14 snack bags of chips, each 1 oz.) can increase willingness to pay compared to presenting the standardized unit before (e.g., 14 oz. of chips in snack bags, each 1 oz.). This proposition, though counterintuitive, is consistent with a large body of work in

psychology showing that the order in which information is presented can bias judgments and decisions.

Seminal work by Asch (1946) showed that when students were asked to form judgments of individuals based on a list of personality traits, those with more positive traits listed first (vs. last) were evaluated more favorably. Similarly, implicit first impressions affect judgments of wealth, social class, competence and employability (Todorov et al. 2005), and these implicit first impressions are very difficult to undo (Gregg, Seibt, and Banaji 2006). More directly relevant to the present research, judgment and decision-making scholars have identified an information distortion effect such that the first bit of information individuals attend to can "steer" or "distort" subsequent information processing (Bond et al. 2007; Carlson, Meloy, and Russo 2006). Once a person forms an opinion based on a first attribute, the processing of the following attributes is biased towards the initial evaluation (Carlson et al. 2006; Russo, Carlson, and Meloy 2006). Such order of presentation effects can manifest in numeric judgments too. Davis and Bagchi (2018) showed that when exposed to two percentage price changes simultaneously (i.e., two discounts), individuals were more likely to buy the product when the larger discount (e.g., 18%) was presented first than when the smaller discount (e.g., 12%) was presented first. These findings support our proposition that even when both perceptual and standardized units are provided, the mere salience of perceptual units can increase perceived economic value.

The Role of Pack Size

The effect of perceptual units is likely to vary with pack size, the effect becoming weaker with increasing pack size. Previous research has shown that framing effects in numerical cognition, such as the left-digit effect and the unit discretization effect, are weaker for larger magnitudes than for smaller magnitudes because of the logarithmic

nature of the mental number line used to make magnitude judgments (Lembregts and Van den Bergh 2019; Thomas and Morwitz 2005). Larger magnitudes are less discriminable on the logarithmic mental number line, thus making framing effects weaker for such magnitudes.

Additionally, it is also possible that the numerosity (i.e., number magnitude) of larger packs might increase the salience of the numbers and thus weaken the effect of units. Quantity information has two distinct elements—a number and its associated unit. For example, "9 oz." has two elements, "9" and "oz." and similarly "9 bags" has two elements, "9" and "bags." Our hypothesis is that when "bags" is more salient than "oz." consumers' subjective valuation of the product will be higher. However, the attentional salience of "bags" also depends on the magnitude of the associated number. If the number is conspicuously high, consumers might not pay much attention to the unit, thus mitigating the effect of perceptual units. For example, if consumers are evaluating "36 oz." or "36 bags" of chips, since the number 36 by itself suggests that the quantity is very large, the effect of perceptual units will be mitigated. Indeed, prior research has shown that in magnitude judgments, sometimes judgments are influenced by numerosity and sometimes by unitosity (Monga and Bagchi 2012; Ülkümen and Thomas 2013). Based on this reasoning, we posit that the effect of perceptual units will be mitigated for large packs with large number magnitude in quantity description.

OVERVIEW OF STUDIES

We test our hypotheses in seven studies. We begin our empirical investigation with an archival study that examines whether the effect of perceptual units manifests in the marketplace, that is, in retail prices. Study 1 shows that retailers set higher unit prices when perceptual units

are more salient, and that this effect is mitigated for large packs. We then turn to controlled experiments to establish causality. Using incentive-compatible willingness to pay (WTP) elicitations, study 2a shows that merely increasing the salience of perceptual units increases perceived value, and study 2b shows that the effect is mitigated for large packs.

The subsequent studies delve into the psychological mechanisms. First, we examine the role of experiential processing. Study 3a uses an ecologically-valid manipulation by exposing participants to an either experiential or analytical consumer review before indicating their WTP. Results show that the experiential review increases WTP when perceptual units are more salient, but not when standardized units are more salient. Study 3b conceptually replicates this effect using a different paradigm, showing that the effect of product enjoyment—an experiential input—is stronger when perceptual (vs. standardized) units are more salient.

The final two studies look at how perceptual units bias quantity perceptions. Studies 4a and 4b show mediation by perceived quantity. Additionally, using a paradigm from the information distortion literature, study 4a shows that salient perceptual units "distort" the processing of subsequent information. Study 4b further shows than the distorting effect of perceptual units prevails even when both perceptual and standardized units are salient.

Across experiments, we show that the proposed effect is robust to different measures of perceived value, using an incentive-compatible estimation of others' WTP (studies 2a and 2b), personal WTP (studies 3a, 3b, 4a, and 4b), as well as a perceived value scale (supplemental study S1). All experiments were conducted among US respondents who are familiar with the standardized units of the imperial system of measurement (e.g., ounces and pounds). Participants in all our experiments were approved by the Cloud Research platform, had previously completed at least 500 HITs and had an approval rate of at least 97%. All experimental studies were

preregistered and we have made the preregistrations, data, and study materials publicly available on the Open Science Framework at https://bit.ly/3fOCyCM.

STUDY 1: QUANTITY FRAMING & RETAIL PRICES

Our first study uses archival data to test whether the use of perceptual units is associated with higher retail prices. We analyzed data from a large online retailer in the US, Amazon.com, to examine whether the retailer charges higher unit prices for products with a salient perceptual unit (e.g., bags) in quantity description than for products with a salient standardized unit (e.g., ounces).

Data

Amazon publishes on its website the 100 most popular products per category based on sales (i.e., category best sellers). We selected 15 product categories where retailers could use either perceptual units or standardized units to describe quantity, and for each category we scraped online data to collect the prices and quantity descriptions of the top 100 best sellers. These 15 categories had a sufficient number of observations for both perceptual and standardized quantity descriptions, which made them particularly suitable for our analysis. Each category had at least 28% of products where the quantity description did *not* have a salient perceptual unit and at least 34% of products where quantity descriptions *did* have a salient perceptual unit. To ensure the generalizability of our results, we collected data in two waves separated by twelve months, with five product categories in the first wave and ten categories in the second wave. This allowed us to test our hypotheses on a reasonably wide range of products and prices, over different periods of time. One hundred and twelve products had missing price and/or weight information, leaving us with a total of 1,388 observations.

Independent Variable. We coded whether perceptual units were salient in the quantity description. If a perceptual unit was used to describe quantity in the first sentence, that is, in the product description at the top of the webpage for the product, the product was categorized as having a salient perceptual unit. Examples of descriptions with a salient perceptual unit are: "Keebler Scooby-Doo! Graham Cracker Sticks, Cinnamon, 12 count," where shoppers can easily visualize 12 packs of cracker sticks; "Oreo Mini Chocolate Sandwich Cookies, 12 Count Individual Snack Bags," where shoppers can easily visualize 12 snack bags; and "Hapi Hot Wasabi Peas, 9.9 Ounce (Pack of 3)," where shoppers can easily visualize 3 packs of wasabi peas. Examples of descriptions with only the standardized unit salient are: "Keebler, Zesta, Saltine Crackers, Original, 16 oz," "Oreo Mint Creme Chocolate Sandwich Cookies, 15.25 Ounce," and "Hapi Hot Wasabi Peas, 9.9 Ounce." We ended up with 669 products (48%) with quantity expressed with only a standardized unit, and 719 products (52%) with a salient perceptual unit in the quantity description. This binary variable reflecting the salience of perceptual units in quantity description—perceptual unit salient versus not salient—was our primary independent variable.[2]

Dependent Variable. Unit price (i.e., price per ounce) was our dependent variable of interest (note that since products vary in quantity, it is not meaningful to use overall price).

[2] When both perceptual and standardized units were salient in the quantity description, we coded the product as having a salient perceptual unit. This is based on our theorizing that when both units are salient, the effect of perceptual units prevails. We empirically validate this in study 4b. Moreover, our results hold up even when such cases are excluded from our analysis.

In addition to unit price and quantity framing, we obtained the following variables for each item: pack size (in ounces), sales ranking (1 to 100; note that a higher sales rank indicates lower sales), and product category.

Results

All continuous variables in our analyses were log-transformed to reduce the effect of outliers. All models were run using PROC MIXED in SAS. The regression models are in Table 1. To account for category effects, we specified random intercepts for product category in all our analyses. First, we regressed unit price (log-transformed) on perceptual unit salience (a dummy variable coded 1 when perceptual unit was salient and 0 when it was not). We found a significant effect of perceptual units, such that unit price increased when perceptual units were salient in the description, b = .29, SE = .04, $t(1372) = 7.47$, p <.001, η_p^2 = .039. The average price per ounce was higher when products had a salient perceptual unit (model-free means: $M_{\text{perceptual}}$ = .90, $M_{\text{standardized}}$ = .66).

Second, we tested whether this effect was robust to the inclusion of covariates that can affect unit price. We ran a second model that included pack size (i.e., weight in oz.) and sales ranking. All covariates had the expected effects on unit price. Unit price decreased when pack size increased, that is, bigger packs had lower unit prices, b = -.56, SE = .02, $t(1370) = -32.40$, p <.001. Unit price increased with sales rank, that is, products further in the ranking (i.e., lower sales) tend to have higher unit prices, b = .15, SE = .02, $t(1370) = 9.82$, p <.001 (or cheaper products have higher sales). Importantly, the effect of perceptual units remained robust after including these covariates, b = .59, SE = .03, $t(1370) = 19.33$, p <.001, η_p^2 = .214.

TABLE 1. REGRESSIONS PREDICTING UNIT PRICE USING QUANTITY FRAMING (STUDY 1)

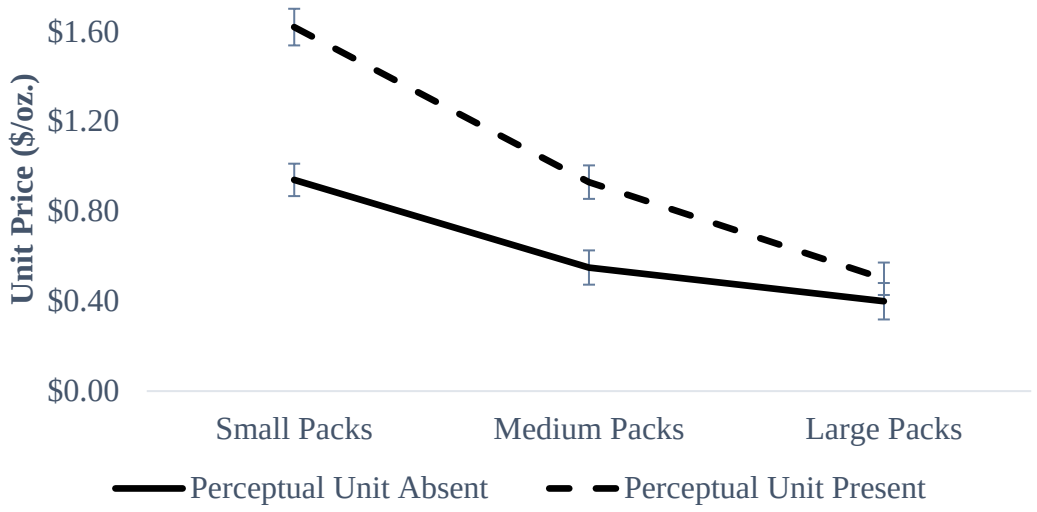
	Regression Coefficients		
Variable	Model 1	Model 2	Model 3
Perceptual unit salient	.29***	.59***	.59***
Pack size in oz. (log)	—	-.56***	-.49***
Sales ranking (log)	—	.15***	.15***
Perceptual unit salient * Pack size (log)	—	—	-.13***
Number of observations	1388	1388	1388
AIC	3072.3	2243.7	2234.1

Note. *** $p < .001$. *Table 1 reports the results of linear mixed model regressions using unit price (log) as dependent variable and random intercepts for product category. In all these models, the effect of perceptual unit salience on price per ounce was significant. A lower Akaike's information criterion (AIC) value indicates a better model fit with the data.*

Third, we tested whether the effect of perceptual units varied with pack size. We expected that for large packs, the effect of perceptual units is mitigated.[3] Note that pack size varied from .75 oz. to 256 oz. We regressed unit price (log) on perceptual unit dummy, pack size (log-transformed and mean-centered), and their interaction, using random intercepts for product category and controlling for sales ranking. As previously, we found a significant effect of quantity framing, such that unit price increased when perceptual units were salient, $b = .59$, $SE = .03$, $t(1369) = 19.41$, $p < .001$, $\eta_p^2 = .216$. Furthermore, we found a significant interaction such that the effect of perceptual units was mitigated for larger packs, $b = -.13$, $SE = .03$, $t(1369) = -3.83$, $p < .001$, $\eta_p^2 = .011$. Table 1 summarizes these results.

[3] We test this hypothesis using a causal approach in study 2b.

FIGURE 1. UNIT PRICE AS A FUNCTION OF QUANTITY FRAMING AND PACK SIZE (STUDY 1)



Note. *Figure 1 shows unit price (in $/oz.) as a function of quantity framing and pack size on Amazon.com in 15 product categories. Vertical bars represent the standard errors.*

To test the robustness and probe the pattern of the interaction, we did a follow-up analysis. We split the products in our dataset into three categories of pack size based on their weight to create a new categorical variable with three levels: small (M_{weight} = 7.98 oz., n = 462 products), medium (M_{weight} = 18.37 oz., n = 456 products), and large (M_{weight} = 52.84 oz., n = 470 products). We examined whether pack size robustly moderates the effect of quantity framing, controlling for sales ranking. Again, we found an interaction between quantity framing and pack size, $F(2, 1367) = 22.33$, $p < .001$, $\eta_p^2 = .032$. The effect was strongest for the small packs ($M_{perceptual}$ = 1.62 vs. $M_{standardized}$ = .94, $F(1, 1367) = 119.19$, $p < .001$, $\eta_p^2 = .080$), weaker but significant for the medium packs ($M_{perceptual}$ = .93 vs. $M_{standardized}$ = .55, $F(1, 1367) = 41.83$, $p < .001$, $\eta_p^2 = .030$), and not significant for the large packs ($M_{perceptual}$ = .50 vs. $M_{standardized}$ = .40, $F(1, 1367) = 2.60$, $p = .107$, $\eta_p^2 = .002$). See Figure 1.

Numerosity. Are the effects of perceptual units confounded with numerosity effects (Bagchi and Davis 2016; Pelham et al. 1994)? That is, when retailers use perceptual units, they might be using higher numbers in quantity descriptions, which in turn might cause the aforementioned results. To test this alternative account, we repeated the previous analyses while controlling for numerosity. We coded the largest number in product descriptions. For example, "pack of 5 pouches of 6 oz." has a numerosity of 6, whereas "pack of 12 snack bags of 2 oz. each" has a numerosity of 12. The effect of perceptual units remained significant after controlling for numerosity, b = .33, SE = .04, $t(1370) = 8.86$, $p < .001$, $\eta_p^2 = .054$. Numerosity had a negative effect on unit price, b = -.22, SE = .02, $t(1370) = -10.71$, $p < .001$, $\eta_p^2 = .077$, suggesting that numerosity is correlated with pack size.

TABLE 2. UNIT PRICE AS A FUNCTION OF QUANTITY FRAMING (STUDY 1)

Product Category	Mean price per ounce	
	No Perceptual Unit Salient	Perceptual Unit Salient
Breadsticks	.90	1.20
Candy & Chocolate	.98	.94
Condiments	.39	.99
Cookies	.27	.84
Crackers	.15	.64
Deli and Prepared Foods	.87	1.29
Fruit Leather	.56	1.02
Olives & Pickles	.62	1.06
Party Mix	.28	1.05
Pork Rinds	1.17	1.37
Pretzels	.38	.92
Rice Cakes	.25	.89
Salsa Dips	.37	1.04
Trail & Mixes	.64	.97
Wasabi Peas	.67	.98
Total	.57	1.01

Note. *Average unit price expressed in $/oz., after controlling for pack size in oz. (log) and sales ranking (log), as a function of whether a perceptual unit was salient or not.*

Generalizability. Finally, we assessed the generalizability of the quantity framing effect. Table 2 presents the estimated average unit price as a function of product category and quantity framing after controlling for pack size and sales ranking. Overall, this analysis showed that salient perceptual units were associated with higher unit prices in 14 of the 15 categories.

Discussion

Using hundreds of price observations from Amazon.com in 15 product categories, this study demonstrates that products that are described with a salient perceptual unit are associated with higher unit prices. This suggests that retailers, perhaps based on some managerial intuition learned over time, tend to charge a higher price for products when quantity information is more perceptual.[4] Furthermore, this result is generalizable to several product categories and persists even after controlling for sales ranking and pack size. Study 1 also shows that the effect is weaker for large packs.

Nevertheless, this study has the common limitation of observational studies that causality cannot be inferred. For instance, it is possible that more astute marketers use perceptual units, and the observed price premium is due to the marketing prowess of the company rather than due to perceptual units per se. It is also possible that these results reflect a reverse causality such that retailers tend to use perceptual units for more expensive products, rather than the use of perceptual units causing a price premium, an interpretation that would not be inconsistent with

[4] Consistent with Adam Smith's conceptualization (Grampp 2000) that unseen forces shape market practices, managers often have a way of instinctively identifying psychological pricing tactics that work in the marketplace through hit-and-trial even though they might not fully understand why it works. For example, retailers have been using 99-ending prices for over a century, even though it is only recently that researchers have been able to delineate the psychological mechanism underlying this practice (Thomas and Morwitz 2005).

our hypotheses. We designed the following controlled experiments to rule out these accounts and establish the causal effect of perceptual units on price premium.

STUDY 2A: PERCEPTUAL UNITS INCREASE WTP

In study 2a we manipulated the relative salience of perceptual and standardized units, and used an incentive-compatible design to elicit estimates of the amount that customers would be willing to pay. Importantly, we controlled for numerosity as well as the information content, manipulating only the attentional salience of perceptual units. We also measured response time to test whether the effect may be explained by processing difficulty or task complexity. This experiment and all subsequent ones were preregistered, and the preregistrations are available on the OSF repository of this article.

Method

Participants and Screening Procedure. Five hundred and one U.S. participants were recruited from the Cloud Research platform. In this experiment and all subsequent ones, all participants were approved by Cloud Research, and had previously completed at least 500 HITs on the platform with more than 97% approval rate. To identify and exclude inattentive participants, we included two filters at the beginning of the survey; only those who answered these attention checks correctly were allowed to participate. In addition, at the end of the survey, we included two comprehension check questions to see whether participants were able to comprehend the necessary information to make the judgment. Per the preregistered criteria, we excluded 36 participants who failed either of our two comprehension checks, leaving us with 465 participants (52 % female, M_{age} = 40).

Experimental Design and Procedure. This study used a two-cell between-participants design (quantity framing: perceptual unit salient vs. standardized unit salient). All participants read the procedure for our incentive-compatible price elicitation method. We asked participants to estimate the average amount that customers would be willing to pay for a new multipack of snacks. To incentivize them to provide thoughtful estimates, we told them that the respondent whose estimate was the closest to the average response from all respondents would win a $10 bonus. Since we had two separate conditions, after the study was completed we selected two winners: in each condition, the participant whose estimate was the closest to the average response in that condition was awarded $10. Participants were provided the following information: "First, you will indicate the average amount that you believe people are willing to pay for the snack multipack in a retail store by entering an amount between $1 and $10. After the survey is completed, we will compute the average of all estimates. The respondent whose estimate is the closest to the average of all estimates will win a $10 prize. If more than one respondent is able to correctly estimate the average response, then we will select one winner using a lottery."

Participants were then randomly assigned to one of two conditions. In both conditions, they read that an 8-oz regular pack of Lay's chips is priced at $2.99, and they were asked to estimate the average amount customers would be willing to pay for a (fictious) new multipack of snack bags from the same brand. We subtly manipulated the salience of perceptual units in the first sentence of the product description of this new multipack. Those assigned to the perceptual unit salient condition saw the following information on their computer screen, with the perceptual unit, 14 snack bags, salient in the first sentence of the product description.

Lay's Chips, 14 snack bags
Lay's Classic Chips, 14 oz. of chips in snack bags of 1 oz. each

Those assigned to the standardized unit condition saw the following information, with the standardized unit, 14 oz., salient in the first sentence.

Lay's Chips, 14 oz.
Lay's Classic Chips, 14 oz. of chips in snack bags of 1 oz. each

Importantly, the information content was identical across the two conditions. The second sentence in both conditions clearly informed participants that the multipack had a total of 14 oz. of chips in snack bags of 1 oz. each. Number magnitude (i.e., numerosity) was also held constant. To make the description more realistic, in addition to this verbal description, participants also saw a picture of a 1-oz. snack bag of Lay's chips. Thus, in both conditions, it was made amply clear that the multipack had 14 snack bags of 1 oz. each. After reading the full product description, participants submitted their estimate of customers' WTP in an open-text box by entering an amount between 1 and 10.

On the subsequent webpage, we administered our two comprehension checks. Participants were shown the product description again and asked how many oz. and how many snack bags there were in the multipack. For each question, participants responded by selecting one response among a set of four possible responses. Lastly, age and gender were captured.

