

THE UNIVERSITY OF CHICAGO

CONSUMER INFERENCES AND HEURISTICS UNDER INCOMPLETE INFORMATION

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OVERVIEW

This dissertation is comprised of two distinct works of research investigating how consumers apply heuristics when making decisions about products under incomplete information. The first chapter studies a specific heuristic under asymmetric information disclosure, and the second chapter studies a set of heuristics when consumers infer magnitude from prevalence information, which causes opposite inferences and choices, depending on the heuristic used.

The two chapters investigate overgeneralized heuristics from different perspectives. The first chapter studies *a mere presence effect*, an overgeneralized heuristic of merely relying on the presence while ignoring the magnitude of a numeric attribute when it is non-evaluable in the context of product quality judgment. The first chapter also shows that such a heuristic can be eliminated when factual information is provided and emphasized to consumers as a reference point, making the information evaluable.

Next, the second chapter shows a pair of different heuristics, with opposite implications for decision-making. Consumers associate prevalence with magnitude in different directions when prevalence is framed generally and by words (Rare = Severe) or specifically and by numbers (Common = Severe). The second chapter also proposes a framework that is effective in influencing consumers to use different heuristics, outward vs. inward thinking, which reverses how prevalence is associated with magnitude.

Based on existing findings in chapter one, one criterion that defines an overgeneralized heuristics could be that once factual information is provided to consumers to evaluate the situation, consumers would no longer apply the heuristic, thus making the “correct” decision.

Based on chapter two, contextual cues may shift people from one kind of heuristic to another (i.e., from a learned association to a category-based inference).

**Chapter 1 A MERE PRESENCE EFFECT OF ASYMMETRIC INFORMATION:
CONSUMERS RELY ON ATTRIBUTE PRESENCE BUT ARE INSENSITIVE TO
QUANTITY**

ABSTRACT

Differences in discretionary disclosures of quantitative product attributes often result in asymmetric information across products. For example, one brand of milk may feature their protein content on the package label, while the other does not. How do such asymmetric product claims affect consumer choices? We predict that consumers will be sensitive to the mere presence of a quantified claim, judging a product that presents attribute quantity by the valence of the disclosed attribute (positive vs. negative) regardless of the quantity communicated (e.g., high vs. low value of the attribute). Across seven pre-registered studies, we find a robust mere-presence effect, in which consumers judge products more (less) favorably when a positive (negative) quantitative quality-relevant attribute is presented, even when the quantitative information represents a low level of quality. Our finding is most consistent with an overgeneralized heuristic account, in which consumers rely on the valence of an attribute when it is present, instead of the quantity conveyed. Our findings demonstrate that, under certain circumstances, asymmetric information disclosure may impede, rather than facilitate, consumers' judgments of product quality.

Keywords: consumer choice, numeric attribute, overgeneralization, product quality, signaling

Core principles in the economics of information hold that reducing the cost of truthful information enhances consumer welfare, and that firms have an incentive (e.g., due to “unraveling”; Jin and Leslie 2003) to disclose even negative information. Likewise, legal standards in the U.S. have generally taken a “market of information” approach, favoring more information provision to consumers, including by encouraging greater voluntary disclosure by firms (Beales III 2011). A common assumption is that disclosing positive information about a product will result in greater preference for that product, while disclosing negative information will result in less preference for that product. In this research, we question these assumptions in the context of asymmetric information resulting from sellers’ voluntary disclosure.

Consider an everyday scenario in which a consumer, shopping for milk at a grocery store, sees two products, similar in price and size, side-by-side on a shelf. One product displays an eye-catching label with a protein content claim on the front of the package: “8g protein per serving,” while the other does not present any protein information. How would this difference in claims affect consumers’ purchase decisions? How would the impact on consumers’ decisions change if instead the labeled product had claimed a higher level of protein, “12g protein per serving”? Such quantitative product claims occur in many shopping contexts and represent a common strategy that brands use to promote their products (see Figure 1-1 for examples at Target).

Figure 1-1 IN-STORE EXAMPLES OF ASYMMETRIC QUANTIFIED ATTRIBUTE CLAIMS

(products sold at Target; photo taken in 2023)



Unlike industry-standard or regulated claims (e.g., the Nutrition Facts Panel in the U.S.), discretionary claims may be non-comparable, only present on some products or brands. According to normative models, the effect of such claims depends only on the utility conferred by the claimed attribute (e.g., “8g protein per serving” or “12g protein per serving”), relative to the utility assumed in the consumers’ prior beliefs. In particular, numeric claims about well-defined attributes have been assumed to be meaningful, representing either positive or negative signals that suggest benefits or harms, unlike invented attributes that lack definite meaning (e.g., Carpenter, Glazer and Nakamoto 1994), which do not actually disclose meaningful information. In some cases, consumers incorporate such claims in their decision-making, particularly in the form of salient, front-of-package claims (Roe, Levy and Derby 1999; Kozup, Creyer and Burton 2003). However, in other cases, consumers may lack the background knowledge to objectively evaluate the utility implied by such claims in absolute terms. When the claims are non-comparable, the context may not provide cues helpful for evaluating utility.