Results

Willingness to Pay Estimates. We ran an ANOVA with WTP estimates as the dependent variable and quantity framing (perceptual unit salient vs. standardized unit salient) as between-participants factor. The main effect of quantity framing was significant, $F(1, 463) = 7.85$, $p = .005$, $\eta_p^2 = .017$, such that WTP estimates were higher in the perceptual unit salient condition

(M = \$5.56) than in the standardized unit salient condition (M = \$5.07). Participants estimated the average WTP to be about 10% higher when the perceptual unit was made salient.

Response Time. Response time (log) did not vary between conditions, $F(1, 463) = 1.21$, $p = .27$ (untransformed means: $M_{\text{perceptual}} = 58.2$ seconds, $M_{\text{standardized}} = 55.1$ seconds). Furthermore, the effect of quantity framing on WTP estimates held when controlling for response time, $F(1, 462) = 8.77$, $p = .003$, $\eta_p^2 = .019$, and response time did not mediate the effect, indirect effect = -.02, *SE* = .03, *95%CI* [-.08, .02]. Thus, the differences in WTP estimates cannot be attributed to differences in processing difficulty or task complexity.

STUDY 2B: MODERATION BY PACK SIZE

Study 2b causally tests the moderation by pack size observed in study 1, namely, that the effect of perceptual units is attenuated for large packs. Study 2b uses the same experimental design as in study 2a, but with pack size (small vs. large) as an additional factor, thus making this a 2 x 2 between-participants design. As mentioned earlier, we posit that perceptual units increase perceived value only when people first attend to the perceptual units in the quantity description. Thus, if shoppers' attention is directed away from the units then the effect of perceptual units should be mitigated. Quantity descriptions have two elements—a number and its associated unit (e.g., "9 oz." has two elements "9" and "oz."). When the number magnitude increases, attention shifts from the unit to the number. This should reduce the effect of perceptual units on perceived value.

Pretest

Before running experiment 2b, we ran a pretest (n = 100) to empirically validate the assumption that when number magnitude in quantity information increases, attention shifts away

from the unit to the number. In this pretest, all participants made four quantity judgments in a 2 (unit: perceptual vs. standardized) x 2 (pack size: small vs. large) within-participants design. For the small pack size, we used multipacks of 8 snack bags and 8 oz. of chips as stimuli. For the large pack size, we used multipacks of 24 snack bags and 24 oz. of chips as stimuli. After evaluating the quantity in these four products, participants indicated which information influenced their judgment more, the "number" (1) or the "unit" (7). We found that participants were less influenced by the unit when pack size was large (M_{large} = 3.17, M_{small} = 4.00, $F(1,99)$ = 26.60, $p < .001$). Thus, attention shifts from units to the numbers for large packs with large number magnitude.

Method

Participants and Screening Procedure. We recruited 1,000 participants via Cloud Research. We included the same filters and comprehension checks as in the previous study. As preregistered, we excluded 60 participants who failed any of our two comprehension checks administered at the end of the study (6% of our sample). In addition, we excluded one participant due to technical error.[5] This left us with 939 participants (54 % female, M_{age} = 39).

Experimental Design and Procedure. This experiment used a 2 (quantity framing: perceptual unit salient vs. standardized unit salient) x 2 (pack size: small vs. large) between-participants design. As in the previous study, the dependent variable was the WTP estimate for a multipack of chips. In the small pack condition, we used a multipack of Lay's chips with 9 snack bags and 9 oz. weight as stimulus. In the large-pack condition we used a multipack with 24 snack bags and 24 oz. weight as stimulus. The procedure followed that of study 2a with only minor

[5] For this participant, the WTP estimate was recorded as $850. For all other participants, WTP was technically constrained between $1 and $15.

changes. After the two screening questions, participants read the instructions asking them to estimate the average amount that customers would be willing to pay for a new multipack of snacks. Again, this was an incentive-compatible procedure. Participants were informed that the respondent whose estimate was the closest to the average response would win a $10 bonus (one winner per condition).

Participants were randomly assigned to one of four conditions. As in the previous study, they were provided a reference price. They read that an 8-oz regular pack of Lay's chips is priced at $2.99, and then were asked to estimate the average price customers would be willing to pay for a new multipack. Again, the information content was identical across the perceptual unit and standardized unit conditions. We only manipulated unit salience in the first sentence (snack bags vs. oz.); the second sentence was identical in the perceptual unit and standardized unit conditions for both levels of pack size (for small packs: *Lay's Classic Chips, 9 oz. of chips in snack bags of 1 oz. each*; for large packs: *Lay's Classic Chips, 24 oz. of chips in snack bags of 1 oz. each)*. In addition, a picture of a 1-oz. snack bag of chips was again included.

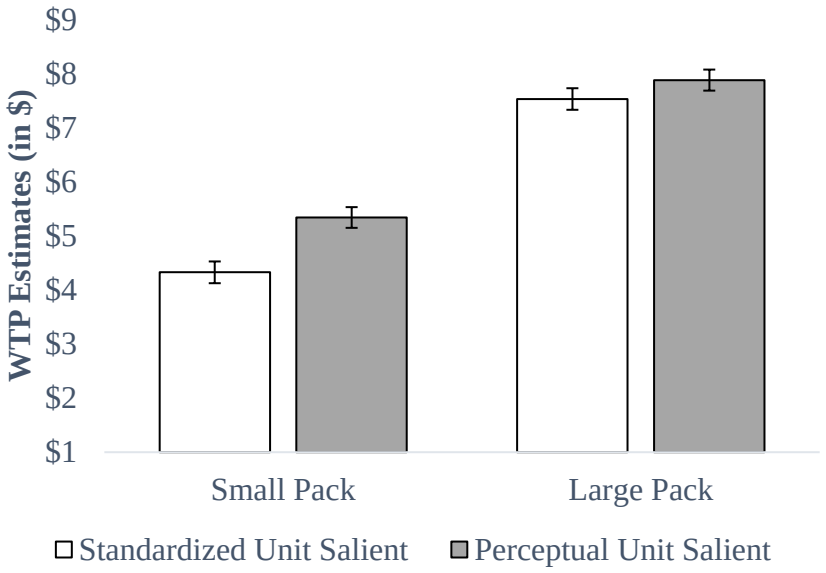
Participants then submitted their WTP estimate in an open-text box by entering an amount between $1 and $15 (to account for the larger pack used in this experiment). On the subsequent screen, we administered the same comprehension checks as in study 2a. Lastly, we recorded age and gender.

Results

Willingness to Pay Estimates. We ran an ANOVA with WTP estimates as dependent variable, quantity framing (perceptual unit salient vs. standardized unit salient), pack size (small vs. large), and their interaction as independent variables. We found a main effect of quantity

framing, $F(1, 935) = 12.03$, $p < .001$, $\eta_p^2 = .013$, such that WTP estimates were higher in the perceptual unit salient condition ($M_{perceptual} = \$6.61$ vs. $M_{standardized} = \$5.93$). This main effect was qualified by a marginally significant interaction, $F(1, 935) = 2.85$, $p = .091$, $\eta_p^2 = .003$. Decomposing this interaction, we found that for small packs, making the perceptual (vs. standardized) unit salient significantly increased perceived value, $M_{perceptual} = \$5.34$, $M_{standardized} = \$4.32$, $F(1, 935) = 13.33$, $p < .001$, $\eta_p^2 = .014$. The average WTP estimate was 24% higher when the perceptual unit was salient. In contrast, for large packs, making the perceptual unit salient did not significantly increase perceived value, $M_{perceptual} = \$7.88$, $M_{standardized} = \$7.53$, $F(1, 935) = 1.58$, $p = .21$, $\eta_p^2 = .002$. Figure 2 plots this interaction.

FIGURE 2. WTP ESTIMATES AS A FUNCTION OF QUANTITY FRAMING AND PACK SIZE (STUDY 2B)



Response Time. Running the same model as above with response time as dependent variable (log), we did not observe any effect of quantity framing, $F(1, 935) = .00$, $p = .96$, pack size, $F(1, 935) = .67$, $p = .41$, or their interaction, $F(1, 935) = .32$, $p = .57$. In addition, controlling for response time did not alter the quantity framing effect on WTP estimates reported previously.

This suggests that again the differences in WTP estimates cannot be explained by processing difficulty or task complexity.

Discussion of Studies 2a and 2b

Using an incentive-compatible method, study 2a shows that making the perceptual unit salient in quantity description increased perceived value by 10% on average compared to making the standardized unit salient. Using the same procedure, study 2b shows that the quantity framing effect is attenuated for large packs. Notably, these findings replicate the results from study 1 that showed that the association between the use of perceptual units and unit prices on Amazon.com was weaker for large packs (see Figure 1). This moderation provides initial evidence for the attentional salience mechanism. When pack size increases, attention shifts from the unit to the number, which mitigates the effect of perceptual units.

It is important to note that perceptual units increased perceived value even though standardized units were provided in both conditions. In addition, we retained only participants who successfully answered our comprehension checks, indicating that all participants could clearly see both units. Thus, these studies show that holding the information content constant, merely increasing the salience of perceptual units influences perceived economic value.

In addition, response time did not differ across unit conditions, suggesting that the effect cannot be explained by a reduction of cognitive effort or task complexity. This is consistent with past research showing that experiential processing is not necessarily faster (Maglio and Reich 2020). Having established the robustness of the quantity framing effect, in the next experiments we delve into the psychological mechanisms. Table 3 provides a summary of the results from all seven studies in the manuscript.

TABLE 3. SUMMARY OF RESULTS

Study 1 (Archival data from an online retailer, *n* = 1,388 products)

	Unit Price ($/oz.)
Products with salient perceptual unit	$/oz. .90
Products without salient perceptual unit	$/oz. .66
Effect Size (η_p^2)	.039
Design	Archival data on 1,388 product prices in 15 categories
Main finding	Retailers charge a higher unit price for products described using salient perceptual units.

Study 2a (*n* = 465, *M*age = 40, 52% female, Cloud Research)

	Incentive-Compatible WTP (14 oz. / 14 snack bags)
Perceptual unit salient	$5.56
Standardized unit salient	$5.07
Effect Size (η_p^2)	.017
Design	Between participants: Salient unit (perceptual vs. standardized)
Main finding	Making the perceptual unit salient increases perceived value compared to making the standardized unit salient.

Study 2b (*n* = 939, *M*age = 39, 54% female, Cloud Research)

	Incentive-Compatible WTP (small pack 9 oz. / 9 snack bags)	**Incentive-Compatible WTP (large pack 24 oz. / 24 snack bags)**
Perceptual unit salient	$5.34	$7.88
Standardized unit salient	$4.32	$7.53
Effect Size (η_p^2)	.014	.002 (ns)
Design	Between participants: 2 (salient unit: perceptual vs. standardized) x 2 (pack size: small vs. large)	
Main finding	Making the perceptual unit salient increases perceived value for small packs, and the effect is mitigated for large packs. When pack size increases, attention shifts from the unit to the number, attenuating the positive effect of perceptual units.	

Study 3a (*n* = 400, *M*age = 41, 54% female, Cloud Research)

	Personal WTP Analytical review (10 oz. / 10 snack bags)	**Personal WTP Experiential review (10 oz. / 10 snack bags)**
Perceptual unit salient	$3.95	$4.71
Standardized unit salient	$3.35	$3.16
Effect Size (η_p^2)	.013	.079
Design	Between participants: 2 (salient unit: perceptual vs. standardized) x 2 (type of consumer review: analytical vs. experiential)	
Main finding	Highlighting experiential aspects of the product increases WTP when a perceptual unit is salient but not when a standardized unit is salient, suggesting greater experiential processing for perceptual units.	

Study 3b (*n* = 400, *M*age = 40, 50% female, Cloud Research)

	Personal WTP Low product enjoyment (3 replicates)	**Personal WTP High product enjoyment (3 replicates)**
Perceptual unit salient	$4.26	$5.89
Standardized unit salient	$2.76	$3.94
Effect Size (η_p^2)	.122	.191
Design	Between participants: Salient unit (perceptual vs. standardized) x product enjoyment (measured)	
Main finding	The effect of product enjoyment is stronger for perceptual units (vs. standardized units), suggesting greater experiential processing for perceptual units.	

Study 4a (*n* = 210, *M*age = 41, 58% female, Cloud Research)		
	Personal WTP Step 1 (only one unit provided)	**Personal WTP Step 2 (full description provided)**
Perceptual unit salient	$6.27	$5.66
Standardized unit salient	$4.07	$4.65
Effect Size (η_p^2)	.246	.068
Design	Mixed: 2 (salient unit: perceptual vs. standardized, manipulated between participants), x 2 (information step: one unit only vs. full description, within participants)	
Main finding	When only one unit is given, perceptual units increase WTP. The bias persists even when participants are given both units subsequently, suggesting the initially salient unit distorts subsequent judgments. The effect is serially mediated by attention to perceptual unit and quantity judgment.	

Study 4b (*n* = 310, *M*age = 39, 59% female, Cloud Research)	
	Personal WTP difference between the multipack and regular pack
Perceptual unit salient	$3.63
Standardized unit salient	$2.29
Both Units Salient	$3.07
Effect Size (η_p^2)	.107
Design	Between participants: Salient unit (perceptual unit, standardized unit, both units)
Main finding	Even when the standardized unit is prominently displayed, merely increasing the salience of perceptual unit increases perceived value. The effect is serially mediated by attention to perceptual unit and quantity judgment (same as in the previous study).

Note. *Studies 2a and 2b used an allocentric incentivized measure of WTP estimates. Subsequent studies used personal WTP.*

STUDY 3A: THE ROLE OF EXPERIENTIAL PROCESSING

In study 3a, we manipulated experiential processing. Participants were exposed to a consumer review with either experiential information (i.e., taste and texture) or analytical information (i.e., value and unit price) about the product. Our conceptualization contends that perceptual units facilitate experiential processing compared to standardized units. Therefore, when the perceptual unit is salient we posited that the experiential consumer review would increase WTP. In contrast, when the standardized unit is salient we predicted that analytical processing is triggered, which should render participants insensitive to experiential information. We used stimuli that closely matched real presentations on Amazon.com, with large pictures.

Method

Participants and Screening Procedure. Four hundred U.S. participants were recruited via Cloud Research (54 % female, M_{age} = 41). We applied the same two pre-screening attention check filters as in the previous experiments, and there were no data exclusions.

Experimental Design and Procedure. This experiment employed a 2 (quantity framing: perceptual unit salient vs. standardized unit salient) x 2 (consumer review: analytical vs. experiential) between-participants design. As in the previous studies, we told participants that we were interested in their opinion about snacks. On the first screen, we showed participants the description of a multipack of snack bags of pretzel crisps along with a consumer review, and asked them to read the review carefully. The description mimicked the real product description available on Amazon.com, with a large picture as well as the Amazon frame at the top of the screen to increase ecological validity. In the perceptual unit salient condition, the description highlighted perceptual units.

Snack Factory Pretzel Crisps, 10 snack bags
Ten 1 oz. bags of Snack Factory Pretzel Crisps

In the standardized unit salient condition, the description highlighted standardized units.

Snack Factory Pretzel Crisps, 10 ounces
Ten 1 oz. bags of Snack Factory Pretzel Crisps

Additionally, we manipulated the content of the consumer review. The consumer review was shown immediately below the description, next to the product image. Again, the review mimicked the design of real reviews on Amazon.com. The experiential review primarily focused on the sensory experience with the product:

I always consider the taste before I buy snacks!
These pretzels have the perfect thickness, very crunchy and easy to eat. The flavor is great, with just the right amount of salt. I love the taste, specifically to dip into hummus or a wee bit of soft butter. I also often use them on salads like croutons.

The analytical review primarily focused on price-quantity evaluation and value calculation:

I always consider the price-per-ounce before I buy snacks!
This 10 oz pack is a good alternative to the regular 7 oz bag. You usually can get a reasonable price for the amount of product you get. Check the price. If you get it for a reasonable price, this 10 oz pack can be a pretty good value for money.

Both analytical and experiential reviews were identical in other aspects; they both had a five-star rating and were titled "Great snack!" After spending some time reading the review, participants moved to the next screen where the stimulus was still provided, and indicated their personal WTP. We gave participants the price of a regular pack of the product, and asked them to indicate their WTP for the multipack by entering a number between 1 and 10.

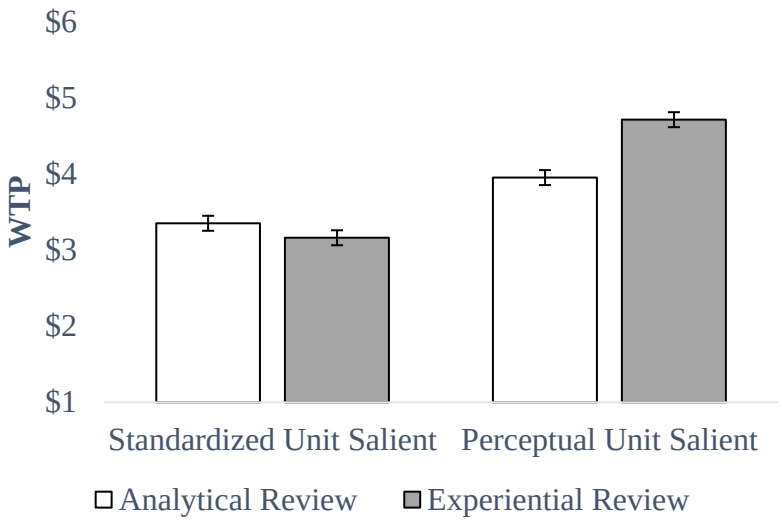
On the next screen, we again showed the stimulus and administered a manipulation check question: "Does this review focus on price-quantity evaluation or on consumption experience?" Participants responded on a 7-point scale anchored on 1 = "Price-quantity evaluation" and 7 = "Consumption experience." Lastly, age and gender were recorded.

Results

Manipulation Check. Our manipulation worked as intended. Participants in the analytical review condition indicated that the review focused more on price-quantity evaluation ($M = 1.80$), while participants in the experiential review condition indicated that the review focused more on consumption experience ($M = 6.43$, $p < .001$). There was no effect of quantity framing on this measure ($M_{\text{standardized}} = 4.08$, $M_{\text{perceptual}} = 4.14$, $p = .69$).

Willingness to pay. We ran an ANOVA with WTP as dependent variable, and quantity framing (perceptual unit salient vs. standardized unit salient), consumer review (analytical vs. experiential), and their interaction as predictors. We found again a main effect of quantity framing, $F(1, 396) = 32.69$, $p < .001$, $\eta_p^2 = .076$, such that WTP was higher when the perceptual unit was salient ($M = \$4.33$) than when the standardized unit was salient ($M = \$3.25$). There was no main effect of consumer review, $F(1, 396) = 2.30$, $M_{analytical} = \$3.65$, $M_{experiential} = \$3.93$, $p = .13$). Most importantly, we found a significant interaction, $F(1, 396) = 6.36$, $p = .012$, $\eta_p^2 = .016$. When the standardized unit was more salient, the experiential consumer review did not significantly alter WTP compared to the analytical review ($M_{analytical} = \$3.35$, $M_{experiential} = \$3.16$, $p = .48$). In contrast, when the perceptual unit was more salient, the experiential review significantly increased WTP ($M_{analytical} = \$3.95$, $M_{experiential} = \$4.71$, $p = .005$, $\eta_p^2 = .020$). See Figure 3.

FIGURE 3. WTP AS A FUNCTION OF QUANTITY FRAMING AND TYPE OF CONSUMER REVIEW (STUDY 3A)



Looking at the interaction another way, the effect of the perceptual unit was stronger when the review was experiential ($M_{standardized} = 3.16$, $M_{perceptual} = 4.71$, $p < .001$, $\eta_p^2 = .079$) than when it was analytical ($M_{standardized} = 3.35$, $M_{perceptual} = 3.95$, $p = .025$, $\eta_p^2 = .013$).

STUDY 3B: THE EFFECT OF PRODUCT ENJOYMENT

In study 3b, we used a different approach to conceptually replicate the results of study 3a. We measured participants' product enjoyment and tested whether the effect of product enjoyment varied for standardized and perceptual units. We posited that if perceptual units beget experiential processing, then the effect of product enjoyment—an experiential input—on WTP should be stronger when a perceptual (vs. standardized) unit is more salient. As in the previous study, we used stimuli that closely matched real product presentations on Amazon.com, with large pictures of the products.

Method

Participants and Screening Procedure. Four hundred U.S. participants were recruited from the Cloud Research platform (50 % female, $M_{age} = 40$). We used the same pre-screening filters as in the previous experiment, and there were no data exclusions.

Experimental Design and Procedure. As in the previous studies, we manipulated quantity framing between participants (perceptual unit salient vs. standardized unit salient). However, in this study, we used three snack products (Lay's, Snack factory, Terra), such that each participant had to provide three WTP estimates. Additionally, we measured product enjoyment for each of the three replicates before the WTP questions.

First, we measured product enjoyment for each of the three brands in a random order by asking participants to indicate their agreement with three items ("I like this product," "This

product is desirable," "I enjoy eating this product," alpha = .97, from 1 = "Strongly disagree" to 7 = "Strongly agree"). We collected product enjoyment before WTP to have a clean measure, not biased by their WTP responses. Next, participants moved to the WTP section where they indicated their WTP for the three multipacks of snacks in a random order, one at time. We used similar stimuli as in study 3a, matching the description provided on Amazon.com.

We manipulated quantity framing as in the previous experiments, by changing the salient unit in the main quantity description. For instance, for Lay's, the perceptual unit condition displayed the main description "Lay's Classic Potato Chips, 12 snack bags," and the standardized unit condition displayed "Lay's Classic Potato Chips, 12 ounces." To make sure the objective information about the quantity was the same across conditions, immediately below the main product description we provided full details about the quantity. For instance, for both participants in perceptual unit condition and those in standardized unit condition, the first line below the main product description of Lay's multipack indicated "Twelve 1 oz. bags of Lay's classic potato chips." Below this, we provided some additional information about each product (taken from Amazon's website). For each WTP elicitation, we provided the price of a regular pack for reference, and asked participants to indicate their WTP for the larger multipack by entering a number between 1 and 10 in an open-text box. Lastly, age and gender were measured.

Results

Willingness to Pay. As preregistered, we ran a repeated measures regression with WTP as dependent variable and the following predictors: quantity framing as between-participants factor, product enjoyment (mean-centered per replicate), and their interaction. We found a significant effect of quantity framing, $b = 1.72$, $F(1, 398) = 90.48$, $p < .001$, $\eta_p^2 = .185$, such that WTP was

higher when the perceptual unit was salient (M = 5.07) than when the standardized unit was salient (M = 3.35). We found a significant effect of product enjoyment, such that higher enjoyment led to higher WTP, b = .35, $F(1, 796) = 260.83$, $p < .001$, $\eta_p^2 = .247$. Most importantly, we found a significant interaction, b = .14, $F(1, 796) = 6.79$, $p = .009$, $\eta_p^2 = .008$. Decomposing this interaction, we found that the slope of product enjoyment was greater in the perceptual unit salient condition (b = .49, $p < .001$) than in the standardized unit salient condition (b = .35, $p < .001$), showing evidence for a stronger effect of product enjoyment in the presence of a perceptual unit salient.

Put differently, the effect of perceptual units on WTP was stronger at high level of product enjoyment (M + 1SD, $M_{\text{standardized}} = 3.94$, $M_{\text{perceptual}} = 5.89$, $p < .001$, $\eta_p^2 = .191$) than at low level (M – 1SD, $M_{\text{standardized}} = 2.76$, $M_{\text{perceptual}} = 4.26$, $p < .001$, $\eta_p^2 = .122$).

Discussion of Studies 3a and 3b

Findings from studies 3a and 3b provide evidence that making the perceptual unit salient in quantity description increases the role of experiential processing in assessing economic value. In study 3a, we used an ecologically-valid manipulation of consumer reviews to show that highlighting experiential aspects of consumption increases WTP when a perceptual unit is salient, but not when a standardized unit is salient. In study 3b, we took a different approach by measuring product enjoyment before eliciting WTP. We found that the positive effect of product enjoyment was stronger when a perceptual unit was salient, again suggesting that consumers rely more on experiential processing in the presence of such unit.

While studies 3a and 3b show that perceptual units activate experiential processing, studies 4a and 4b test some of the other postulates about the psychological mechanism. In the final two studies, we examine the roles of attentional salience and biased quantity perception.

STUDY 4A: THE DISTORTING EFFECT OF PERCEPTUAL UNITS

Our conceptualization posits that if a consumer makes an initial evaluation based on perceptual units, she will not completely change her initial evaluation even when she considers the quantity in standardized units. That is, when the quantity description leads with perceptual units (first *perceptual units* and then *standardized units*), people's final evaluative judgments are anchored on the perceptual unit, which will bias subsequent judgments. Study 4a tests this assumption by unveiling the quantity information in two stages and eliciting WTP in each stage. Such a design is often used in the information distortion literature (Bond et al. 2007; Kostopoulou et al. 2012), and allows us to test the "steering" effect of the initial information on the later stages of information processing.

This study also had a second objective. It also tests the second convergent mechanism posited in our conceptualization, namely that perceptual units can bias quantity judgments. We measured participants' quantity judgments and tested whether the effect of perceptual units on WTP is mediated by quantity judgments.

Method

Participants and Screening Procedure. We recruited 210 participants on Cloud Research (58 % female, M_{age} = 41). We again included an attention check at the beginning of the survey (participants who failed that question were filtered out and did not participate).

Experimental Design and Procedure. This experiment had a 2 (quantity framing: perceptual unit first vs. standardized unit first) x 2 (information stage: only one unit vs. both units) mixed design with quantity framing manipulated between participants and information stage within participants.

The stimuli were similar as in the previous studies, but the information about the target product's quantity was presented sequentially, in two stages. Participants were told that we were interested in their WTP for a snack product, and that we would provide product information in two stages, with WTP collected in both stages. In the first stage, we provided only one unit (either perceptual or standardized, depending on the condition) and collected WTP. In the second stage, we provided both units simultaneously, and collected the WTP again, allowing participants to correct their initial WTP. Participants indicated their WTP for the multipack in an open-text box by entering a number between 1 and 10. Thus, participants submitted their WTP twice, first based on only one unit and then based on both units.

In the perceptual-unit-first condition, the following description was given at stage 1.

Lay's Classic Potato Chips Multipack, 12 snack bags

Based on this information, participants submitted their WTP. On the next screen they saw additional information as follows, with both units, and submitted their WTP again.

Lay's Classic Potato Chips Multipack, 12 snack bags
This Multipack contains 12 oz., 12 snack bags of 1 oz. each.

The second stage also included a picture of the multipack. Participants were told right at the outset that they could, if they wished, change their WTP based on the new information. Note that participants could not go back and change their initial estimate.

Likewise, participants in the standardized-unit-first condition first read the following description, and submitted their WTP.

Lay's Classic Potato Chips Multipack, 12 oz.

On the next screen, they saw the complete information with both standardized and perceptual units and submitted their WTP again. At this stage, they also saw the same picture as in the other condition, clearly showing that the multipack had 12 snack bags.

Lay's Classic Potato Chips Multipack, 12 oz.
This Multipack contains 12 oz., 12 snack bags of 1 oz. each.

Note that the final description in both conditions is identical in terms of information content; all participants saw the quantity information in both perceptual and standardized units. And all of them saw an identical picture of the multipack. If there is no information distortion of the initial information, their WTP estimate in the second stage should be identical to that in the first stage.

Perceived Quantity. On the following screens, we administered two process measures. First, using a measure adopted from Lembregts and Van den Bergh (2019), we collected quantity perception. Participants saw again the full product description and indicated on a 100-point unnumbered slider scale how large was the quantity difference between the regular pack and the multipack from "Very small difference" (0) to "Very large difference" (100).

Attention to Perceptual Units. Next, we measured relative attention to the units. Participants saw again the full product description with picture and indicated on a seven-point scale whether they focused more on "12 oz." (1) or "12 snack bags" (7) while evaluating the multipack. Finally, age and gender information were collected.

Results

Willingness to Pay. We ran a mixed ANOVA with quantity framing as between-participants factor (standardized unit first vs. perceptual unit first), information stage (only one unit vs. both units) as within-participants factor, and their interaction. We found a main effect of quantity framing, $F(1, 208) = 44.74$, $p < .001$, $\eta_p^2 = .178$, such that WTP was higher in the perceptual-unit-first condition (M = \$5.97) than in the standardized-unit-first condition (M = \$4.36). The main effect of information stage was not significant, $F(1, 208) = .03$, $p = .87$. We also found a significant interaction between quantity framing and information stage, $F(1, 208) = 28.58$, $p < .001$, $\eta_p^2 = .121$. When only one unit was provided, the WTP estimate was much higher in the perceptual unit condition (M = \$6.27) than in the standardized unit condition (M = \$4.07, $p < .001$, $\eta_p^2 = .246$). In the second stage where both units were provided, the difference in WTP between the two conditions was attenuated, yet it remained significant ($M_{\text{perceptual}}$ = \$5.66, $M_{\text{standardized}}$ = \$4.65, $p < .001$, $\eta_p^2 = .068$). These results clearly show that participants' evaluations are anchored on the attentionally salient unit, and that the effect of the perceptual unit persisted even when participants were prompted to attend to the standardized unit in the later stage of information processing.

Process Measures. There was a main effect of quantity framing on the relative-attention-to-units measure, $F(1, 208) = 5.77$, $p = .017$, $\eta_p^2 = .027$, such that participants reported paying more attention to the perceptual units (relative to standardized units) in the perceptual-unit-first condition ($M_{\text{perceptual}} = 4.63$ vs. $M_{\text{standardized}} = 4.01$).

Surprisingly, and contrary to our expectation there was no effect of quantity framing on quantity perception (i.e., perceived quantity difference between the multipack and the regular

pack), $F(1, 208) = .28$, $p = .60$, $\eta_p^2 = .001$ ($M_{perceptual} = 46.86$ vs. $M_{standardized} = 45.19$). We believe that this absence of a direct effect of quantity framing on quantity perception is due to the study design. The two-stage design might have prompted participants to consider perceptual and standardized units carefully in the second stage, thereby preventing them from relying on their intuitive quantity perceptions. We address this possibility in the next study.

Mediation. We conducted a post hoc[6] mediation analysis and found evidence for serial mediation (model 6, Hayes 2018) through attention to units and quantity perception. The indirect pathway "perceptual unit first → attention to perceptual units → perceived quantity → WTP" was significant, indirect effect = .0378, *SE* = .0244, *95%CI*[.0034, .0964]. This mediation result suggests that increasing the salience of perceptual units in the quantity description directed participants' attention to perceptual units, which influenced their quantity perception, and thus increased their WTP. Note that when accounting for the indirect effect, the direct effect of perceptual units on WTP remained significant, $b = .85$, $p < .001$ (i.e., partial mediation by perceived quantity), suggesting the effect is indeed multiply determined.

STUDY 4B: MAKING BOTH UNITS PROMINENT

Study 4b conceptually replicates the previous study and addresses a related question— what happens when both units are prominent in the product description? This question is of practical relevance to managers because it informs whether practitioners should completely avoid standardized units in product descriptions, or whether they can simply add a perceptual unit next to the standardized unit to improve perceived value. To address this question, in addition to the perceptual unit salient and standardized unit salient conditions, we added a third

[6] We replicate these mediation results in the next study, reassuring us about the reliability of this post hoc analysis.

condition where both units were prominently displayed. We predicted that the effect of the perceptual unit should manifest even when it is presented alongside a standardized unit.

Method

Participants and Screening Procedure. Three hundred and ten U.S. participants were recruited from Cloud Research (59 % female, M_{age} = 39). To filter out inattentive participants, we again included an attention check at the beginning of the survey; participants who failed that question were screened out and not allowed to participate.

Experimental Design and Procedure. This experiment had a 3 (quantity framing: perceptual unit salient vs. standardized unit salient vs. both units salient) x 2 (replicates) mixed design with quantity framing manipulated between participants and replicates within participants. We slightly altered our dependent variable to test the generalizability of the result; in this study we asked participants to estimate the WTP for a regular pack and then estimate the WTP for a multipack of the same snack. (That is, unlike in the previous studies, no reference price was given to participants.)

Participants were told that they would have to evaluate four products—a regular pack of snacks and a multipack each from two brands, Lay's and Snack Factory. Participants evaluated the two brands in a random order. For each brand, participants submitted their WTP for a regular pack (i.e., Lay's 8 oz. bag and Snack Factory Pretzel Crisps 7 oz. bag) and then for a multipack of snack bags of the same brand. We manipulated the salient unit in the description of the multipack. Participants entered an amount between $1 and $10 in an open-text box for each of the four products. For each brand, we computed the difference between the WTP for the

multipack and the WTP for the regular pack (i.e., the premium for the multipack) and used that as our dependent measure.

As noted previously, in addition to the perceptual unit salient and standardized unit salient conditions, we also had a third condition with both units salient. Salience of unit was manipulated by presenting the relevant unit(s) in the first sentence of the product description. The second sentence was identical across the three conditions, keeping the information content constant. The stimuli used in the three conditions are summarized below.

Perceptual Unit Salient	
Lay's	Lay's Classic Potato Chips Multipack, 12 snack bags Twelve 1 oz. snack bags of Lay's classic potato chips
Snack Factory	Snack Factory Pretzel Crisps, 10 snack bags Ten 1 oz. snack bags of Snack Factory pretzel crisps
Standardized Unit Salient	
Lay's	Lay's Classic Potato Chips Multipack, 12 oz. Twelve 1 oz. snack bags of Lay's classic potato chips
Snack Factory	Snack Factory Pretzel Crisps, 10 oz. Ten 1 oz. snack bags of Snack Factory pretzel crisps
Both Units Salient	
Lay's	Lay's Classic Potato Chips Multipack, 12 snack bags, 12 oz. Twelve 1 oz. snack bags of Lay's classic potato chips
Snack Factory	Snack Factory Pretzel Crisps, 10 snack bags, 10 oz. Ten 1 oz. snack bags of Snack Factory pretzel crisps

Product descriptions again followed the display format closely matching that used by Amazon.com, with pictures. After collecting the WTP for the two brands, we collected the same

two process measures as in study 4a, that is, perceived quantity difference between the multipack and the regular pack, and a measure of relative attention to the two units. Lastly, age and gender were collected.

Results

WTP Premium. For each participant, we computed the difference between the WTP for the multipack and the WTP for the regular pack to estimate the premium they were willing to pay for the multipack. We ran a repeated-measures ANOVA with quantity framing as between-participants factor (standardized unit salient vs. perceptual unit salient vs. both units salient), replicate as within-participants factor, and their interaction. We found a main effect of quantity framing, $F(2, 307) = 18.32$, $p < .001$, $\eta_p^2 = .107$. The interaction between quantity framing and the replicate was not significant, $F < 1$, $p = .90$. Pairwise comparisons revealed that WTP premium was significantly larger when the perceptual unit was salient (M = \$3.63) than when the standardized unit was salient (M = \$2.29), $t(307) = 6.03$, $p < .001$, $\eta_p^2 = .088$. Even when both units were salient (M = \$3.07), WTP premium was significantly larger than when only the standardized unit was salient, $t(307) = 3.49$, $p < .001$, $\eta_p^2 = .031$. The difference between the both units salient condition and the perceptual unit salient condition was also significant but smaller, $t(307) = - 2.49$, $p = .013$, $\eta_p^2 = .013$.

Relative Attention. We ran the same model as above using relative-attention-to-units measure as dependent variable (with higher scores denoting more attention to perceptual unit). We found a main effect of quantity framing on unit attention, $F(2, 307) = 6.04$, $p = .003$, $\eta_p^2 = .038$. Participants paid relatively more attention to the perceptual unit (vs. standardized unit) in the perceptual unit salient condition (M = 4.32) than in the standardized unit salient condition (M

= 3.82), $t(307) = 3.34$, $p = .001$, $\eta_p^2 = .026$. In the condition where both units were salient, this measure of attention ($M = 3.95$) was not different from that in the standardized unit salient condition, $t(307) = .82$, $p = .41$, $\eta_p^2 = .002$, but it was lower than that in the perceptual unit salient condition, $t(307) = -2.49$, $p = .013$, $\eta_p^2 = .015$.

Perceived Quantity Difference. We again ran the same model as above using perceived quantity difference as dependent variable. We found a main effect of quantity framing, $F(2, 307) = 3.43$, $p = .034$, $\eta_p^2 = .022$. Perceived quantity difference between the multipack and the regular pack was larger in the perceptual unit salient condition ($M = 49.08$), than in the standardized unit salient condition ($M = 42.40$), $t(307) = 2.62$, $p = .009$, $\eta_p^2 = .017$. When both units were salient ($M = 45.59$), perceived quantity difference was in the middle; neither significantly larger than in the standardized unit salient condition, $t(307) = 1.24$, $p = .22$, $\eta_p^2 = .004$, nor significantly smaller than that in the perceptual unit salient condition, $t(307) = -1.36$, $p = .18$, $\eta_p^2 = .004$.

Mediation. As in study 4a, we conducted a serial mediation analysis (model 6, Hayes 2018) to test whether our process measures mediated the effect of perceptual unit (vs. standardized unit). The analysis revealed that the indirect pathway "perceptual unit salience → attention to perceptual unit → perceived quantity → WTP premium" was significant, indirect effect = .0146, *SE* = .0101, *95%CI* [.0011, .0399]. Once again, this suggests that increasing the salience of the perceptual (vs. standardized) unit directed participants' attention to perceptual units, which influenced their quantity perception, and thus increased WTP. Furthermore, when accounting for the indirect effect, the direct effect remained significant, $b = .67$, $p < .001$, again suggesting the effect is multiply determined.

Discussion of Studies 4a and 4b

Studies 4a and 4b offer two important insights. First, these studies suggest the existence of a second convergent mechanism. Both experiments found a serial mediation such that making the perceptual unit salient increased attention to snack bags, which in turn increased perceived quantity difference between the multipack and the regular pack, and increased WTP. Thus, our studies show that perceptual units not only increase experiential processing (as observed in studies 3a and 3b), but they also bias quantity perceptions, and both psychological effects jointly increase WTP.

Second, these results show the information distortion effect of perceptual units. Using a paradigm from the information distortion literature (Bond et al. 2007; Kostopoulou et al. 2012), study 4a provides evidence for the attentional salience mechanism. The effect of the attentional salience of perceptual units biased judgments even when participants were explicitly told they could revise their WTP based on the additional information made available in the second stage. By design, all participants had to pay careful attention to both units in the second stage, yet their WTP estimates were anchored on the salient unit that was given first. Study 4b builds on this insight to show that retailers do not have to remove standardized units from the description to increase perceived value. Merely adding a perceptual unit alongside the standardized unit increased the WTP premium for the multipack.

Supplementary Study

In all experiments thus far, we examined our effect on WTP estimates (either others' WTP or personal WTP). Do these effects hold up when shoppers have to evaluate a given retail price? Although our archival study suggests that they do, we cannot make causal claims from

that study. To address this concern, we conducted a follow-up study. In this online experiment (n = 217), we used stimuli that are similar to that of study 2a, subtly manipulated which unit was made salient in the first sentence (perceptual vs. standardized), and used two replicates within participants (chips and cookies). Rather than asking WTP, we provided the price of the products and measured perceived value by asking participants their level of agreement with three items adapted from past research (Grewal, Monroe, and Krishnan 1998) on a seven-point scale ("The price of this product is a good value for money / is a good deal / is attractive," alpha = .96). We also measured satisfaction with quantity. We found that perceived value was evaluated more favorably when the perceptual unit was salient (M = 4.22) than when the standardized unit was salient (M = 3.60, $F(1, 215) = 12.03$, $p < .001$, $\eta_p^2 = .053$). Furthermore, this effect was mediated by satisfaction with quantity, indirect effect = .5722, SE = .1538, CI = [.2734, .8769]. Thus, the quantity framing effect is robust across different measures of perceived value.

GENERAL DISCUSSION

Across seven studies reported here and a supplemental study, we examined how the framing of quantity information affects market prices and perceived economic value. Using a multi-method approach, we found a robust quantity framing effect such that making perceptual units salient increases perceived value compared to making standardized units salient. We first demonstrated in an archival study that the effect manifests in the marketplace using hundreds of price observations from a large online retailer. Products have a higher unit price when quantity is described using perceptual units (vs. standardized units), and this effect is mitigated for large packs. We then established causality in controlled experiments. Using an incentive-compatible WTP estimation procedure, study 2a showed that participants' WTP estimates were about 10% higher when the perceptual unit (vs. standardized unit) was more salient. Study 2b documented a

moderation that lends credence to the role of attentional salience in the mechanism. Because attention shifts from the unit to the number when number magnitude increases, the positive effect of perceptual units on perceived value was mitigated for large packs. Studies 3a and 3b showed that making perceptual units salient increases experiential processing, both when experiential input was manipulated (study 3a) and measured (study 3b). Study 4a used a paradigm from the information distortion literature to demonstrate the biasing effect of perceptual unit salience on subsequent judgments. Study 4b further showed that retailers do not have to necessarily remove standardized units from product descriptions; merely adding a perceptual unit next to the standardized unit significantly increases willingness to pay.

Our studies rule out several alternative explanations. First, we found that response time did not account for the effect of perceptual units, suggesting that the mechanism cannot be explained by changes in processing difficulty or task complexity. Indeed, past research has shown that experiential processing is not necessarily faster (Maglio and Reich 2020). Second, we show that the effect is not due to differences in informational value across unit types. In all our experiments we carefully kept the information content constant across conditions. Our manipulation was very subtle; we only changed which unit was more salient without changing the information content. Third, we show that our effect is distinct from numerosity effects (Bagchi and Davis 2016; Pelham et al. 1994) by also keeping number magnitude constant across conditions in all experiments.