In this research, we propose that consumers may simultaneously show two patterns that make them more likely to choose the product making the quantitative claim: (i) *claim sensitivity* — relying on the mere presence of non-evaluable quantified product claims as a signal of quality based on the valence of the attribute, and (ii) *quantity insensitivity* — failing to process the actual quantity conveyed by the numeric information. We refer to the combination of both claim sensitivity and quantity neglect as the *mere-presence effect*. Studying this topic is important because if consumers are only sensitive to the mere presence, but not the quantity, of numeric product claims, such claims can attract consumers in the short term, regardless of whether the promoted level of the attribute is high or low. This behavioral tendency can lead consumers to purchase products that offer objectively lower quality, which may in turn decrease consumer utility. Marketers and sellers' utility may also be undermined because disclosing lower-than-average levels on a negative attribute that in actuality constitutes a differentiating advantage may fail to attract, and instead impede, consumers from purchasing a product.

THEORETICAL DEVELOPMENT

Asymmetric Information Disclosure and Quantitative Claims

In some cases, such as the cigarette warning that “Smoking Causes Lung Cancer” (Wilkie 1985), disclosures are mandatory and therefore consistent across products. However, the “marketplace of ideas” philosophy holds that market actors should be free to make or not make whichever accurate and reliable statements they choose, and that consumers' reactions to the competing information will discipline the market, absent excessively high costs of information (Beales III 2011). As a result, many aspects of product information are unregulated and

voluntary disclosure represents the strategic decision of one actor, in the context of a broader market of information in which sellers, buyers, and regulators may all provide information to consumers. Because of the non-regulated nature of most marketing information and differing strategies across brands, voluntary disclosure often results in asymmetric information for consumers, with only some of the parties disclosing an aspect but not others. Past research on asymmetric information has argued that more information, even when asymmetric, will often be beneficial for businesses and consumers, because competitive pressures lead to positive market equilibria (Jin and Leslie 2003).

However, incomplete information does not always lead to optimal outcomes. In economic game theory models involving strategic opponents, an equilibrium may only exist at full information disclosure (Wagenhofer 1990). Some research argues that asymmetric information makes it more costly for socially responsible firms to successfully signal their benefits to consumers (Guo, Xiao and Zhang 2017). However, relatively little research has studied how asymmetric information disclosure, which is prevalent in consumer settings such as product packaging, affects consumers' choices.

As an illustrative example, we focus on the case in which a consumer sees two milk products with the same size and price, but only one has a numeric protein content claim, a common situation of asymmetric information. When consumers face this kind of asymmetric information in the context of product labeling, how do they interpret the information and incorporate it into their purchasing decision? We discuss two predictions from the past literature, and explain the rationale for our proposed alternative prediction, the mere-presence effect.

First, theories of optimal decision-making by fully-informed consumers suggest one set of predictions. Imagine a consumer who tracks nutrition information carefully and has a good

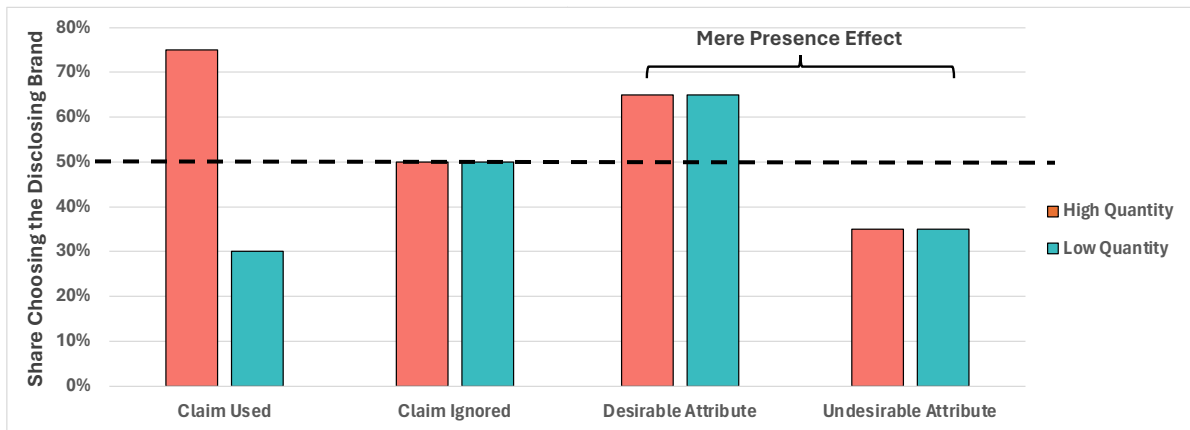
understanding of protein levels in milk. Since this consumer is able to evaluate the absolute level of protein, perhaps by comparing it to the level provided by typical milk products retrieved from memory, the consumer would be more likely to choose a milk product with a claim that communicates a favorable amount (e.g., an amount above their reference point). Conversely, this consumer would be less likely to choose a product with a claim that communicates a low amount (e.g., below their reference point). Therefore, as shown in the first panel of Figure 1-2, this consumer would be sensitive to the exact level of protein that they see on a package rather than to the mere presence of a protein label.