Generalizability and Future Research

Across all experiments we have tested our effect using various measurements of perceived value. Studies 2a and 2b used an incentive-compatible method to measure allocentric WTP estimates (i.e., estimates of customers' average WTP). Studies 3a, 3b, 4a, and 4b used

personal WTP, while the supplemental study used a three-item scale of perceived value. It should be noted that the effect sizes for the studies using personal WTP were larger than the effect sizes for the studies using the allocentric incentivized WTP (see Table 3). We believe this is the case for two reasons. First, the incentive for accuracy in the allocentric method used in studies 2a and 2b may help attenuate some of the biases that underpin the quantity framing effect. Second, the allocentric incentivized method may call for a colder judgment reflective of perceived market value, while the personal WTP measure may mobilize more experiential, dispositional inputs such as product enjoyment, and we have shown in studies 3a and 3b that such experiential inputs increase the effect of perceptual units.

Although we used only multipacks of snacks as stimuli in our experiments, we believe that our effect would generalize to other product categories as well. Our theory suggests that whenever experiential processing can be activated, increasing the salience of perceptual units should increase willingness to pay. However, there are several boundary conditions that we did not consider in the present research. We did not consider the effects of typicality or scale compatibility (Tversky, Sattah, and Slovic 1988). It is conceivable that the effect of perceptual units might be weaker, or even reversed, for certain product categories or contexts where standardized units are the norm. Additionally, the properties of standardized units are likely to make them desirable whenever individuals' goals to assess an objective, precise quantity is critical. While it is not likely in the context of grocery shopping that is often characterized by relatively low consumer involvement, we can expect the advantages of standardized units to matter more when involvement increases, such as in business settings with large revenues at stake. This would be a fruitful area for future research. In addition, future work may also build

on our findings to uncover other areas where subtly manipulating the order of experiential (vs. analytical) information can affect evaluative judgments.

Implications

The current work has important implications for the behavioral pricing literature and, in particular, for the theories of subjective economic value. Our results show that perceived economic value is context-dependent and susceptible to subtle changes in quantity descriptions. Perceived economic value is often predicated on several fleeting judgments of intermediary variables, which in turn, can be influenced by something even as subtle as the salient unit used to describe the quantity being offered. By characterizing the role of quantity description on market prices and perceived economic value, this research contributes to the broader literature on behavioral pricing (Adaval 2013; Adaval and Monroe 2002; Biswas et al. 2013; Monroe and Lee 1999; Thomas 2013; Thomas and Morwitz 2009; Vanhuele and Drèze 2002; Vanhuele, Laurent, and Drèze 2006) as well as to the literature on numerical cognition (Bagchi and Davis 2016; Chandon and Ordabayeva 2009; De Langhe and Puntoni 2016; Lembregts and Pandelaere 2013; Lembregts and Van den Bergh 2019; Monga and Bagchi 2012; Pandelaere, Briers, and Lembregts 2011; Pelham et al. 1994; Schley, Lembregts, and Peters 2017). The present work also contributes to the literature on perceptual and experiential mental processes in consumer behavior (Adaval and Wyer 1998; Andrews et al. 2014; Huyghe et al. 2017; MacInnis and Price 1987; Paivio 1990; Shiv and Huber 2000).

For practitioners, our research characterizes an easy-to-implement and costless framing intervention that can increase willingness to pay. Our results are therefore likely to be of interest to manufacturers and retailers interested in increasing consumers' satisfaction with quantity and

the perceived value of products. And while the effect size may be statistically small to moderate in academic parlance (see Table 3), the economic implications are considerable. Even if increasing the salience of perceptual units can allow a 5% increase in price, it can have non-trivial implications for profitability. Our insights also have implications for policy makers. Currently government agencies do not prescribe how exactly to describe quantity. Retailers have considerable leeway in using idiosyncratic quantity descriptions. Policy makers could consider regulating quantity descriptions to prevent consumers from falling prey to such framing effects.

Our results have important implications for consumer welfare as well. The quantity framing effect documented in this research could be used to reduce consumption of high-calorie food. As scholars studying food consumption have argued (Cadario and Chandon 2019; Cornil and Chandon 2016), improving satisfaction with smaller quantities can reduce overall calorie consumption. Genuinely customer-centric marketers committed to increasing welfare as well as policy makers could use our insights to improve consumers' satisfaction with smaller quantities of high-calorie food products. We hope this work will prompt scholars to study such contextual variables in greater detail and thus contribute to the development of a richer theory of the psychology of economic value.

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CHAPTER 2

Why Consumer Willingness to Pay Does Not Reflect Market Prices

Abstract

Practitioners and marketing scholars often ask consumers how much they are willing to pay (WTP) for a product. While it is generally assumed that hypothetical WTP responses are overestimated relative to actual market prices, this research documents instead that WTP estimates are systematically underestimated relative to actual prices that consumers would pay in the marketplace. In addition, this work demonstrates that WTP estimates can be based on two distinct heuristics: reference-based heuristic and preference-based heuristic. Reference-based WTPs are more influenced by the reference price of similar products ("how much does a similar product cost in the marketplace"). In contrast, preference-based WTPs are more influenced by consumer preferences ("how much do I like the product"). WTP underestimation is more pronounced when consumers use preference-based heuristic. Accordingly, interventions that shift estimation strategies towards reference-based heuristic make WTP estimates closer to market prices. Consumers are more likely to use reference-based heuristic under conditions of uncertainty, and when they estimate other shoppers' WTPs. Incentive-compatible settings further increase the difference between preference-based and reference-based WTPs. Based on these insights, this research provides recommendations on how to measure WTP to set market prices.

"In God we trust; all others bring data."

— W. Edwards Deming

Collecting data from consumers is central to the practice of marketing, as marketers and policy makers routinely use survey information to make strategic decisions. One measure in particular is crucial for marketing and pricing strategy: consumers' willingness to pay (WTP). For instance, accurately measuring consumers' willingness to pay enables marketers to position their new products at the right price on the market, and thus attenuate the risk of market failure and economic loss.

In this research, we examine whether willingness to pay estimates are reflective of market prices. We document that WTP estimates are systematically underestimated relative to actual prices that shoppers would pay in the marketplace—even in incentive-compatible settings when real money at stake. We further examine why this occurs. We propose that consumers use two types of heuristic when assessing the economic worth of a product: reference-based heuristic and preference-based heuristic. Reference-based heuristic is more influenced by what one believes is the retail price of similar products on the market. Preference-based heuristic is more influenced by one's idiosyncratic preferences and the utility one gets from the product. This research aims to characterize when and why consumers use reference-based versus preference-based heuristic. In particular, we investigate the roles of uncertainty, and of whether WTP estimates are egocentric or allocentric in nature. We find that the underestimation of WTP estimates is driven by the use of preference-based heuristic. Reference-based valuations are systematically closer to market prices than preference-based valuations. We discuss implications of these findings for practitioners and academics.

This research contributes to the literature in several ways. First, this paper is the first to document that WTP estimates are systematically underestimated relative to actual prices in the marketplace. Second, the present research delineates the mechanisms through which consumers assess the economic value of products, thus contributing to scholarly works that characterize the psychology underpinning WTP elicitations (Frederick 2012; Jung, Moon, & Nelson 2020; O'Donnell & Evers 2019; Thomas & Kyung 2019; Wertenbroch & Skiera 2002), and more broadly to the literature on how survey and question design may affect responses (De Jong et al. 2008; De Langhe et al. 2011; Schwarz 1999; Weaver and Schwarz 2018). Third, this paper provides guidance to practitioners and marketing scholars on when and why using reference-based WTP or preference-based WTP is more appropriate. For instance, if the goal is to set market prices for new products to be introduced, then reference-based WTP should be used. In contrast, if the goal is to evaluate variations in preferences for products, then preference-based WTP should be used.

Theoretical background

Academics have studied the reliability of WTP elicitation techniques for decades, as well as contextual factors that affect one's economic valuation of a good, such as buyer-seller differences in the valuations of the prices of goods (Becker, DeGroot & Marschak 1964; Frederick 2012; O'Donnell & Evers 2019; Thaler 1980; Thomas & Kyung 2019; Van Boven, Dunning, & Loewenstein 2000; Vickrey 1961; Weaver & Frederick 2012; Wertenbroch & Skiera 2002). Surprisingly, to best of our knowledge, no work has systematically investigated whether WTP measurements in consumer surveys are reflective of actual market prices. Of note, observations that hypothetical WTP responses are overestimated relative to incentive-compatible WTP responses prompted academics to caution that hypothetical WTP responses may lead

practitioners to set their market prices too high (Harrison, & Rutström 2008). As Wertenbroch and Skiera put it (2002, p. 238), "stated preferences methods may lead managers to overprice compared with consumers' true WTP, unless hypothetical survey responses can be recalibrated if the bias is known and stable." To the contrary, the present research documents a systematic tendency for WTP responses—even hypothetical—to underestimate the economic value of products relative to actual market prices. To understand why this may occur, we must dig into the psychological processes involved when consumers evaluate prices. To this end, we first distinguish two distinct heuristics that consumers use when estimating WTP: reference-based heuristic and preference-based heuristic. That is, consumers may both rely on reference prices and on their own preference when estimating WTP, and variations in elicitation techniques may influence the extent to which consumers will rely more on one or the other.

Preference-based WTP

A first heuristic that consumers may use is the preference-based heuristic. Predominant use of the preference-based heuristic in WTP estimation means that consumers' economic valuation of a good will be primarily influenced by how much they like the product, or how much utility they derive from it. After assessing their liking or the utility they derive from the product, consumers will determine how much money they are willing to part with to obtain the good. This valuation process is rooted in classic economic theories that argue that consumers are rational agents that maximize utility by weighing the perceived utility of the good against the subjective value of money they have to part with to acquire the good. The maximum amount consumers would be willing to pay is determined by the threshold where the utility derived from the good reaches the disutility of parting with money. Thus, in such situation WTP will be largely determined by one's idiosyncratic preference for the good.

The use of WTP as a preference-based valuation is ubiquitous in academic research. In fact, WTP is expected to be a measure of preference and is used as such (Fuchs, Schreier, & van Osselaer 2015; Hsee, Yang, & Ruan 2015; Jiang et al. 2016; Kim & Kramer 2015; Kupor & Tormala 2015; O'Donnell and Evers 2019). Probably the most popular preference-based WTP measure is the incentive-compatible BDM procedure (Becker, De Groot, & Marschak 1964). In the BDM procedure, participants have a chance to buy a good at their stated preferred price. Participants are asked to indicate the maximum price they are willing to pay for the product between, say, 0 and $10. Then a random number between 0 and 10 is drawn from an urn. If the participant's bid is higher than the random number, the participant purchases the good at the randomly-drawn price. If the participant's bid is lower than the random number, the participant does not purchase the good. The popularity and wide use of the BDM procedure in marketing research reflects scholars' concern for assessing individuals' true preferences. That is, past research has cautioned that hypothetical WTP estimates may not reveal individuals' true preference—and overestimate their true WTP (Harrison, & Rutström 2008; Neill et al. 1994; Wertenbroch & Skiera 2002).

To the extent that there is heterogeneity in the liking of the product or in the utility derived from it, preference-based valuations will yield WTP estimates that are lower than market prices because at least *some* individuals do not like the product. The distribution of WTP responses will therefore tend towards zero for those who do not like the product at all or do not derive any utility from it. For instance, in the BDM procedure example discussed above, a participant who do not want the product at all has an incentive to bid exactly zero on the product. In contrast, the WTP estimates of individuals who like the product a lot should tend towards the market value of the product. Note that because the outcome of the bid is contingent on drawing a

random number, there is a non-zero probability that participants get the product at a price that is lower than its market price; thus, even individuals who like the product a lot may have some incentive to bid at least slightly below what they believe market value is. Therefore, we posit that in preference-based elicitation settings, WTP estimates are likely to be largely underestimated relative to market prices, and this underestimation is driven by those with low-liking for the product.

Even though WTP is often used as a preference-elicitation measurement, past research has documented numerous examples of presumed judgment anomalies where WTP exhibit preferences that are different than those obtained through other elicitation techniques such as choice and scale ratings (Amir, Ariely, & Carmon 2008; Frederick & Loewenstein 2008; O'Donnell and Evers 2019; Moon and Nelson 2020). This suggests that WTP can also be a more hybrid measure that incorporates a variety of rules and factors other than one's idiosyncratic preferences (Amir and Ariely 2007). Here we argue that a second type of heuristic can be predominant in economic valuation depending on the context: reference-based heuristic.

Reference-based WTP

Primacy of the reference-based heuristic means that individuals will primarily anchor their WTP estimates on reference prices for the product, that is, based on what they believe market prices of similar products are. A notorious illustration of this influence of reference prices in WTP comes from Nobel Laureate Richard Thaler (1985). In a survey, Thaler asked respondents to imagine that they were lying on a beach on a hot day, and that a companion offered to buy them a beer at a nearby location. Respondents' median WTP for the beer was $2.65 when the location was a fancy resort hotel, but only $1.50 when the location was a small, run-down grocery store—even though purchase location should in theory not affect consumption

enjoyment. Thus, one's willingness to pay is influenced by reference prices that may be context-dependent and act as comparison standards. Adaval and Monroe (2002) established that standards of comparison that consumers use to estimate prices can be constructed spontaneously, without awareness of how these standards were constructed in the first place. The authors showed that by contrast effect, an identically-priced good was judged as less expensive when it was surrounded by more expensive products than when it was surrounded by less expensive products, even though participants explicitly recalled the price of the good to be more expensive when surrounded by expensive products. Other works have shown that consumers are often bad at explicitly remembering the prices of recent purchases, yet reference prices can still influence product evaluations at the implicit level (Kyung and Thomas 2016; Monroe and Lee 1999).

As a demonstration that the role of reference prices is prominent in value estimation, an extensive body of work has delved into the mechanisms through which individuals form reference prices, from personal antecedents such as purchase history to contextual moderators such as product category and store environment (Baucells, Weber, & Welfens 2011; Biswas & Blair 1991; Carmon & Ariely 2000; Grewal, Monroe, & Krishnan 1998; Kalyanaram, & Winer 1995; Mazumdar, Raj, & Sinha 2005; Monroe 1973; Urbany, Bearden, & Weilbaker 1988; Winer 1986). Overall, this stream of research suggests that when individuals estimate their WTP for a good, they may rely primarily on a reference price—consciously or not. Any prices higher than the reference price would generate disutility, or negative transaction utility as termed by Thaler (1985). Therefore, when WTP is primarily derived from comparison with reference prices, it may be largely influenced by past prices that consumers encountered in the marketplace for similar goods. Thus, we expect that the tendency of WTP estimates to be lower than market prices should be mitigated when individuals primarily use the reference-based heuristic.

The effect of contextual factors

So far, we have described how WTP can be derived from preference-based or reference-based valuations. There is consensus in behavioral research that the heuristic individuals use during economic valuation can be influenced by contextual factors (Tversky & Simonson 1993). Here we identify two factors that can affect which heuristic people will use in WTP estimates: uncertainty, and whether one estimates others' or one's own WTP.

Uncertainty. There is evidence that when individuals make numeric estimates, they tend to first generate internal anchors, and then consider multiple other potential values that serve to adjust their initial estimate (Epley & Gilovich 2001). One factor that can affect the magnitude of such adjustment is uncertainty. In particular, Nisbett and Ross (1980) argued that individuals with high confidence are more prone to judgment miscalibration because they are less likely to revise their initial estimate. Consistent with this theorizing, Ülkümen, Thomas, & Morwitz (2008) found that estimates for budgets that were more certain (e.g., monthly budget) were lower than budgets that were more difficult to estimate (e.g., unitized yearly budget). It follows that in the context of this research, consumers who feel confident about the task will be less likely to revise their initial WTP estimate. We have argued earlier that individuals may use both preference-based heuristic and reference-based heuristic, and that the underestimation of WTP is due to the influence of the preference-based heuristic. When consumers feel more uncertain about the task at hand, they are likely to adjust their first estimate to a greater extent by considering more reference prices. We thus expect than WTP estimates made under conditions of high uncertainty will yield WTP estimates that are closer to market prices.

Others' WTP. Past research has documented a robust bias in estimating others' WTP such that consumers believe others' WTP to be significantly higher than their own (Frederick 2012;

Jung et al. 2020). Jung et al. (2020) have suggested that this occurs because individuals fail to account for the whole distribution of experiences of others with the products, and thus fail to consider potentially negative aspects of the products. Consistent with this, Jung et al. (2020) showed that consumers also overestimate others' enjoyment compared to their own. However, there seems to be variation across products, such that overestimation of others' WTP occurs for products for which participants do not overestimate enjoyment, and vice versa. Even though evidence is not conclusive regarding the causal link from overestimating enjoyment to overestimating WTP, asking participants to estimate the average WTP of a customer rather than their own should attenuate the tendency to underestimate WTP relative to market prices. Here we argue that this occurs because consumers will rely less on the preference-based heuristic when asked about others' WTP, increasing the influence of the reference-based heuristic. Therefore, we expect allocentric WTP estimates to be closer to market prices than egocentric WTP estimates.

Incentive-compatibility. In the work reviewed earlier, we have argued that the incentive-compatible BDM procedure makes consumers primarily rely on preference-based heuristic rather than reference-based heuristic. In another paper supporting this account, Weaver and Frederick (2012, study 2) examined how manipulating reference prices may affect the endowment effect (i.e., the propensity for the minimum selling price of individuals endowed with a good to be higher than the maximum willingness to pay of buyers, Thaler 1980). Increasing reference prices significantly affected sellers' prices, but not buyers' WTP elicited by the BDM procedure. This suggests again that respondents in the BDM procedure may not use reference-based valuation as a dominant heuristic, but rather primarily rely on their own preference ("How much do I like the product") when estimating WTP in such paradigm. In addition, Wertenbroch and Skiera (2002)

reported that the BDM procedure lowered WTP estimates compared to non-incentive compatible procedures. Therefore, we propose that the BDM procedure increases reliance on preference-based heuristic relative to non-incentivized methods. This also suggests that preference-based WTP is not appropriate in certain contexts, such as when companies want to determine the price at which they should introduce a new product on the market. In such contexts, we argue that allocentric incentivized methods of WTP estimation will be more appropriate, because such methods rely more on reference-based valuations and are therefore more likely to generate revenue-maximizing WTP estimates.

Overview of studies

We present four experiments that examine the WTP is underestimated relative to market prices, and the mechanisms involved. Studies 1a and 1b show the pervasiveness of the underestimation across a variety of products, and provides evidence that the underestimation occurs because consumers use a preference-based heuristic when estimating willingness to pay (WTP). Study 2 uncovers two interventions that attenuate this effect, and shows evidence that shifting valuations towards reference-based valuations renders WTP estimates closer to market prices. Lastly, study 3 demonstrates that the WTP underestimation also occurs in incentive-compatible experiments when real money is at stake, and further documents the opposite effects of preference-based and reference-based valuations on WTP underestimation. Study 3 also unveils a novel incentivized allocentric method of WTP elicitation that yields WTP estimates closer to market prices compared to incentivized egocentric methods (e.g., BDM procedure). Throughout all experiments, we compare participants' WTP estimates with the actual prices of the products that they evaluate. We recorded the actual prices of the products on the day the experiments were conducted. To this end, we checked the market prices of the products on three

popular retail websites, Amazon.com, Walmart.com, and Target.com. For each product, we retained the actual market price that was the lowest across these three websites. Hence, our experiments provide a conservative test of the underestimation of WTP relative to market prices. All experiments are preregistered. In all studies, we apply the same exclusion criteria, and we report all measures collected. Given that all studies involve multiple product replicates, we control for the effect of product replicate in all analyses.

Study 1a: Generalizability

Study 1a (AsPredicted # 93787) has two main goals. First, we test the pervasiveness of the underestimation of WTP relative to market prices across a variety of products (cheap and expensive, hedonic and utilitarian, durable and nondurable). Second, study 1a investigates the role of product liking in the propensity to underestimate WTP. We posited that the underestimation is due to individuals using preference-based heuristic in WTP estimation, such that the tendency to underestimate WTP is more pronounced among individuals with low product liking.

Method

Participants and experimental design. We recruited 500 participants on Cloud Research. The survey began with two pre-screening questions aimed at filtering out inattentive participants. Those who failed these attention check questions were not allowed to participate. As preregistered, we excluded participants who gave responses more than three standard deviations away from the mean at the product level. This left 472 participants (43% female, M_{age} = 41). This was a survey in which all participants indicated their WTP and their liking for each of the eight product replicates.

Procedure. We told participants that we were interested in their evaluation of eight products. The products were: Nature Valley granola bars variety pack (24 count), Chips Ahoy! Chocolate chip cookies party size (25.3 oz.), Ben & Jerry Chocolate fudge ice cream 16-oz. pint, Black & White hummingbird 16-oz. mug, SodaStream Jet sparkling water maker kit, American Tourister Carry-on luggage 21-inch, Bose sport wireless earbuds, and Mr Coffee coffee & cappuccino maker Café Barista. Participants started by indicating their WTP for the eight products, in a random order. They did so by entering their amount in an open-ended text box. In the second section of the survey, participants indicated their liking for each of the eight products, again in a random order. Liking was measured by asking participants to indicate their level of agreement with three items on a seven-point scale ("I like this product," "This product is desirable," "I am likely to buy this product," from 1 = *strongly disagree*, to 7 = *strongly agree*, alpha = .91). Lastly, age and gender were captured.