Second, consider a consumer who does *not* know what constitutes a good or bad level of protein, but who is also aware that their lack of knowledge *precludes* evaluating protein information. When this consumer shops for milk and sees a protein label on a package, they would be aware that the claim does not provide them with additional interpretable information, due to their insufficient knowledge. In this case, the consumer would be expected to ignore the non-evaluable protein claim, either because they edit it out, or because they infer that the claimed protein level may be typical and therefore the product without the claim may have a similar amount of protein (as shown in the second panel of Figure 1-2).

Consistent with this possibility, prior research has shown that consumers often primarily rely on *comparable* attributes (i.e., attributes available for all options in a choice set) when making their choices. Consumers tend not to rely on incomparable attributes, such as quantified claims presented for only one option but not the other (e.g., Slovic and MacPhillamy 1974; Sanbonmatsu et al. 1997, 2003; Kivetz and Simonson 2000). This line of research suggests that noncomparable information may have very limited impact on consumer decisions, because consumers may only focus on information that is available for *all* product options.

The existing theory of evaluability (Hsee et al. 2005) makes a similar prediction, that the quantity of a stimulus will influence subjective evaluations to the degree that quantity is *evaluable*. When consumers lack a frame of reference, non-evaluability will lead them to under-rely on numeric information, resulting in judgments and behaviors that are insensitive to quantity (e.g., Kahneman and Knetsch 1992; Shen and Urminsky 2013). In our example, when a consumer does not know if 8g of protein is a lot or a little for a cup of milk, the protein attribute is not evaluable, and therefore these theories predict that the consumer is likely to be quantity insensitive, failing to process the non-evaluable quantitative claim when judging the value of the product.

Figure 1-2 HOW ASYMMETRIC QUANTITATIVE CLAIMS IMPACT CONSUMER PREFERENCES



The Mere-Presence Effect

In the two theoretical predictions outlined above, whether the quantitative claim is used in decision-making depends on the information provided by the claim: if the information is

comparable and therefore interpretable, it is used (Figure 1-2, first panel) and if it is not interpretable, then it is ignored (Figure 1-2, second panel). However, we propose a novel third possibility, that in contexts where consumers fail to evaluate the numeric value of an attribute, they will cope with *quantity insensitivity* by displaying *claim sensitivity*, treating the mere presence of a quantitative claim as an indicator of product quality (positive or negative, depending on the valence of the attribute).

That is, for a generally desirable attribute, such as protein in milk, the presence of the claim would increase consumer preference, whether that claim actually conveyed a high or low quantity (Figure 1-2, third panel). By contrast, when the claim quantifies a generally undesirable attribute, such as saturated fat, the presence of either high or low valued claims would decrease consumer preference (Figure 1-2, fourth panel). In sum, consumers would display a *mere-presence effect*, overly relying on the presence of a product attribute claim to judge its quality as in line with the attribute valence, regardless of whether the claimed value is relatively high or low.

The Mere-Presence Effect as an Overgeneralized Heuristic

We propose that when consumers encounter a numeric claim on a product but lack the prior knowledge to systematically process the specified quantity, they will instead heuristically process the easy-to-evaluate presence of the claim. The content of the quantitative claim is processed by consumers as consisting of *two components*: not only the quantity conveyed, which is difficult to evaluate without a reference point, but also the mere presence of the claim, which is easy to evaluate when comparing to a product lacking that claim. The evaluability of the

presence of the quantitative claim implies that consumers may *not* simply ignore or edit out non-evaluable quantitative claims, but instead use an overgeneralized heuristic.

In our account, consumers who find the attribute relevant and important will incorporate the presence of the claim for judging product quality by relying on an overgeneralized “positive attribute = good product” and “negative attribute = bad product” associations. Specifically, when faced with asymmetric disclosure of a quantified attribute, consumers would exhibit a substitution-based heuristic (Kahneman and Frederick 2005): they would rely on attribute valence as a cue of quality instead of independently processing the claimed quantity, unless they have a sufficiently credible basis of comparison. In our overgeneralized heuristic account of the mere-presence effect, it is the potential relevance and perceived informativeness of the claim that prompts incorporation into decision-making, unlike the use of inherently irrelevant or even meaningless (e.g., made-up) information documented in other contexts (Carpenter et al. 1994; Hsee et al. 2009; Baskin and Liu 2021).

Furthermore, unlike prior findings of scope insensitivity for non-evaluable attributes (Hsee et al. 1999; Hsee, Rottenstreich and Xiao 2005), the proposed mere-presence effect predicts that consumers *will not* simply edit out an entire quantitative claim that they cannot evaluate. Prior research found scope insensitivity in separate-evaluation mode (e.g., no difference in WTP for a single product with a high vs. low value attribute), which was contrasted with scope sensitivity in joint-evaluation (e.g., preference for a product with a high value attribute over one with a low value attribute). In our context, however, even though consumers are in joint-evaluation mode (e.g., comparing products), the quantitative claim will not be evaluable, because it only appears on one product, as long as the consumer lacks a basis of comparison.

People often generalize heuristics learned in specific situations, in which the belief is observed to be valid, to other situations, including those in which the belief no longer applies (Tversky and Kahneman 1974). Some heuristics are characterized as “System 1” short-cuts that trade off decision speed for reduced accuracy (e.g., Shah and Oppenheimer 2008). However, overgeneralized heuristics that consumers adopt as decision “rules” can persist in deliberative, analytical thinking, even resulting in bias when the rule is judged to be relevant but over-applied (Wilson et al. 1996; Gigerenzer and Gaissmaier 2011; Evans and Stanovich 2013). In our overgeneralized heuristic account, the mere-presence effect arises because consumers who care about the displayed attribute are using a heuristic rule to incorporate information that seems relevant to judging quality into their deliberation, consistent with an “illusion of validity” (Tversky and Kahneman 1974), despite not being able to directly evaluate the quantity conveyed.

Alternative Inferred-Intention Accounts

We also consider two other possible explanations for a mere-presence effect, both based on consumers’ inferences of the seller’s or the manufacturer’s intentions: a strategic account, and a hidden-information account.

The notion of marketplace meta-cognition suggests that consumers use their beliefs about “the mental states, strategies, and intentions of others as these pertain directly to the social domain of marketplace interactions” (Wright 2002), often learned from experience. Consumers may therefore assess product claims based on inferences about the marketers’ strategic intentions, i.e., that marketers would only choose to feature a claim if it was, in fact, an actual strength of the product. For example, consumers may assume that marketers would only decide

to place a quantitative protein claim on the package if the claimed quantity was superior to most other products. When an attribute is negative or generally seen as undesirable, consumers could likewise infer that, marketers, wanting to promote the product, would voluntarily disclose “good” (i.e., lower than typical) levels of the negative attribute, maintaining the “disclosed attribute = good product” heuristic. On the other hand, consumers could instead assume that the disclosure was mandated, potentially because the level of the negative attribute had triggered a disclosure requirement, generating a “negative disclosed attribute = bad product” heuristic.

Strategic explanations imply that consumers will be highly sensitive to the source of the information. Under the strategic account, if a positive quantitative attribute is instead provided by an independent organization with different motives (e.g., Consumer Reports providing information to inform consumers), the inferences that consumers make, and the consumers’ resulting preferences, should no longer reflect the mere presence effect.

Alternatively, the mere-presence effect could be consistent with some theories of how people interpret hidden information, regardless of the manufacturer’s or the seller’s intentions. When only one of two products displays attribute information, consumers may assume that the company or seller of the non-disclosing product is hiding information from consumers, reducing trust and resulting in more negative inferences about that product. Past research has argued that a person who deliberately chooses not to reveal information may be judged more negatively than if they had disclosed the worst level of the information (John et al. 2016). In the purchase context, Johnson and Levin (1985) found that when shopping for TVs, the greater the amount of hidden information, the less favorable consumers’ evaluations were. Therefore, consumers may process the lack of disclosure as negative, creating a negative assessment of whichever product has failed to provide the information they were expecting.

Testing the Mere-Presence Effect

The proposed *mere-presence effect* implies two empirically testable patterns, *claim sensitivity* and *quantity insensitivity*:

H1a: *Claim sensitivity* -- Consumers prefer a product with a numeric claim on a positive attribute more than a competing product without the claim and prefer a product with a numeric claim on a negative attribute less than a competing product without the claim.

H1b: *Quantity Insensitivity* -- Consumers have the same level of preference for the product with the claim whether the claim presents a higher vs. lower level of the attribute.

Across a series of studies, we test whether and why consumers prefer product options with a quantified claim over a similar product option without a corresponding claim when the attribute is desirable, regardless of the claimed amount, and whether and why the opposite holds when the attribute is undesirable. First, we establish the mere-presence effect in studies 1 to 3 using both hypothetical scenarios and an incentivized design. We then test between our proposed account and alternative accounts (lack of disclosure and visual salience effects, in study 2; strategic communication, in study 3). We directly test our overgeneralized heuristic process in studies 4 to 5, in which we also test perceived quality as a mediator. All our study materials, pre-registrations, data, code, and supplementary studies have been posted in an Open Science Framework (OSF) repository:

https://osf.io/vmbpf/?view_only=5c10afb60a1a4f17b351b293a9d6470e. A summary of all studies (including supplementary studies) can be found in Web Appendix D.

STUDY 1A: THE MERE-PRESENCE EFFECT OF A DESIRABLE ATTRIBUTE ON REALISTIC PRODUCT PACKAGES

We conducted a calibration test on Amazon's MTurk ($N = 99$, $M_{\text{age}} = 41.43$, 48.4% female; preregistered at [/aspredicted.org/c32q-g5q8.pdf](https://aspredicted.org/c32q-g5q8.pdf)) to identify product attributes that are generally seen as either desirable or undesirable by consumers. Participants evaluated a series of product attributes, selecting either "It's a good thing," "It's a bad thing," or "It could be good or bad depending on the amount" for each attribute (see Web Appendix B, table B1). We also conducted a pilot test showing that all attribute differences we test are large enough to be meaningful when making judgments, but independently nonevaluable (Web Appendix B, tables B3 and B4).