Results

WTP underestimation. As preregistered, we began by examining WTP underestimation for each product separately. To this end, for each product we performed t-tests comparing WTP estimates to the market price of the product. Table 1 presents a detailed summary of the results. For seven out of eight replicates, WTP estimates were significantly underestimated (all *p*s <.001). For one product, Ben & Jerry ice cream, the effect was directionally consistent with the underestimation, but not significant, $t(471) = -1.42$, $p = .15$. Overall, the magnitude of the underestimation ranged from 5% to 55% of the market price, and between 60% and 93% of the participants underestimated WTP relative to market price.

Table 1. Summary of results per product in study 1a.

Product	WTP	Actual Price	Underestimation Magnitude (%)	t value	Effect size (Cohen's d)	% of sample underestimating
Sport wireless earbuds	$80.96	$179.00	$98.04 (55%)	-39.58***	-1.82	93%
Mug	$7.51	$13.60	$6.09 (45%)	-25.31***	-1.16	88%
Cappuccino maker	$118.57	$199.99	$81.42 (41%)	-23.98***	-1.10	83%
Sparkling Water Maker	$48.60	$76.49	$27.89 (36%)	-18.16***	-0.84	81%
Carry-on suitcase	$74.02	$101.95	$27.93 (27%)	-14.88***	-0.68	84%
Granola bars	$6.65	$9.22	$2.57 (28%)	-13.91***	-0.64	79%
Cookies	$4.44	$5.28	$0.84 (16%)	-4.53***	-0.21	86%
Ice cream	$4.66	$4.88	$0.22 (5%)	-1.42	-0.07	60%

Note.—*** p <.001.

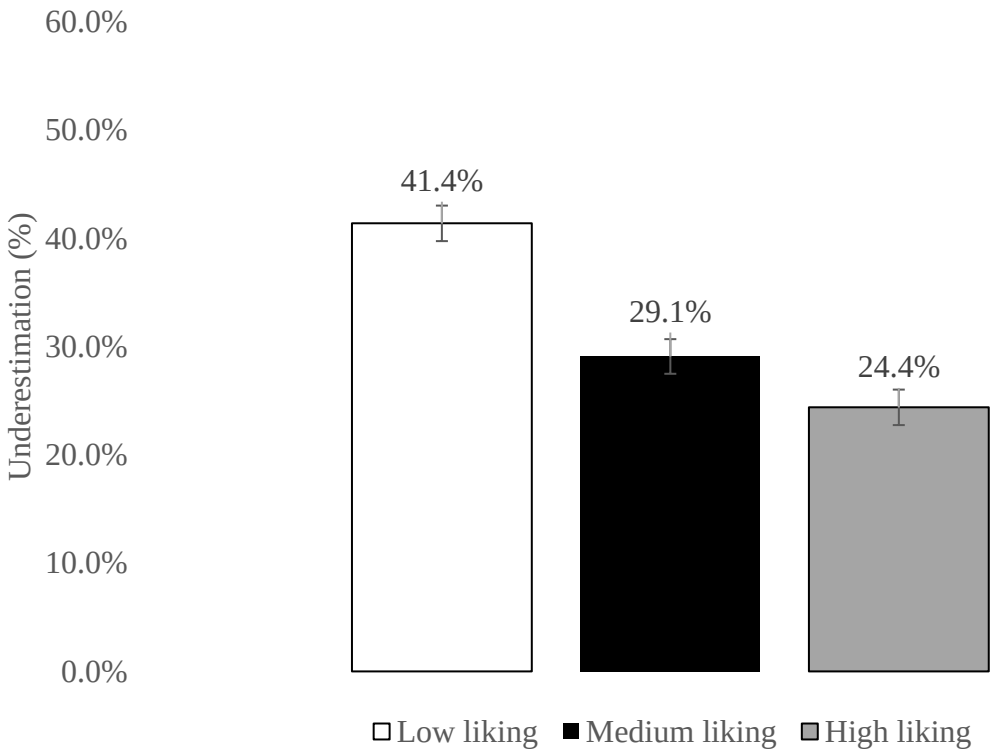
Effect of liking on WTP underestimation. Second, we regressed the underestimation percentage (i.e., underestimation index) on product liking, while controlling for the effect of product replicate. The underestimation index was computed as follows: (market price – WTP estimate)/market price. We found a significant effect of product liking on the underestimation index, b = -0.05, $F(1, 3296) = 114.79$, $p < .001$, $\eta_p^2 = 0.034$, such that higher product liking decreases the magnitude of the underestimation.

Effect of liking on likelihood to underestimate. Third, we conducted a repeated measures logistic regression using the Genmod procedure in SAS to test whether liking affects likelihood to underestimate WTP. Our dependent variable was a binary variable indicating whether WTP was underestimated or not relative to market prices (1 if WTP < market price, 0 if WTP >= market price). Our independent variable was product liking, and we again controlled for the effect of product replicate. We found a significant effect of liking, b = -.03, Z = -8.31, $p < .001$, such that higher product liking reduces consumers' propensity to underestimate WTP.

Robustness checks. To corroborate the previous analyses, we further conducted two robustness checks. We split our dataset into three groups based on product liking: low-liking (1244 observations), medium-liking (1266 observations), and high-liking (1266 observations),

and tested whether the propensity to underestimate WTP varied between the three groups. First, we ran a repeated measures regression with the underestimation index as dependent variable, and the liking group categorical variable as independent variable, while controlling for product replicate. There was a significant effect of the liking categorical variable, $F(2, 711) = 38.29$, $p < .001$, $\eta_p^2 = 0.097$. Pairwise contrasts showed that underestimation was larger in the low-liking group compared to the medium liking group, $M_{low} = 41.4\%$ vs. $M_{medium} = 29.0\%$, $t(711) = 6.42$, $p < .001$, and underestimation was also larger in the medium-liking group relative to the high-liking group, $M_{high} = 24.4\%$, $t(711) = 2.39$, $p = .017$. Figure 1 plots these results.

Figure 1. Underestimation magnitude as a function of product liking expressed as percentage of actual market price



Second, we ran a repeated measures logistic regression using underestimation likelihood as dependent variable, liking group as independent variable, and controlling for product replicate. We found again a significant effect of the liking group variable on propensity to

underestimate WTP, such that relative to the high-liking group (M_{high} = .88), likelihood to underestimate WTP was higher in both the low-liking group, M_{low} = .77, b = - 0.11, Z = 6.54, p < .001, and the medium-liking group, M_{medium} = .81, b = - 0.04, Z = 2.33, p = .020.

Study 1b: Maximum WTP

Study 1b (AsPredicted # 93468) complements study 1a in two ways. First, we test whether WTP underestimation also occurs when the WTP question asks participants about their *maximum* WTP, which is a common wording used in behavioral research (e.g., Amir, Ariely, & Carmon 2008; Frederick 2012; O'Donnell and Evers 2019). Second, we use different product replicates from those in study 1a to further increase generalizability. In particular, we use products that have market prices lower than $12, based on the premise that i) goods with low prices are easier to evaluate, and ii) the effect sizes in study 1a were smaller for cheaper products (see Table 1). Hence, focusing on products with low market prices provides a more conservative test of the tendency to underestimate WTP relative to market prices.

Method

Participants and experimental design. We recruited 551 participants on Cloud Research, and applied the same two pre-screening questions as in study 1a. As in the previous study, we excluded 13 participants who gave responses more than three standard deviations away from the mean at the product level. This left us with 538 participants (52.8% female, M_{age} = 39). Participants were randomly assigned to one of two conditions: classic WTP or maximum WTP.

Procedure. All participants gave their WTP estimate for four replicates:[7] Ferrero Rocher chocolates (24 count), a 10-inch Teddy bear, Pré de Provence artisanal French soap bar (150 g), and Uni-ball rollerball pens (4 count). Participants in the classic WTP condition were asked to indicate their personal WTP as in study 1a ("How much would you be willing to pay for this product?"). Those in the maximum WTP condition answered the question "What is the maximum amount that you are willing to pay for this product?" Participants indicated their WTP estimates by entering an amount between $1 and $15 in an open text box (see Monnier and Thomas 2022 for an example of use of this elicitation procedure). After the four WTP questions, we administered a process measure. We told participants that WTP generally depends on two considerations: product liking, and the price of similar products in the market. We asked participants which of these two considerations influenced their responses more, from 1 = *Liking for the product,* to 7 = *Market price of similar products.* Lastly, age and gender information were collected.

Results

WTP and wording. As preregistered, we ran a mixed model ANOVA with WTP as dependent variable, and wording condition as independent variable, controlling for product replicate. We found no effect of question wording on WTP estimates, $F(1, 536) = 0.88$, $p = .35$, such that WTP estimates in the maximum wording condition were not significantly higher than WTP estimates in the classic wording condition, $M_{maximum} = \$6.74$ vs. $M_{classic} = \$6.56$.

[7] We preregistered that we would collect WTP estimates for five replicates. However, we were able to collect estimates for only four replicates due to a technical issue with the survey. Subsequent studies test our hypotheses using all five replicates.

WTP underestimation. Looking another way at the analysis above, the magnitude of the WTP underestimation relative to actual market prices was not significantly lower in the maximum WTP condition, $M_{maximum}$ = \$1.85 vs. $M_{classic}$ = \$2.02, $F(1, 536) = 0.88$, $p = .35$. Similarly, running the same model using the underestimation percentage as dependent variable, there was no difference between conditions, $M_{maximum}$ = 19.1% vs. $M_{classic}$ = 21.9%, $F(1, 536) = 1.58$, $p = .21$. Next, we ran t-tests to examine whether WTP was significantly underestimated in both conditions compared to actual prices. WTP estimates were on average significantly underestimated in both the maximum wording condition, M = \$1.85, $t(1079) = -17.15$, $p < .001$, $d = -0.52$, and in the classic wording condition, M = \$2.02, $t(1071) = -18.91$, $p < .001$, $d = -0.58$.

Process measure. We found no effect of the wording condition on our process measure ($M_{maximum}$ = 3.93 vs. $M_{classic}$ = 3.99, $F(1, 536) = 0.16$, $p = .69$), suggesting that participants do not rely more on market prices when asked about their maximum WTP.

Discussion of studies 1a and 1b

Studies 1a and 1b show a pervasive underestimation of WTP estimates relative to the actual market prices of the products. We document this underestimation across a variety of products: cheap and expensive, branded and unbranded, hedonic and utilitarian, durable and nondurable. In addition, we provide evidence that this underestimation is driven by individuals with low product liking. In other words, preference-based WTP estimations lead to underestimation of WTP relative to actual prices. Asking participants about their maximum WTP does not significantly alleviate this underestimation.

Study 2: Allocentric WTP and uncertainty

In study 2 (AsPredicted #91805), we aim to further understand the mechanisms. We employ the same paradigm as in study 1b, and test two interventions that may affect the underestimation of WTP. If the underestimation is driven by individuals relying on preference-based valuations, then interventions that shift estimation strategies towards reference-based valuations should mitigate this underestimation. Study 2 examines two such interventions by manipulating i) whether the WTP elicitation technique is egocentric versus allocentric, and ii) participants' uncertainty regarding their estimates.

Method

Participants and experimental design. We recruited 1500 participants on the Cloud Research platform. As in previous studies, we had two simple attention check filters. Only those who answered these questions correctly were allowed to participate. We excluded 65 participants who gave responses more than three standard deviations away from the mean, as in the previous studies. This left us with 1435 participants (47% female, M_{age} = 42). Participants were randomly assigned to one of four conditions in a 2 (WTP method: egocentric vs. allocentric) x 2 (uncertainty: high vs. low) full factorial design.

Procedure. All participants gave their willingness to pay estimate for five replicates: Ferrero Rocher chocolates (24 count), a 10-inch Teddy bear, a squeeze stress relief educational Earth ball, Pré de Provence artisanal French soap bar (150 g), and Uni-ball rollerball pens (4 count). Participants in the egocentric WTP condition were asked to indicate their personal WTP ("How much would you be willing to pay for this product?"). Those in the allocentric WTP condition were asked to indicate the WTP of a customer ("How much would a customer be

willing to pay for this product?"). In addition, we manipulated participants' uncertainty regarding their responses. Participants in the *low* **[high]** uncertainty condition were told, before submitting their WTP:

> "Before answering the question below, please note that a majority of the participants who have completed this task found this task to be *very easy* **[quite difficult]**. *Just submit your intuitive response* [**They had to often correct their initial estimate**]".

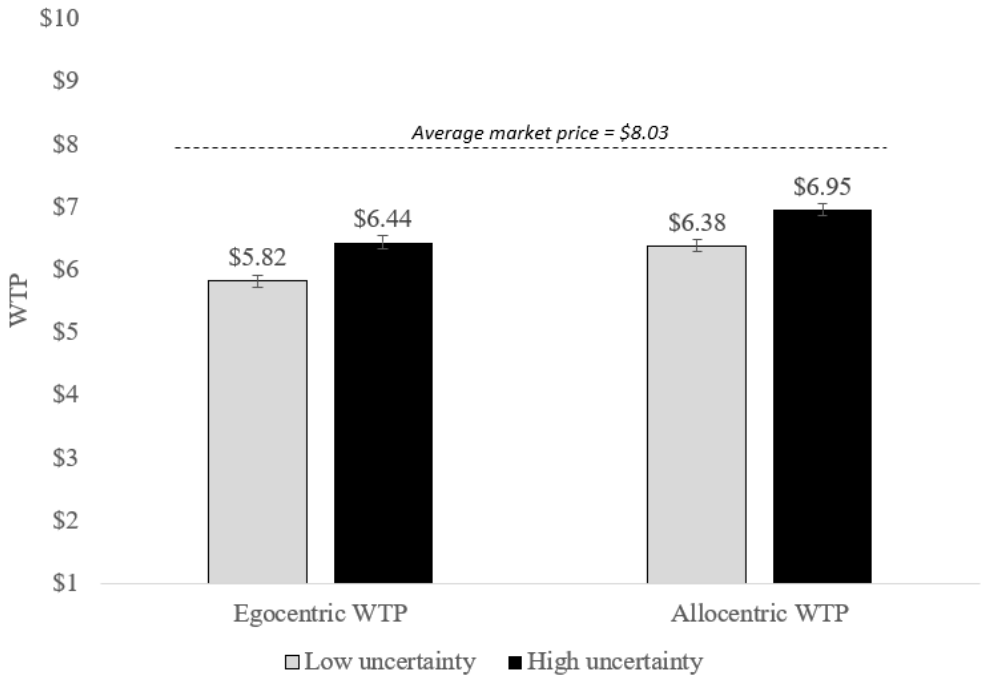
Participants in all conditions had to indicate their WTP responses by entering a number between $1 and $15 in an open-ended text box.

After participants gave their five WTP estimates, we administered our process measure exactly as in study 1b. Participants indicated whether they relied more on product liking or market prices when estimating WTP ("Which of these two considerations influenced your responses more?", 1 = *Liking for the product*, 7 = *Market price of similar products*). Finally, we collected age and gender information.

Results

WTP. As preregistered, we ran a mixed model ANOVA with WTP as dependent variable, and the following independent variables: WTP method, uncertainty, and their interaction. We further controlled for product replicate. We found a main effect of WTP method such that allocentric WTPs are higher than, and closer to actual market prices than, egocentric WTPs ($M_{allocentric}$= \$6.66 vs. $M_{egocentric}$ = \$6.13, $F(1, 1431) = 32.15$, $p < .001$, average market price = \$8.03). We also found a main effect of uncertainty such that WTPs are higher, and closer to actual market prices, in the high (vs. low) uncertainty condition (M = \$6.69 vs. \$6.10, $F(1, 1431) = 40.00$, $p < .001$). There was no interaction, $F(1, 1431) = 0.06$, $p = .80$. See Figure 2.

Figure 2: WTP as a function of WTP elicitation method and uncertainty



WTP underestimation. Looking at the results another way, we find that both interventions attenuated the magnitude of underestimation, $M_{\text{egocentric}}$ = \$1.90 vs. $M_{\text{allocentric}}$ = \$1.36, $F(1, 1431) = 32.15$, $p < .001$, and $M_{\text{low uncertainty}}$ = \$1.93 vs. $M_{\text{high uncertainty}}$ = \$1.33, $F(1, 1431) = 40.00$, $p < .001$. When using underestimation percentage as a dependent variable, results were similar. Underestimation index was higher in the egocentric condition compared to the allocentric condition, $M_{\text{egocentric}}$ = 23.0% vs. $M_{\text{allocentric}}$ = 16.4%, $F(1, 1431) = 27.59$, $t(1431) = 5.25$, $p < .001$. Underestimation index was also higher in the low uncertainty condition compared to the high uncertainty condition, $M_{\text{low uncertainty}}$ = 23.4% vs. $M_{\text{high uncertainty}}$ = 16.0%, $F(1 , 1431) = 34.73$, $t(1431) = 5.89$, $p < .001$. There was no interaction, $F(1, 1431) = 0.28$, $p = .60$.

Of note, t-tests revealed that participants in all four conditions significantly underestimated WTPs relative to actual market prices, showing once again the pervasiveness of

the underestimation (allocentric high uncertainty condition: $t(1744) = -12.05$, $p < .001$; allocentric low uncertainty condition: $t(1824) = -19.64$, $p < .001$; egocentric high uncertainty condition: $t(1779) = -18.58$, $p < .001$; egocentric low uncertainty condition: $t(1824) = -27.76$, $p < .001$).

Process measure. We found a main effect of WTP method such that individuals in the allocentric condition considered more the market prices (vs. product liking) when estimating WTP than those in the egocentric condition ($M_{\text{allocentric}} = 4.52$ vs. $M_{\text{egocentric}} = 4.09$, $F(1, 1431) = 23.82$, $p < .001$). We also found a main effect of uncertainty such that individuals in the high uncertainty condition considered market prices more (vs. product liking) than those in the low uncertainty condition ($M_{\text{high uncertainty}} = 4.51$ vs. $M_{\text{low uncertainty}} = 4.10$, $F(1, 1431) = 21.82$, $p < .001$). There was no interaction, $F(1, 1431) = 1.26$, $p = .26$.

Mediation. In addition, both main effects were mediated by consideration of market prices (vs. liking). For the allocentric WTP versus egocentric WTP contrast, indirect effect = .0391, SE = .0108, 95%CI = [.0201, .0621]. For the high vs. low uncertainty contrast, indirect effect = .0372, SE = .0104, 95%CI = [.0189, .0598].

Discussion

Study 2 uncovers two interventions that can mitigate participants' propensity to underestimate WTP. Using an allocentric WTP elicitation technique (vs. egocentric WTP elicitation) renders WTP estimates closer to market prices. This occurs at least in part because allocentric WTP estimates makes people rely more on reference prices (i.e., market prices) during the value estimation process. Similarly, increasing the uncertainty about participants' estimates (i.e., lowering their confidence by framing the task as difficult) brings WTP estimates

closer to actual market prices. This also occurs in part because uncertainty increases people's reliance on reference prices of similar products when estimating WTP.

Study 3: Incentive-compatible WTP

Study 3 (AsPredicted # 93582) has three main goals. First, we aim to test whether the underestimation of WTP also manifests when the WTP elicitation technique is incentive-compatible. Therefore, we test the effect using a version of the well-established BDM procedure (Becker, De Groot, & Marschak 1964) adapted to online surveys. It is possible that when real money is at stake, the underestimation is mitigated. Second, we test whether a novel allocentric incentivized method (AIM) yields WTP estimates that are more reflective of market prices. Third, we examine the mechanism through which people estimate WTP using a different operationalization, by measuring both product liking and perceived retail price for each of the five replicates. We thus use two separate measurements rather than using a binary scale as in the previous study.

Method

Participants and experimental design. We recruited 351 participants on Prolific. As in the previous study, only those who answered the first two attention check questions correctly were allowed to participate. Per our preregistered criteria, we removed from our dataset 13 participants who indicated a WTP more than three standard deviations away from the mean at the product level. 338 participants remained (60% female, M_{age} = 39). In this experiment, we randomly assigned participants to one of two between-participants condition (BDM procedure vs. AIM procedure). Participants estimated WTP for the same five replicates as in the previous study. We also measured product liking and perceived retail price for each replicate.

Procedure. The study started with an explanation of the WTP elicitation procedure. Participants were told that they would get five chances to earn a $15 prize. We first instructed them to spend at least one minute on the screen explaining the procedure. In the BDM condition, participants were told that we were interested in the maximum amount they were willing to bid for a product, and that they would have the opportunity to win the product or a $15 bonus. The procedure highlighted the three steps of the elicitation method, inspired by the procedure used to administer the BDM WTP in online experiments by Fuchs et al. (2015).

> 1. First, you will indicate the maximum amount you are willing to bid for the displayed product by entering an amount between $1 and $15.
> 2. Next, the computer will randomly draw a number between 1 and 15. If your bid amount is higher than this randomly drawn number, we will mail you the product and also pay you as bonus what is left of the $15 after subtracting your bid amount. If your bid amount is lower than the random number, you will receive $15 bonus but no product.
> 3. This procedure will be applied to only one lucky participant selected through a lottery.