Study 1a used protein content in milk as the focal attribute, and the calibration test results confirmed that protein content of milk was more likely to be rated as "good" (87.4%) than the three control items (caffeine in coffee, 15.8%, $\chi^2(1, N = 190) = 94.60, p < .001$; heaviness of dumbbells, 37.9%, $\chi^2(1, N = 190) = 47.58, p < .001$; ibuprofen content in painkillers, 22.1%, $\chi^2(1, N = 190) = 79.05, p < .001$). These findings confirm that protein is widely seen as a desirable attribute of milk.

The main study tests our central prediction, the mere-presence effect, in the context of milk purchasing, using realistic stimuli. We manipulated the amount of protein specified in a claim on the front side of a half-gallon milk carton in two between-subjects conditions: either a high-protein-level claim or a low-protein level claim. In both conditions, participants were

presented with two options, one with a protein claim and another without a protein claim, with order and brand counterbalanced.

Method

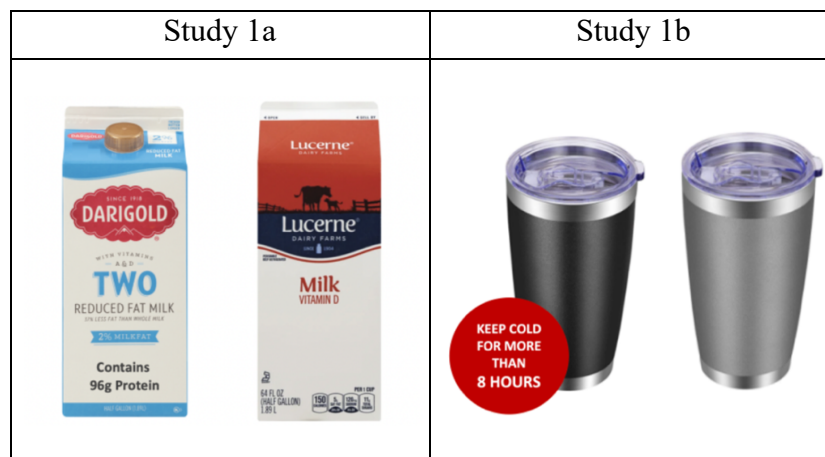
We chose our stimuli from actual 2% non-organic US-brand milk carton packages which, based on a pretest, UK customers are unfamiliar with. We presented US brands to UK customers to use realistic products while simulating the situation in which consumers make choices between new products, in the absence of pre-existing brand preferences (see study 4a for a replication with a US sample). A pretest among 100 UK participants on Prolific (49.0% females, $M_{\text{age}} = 40.58$) showed that more than 90% were “not at all familiar” with either of the brands we chose, Darigold or Lucerne, on a seven-point Likert scale. We then made minor edits to the actual milk product packages currently sold in the U.S. in order to incorporate the protein content claims on the packages.

All participants were first presented with the following instruction: *“Imagine you are shopping for milk and see the following two options at a grocery store. The two options are the same in price and total capacity.”* Participants were randomly assigned to either the high-quantity condition or the low-quantity condition. In both conditions, participants were shown two milk cartons presented side-by-side. Those in the high-quantity condition were shown a milk product featuring the claim “contains 96g protein” on the front side of one of the two cartons, while for those in the low-quantity condition, the claim instead read “contains 32g protein” (see Figure 1-3, left panel). Which product was labeled and the order of the two brands were both independently counterbalanced. The protein amount was selected based on USDA averages (8g

per cup for whole milk, which equals roughly 64g per half gallon; USDA 2019), so that the high-protein-quantity label displayed a higher protein content (96g) than average, and the low-protein-quantity label displayed lower protein content (32g) than an average for a carton of milk.

After reading the scenario, all participants answered the question, “Remember that the two options are the same in price and capacity. Which option would you choose to purchase?” and selected one of the two options.

Figure 1-3 SAMPLE STIMULI FOR STUDIES 1A AND 1B



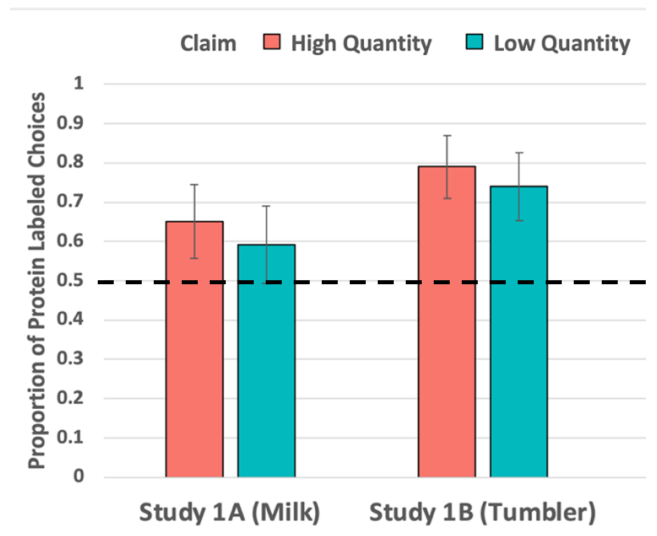
Results

Two hundred and six participants who live in the UK participated in this study on Prolific. Pre-registered exclusion of eight participants who failed the attention check left a total of 198 participants (47.0% females; $M_{\text{age}} = 39.51$). They received \$0.45 for their participation in the approximately 3-minute study (pre-registered at https://aspredicted.org/SXD_7LY).

Descriptives. Overall, significantly more than 50% of the participants chose the labeled product (62.1%, $\chi^2 = 11.64$, 95%CI = [.55, .69], $p < .001$). Specifically, a majority of the participants chose the labeled product, both in the high-quantity condition (65.0%, $\chi^2 = 9.00$, 95%CI = [.55, .74], $p = .003$) and directionally in the low-quantity condition (59.2%, $\chi^2 = 3.31$, 95%CI = [.49, .68], $p = .069$).

Regressions. Next, we conducted a regression analysis designed to separately test the two outcomes predicted by the overgeneralized heuristic account: claim sensitivity and quantity neglect. We fit a logistic regression predicting choice of Darigold (the target brand) based on two dummy coded variables: Claim Presence indicated whether the target option had a protein label (1) or not (0) and Claim Quantity indicated whether the target option's protein level was objectively better (1) or worse (-1) than the competitor option, under the assumption that the unlabeled product had an average level of protein. Specifically, Claim Quantity was coded as better if the target option had the high protein level and the competitor was unlabeled or if the target option was unlabeled and the competitor had the low protein level, and as worse otherwise.

Figure 1-4 SUMMARY OF RESULTS OF STUDIES 1A AND 1B



Consistent with our hypothesis, we found a significant effect of Claim Presence, $b = 1.01$, $SE = .30$, $Wald \chi^2 = 3.35$, $p < .001$, but no significant effect of Claim Quantity ($b = 0.14$, $SE = .15$, $Wald \chi^2 = .95$, $p = .34$). These results confirmed our hypothesized mere presence effect: participants prefer the claim-labeled option over the alternative without the claim, regardless of the product quality (high vs. low) conveyed by the claim, using real product packages. Additional exploratory analysis and results of this study and all the following studies can be found in Web Appendix B.

STUDY 1B: REPLICATION WITH CONSEQUENTIAL TUMBLER CHOICES

To test the generalizability of our findings in study 1a, we investigated different products and claims using consequential choices between tumbler cups, with the length of time a cup is able to keep things cold, a pre-tested desirable attribute, as the central attribute. Consumers were informed that their decisions were not hypothetical and would happen for real for five

participants who would be randomly chosen to win the product they chose. Winners were contacted separately after data collection was complete, and instructions for claiming the products they had won from Amazon.com were mailed to them¹. Participants were informed about the possibility of receiving their choice before seeing the product choice scenario.

Method

As in study 1a, participants were randomly assigned to one of two experimental conditions (high-quantity vs. low-quantity), and they made a purchase decision, choosing one of the two pictured products (Figure 1-3, right panel). Participants were shown pictures of a black tumbler cup and a grey tumbler cup of the same design and size that had been taken from an online shopping website.

The focal attribute described to participants in this study was the amount of time the tumbler cup would keep water cold. Specifically, in the high-quantity condition, participants were told that the tumbler “can keep cold for more than 8 hours,” while in the low-quantity condition, participants were told that the tumbler “can keep cold for more than 5 hours.” Since both tumblers can keep cold for more than 8 hours, per the product website, both claims are true. The calibration test confirmed that keeping contents cold was widely viewed as a positive attribute (60%; see Web Appendix B). Participants were asked to choose one of the two tumbler cup options. We counterbalanced which product was labeled (black vs. grey) and the order of the colors.

¹ When cleaning data for study 1b, we found that the lottery mechanism for selecting winners failed to perform the designated lottery function, such that the study resulted in two winners (instead of five, as promised to participants in the survey). To correct this, we later randomly selected three additional participants as winners and sent each of them a bonus with a value equal to the price of the product that they won.

Results

Two hundred and nine participants participated in the study on Prolific. Excluding nine participants who failed the attention check question left a total of 200 participants (48.5% females; $M_{\text{age}} = 33.77$). They received \$0.50 for their participation in the approximately 3 to 4-minute study (pre-registered at https://aspredicted.org/8RS_2NS).

Descriptives. Overall, a significant majority of the participants chose the labeled product (76.5%, $\chi^2 = 56.18$, 95%CI = [.70, .82], $p < .001$). Specifically, 79.0% of participants chose the labeled product in the high-quantity condition ($\chi^2 = 33.64$, 95%CI = [.70, .86], $p < .001$) and 74.0% did so in the low-quantity condition ($\chi^2 = 23.04$, 95%CI = [.65, .82], $p < .001$).