In the AIM procedure, we told participants that we were interested in their ability to estimate customers' WTP, and that they would have the opportunity to earn a $15 bonus. The procedure detailed the three following steps:

> 1. First, you will indicate the average amount that you believe customers are willing to pay for the displayed product by entering an amount between $1 and $15.
> 2. Next, we will compute the average of the estimates from all participants. The participant whose estimate is the closest to the average of all estimates will win a $15 prize for that product.
> 3. If more than one participant is able to correctly estimate the average response, then we will select one winner using a lottery.

To make sure that all participants were able to comprehend the procedure, on the next screen we administered three comprehension checks. Participants had to respond to three True/False items pertaining to the procedure (the correct answer was "True" for all items, which allowed us to make sure that participants read true information about the procedure one more time). Participants who did not respond correctly were again shown the procedure in detail, and had to answer the comprehension questions one more time. If participants failed any of the comprehension questions for the second time, they were not allowed to participate in the study (this occurred for only two respondents).

Next, participants began the task of estimating the WTP for each of the five products in a random order. Participants indicated their answers by entering an amount between $1 and $15 in an open-ended text box. After the WTP section, participants completed the two other sections of the study, product liking and retail price. We counterbalanced whether participants completed the liking section before or after estimating the retail price of the products. (We found no order effect on any of the two process measures.) As in study 1a, for the liking measure participants had to indicate their level of agreement with three items on a seven-point scale ("I like this product," "This product is desirable," "I am likely to buy this product," from 1 = *strongly disagree*, to 7 = *strongly agree*, alpha = .90). To estimate the retail price of the products, participants entered an amount between $1 and $15 in an open-ended text box. Lastly, we collected age and gender information.

Results

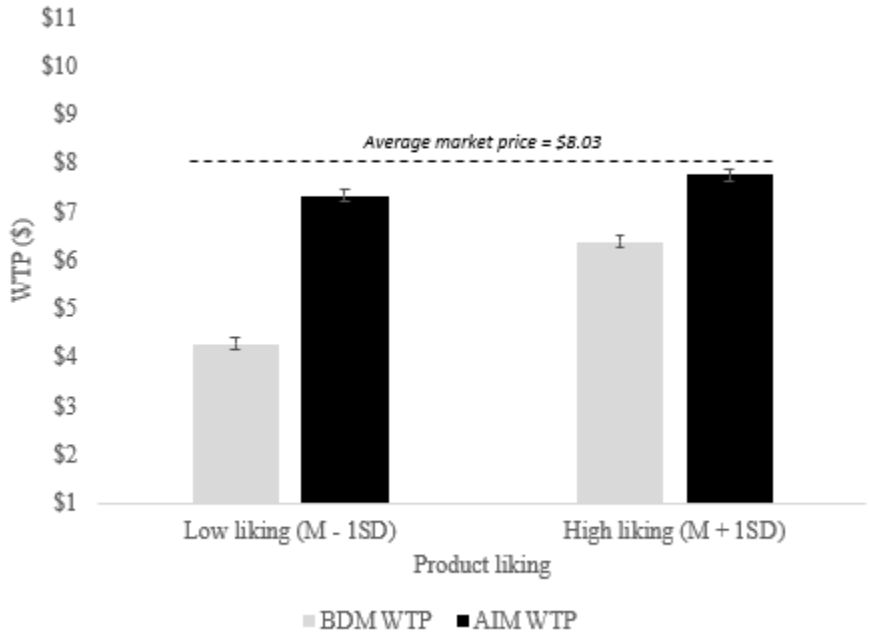
WTP underestimation. There was a main effect of WTP method such that WTPs were higher in the AIM condition (M = 7.31) than in the BDM condition (M = 4.71, $F(1, 336)$ =

118.24, η_p^2 = .26). Put differently, relative to actual market prices (taken from Amazon.com on the day of the experiment, average market price = $8.03), participants underestimated WTPs significantly more in the BDM condition (*M* = - 3.32) than in the AIM condition (*M* = - 0.71). Of note, in both conditions t-tests revealed that participants significantly underestimated WTPs compared to actual market prices, M_{AIM} = - 0.71, *t*(859) = -7.42, *p* < .001, *d* = - .25; M_{BDM} = - 3.32, *t*(859) = -23.97, *p* < .001, *d* = - .83.

Running the same model as above using underestimation percentage as dependent variable confirmed that underestimation was larger in the BDM condition compared to the AIM condition, M_{BDM} = 37.6% vs. M_{AIM} = 7.6%, *F*(1, 336) = 85.0, *t*(859) = -9.22, *p* < .001.

Process. As preregistered, we next ran a repeated measures regression using WTP as dependent variable, and both interactions of the WTP method factor with 1) liking, and 2) perceived retail price (both mean-centered) as independent variable, while controlling for product replicate. We again found a main effect such that AIM WTPs were higher than BDM WTPs, M_{AIM} = = 7.07, M_{BDM} = 4.87, *F*(1, 336) = 131.91, η_p^2 = .28. Unsurprisingly, we found a main effect of product liking, *b* = .67, *p* < .001, and a main effect of perceived retail price *b* = .33, p < .001, with both factors increasing WTPs. More interestingly, we found that both interactions were significant. The influence of product liking on WTP estimates was weaker in the AIM condition than in the BDM condition, *b* = -.53, *p* <.001. Figure 3 plots this interaction. There was also a significant interaction between WTP method and perceived retail price, such that perceived retail price influenced WTP more in the AIM condition than in the BDM condition, *b* = .47, *p* < .001.

Figure 3. WTP as a function of WTP elicitation method and product liking



Discussion

Study 3 finds that even when WTP elicitation techniques are incentive-compatible (i.e., when real money is at stake), participants systematically underestimate WTP. In addition, study 3 compared two different incentive-compatible elicitation techniques and found that the AIM procedure yields WTP estimates significantly closer to actual prices than the BDM procedure. Study 3 also provides evidence for why this occurs. In the BDM procedure, the influence of product liking on WTP estimates was stronger, suggesting that participants use preference-based heuristic more in that condition. In contrast, perceived retail price had a stronger effect in the AIM condition, suggesting that participants use reference-based heuristic more in that condition, which in turn makes WTP estimates using the AIM procedure closer to actual market prices.

General Discussion

Marketing practitioners and researchers both rely heavily on consumers' willingness to pay to make strategic managerial decisions and advance scholarly knowledge, respectively. Despite the wide use of WTP measurement, there is a lack of research on exactly how consumers make such judgment of economic valuation and whether it is reflective of market prices. In this research, we show a pervasive tendency of WTP estimates to underestimate actual prices shoppers would pay in the marketplace. Studies 1a and 1b show this underestimation across a wide range of popular and widely-distributed products, while providing evidence that the underestimation is driven by consumers' use of the preference-based heuristic in WTP estimations. Study 2 documents that increasing uncertainty and asking participants to estimate others' WTP both reduce underestimation by making consumers rely more on the reference-based heuristic. Study 3 shows that incentivized methods that increase reliance on the preference-based heuristic, such as the BDM procedure, tend to increase the magnitude of underestimation, while incentivized methods that increase reliance on the reference-based heuristic yield WTP estimates that are closer to market prices.

Theoretical implications

First, this article documents a pervasive tendency of consumers to underestimate WTP relative to market prices. This contrasts with past research that suggested that consumers' may overestimate WTP because they either lack an incentive to provide truthful estimates in hypothetical questions (Wertenbroch & Skiera 2002) or overestimate others' WTP (Frederick 2012). Our systematic investigation documents that this underestimation is robust, as it occurs for a wide range of products, but also for WTP procedures that are hypothetical and allocentric. In addition, we believe that our experiments provide conservative tests of the underestimation for

two reasons. First, our empirical focus was on low-priced products in most studies (< $12 in studies 1b, 2, and 3). Such low-priced products may be easier to evaluate, and show the smallest effect sizes compared to more expensive products (see table 1). Second, in all studies we compared WTP estimates with the lowest market prices we found on the websites of the most competitive retailers in the marketplace, namely Amazon and Walmart. As a telling example of the underestimation tendency, only 14% of our sample in study 1a was willing to pay the lowest market price for Chips Ahoy cookies, one of the most popular snack products in the U.S.

A second contribution is to advance scholarly work on how individuals assess the economic value of products (Frederick 2012; Jung et al. 2020; O'Donnell & Evers 2019; Thomas & Kyung 2019; Wertenbroch & Skiera 2002). By showing the distinct effects of preference-based and reference-based valuations, our work deepens our understanding of the psychology behind WTP estimations. Our contention that individuals rely on two main heuristics, preference-based and reference-based, could also shed new light on past findings. For instance, it has been suggested that consumers believe others are willing to pay more than they themselves are for an identical good because people fail to account for the whole distribution of experiences, especially negative ones, with the product (i.e., others are believed to have more uniformly positive experiences, Jung et al. 2020). Our findings suggest that the tendency to overestimate others' WTP relative to one's own WTP also stems at least in part from a greater reliance on the reference-based heuristic when estimating others' WTP.

Practical implications

For practitioners, our findings show the perils of relying on consumers' WTP to set the market prices for new products. The underestimation of WTP estimates means that revenue-maximizing prices may be set too low, and not too high as past research suggested (Neill et al.

1994; Wertenbroch & Skiera 2002). We have documented three interventions that can provide guidance on how to elicit WTPs in order to alleviate the tendency to underestimate WTP, and collect estimates that are more reflective of market prices: 1) targeting consumers who like the brand the most, 2) making sure that respondents are not overconfident, and 3) asking them to estimate the WTP of a customer.

Our results have implications for academic research too. By delineating two distinct heuristics in WTP estimations, we show that different elicitation procedures may be more appropriate in different contexts. For instance, if the goal of researchers is to study variations in preferences for a good as a function of behavioral interventions, it is likely that preference-based WTP estimations will be more sensitive. In particular, incentive-compatible methods such as the widely used BDM procedure can express true preferences better than self-report (Becker et al. 1964; Vickrey 1961; Wertenbroch & Skiera 2002). On the other hand, WTP elicitation procedures that encourage reliance on the reference-based heuristic can provide useful insights on product categorization. For instance, when asked how much they are willing to pay for a dinner at a local Korean restaurant, participants may estimate their WTP based on reference prices of a category of restaurants that they believe are similar, such as Asian restaurants or fancy restaurants. Hence, such WTP estimates can reveal which category the target restaurant is associated with.

Limitations and Future Research

Like all research, this work leaves some unanswered questions that open avenues for additional investigations. As mentioned above, preference-based WTP may be preferred if the researchers' goal is to test changes in preference as a function of behavioral interventions. Yet it is also plausible that the type of behavioral interventions matters, and that for some interventions

reference-based valuations may be more sensitive. For instance, psychological effects that are dependent on and/or vulnerable to changes in reference points, such as the endowment effect (Thaler 1980; Weaver & Frederick 2012) or the slider scale effect in consumer surveys (Thomas and Kyung 2019), may be better captured by reference-based elicitation techniques.

Another fruitful area for future research could be to systematically investigate factors that may moderate the propensity of consumers to underestimate WTP relative to market prices. While we have established the generalizability of our findings by sampling product replicates from a wide range of categories, it is possible that factors such as brand type (national vs. private label) or product type (hedonic vs. utilitarian) moderate the effect. For instance, it is unclear whether consumers might underestimate preference-based WTP more or less for products that are from private labels or for purely utilitarian products. On the one hand, liking for such products may be lower and therefore leads to greater underestimation. On the other hand, the affect-poor nature of such products may evoke the preference-based heuristic less and thus make consumers rely more on reference prices when estimating WTPs, thus attenuating the underestimation.

To conclude, this research documents a pervasive tendency of consumers to underestimate WTP relative to actual market prices. This has important implications for both the practice of marketing and academic research. We hope that this article will inspire researchers to further examine how people assess the economic value of products, and how it affects our interpretation of survey data.

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CHAPTER 3

Spreading Roots:
How Making Things Yourself Increases Feelings of Groundedness

Abstract

The past few years have seen a renewed interest in making things from scratch (i.e., do-it-yourself or DIY) rather than buying them premade, despite premade products' wide availability and greater convenience. Across six online, lab, and field studies using diverse product categories and populations (N = 1,757), we investigate a heretofore overlooked motivation for DIY activities: feelings of groundedness, defined here as a state of emotional rootedness. We find that individuals who make things themselves feel more grounded than participants who merely receive the same product ready-made (e.g., apple juice, Study 1). In turn, this feeling of groundedness makes people feel stronger, safer, and more stable (Study 2). Conversely, the need for groundedness acts as a critical driver of DIY engagement. Individuals with high dispositional need for groundedness engage more in DIY activities (Study 3a). Similarly, people who feel more shaken by life-disrupting events (such as the COVID-19 pandemic) experience higher need for groundedness and, in turn, engage more in DIY (Study 3b). Additionally, we show that need for groundedness is distinct from other psychological needs that may affect DIY engagement (i.e., need for competence and need for accomplishment). Lastly, Studies 4a and 4b characterize how certain premade products (i.e., artisanal products) can generate vicarious feelings of self-production and, in turn, satisfy individuals' need for groundedness. This suggests that people may still benefit from increased feelings of groundedness, even when they don't have the time or energy to engage in DIY activities. Implications for research on well-being are discussed.

Individuals commonly engage in do-it-yourself (DIY) projects. For instance, more than 60 % of homeowners started a DIY project in 2021 (The Farnsworth Group 2021), and the DIY home-improvement market has reached an estimated $538 billion in sales in the U.S. (Hardware Retailing, 2021). Yet, antecedents—along with the psychological benefits—of making things yourself are not well understood, with very little research on this topic found in the social psychology literature. DIY activities involve making, preparing, renovating, repairing, or assembling products oneself, in a non-professional capacity and often in the context of one's home (Collier & Wayment, 2018). For instance, individuals may engage in DIY activities to create a product themselves rather than buy it ready-made (e.g., food, clothes, painting), or perform an act of transformation themselves instead of hiring a professional (e.g., car repair, home maintenance, gardening).

In the present research, we document a heretofore overlooked psychological antecedent, and benefit, of engagement in DIY activities: the feeling of groundedness—or the need thereof. Groundedness refers to a feeling of emotional rootedness, derived from a sense of connectedness to one's physical (place), social (people), and/or temporal (past) environment (Eichinger et al., 2021). In other words, feeling grounded provides a sense of being firmly anchored to a strong foundation, which makes individuals less vulnerable to psychological distress.

Our main proposition is that making things yourself is a powerful means to achieve feelings of groundedness, which is an important antecedent to higher well-being and in particular feelings of safety, stability, and ability to withstand adversity. In addition, we propose that conversely, the need for groundedness encourages people to engage in DIY activities. This research introduces the construct of groundedness to the social psychology literature and delineates implications for well-being, how DIY activities may help people cope with external

threats (such as the COVID-19 pandemic), and how the need for groundedness can be satisfied without actually engaging in DIY activities.

The Need for Groundedness

The popular press frequently alludes to the need for groundedness (Asimov, 2017; Binkley, 2008; Brooks, 2018; Olmstead, 2021; Steiner, 2005; Stulberg, 2021). A recurring theme in these mentions is that individuals often feel uprooted in an increasingly fast-paced, urbanized, digitized, and globalized world. In particular, postmodern societies have witnessed social acceleration and fragmentation (Rosa, 2013), that—among other consequences—has generated a proliferation of convenience goods in the marketplace (Wu, 2018). In turn, people feel more and more disconnected from the production process of the goods they consume and use on a daily basis, with little knowledge of the origin and transformation of these goods (van Osselaer et al., 2020). Thus, the ecosystem in which individuals live often leaves them feeling uprooted—or does little to help them feel grounded.

Against these structural forces of digitization, urbanization, globalization and social acceleration, we propose that individuals experience an increased need for groundedness that manifests in a number of decisions and behaviors. Several recent trends can be understood through the lens of this increased need for groundedness, such as the increase in meditation practice (Cramer et al., 2016; Hafenbrack et al., 2021), or the demand for craft beers, local food, and handcrafted products (Eichinger et al., 2021; Fuchs et al. 2015). However, the need for groundedness has largely been overlooked in the social psychology literature. It has only been touched upon disparately in various other disciplines in the past, and mostly referred to as a need to feel "rooted." For instance, academics alluded to the notion of groundedness by evoking a fundamental human drive to feel "rooted" in the fields of education psychology (McAndrew,

1998), philosophy (Fromm, 1976; Steiner, 2005; Weil, 1952), psychotherapy (Ndi, 2014), and consumer culture theory (Thompson & Coskuner-Balli, 2007). For instance, Weil argued that "to be rooted is perhaps the most important and least recognized need of the human soul" (1952, p. 40). Yet these works were mostly limited to the need to feel attached to a place—eschewing the other two important facets of groundedness, namely, feeling connected to people and the past.

Similarly, psychologists have studied the need for social connectedness separately by examining humans' need to belong (Baumeister & Leary, 1995), their need for social affiliation (O'Connor & Rosenblood, 1996), or need for intimacy (Reis 1990; Wheeler et al., 1983). Works on connectedness with the past have mostly focused on past-self continuity and nostalgia (e.g., Davis, 1979; Iyer & Jetten, 2011; Schanbacher et al., 2021). Building on these past works, Eichinger et al. (2021) recently examined, defined, and empirically investigated the need for groundedness in the context of ready-made product consumption, and established the distinctiveness of the need for groundedness vis-à-vis related constructs such as the need for self-authenticity, belonging, self-identity, and meaning in life. Eichinger et al. (2021) showed further evidence that the need for groundedness may be higher in environments with high levels of urbanization and digitization: the need for groundedness is particularly pervasive among individuals who live in big cities (vs. rural areas), and more prevalent among individuals with desktop jobs ("work of the head") than those doing manual labor ("work of the hands").

The Feeling of Groundedness

Eichinger et al. (2021) defined groundedness as a feeling of emotional rootedness. Groundedness is derived from a feeling of deep metaphorical connectedness to one's physical, social, and/or historic environment. These three dimensions (physical, social, historical) parallel that of the French notion of terroir—a word that "refers to the land including its human capital

and cultural history" (Rozin & Wolf, 2008, p.325), or in other words, to land, community, and traditions. For instance, one may feel grounded when spending time in one's home town for Christmas, meeting with old friends, shopping at a local farmer's market, or picking fruits from one's backyard. Eichinger et al. (2021) showed that consumption episodes evoking any of the three dimensions—connection to past, place, and/or people—can trigger elevated feelings of groundedness.

Why, then, is the feeling of groundedness important? Feelings of groundedness can help increase subjective well-being, and make individuals more resilient against the hardships of life. Feeling grounded entails feeling securely anchored, with a strong foundation that acts as a buffer against adverse events and begets the feeling that nothing can "stir one up" (Eichinger et al., 2021). As Stulberg (2021, p. 13) puts it in his popular press book, "Groundedness is unwavering internal strength and self-confidence that sustains you through ups and downs. It is a deep reservoir of integrity and fortitude, of wholeness, out of which lasting performance, well-being, and fulfillment emerge." Metaphorically, grounded individuals are like trees tethered to the ground by a deep network of interconnected roots. Storms may shake the upper branches, but the trunk and roots hold firm and strong.

Do-It-Yourself

Research on the psychological antecedents and benefits of engaging in DIY is surprisingly scarce in the field of social psychology—especially given the wide adoption of DIY activities by individuals. A small number of studies have attempted to uncover the psychological benefits of DIY, but to the best of our knowledge none of them employed randomized controlled experiments. Most relevant to the current research is the study on happiness by Collier & Wayment (2018), who asked a sample of college students what type of DIY activities they

engage in and their self-perceived reasons for doing so. Collier & Wayment (2018) reported that mood repair, social connection, and enjoying the process of making something are the most common reasons cited, and the authors provided initial support for the positive association between holding a DIY identity and subjective well-being. In a similar vein, research in psychiatry found that engagement in DIY was one of several factors associated with reduced odds of depression (Choi et al. 2020).

Relatedly, a few papers in the consumer psychology literature have used randomized control experiments to start delineating some of the psychological implications of DIY, showing that making things yourself entails increased product valuation (vs. equivalent ready-made options) and implicates feelings of competence and accomplishment (Franke et al., 2010; Mochon et al., 2012; Norton et al., 2012). Other fields have examined the implications of doing things yourself, but mostly with regards to very specific outcomes; for instance, nutrition research has suggested that cooking from scratch is associated with better diet quality (Wolfson & Bleich, 2015). To summarize, research on the psychological tenets of DIY engagement suggests potential benefits for well-being, but empirical investigations are lacking. In this research, we document a previously overlooked psychological benefit, and antecedent, of DIY engagement: the feeling of groundedness, or the need thereof.