Regressions. In the regression analysis, we treated the black option as the target and the grey option as the competitor. Replicating study 1a, and consistent with our hypothesis, we found a significant effect of Claim Presence, $b = 2.90$, $SE = .42$, Wald $\chi^2 = 6.88$, $p < .001$, but no significant effect of Claim Quantity ($b = 0.36$, $SE = .37$, Wald $\chi^2 = .97$, $p = .33$; Figure 1-4, right panel). Consumers preferred a product with the claim (76.5%) over an unlabeled competitor (23.5%, $p < .001$), but there was no significant effect of claim quantity on choice (i.e., 79% for high vs. 74% for low, $p = .505$). Therefore, consistent with our hypothesis, when making consequential choices with real products, participants displayed the mere-presence effect.

Discussion

We proposed that consumers incorporate the presence of numeric information but do not evaluate the level or quantity conveyed by the information. Two different scenarios in study 1, using different types of product stimuli and claims and including incentive-compatible designs, support our prediction - we consistently found a significant effect of Claim Presence, but not of Claim Quantity. It is noteworthy that evaluability theory predicts that consumers would completely edit out the attribute, which includes both its presence and quantity. However, for both studies we ran, participants' choices for the product in the low-quantity condition were never lower than 50%. These results suggest that disclosing a low quantity level in a numeric claim does not hurt the product with that label, when it is the only product making the claim.

STUDY 2: THE MERE-PRESENCE EFFECT OF AN UNDESIRABLE ATTRIBUTE

The previous studies demonstrated the mere presence effect for attributes confirmed to be widely seen as desirable. Two prior theories could explain this effect. First, the unique claims may have simply attracted consumers' attention to the product making the claim, increasing preference for that product (Cavanagh et al. 2014; Bhatnagar and Orquin 2022). For example, Carpenter et al. (1994) proposed that consumers prefer products with meaningless descriptors merely due to their novelty and distinctiveness relative to other products.

Second, consumers may prefer companies that voluntarily disclose attributes (and mistrust those they see as refusing to disclose; Johnson and Levin 1985; John et al. 2016). According to this hidden information account, consumers would prefer the product with a claim, not because they see the mere presence of the protein information as a positive signal (as predicted by our overgeneralized heuristic account), but because they dislike or distrust the other product that *failed to disclose* protein information. If either of these theories explain the mere

presence effect, then consumers should always prefer the product with the numeric-attribute disclosure, not only when the attribute labeled is something generally seen as desirable (as in Study 1) but also when the attribute is undesirable.

To test the above accounts, we used another attribute in Study 2, saturated fat, that was confirmed in our calibration test to be widely seen as a negative attribute (68.4%; see Web Appendix B). We showed two bacon packages (Oscar Mayer and Hormel) that are commonly found in grocery stores to participants (Figure 1-5). We added a sticker displaying the amount of saturated fat in the product to one of the packages. Testing disclosure of an undesirable attribute raises a potential confound: consumers may infer that the negative attribute information on the package is due to a regulation requiring disclosure of the attribute when it exceeds some statutory level. To avoid this confound, we informed participants that the information on the front of the product packages was not regulated. This design tests the generalizability of the mere presence effect to asymmetric disclosure of a negative attribute.

Method

Participants were randomly assigned to one of two experimental conditions (high-quantity vs. low-quantity), and they made a hypothetical purchase decision, choosing between the two pictured 12-oz bacon products.

On the top of the scenario-description screen, participants were told: *“Note that there is no regulation or requirement on what information should or should not be put on the front of a product package.”* Below this line, in the high-quantity condition, one of the two package images displayed a sticker with “66g saturated fat,” while in the low-quantity condition, one package

image displayed “22g saturated fat” (e.g., see Figure 1-5). The two values were selected as high or low relative to USDA data that on average uncooked bacon products in 12-oz packages contain around 44g of saturated fats (USDA 2019). We counterbalanced which product was labeled and the order of the products. Participants were also informed that the two products had the same price and package size.

Figure 1-5 SAMPLE STIMULI IN STUDY 2



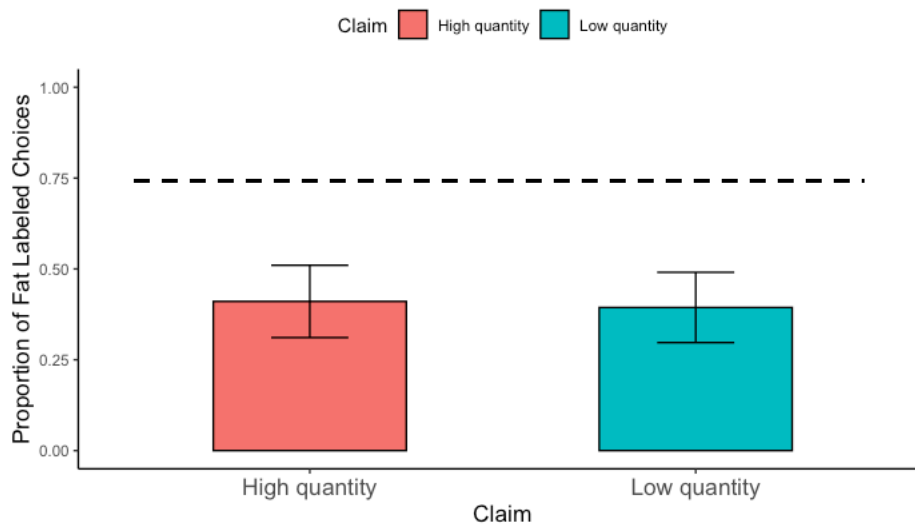
Results

Two hundred participants on Prolific (47.5% females; $M_{\text{age}} = 40.99$) received \$0.45 each for the approximately 3-minute study (pre-registered at https://aspredicted.org/X2V_Q77).