Do-It-Yourself Increases Feelings of Groundedness

In this paper, we argue that making things yourself provides a powerful means to achieve feelings of groundedness. Consider the example of someone baking an apple pie according to an old family recipe. We view this as an illustration of how DIY can make individuals feel grounded—more so than buying a ready-made apple pie. Observations from consumer culture theory lend credence to this association between DIY and groundedness. Wallendorf and

Arnould (1991, p. 27) described how the expression "making something from scratch" etymologically refers to "scratching the soil to plant a seed to grow food that is then transformed into edible dishes at home," suggesting a metaphorical connection between making things from scratch and soil or ground ("terroir"). Making things oneself indeed entails physically interacting with, transforming, and shaping things in one's environment. By doing so, we connect with the elements around us and metaphorically spread our roots by transforming these elements. Arnould and Price (2000, p. 150) also described how individuals engage in the transformation of commodities to combat "deterritorialization," thereby restoring a sense of community and tradition.

In addition, DIY activities carry strong associations with know-how and old methods inherited from our ancestors—in other words, how things used to be done. Collier (2011) conducted a survey among women textile handcrafters and asked them their reasons for making textiles. Among other motivations, they mentioned a sense of continuity with the past. Collier also performed a factor analysis on motivations and labeled one factor "feeling grounded."

Fromm (1976) stressed the importance of product transformation for the self and the human species, stating that "our civilization began when the human race started taking control of nature." Likewise, Wrangham (2009) suggested that our ability to transform raw materials is a defining feature of who we are as human beings. Specifically, Wrangham argued that cooking is the most important skill differentiating humans from animals, because cooking makes diets more efficient and generates free time for the emergence of culture and civilization. However, Fromm (1976) argued that the process of transforming our environment to our benefit has gone too far. That is, the quest for efficiency, rationalization, and task fragmentation in the transformation process of most consumable goods leaves people uprooted and disconnected from the process of

product creation (see also van Osselaer et al. 2020). Thus, there is evidence suggesting that making things yourself (rather than merely buying or receiving the same products) might be related to the need for groundedness.

Need for Groundedness Triggers DIY Engagement

Our conceptualization proposes that feelings of groundedness are not solely the result of DIY engagement. To the extent that groundedness is an important psychological need, motivational forces may lead individuals to seek ways to satisfy that need—especially when that need is high or frustrated. Two testable hypotheses follow. On the one hand, individual differences in need for groundedness should be predictive of individuals' frequency of engagement in DIY activities. On the other hand, life-disrupting events that shake people's foundations should increase their need for groundedness, which in turn increases DIY engagement. This proposition is consistent with research showing that major life events can threaten one's identity (Pearlin, 1989; Lucas, 2007), which may lead to coping and behavioral adjustments to restore stability (Lazarus & Folkman, 1984). Recent research (Shamblaw et al., 2021) along with anecdotal evidence suggest that the COVID-19 pandemic could be one such major event. For instance, during the COVID-19 stay-at-home orders, with social isolation (Hamza et al., 2021) presumably frustrating their need for groundedness, large numbers of individuals engaged in DIY activities. Product categories featuring components for DIY products recorded faster sales growth than ready-made, more convenient options (Abdul, 2020). For instance, flour, refrigerated dough, yeast, and baking mixes all saw a 36% to 55% growth in sales in 2020, well above the average 19% growth for packaged goods (Redman 2021). The same pattern emerged for DIY meal kits, gardening, and home-remodeling projects (Acosta, 2021; Hardware Retailing, 2021). To confirm these trends, we looked at daily Google search volumes

for the terms "social distancing" and "DIY" in the USA from March 1 to May 1 in 2020, the period during which stay-at-home orders were implemented.[8] We found a significant correlation between daily search volumes for social distancing and DIY (r =.33, p =.008), social distancing and cooking (r = .39, p = .002), and social distancing and gardening (r = .26, p =.038). Therefore, we predict that those who felt more threatened by the pandemic will have the largest increase in need for groundedness, with a subsequent increase in DIY engagement.

Artisanal Products as a Shortcut to Groundedness

People may not always engage in DIY activities, despite the emotional benefits of doing so. This is because of possible barriers to DIY engagement such as time, effort, or necessary skills. This begets the question: are there any shortcuts to obtaining feelings of groundedness that do not require actual DIY engagement? We posit that the emergence of feelings of self-production is not completely contingent on actually making a product. Instead, we argue that products are capable of evoking vicarious feelings of self-production. That is, individuals may feel that they could have made the product themselves, or that the product was made following a process resembling methods they themselves may use at home. Vicariously experiencing feelings and emotions is common in human psychology (e.g., Brummelman et al., 2013; Cialdini et al., 1997). This process of treating ready-made products like self-made ones may occur through Rozin and Nemeroff's (1990) second law of sympathetic magic—that is, the law of similarity—which holds that "things that resemble one another share fundamental properties." Artisanal products may resemble self-made products in their composition, aspect, and production process. First, artisanal products often use simple ingredients that are the same as, or similar to, the ones

[8] For a similar procedure, see Hoffarth et al. (2018), and Murray et al. (2021)

used when making products at home. Second, they often look like self-made products—sharing some of the same imperfections, shapes, and colors found in home-made products. Third, the smaller scale of production and related techniques also bear some similarities with DIY practices. Thus, consuming artisanal products may feel as if one made the product oneself.

Consistent with this rationale, past qualitative research has provided observations that might be taken to suggest that purchased goods can psychologically act like self-made goods. Cronin et al. (2014) described how "hipsters" who generally strive to cook from scratch often replace home-made products with ready-made organic or artisanal foods. The authors noted that "in the hipster logic, a meal can be considered home-made as long as it is not a ready-made convenience product sold under such commodifying logic" (p. 16). Similarly, Ulver-Sneistrup et al. (2011) depicted how individuals explicitly treat "craft" food as a substitute for home-made food. Thus, some product categories appear better positioned to create feelings of groundedness. Accordingly, we believe that artisanal products vicariously enhance feelings of self-production compared to industrial products—even when no actual self-production is required. This in turn should increase feelings of groundedness. Artisanal products therefore likely fall between self-made products and industrial products in their ability to beget feelings of groundedness, at least in part because artisanal products generate vicarious feelings of self-production.

Current Research

In the following section we present six studies using a variety of samples across two continents. In the first experiment, we provide evidence for our basic effect by showing that participants who made apple juice themselves reported higher feelings of groundedness compared to participants who did not. Study 2 shows that individuals who engage in DIY activities feel stronger, safer, and more stable, and that this effect is mediated by feelings of

groundedness. Next, we report two studies showing the reverse association. Study 3a demonstrates that higher levels of need for groundedness are associated with more frequent DIY engagement. Using a representative panel, Study 3b shows that individuals who felt more threatened by the COVID-19 pandemic during Spring 2020 engaged more heavily in DIY activities, and that this effect is mediated by an elevated need for groundedness. The last two studies show how ready-made products can provide a shortcut to groundedness by generating vicarious feelings of self-production. Study 4a shows that artisanal products increase feelings of groundedness compared to industrially-made products, but less so than self-made products. We further demonstrate that this increase in feelings of groundedness is mediated by vicarious feelings of self-production. Study 4b replicates this result using another product category in a field setting among a sample of museum visitors, while accounting for alternative explanations. We report all measures, manipulations, and exclusions. Data and R code scripts are publicly available on the Open Science Framework (https://bit.ly/3hLmoeO). The study designs and analyses were not preregistered unless otherwise indicated.

In several of our studies, we examine our proposed mechanism (along with potential alternative explanations) through mediation (Studies 3b and 4b). In these cases, our analysis entails testing whether our independent variable significantly affects our proposed mediator, as well as potential alternative mediators. If we find a significant effect of the independent variable on a rival mediator in the expected direction, we consider it concurrently in the mediation analysis (i.e., parallel mediation) to test whether our proposed mediation still holds when accounting for the alternative explanation. If the independent variable significantly predicts multiple alternative mediators, we also run a concurrent parallel mediation with said mediators.

Our findings prove robust across a variety of populations. Study 1 was conducted among a population of students at a US university. Studies 2 and 4a involved students at a European university. Study 3a was conducted online, among a sample of Americans (MTurk). Study 3b used an online panel that was nationally representative of the population in a European country. Study 4b was conducted in the field, at a museum in a large European city.

Sample sizes were determined in advance, and data were analyzed only after data collection was complete. For the laboratory experiments at US and European universities (experiments 1, 2, and 4a), we sought to collect data from at least 80 participants per cell. We planned data collection over a fixed number of days, and recruited as many participants as possible over that period to reach our minimum threshold. No upper limit was set. Study 3a was correlational, and aimed to recruit 250 online participants on Mturk. Study 3b was part of a broader project on individuals' responses to the COVID-19 pandemic, and recruited more than 500 individuals in a European country. Study 4b was conducted as part of a temporary lab in a museum, and recruited as many respondents as possible during a given period.

Study 1: Groundedness from Making Apple Juice

In our initial preregistered experiment, we tested our main proposition that self-production increases feelings of groundedness. To this end, we randomly assigned half of our participants to make apple juice, while the other half did not make apple juice. The preregistration is available at aspredicted.org/AIQ_GQZ.

Method

Participants and experimental design. As preregistered, we decided to run the experiment in the lab at a large US university over a period of six days, and to recruit as many participants as

possible over that period. We enlisted 293 participants (74% female, M_{age} = 23), who participated in exchange for a $5 compensation. Participants were randomly assigned to one of two conditions (DIY vs. control).

Procedure. Participants were recruited via the participant pool of the university's lab for a 15-minute apple juice tasting study. Upon arrival, all participants were asked to wash their hands before starting the experiment. To avoid any experimental demand effects, the two conditions were not run simultaneously; instead, we rotated the experimental condition every other session (sessions started every 25 minutes) or every two sessions—to make sure there was enough apple juice for those in the control condition. In the DIY condition, participants were directed to a room and seated in front of an individual apple juicer and instruction sheet. They were asked to read the instructions for making apple juice. The procedure involved cutting and juicing apples. Participants were then asked to divide the resultant apple juice into two disposable cups. Next, they moved to a second room where they were seated at a computer in an isolated cubicle to complete our survey with a cup of the apple juice they made. In the control condition, participants were directly seated in isolated cubicles and provided with a cup of apple juice that had been freshly made by a participant in the other condition. Note that this design allowed us to control for the quality of the apple juice. Participants in both conditions were told that the apples came from a local orchard. Once seated in front of the computer in individual cubicles, all participants were asked to take a moment to taste the juice and then start the survey when ready. We collected our dependent variable (feelings of groundedness) via a three-item scale (Eichinger et al. 2021). The scale asked participants to indicate their level of agreement with two verbal statements (*I feel deep-rooted; I feel well-grounded*), as well as a pictorial representation of a human form with branches for arms and a deep and wide root system instead of legs (*How well*

does the following picture describe your feelings at this moment?, see Appendix, α = .88). All items used a seven-point scale from *1 = does not describe my feelings at all* to *7 = describes my feelings very well*. Lastly, age and gender information were collected for sample description.

Results

As preregistered, we conducted an ANOVA with feelings of groundedness as dependent variable and experimental condition as independent variable. We found a main effect of DIY engagement on feelings of groundedness ($F_{(1,291)}$ = 10.38, p = .001, η_p^2 = .034), such that participants felt significantly more grounded in the DIY condition than in the control condition (M_{DIY} = 4.74, $M_{Control}$ = 4.25).

Discussion

Study 1 establishes the basic effect of engaging in DIY on feelings of groundedness. Participants who made apple juice themselves reported higher feelings of groundedness than those who did not make the juice.

Study 2: Self-Production, Groundedness, and Well-Being

Study 2 uses a recall paradigm to examine an important downstream consequence of DIY engagement and increased feelings of groundedness. We posit that engaging in DIY makes individuals feel stronger, safer, and more stable, and that this effect is mediated by increased feelings of groundedness.

Method

Participants and experimental design. 169 students from a large European university participated in exchange for course credit (48% female, M_{age} = 22). This experiment had a two-cell between-participants design (recall: DIY vs. buy ready-made).

Procedure. Participants were asked to recall a time when they decided to either make something themselves instead of buying it ready-made (DIY condition), or buy something ready-made rather than making it themselves. In particular, participants in the DIY condition [ready-made condition] read:

> Please think about a time when you had to decide whether to make, prepare, or grow something yourself or buy an equivalent item ready-made, and you eventually **decided to do it yourself [decided to buy it ready-made].**

Next, participants were given six examples of such situations (e.g., *buying food ready-made at a store/take-out restaurant or preparing the same food yourself, buying furniture ready-made at a store or making it from scratch, etc.*), and asked to write about their personal experience. In particular, they read:

> Please take a few minutes to think about it, and write a few sentences describing the process of **doing it yourself [buying it ready-made]**. How did it happen? How did **doing it yourself [buying it ready-made]** make you feel? Please also describe how you felt while consuming or using the product.

Then, participants were asked to indicate how strong, safe, and stable they felt in that situation by indicating their agreement with five items (*I had a strong feeling of basic trust and confidence; I felt truly safe; I experienced a feeling of inner strength; I felt truly*

stable; I felt that nothing could stir me up; Eichinger et al. 2021, α = .87) on a seven-point scale (*1 = strongly disagree, 7 = strongly agree*). Next, participants were given our definition of groundedness, and subsequently indicated how grounded they felt in said situation by responding to the same three items as in the previous study (α = .82). Lastly, age and gender were captured and participants were debriefed.

Results

Discriminant validity. We conducted a confirmatory factor analysis to assess discriminant validity between feelings of groundedness and feelings of strength, safety, and stability, following Fornell and Larcker's (1981) procedure. Results indicate that the constructs are empirically distinct. We used the same procedure to assess discriminant validity between constructs in Study 3a.

Strength, Safety, Stability. An ANOVA with experimental condition as independent variable revealed a main effect of DIY, $F_{(1,167)} = 52.50$, $p < .001$, $\eta_p^2 = .239$, such that participants felt stronger, safer, and more stable in the DIY condition than in the ready-made condition ($M_{\text{DIY}} = 5.15$, $M_{\text{Ready-made}} = 3.75$).

Groundedness. A similar ANOVA with feelings of groundedness as dependent variable revealed a significant effect of DIY engagement, $F_{(1,167)} = 51.90$, $p < .001$, $\eta_p^2 = .237$, such that participants reported higher feelings of groundedness in the DIY condition than in the ready-made condition ($M_{\text{DIY}} = 4.50$, $M_{\text{Ready-made}} = 3.09$).

Mediation. We ran a mediation analysis (model 4, Hayes 2018) that revealed a significant indirect effect of engaging in DIY (vs. buying ready-made) on feelings of

strength, safety, and stability through feelings of groundedness, *indirect effect* = .3372, *SE* = .0798, $CI_{95\%}$ [.1975, .5094].

Discussion

Study 2 replicates the results from Study 1 using a recall paradigm, and further documents an important downstream consequence of engaging in DIY for well-being. In particular, engaging in DIY makes individuals feel stronger, safer, and more stable compared to purchasing a similar ready-made product, and this effect is mediated by elevated feelings of groundedness.

Studies 3a-3b: Need for Groundedness Predicts DIY Engagement

Studies 3a and 3b have three goals. First, building on the results from the previous two studies, we test whether the reverse pattern also occurs: that is, whether higher need for groundedness is associated with greater engagement in DIY activities. We demonstrate that the link between groundedness and DIY is bidirectional. Second, we test whether need for groundedness is associated with greater engagement in DIY activities when need for groundedness is measured as a trait (Study 3a), and also when life-disrupting events (such as the COVID-19 pandemic) increase need for groundedness (Study 3b). Third, we test whether the need for groundedness is conceptually distinct from other potential antecedents of DIY engagement, namely need for competence and need for accomplishment (Franke et al. 2010; Mochon et al. 2012; Norton et al. 2012).

Study 3a: Dispositional Need for Groundedness

Method

Participants and experimental design. 253 participants located in the United States were recruited from Amazon Mturk (45% female, M_{age} = 38). Each participant responded to all scales: need for groundedness, DIY engagement, need for competence, and need for accomplishment.

Procedure. Participants were instructed that we were interested in their day-to-day feelings and activities. They first read a definition of feelings of groundedness, and then completed a need for groundedness scale. The three scale items were adapted from Study 1 to capture need for groundedness as a trait. The scale included two verbal items *(I generally have a strong need to feel deep-rooted; I generally have a strong need to feel well-grounded,* from *1- does not describe my feelings at all* to *7- describes my feelings very well*), and a pictorial item (*How well does the following picture describe how you generally want to feel?,* from *1- I do not want to feel that way at all* to *7- I very much want to feel that way,* α = .80). Next, participants moved to the second scale where we asked them how often they engaged in five distinct types of DIY activities (cooking, gardening, crafting, repairing, decorating; from *1- never* to *7- very often*). We provided examples of activities within each category. We formed an index of DIY engagement by combining these five items (α = .72). Participants then responded to items related to the two alternative needs, namely, need for competence (four items, *In general, how strong is your need to feel: talented/competent/smart/intelligent,* from *1- not strong at all* to *9- very strong,* α = .84), and need for accomplishment (two items, *In general, how strong is your need to: feel proud of yourself/accomplish something,* from *1- not strong at all* to *9- very strong,* α = .83). Items were adapted from Kaiser et al. (2017). Lastly, age and gender were captured.

Results

DIY engagement and need for groundedness. We regressed the DIY engagement index on dispositional need for groundedness. This analysis revealed that dispositional need for groundedness significantly predicted the frequency of engagement in DIY activities, b =.22, $t(251) = 4.13$, $p < .001$, $\eta_p^2 = .064$.

DIY engagement and alternative needs. We ran two linear regressions of DIY engagement on need for competence and need for accomplishment, respectively. Neither need for competence, $b = .08$, $t(251) = 1.39$, $p = .17$, $\eta_p^2 = .008$, nor need for accomplishment, $b = .08$, $t(251) = 1.66$, $p = .099$, $\eta_p^2 = .011$, significantly predicted frequency of DIY engagement. In addition, we ran two linear regressions of DIY engagement on dispositional need for groundedness while controlling for each of these rival needs; the predictive effect of need for groundedness on DIY engagement remained robust when controlling for one's need for competence ($b = .21$, $t(250) = 3.94$, $p < .001$) or need for accomplishment, respectively ($b = .21$, $t(250) = 3.78$, $p < .001$; the effects of the rival needs were insignificant, and controlling for both need for competence and need for accomplishment concurrently yields similar results).

Discussion

Study 3a shows that dispositional need for groundedness significantly predicts frequency of DIY engagement. We further show that need for groundedness is distinct from need for competence as well as need for accomplishment, two potential drivers of DIY engagement.

Study 3b: Covid-19 Threat and Need for Groundedness

Method

Participants and experimental design. 522 participants from a nationally representative panel in a European country participated in a two-stage experiment, in exchange for ten panel points worth ten euros (51% female, M_{age} = 48). This study was part of a larger project examining the impact of the COVID-19 pandemic on individuals in Spring 2020 (i.e., during the country's first national lock-down). At stage 1, we collected participants' perceived threat from the COVID-19 pandemic (our independent variable). Two weeks later (stage 2), we collected participants' engagement in DIY over the interim (our dependent variable), and our process measures.[9]

Procedure. At stage 1, participants were told that we were interested in their perception of the COVID-19 pandemic. Our portion of the survey came at the beginning of the study. We collected people's perceived threat from the COVID-19 pandemic by asking them to indicate their agreement with three items: *I feel that COVID-19 presents a threat to all of us*, *I feel worried about the current COVID-19 situation, I think that the COVID-19 crisis is exaggerated* (reversed). Responses were collected on a five-point scale (from *1 = strongly disagree*, to *5 = strongly agree*, α = .79). A fourth attention check item was added (*As a little attention check, please select 'strongly agree'*). Participants then responded to unrelated surveys, and age and gender were captured.

[9] 696 participants were initially targeted at stage 1. 612 passed the attention check included in the survey, and among these, 583 fully completed the survey at time 1 and were invited to participate in stage 2. Of these, 522 completed the survey.

The second part of the study was launched two weeks later. Our study came after a series of unrelated surveys. It started by asking participants how often they took part in DIY activities over the past few weeks with a single item (from *1 = not at all* to *7 = very often*). Next, participants responded to our need for groundedness scale. Participants were given the definition of groundedness, and then responded to three items adapted from the previous studies to measure situational need for groundedness. The scale had two verbal statements (*In the past few weeks, I somehow experienced the need to feel deep-rooted*; *… I wanted to feel well-grounded*, measured from *1 = strongly disagree* to *7 = strongly agree*), and our pictorial item (*To what extent does the following picture describe how you wanted to feel in the past few weeks?*) anchored on *1 = does not describe how I wanted to feel at all*, and *7 = describes very well how I wanted to feel* (α = .81). Next, we asked participants the extent to which they experienced other needs during the past weeks. First, we asked about need for competence with four items (*How strong was your need to feel: smart/competent/talented/intelligent*, α = .84), and need for accomplishment with two items (*How strong was your need to: feel proud of yourself/accomplish something*, α = .90), both from *1 = not strong at all* to *7 = very strong*. Second, we asked about two additional factors that could affect DIY engagement: amount of time spent at home (*I've spent a lot more time at home than usual in the past few weeks*), and the desire to save money (*It has been particularly important for me in the past few weeks not to spend as much money as usual*), both from *1 = does not apply to me at all* to *7 = completely applies to me*. Finally, age and gender were again captured. This study was conducted in participants' native language (German).

Results

DIY engagement. We ran a regression predicting DIY engagement with perceived threat from COVID-19. We found a significant effect of perceived threat on DIY engagement, such

that higher perceived threat from the COVID-19 pandemic predicted increased DIY engagement, $b = .14$, $t(520) = 1.99$, $p = .047$, $\eta_p^2 = .008$.

Need for Groundedness. A regression predicting need for groundedness with perceived threat from COVID-19 similarly revealed that higher perceived threat predicted increased need for groundedness, $b = .30$, $t(520) = 5.16$, $p < .001$, $\eta_p^2 = .049$.

Mediation. We ran a mediation model (model 4, Hayes 2018) to test whether need for groundedness mediated the effect of perceived COVID-19 threat on DIY engagement. We found a significant indirect effect of perceived threat on DIY engagement through need for groundedness, *indirect effect* = .0650, *SE* = .0220, $CI_{95\%}$ [.0262, .1124]. Moreover, when accounting for the indirect effect, the direct effect of perceived threat on DIY engagement became non-significant, $b = .07$, $t(519) = 1.04$, $p = .30$.

Alternative accounts. We ran a series of regressions using perceived threat as independent variable, along with the following dependent variables: need for competence, need for accomplishment, time spent at home, and desire to save money. Perceived threat predicted all variables: need for competence, $b = .18$, $t(520) = 3.46$, $p < .001$, $\eta_p^2 = .023$, need for accomplishment, $b = .21$, $t(520) = 3.43$, $p < .001$, $\eta_p^2 = .022$, time spent at home, $b = .43$, $t(520) = 5.59$, $p < .001$, $\eta_p^2 = .057$, and desire to save money, $b = .39$, $t(520) = 3.87$, $p < .001$, $\eta_p^2 = .028$. Therefore, we ran mediation models entering the alternative accounts one by one, as rival mediators to need for groundedness. The indirect effect of perceived threat from COVID-19 on DIY engagement via need for groundedness remained significant in all these analyses. In addition, we found no indirect effect through any of the alternative measures, except need for accomplishment. That is, when entering both need for groundedness and need for accomplishment as parallel mediators, we found an indirect effect through need for

groundedness, *indirect effect* = .0441, *SE* = . 0197, $CI_{95\%}$ [.0085, . 0865], as well as an indirect effect through need for accomplishment, *indirect effect* = .0447, *SE* = .0198, $CI_{95\%}$ [.0128, .0892]. We found the same two significant indirect effects when entering all five alternative accounts in the mediation model simultaneously.

Discussion

In Study 3b, we provide evidence that life-disrupting events that increase need for groundedness, such as the COVID-19 pandemic, significantly increase DIY engagement. Importantly, we demonstrate this association in a study where engagement in DIY activities and need for groundedness were collected two weeks after participants' perception of the COVID-19 pandemic. Additionally, we show that the effect occurs through need for groundedness, while controlling for a number of alternative explanations.

Intermediate Summary

In Studies 1 and 2, we provided evidence that making things yourself increases feelings of groundedness compared to receiving or buying a similar ready-made product, and that this in turn increases feelings of strength, safety, and stability. Studies 3a and 3b showed that both higher dispositional need for groundedness and higher situational need for groundedness predict increased DIY engagement, suggesting that the association between DIY and groundedness is bidirectional. In the subsequent studies (4a and 4b), we aim to show implications of our findings for individuals who may not have the time, skill, or motivation to make things themselves. To this end, we introduce more nuance to the contrast between self-made and ready-made products. That is, rather than just contrasting self-made products with ready-made ones, we compare self-made goods with two distinct types of ready-made products, namely industrial versus artisanal

products. We contend that one of the key differences behind this distinction is that pursuant to the law of similarity (Rozin & Nemeroff 1990), artisanal products beget vicarious feelings of self-production. In turn, we hypothesize that artisanal products will increase feelings of groundedness compared to industrial products, but less so than self-made goods, and that this effect is mediated by increased feelings of self-production.

Study 4a: The Soap Study

Study 4 employs a three-cell design. In two conditions, participants inspected an industrial versus artisanal bar of soap. In a third condition, participants considered having made the bar of soap themselves.

Method

Participants and experimental design. 251 participants from a large European university participated in this lab experiment in return for course credit or monetary compensation (M_{age} = 23, 73% female). This experiment had a three-cell between-participants design.

Procedure. Participants in all conditions were asked to inspect a real bar of soap, provided to them at their desk. Participants in the first condition were exposed to an industrial product, whereas participants in the second condition were exposed to an artisanal product. Participants in both these conditions were asked to imagine having just purchased the product. Conversely, participants in the third condition were asked to imagine having just made the bar of soap themselves (as an example, they were either shown the industrial or the artisanal soap).[10] After inspecting the product, participants completed our survey. Feelings of groundedness were

[10] Participants in the DIY condition did not significantly differ in their feelings of self-production as a function of which type of soap they had been exposed to as an illustration ($M_{Artisanal}$= 4.91 versus $M_{Industrial}$ = 5.19, $F_{(1,92)}$ = .670; p = .415), showing that all participants in that condition were involved in the task which was to imagine making soap themselves rather than to buy the depicted soap.

measured using an expanded scale composed of six items that included the same pictorial item as in the previous studies, and the following five statements (all were translated to German, α = .91): *I feel deep-rooted and entrenched; I feel connected to my environment; I can firmly feel my feet on the ground; I feel close to the things, nature, and people that surround me; I have a sense of belonging.* Feelings of self-production were captured with three items (α = .97): *When I think about the soap, I have a bit of the feeling that "I made it myself"; In a certain way it almost feels as if I were the producer of the soap; I have a bit of the feeling that I have been "involved" or "present" during production.* Both scales were measured from *1 = does not describe my feelings at all* to *7 = describes my feelings very well*. We further added a manipulation check item showing that the artisanal soap was indeed perceived as more artisanal than the industrial soap ($M_{\text{Artisanal}}$ = 4.33, $M_{\text{Industrial}}$ = 2.09, $F_{(1, 249)}$= 111.40, p < .001). Lastly, age and gender were captured.[11]

Results

Feelings of groundedness. An ANOVA with groundedness as dependent variable and experimental condition as independent variable revealed a significant treatment effect ($F_{(2,248)}$ = 21.30, p < .001, η_p^2 = .147). Contrast analyses first revealed that participants in the artisanal soap purchase condition reported significantly higher feelings of groundedness compared to those in the industrial soap purchase condition ($M_{\text{Artisanal}}$ = 4.32, $M_{\text{Industrial}}$ = 3.35, t(248) = 4.30, p < .001). As expected, participants in the third condition, who considered having made the soap

[11] We also measured participants' general experience with self-production with two items: *I often make things myself that I could also buy ready-made, such as food or crafts; It is important to me that I make things myself that I could also buy (example: making jam, planting herbs, knitting hats,…)* (*1 = not true for me at all* and *7 = very true for me*; r = .71). An ANOVA on this measure confirmed that participants across conditions did not vary significantly in terms of general DIY experience ($F_{(2, 248)}$ = 2.37, p = .095, M_{DIY} = 4.68, $M_{\text{Artisanal}}$ = 4.38, $M_{\text{Industrial}}$ = 4.07).

themselves, reported even more pronounced feelings of groundedness compared to those in the artisanal condition (M_{DIY} = 4.77, $t(248) = 2.10$, $p = .037$).

Feelings of self-production. An ANOVA with feelings of self-production as dependent variable similarly produced a significant treatment effect ($F_{(2,248)} = 106.71$, $p < .001$, $\eta_p^2 = .463$). Specifically, we found that participants in the artisanal (vs. industrial) soap condition reported significantly higher feelings of self-production ($M_{Artisanal} = 2.92$, $M_{Industrial} = 1.63$, $t(248) = 5.26$, $p < .001$). As expected, we also found that participants in the DIY condition reported even more pronounced feelings of self-production compared to those in the artisanal condition ($M_{DIY} = 5.05$, $t(248) = 9.17$, $p < .001$). In addition, we found that the effect of DIY on groundedness was mediated by feelings of self-production for both the artisanal versus industrial comparison, *indirect effect* = .6391, *SE* = .1381, $CI_{95\%}$ [.3803, .9284], and the DIY versus artisanal comparison, *indirect effect* = .7099, *SE* = .1594, $CI_{95\%}$ [.4205, 1.0403].

Discussion

Study 4a shows that artisanal products elicit stronger vicarious feelings of self-production than industrial products, which in turn increases feelings of groundedness—but less so than self-made products. Remarkably, feelings of self-production were significantly higher in the artisanal condition than the industrial condition, despite participants not being involved in the actual production process (i.e., one could expect participants to choose the lowest score possible on the scale in both conditions).

Study 4b: The Museum Field Study

Study 4b has three main purposes. First, we conceptually replicate the previous study in a field setting, with another sample in yet another product domain (i.e., birthday cards). Second, we again test mediation of our effect through vicarious feelings of self-production and measure

several alternative explanations. Third, we measure mood to examine whether engaging in DIY increases mood, and whether feelings of groundedness can explain said association between DIY and mood.

Method

Participants and experimental design. Study 4b was conducted at a large museum in a major European city. As part of an exhibition, we hosted a "live lab," where museum visitors were invited to take part in studies about "The Human Dimension of Production." A total of 281 museum visitors took part in the study. Due to concerns about informed consent, we decided up-front not to use any data from participants aged 16 or younger. We therefore excluded 12 under-age participants, for a final sample of 269 museum visitors (M_{age} = 35, 69 % female). We again used a between-participants design with three conditions. Two conditions exposed participants to either industrial or artisanal birthday cards. In the third condition, participants were asked to make birthday cards themselves. Conditions were carefully randomized across different time slots each day.

Procedure. We randomly assigned participants to one of three conditions. Participants were instructed to either (1) inspect a set of industrially-produced birthday cards, (2) inspect a set of artisanal birthday cards, or (3) make a birthday card themselves. In the latter, DIY condition, we provided participants with a blank, folded, A6-size card and colored pencils. In all three conditions, participants read written instructions explaining that they would be doing a task involving birthday cards, which other museum visitors would receive a few weeks after the study's completion. After finishing their respective tasks, participants received a paper-and-pencil questionnaire; not all participants completed all items in the questionnaire, hence the reported sample size and related *df*s may vary in the analyses reported here. Feelings of

groundedness (α = .89) and feelings of self-production (α = .97) were measured as in the previous study (Study 4a). In addition, we captured our control variables by asking participants to what extent they agreed with the following statements (all measured on a 7-point scale from *1 = not true for me at all* to *7 = very true for me*): *I have thought a lot about people that I would like to give presents to* (Recipients); *I have taken a lot of time for this task* (Time); *I have thought a lot about the topic of birthdays* (Birthday); *I consider the quality of the card/the cards as very high* (Quality). Mood was measured using a single item (*My mood during this study was very good).* We also captured age and gender.

Results

Feelings of groundedness. An ANOVA with groundedness as dependent variable indicated a significant treatment effect ($F_{(2,256)} = 28.87$, $p < .001$, $\eta_p^2 = .184$). Contrast analyses revealed that inspecting the artisanal birthday cards made participants feel significantly more grounded compared to inspecting the industrial birthday cards ($M_{\text{Artisanal}} = 3.98$ vs. $M_{\text{Industrial}} = 3.08$, $t(256) = 4.26$, $p < .001$). Participants in the third condition, who actually produced a birthday card themselves, reported even more pronounced feelings of groundedness compared to those in the artisanal condition ($M_{\text{DIY}} = 4.69$, $t(256) = 3.37$, $p < .001$).

Feelings of self-production. An ANOVA with feelings of self-production as dependent variable indicated a significant treatment effect ($F_{(2,258)} = 226.74$, $p < .001$, $\eta_p^2 = .637$). We found that participants who inspected the artisanal birthday cards reported higher feelings of self-production than those who inspected industrial birthday cards ($M_{\text{Artisanal}} = 3.24$, $M_{\text{Industrial}} = 1.44$, $t(258) = 8.16$, $p < .001$). Again, we further found that participants in the actual self-production condition reported still more pronounced feelings of self-production compared to those in the artisanal condition ($M_{\text{DIY}} = 6.12$, $t(258) = 13.04$, $p < .001$). In addition, we found that the effect

on groundedness was mediated by feelings of self-production for both the artisanal versus industrial comparison, *indirect effect* = .5749, *SE* = .1401, $CI_{95\%}$ [.3250, .8736], and the DIY versus artisanal comparison, *indirect effect* = .3951, *SE* = .1884, $CI_{95\%}$ [.0564, .7893].

Mood. We found a significant treatment effect on mood, $F_{(2,262)} = 17.40$, $p < .001$, $\eta_p^2 = .117$. Consistent with the notion that DIY engagement increases well-being, mood was better for those in the DIY condition ($M_{DIY} = 6.13$, *p*s < .001); participants in the other two conditions did not differ in mood ($M_{Artisanal} = 5.00$, $M_{Industrial} = 5.07$, $p = .75$). In addition, we found evidence for indirect effects (i.e., serial mediations, Hayes, 2018) for both contrasts, DIY (vs. artisanal) -> Feelings of Self-Production -> Feelings of Groundedness -> Mood, indirect effect =.1626, *SE* = .0822, $CI_{95\%}$ [.0208, .3468], and artisanal (vs. industrial) -> Feelings of Self-Production -> Feelings of Groundedness -> Mood, indirect effect =.1867, *SE* = .0658, $CI_{95\%}$ [.0710, .3280].

Control measures. A series of ANOVAs with our control measures as dependent variables revealed significant differences between conditions for perceived product quality ($F_{(2,259)} = 63.55$, $p < .001$, $\eta_p^2 = .329$) only (other *p*s > .105). Perceived quality was highest in the artisanal condition ($M_{Artisanal} = 5.55$), followed by the DIY condition ($M_{Self\text{-}production} = 4.00$), and then the industrial condition ($M_{Industrial} = 2.71$, *p*s < .001). Because perceived quality is higher in the artisanal condition than the DIY condition, it cannot account for the effect of DIY on groundedness (i.e., the effect of quality runs counter to the prediction that increased perceived quality in the DIY condition may increase feelings of groundedness). In addition, the indirect effect via feelings of self-production for the artisanal versus industrial comparison remained significant with perceived quality as rival mediator, *indirect effect* = .3976, *SE* = .1259, $CI_{95\%}$ [.1734, .6648].

Discussion

In a field setting using another product category, Study 4b provides evidence that i) engaging in DIY activities increases feelings of groundedness compared to inspecting either industrial or artisanal ready-made products, ii) artisanal products increase feelings of groundedness compared to industrially-made products, and iii) this effect is mediated by feelings of self-production. We further find evidence suggesting that this increased feeling of groundedness is an antecedent to better mood (indirect effect). In addition, we address several alternative explanations that could account for our effect.

General Discussion

Across a variety of populations and product categories, this research provides evidence for a robust association between DIY engagement and feelings of groundedness (or the need thereof). We document this link between self-made products and groundedness in six studies conducted on two continents—including three lab studies, one field experiment, and one online study using a nationally representative panel. In the first experiment, we found that individuals who made apple juice felt significantly more grounded than those who did not make the juice. Study 2 introduced an important downstream consequence of making things yourself in terms of well-being: individuals felt stronger, safer, and more stable, and this effect was mediated by feelings of groundedness. In Studies 3a and 3b, we showed that the association between groundedness and DIY engagement is bidirectional. Dispositional need for groundedness predicted the frequency of engagement in DIY activities (Study 3a), while perceived threat from life-disrupting events (such as the COVID 19 pandemic) increased need for groundedness and also predicted DIY engagement (Study 3b). In other words, both chronic and situationally-induced need for groundedness predicted DIY engagement. We further demonstrated in Studies

4a and 4b that artisanal products can generate vicarious feelings of self-production, which can in turn confer part, but not all, of the benefit of DIY activity on feelings of groundedness.

Theoretical Contributions

First, this research introduces the concept of groundedness to the social psychology literature. Groundedness is defined as a feeling of emotional rootedness, derived from a sense of being firmly anchored in one's physical (place), social (people), and/or temporal (past) environment (Eichinger et al., 2021). There is considerable anecdotal evidence from the popular press to suggest that the need for groundedness is rising as a response to structural societal trends such as globalization, urbanization, digitization, and social acceleration (Rosa, 2013). Yet this need has been largely overlooked in the literature: the closest mentions of groundedness in other disciplines (such as philosophy or psychotherapy) refer mostly to a fundamental need to feel rooted to a place (e.g., Weil, 1952). We believe that the need for groundedness can actually explain a variety of behaviors and decisions—in particular, this research shows that the need for groundedness is an important antecedent to DIY engagement.

Second, this work contributes to research on the psychological tenets of DIY engagement. In this paper, we identify a novel antecedent, and benefit, of DIY engagement. Importantly, we find that feelings of groundedness generated by engaging in DIY activities make individuals feel stronger, safer, and more stable. Although the association between DIY and subjective well-being has been suggested before (e.g., Collier & Wayment, 2018), to the best of our knowledge no randomized controlled trials have established a causal link between engaging in DIY and well-being measures, or examined the mechanism therein. In addition, our research shows that the need for groundedness is predictive of DIY engagement when accounting for alternative

drivers of DIY, namely need for competence and need for accomplishment (Franke et al., 2010; Mochon et al., 2012).

Third, this paper helps us understand how individuals navigate the perils of life-disrupting events (Lazarus & Folkman, 1984; Pearlin, 1989). We theorized that the COVID-19 pandemic represented a real-world situation that shook individuals' psychological foundations (Kniffin et al., 2021; Schamblaw et al., 2021; Van Bavel et al., 2020; Yang et al. 2020). In response to this life-changing threat, individuals' need for groundedness increased, as did their engagement in DIY activities. We suggest an explanation for the surge in DIY engagement observed during the stay-at-home orders of Spring 2020 (e.g., quarantine baking, Abdul, 2020; Rogers, 2020): while this trend may have had multiple causes (such as people spending more time at home and being motivated to save money), Study 3b shows that individuals' need for groundedness predicted the increase in DIY engagement, even after controlling for the aforementioned alternative accounts. Our research thus helps elucidate how people cope with events that uproot them (Lazarus and Folkman 1984; Schamblaw et al., 2021), and characterizes the mechanism behind an economically substantial trend—one that led many DIY product categories to record unprecedented growth rates in 2020 (Redman, 2021).

Practical Implications, Limitations, and Future Research

Our findings may encourage policy makers to promote engagement in DIY activities as a means to improve well-being. We document that engaging in DIY activities makes individuals feel stronger, safer, and more stable, and that this effect is mediated by increased feelings of groundedness (Study 2). DIY practices could therefore positively affect mental health and well-being. Our findings suggest a potential mechanism for why observational studies in psychiatry found that DIY activities were associated with reduced odds of depression (Choi et al. 2020), and

why a “maker” identity has been associated with higher subjective well-being (Collier & Wayment 2018). Our work also suggests that engaging in DIY activities is particularly beneficial when people are facing major, disruptive life events that shake their foundations—as was the case with the COVID-19 pandemic. Of course, our work has limitations that open avenues for future endeavors; for instance, further investigation into the effect of DIY interventions on populations that are particularly vulnerable to psychological distress.

Given the wide range of DIY activities people engage in, another important area to further explore would be which types of DIY activities are more likely to generate feelings of groundedness, and which factors may attenuate or reinforce this phenomenon. Making an apple pie from an old family recipe with fruit picked from the backyard is likely to make people feel firmly grounded. In contrast, making an apple pie with imported fruits and using a random new recipe may have a weaker effect on groundedness. A similar moderation effect may manifest between product categories. For instance, an individual self-assembling a desktop PC by manipulating hard drive, processor, motherboard, and memory stick may feel a relatively weak increase in feelings of groundedness because this DIY episode may not strongly evoke connectedness with land, community, or traditions.

Another avenue for future research would be to examine how feelings of groundedness afforded by self-made goods affect how individuals interact with those goods post-completion. Past research has shown that individuals are more likely to engage in self-production when products are identity-relevant (Leung et al., 2018). It is possible that individuals tend to conserve such products for a longer time instead of using them right away (Sheehan & Dommer, 2020), and they may be more likely to recycle (vs. trash) said products (Trudel et al., 2016). It would be interesting to examine whether the feeling of groundedness is one of the reasons behind these

behaviors. These patterns could have strong implications in the food domain for instance, where cooking one's own food could lead individuals to consume food more slowly (e.g., across several days rather than in one sitting; Monnier et al., in press), thus reducing calorie intake and/or food waste.

Lastly, future work may explore additional psychological consequences of groundedness, beyond its impact on well-being. In particular, groundedness could be an antecedent of grit, which has been shown to be an important predictor of success outcomes for long-term goals (Duckworth et al., 2007). Because groundedness confers feelings of inner strength and resilience that help navigate ups and downs, it may lead people to build stamina and growth in response to challenges, two important elements that characterize grit.

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APPENDIX

Pictorial item for the groundedness scale[12]

How well does the following picture describe your feelings?

(from 1 = *does not describe my feelings at all*, to 7 = *describes my feelings very well*)

[12] Picture taken from earthinginstitute.net/grounding-and-awareness-of-groundedness/