Descriptives. Overall, less than half of the participants chose the unlabeled product (40.2%, $\chi^2 = 7.44$, 95%CI = [.34, .47], $p = .006$). Participants were similarly likely to choose the labeled product in the low-quantity condition (39.4%; $\chi^2 = 4.45$, 95%CI = [.30, .49], $p = .035$) and in the high-quantity condition (41.1%; $\chi^2 = 3.04$, 95%CI = [.32, .51], $p = .081$).

Regressions. In the regression analysis, we treated the Hormel product as the target. We found a significant effect of Claim Presence, $b = -0.80$, $SE = .20$, Wald $\chi^2 = -2.71$, $p = .01$, but no significant effect of Claim Quantity ($b = 0.15$, $SE = .20$, Wald $\chi^2 = .72$, $p = .47$; Figure 1-6). Consumers preferred the bacon product without the claim (59.8%) over the unlabeled competitor (40.2%, $p = .006$), but there was no significant difference in choices based on Claim Quantity (i.e., 41% for high vs. 39% for low, $p = .929$). Even when the asymmetrically disclosed attribute described a negative aspect of the product, we replicated a mere-presence effect, contrary to both the product attention and hidden information accounts. The labeled product was disfavored, regardless of the actual amount of the focal attribute displayed on the label.

Figure 1-6 RESULTS OF STUDY 2



Discussion

Study 2 demonstrated that the mere presence effect generalizes to a situation where a negative attribute is asymmetrically disclosed, leading consumers to prefer the product without the label, regardless of the numeric value displayed. This study has practical implications, particularly for communicating and advertising food attributes. While a lower-than-average level on an undesirable attribute could be a differentiating advantage of a product, a label or advertisement providing that information without sufficient context might paradoxically reduce adoption. Consumers who lack familiarity with specific levels of the attribute and therefore rely on a valence-level judgment based on the presence of the attribute (which is easily evaluable) and fail to process the quantity being labeled (which is relatively difficult to evaluate) would avoid a product that asymmetrically discloses a low level of the negative attribute.

Overall, the results of this study contradict the predictions of the product attention and hidden information alternative accounts, both of which would have predicted that the benefits of asymmetric disclosure would extend to negative attributes, and that consumers would prefer whichever product that discloses information (Johnson and Levin 1985; John et al. 2016).

STUDY 3: TESTING A STRATEGIC INFERENCE ACCOUNT

The mere-presence effect, particularly for positive attributes, could also be explained by consumers' strategic inferences about the manufacturer's or retailer's motives. Market meta-cognition theory (Wright 2002) predicts that as consumers develop knowledge about sellers, they make inferences based on sellers' presumed intentions, such as only including differentiating claims that are objectively a strength of the product. For example, past research found that consumers rely on sales signs to judge when products have relatively low prices and update their

belief about likelihood of availability in the next period, by making inferences based on the incentives of sellers and other consumers (Anderson and Simester 1998, 2001).

In our context, consumers may therefore make inferences about the products based on the assumed strategies of firms. In the inference account, based on seeing a numeric claim being explicitly highlighted for a product, consumers will assume that the manufacturer of the product strategically chose to promote an actual differentiating benefit of their product, and that the choice to disclose therefore reveals that the disclosed amount is better than average. Conversely, the consumer would assume that the product which has not disclosed must have a worse level of the attribute (Prelec et al. 1997; Jin and Leslie 2003).

Study 3 was designed to test whether such strategic inferences regarding positive attributes explain the mere-presence effect. Specifically, we investigated whether participants displayed a mere-presence effect only because they believed that the claim was strategically chosen by the brand who has an incentive to promote the benefits of the product. If this strategic-inference account explains the effect, consumers should no longer rely on the presence of the claim if they learn that the asymmetrically disclosed information was instead provided by an independent third-party with no such strategic motive.

Method

This study had a 2 (claim: high protein quantity – 96g per half gallon vs. low protein quantity – 32g per half gallon) by 2 (source: manufacturer vs. independent) design. Participants in both conditions were first shown a scenario in which they were shopping online at the website of a fictitious retailer, Deale.com (see Web Appendix A, figure A1). Participants were instructed:

“Imagine you are visiting a retailer's website. The retailer, Deale, sells various groceries that you may be interested in purchasing. You are shopping for milk today. On the next page, you will read some information posted on Deale about two milk products.”

Next, participants in the manufacturer (strategic incentive) conditions were told, *“The retailer posts product information provided by the product's manufacturer. If the information is missing, that is because the manufacturer has decided not to provide the information for that product.”* By contrast, participants in the independent organization (no strategic incentive) conditions were told, *“The retailer posts product information provided by a nonprofit consumer organization dedicated to independent product testing. The lab chooses which products to test at random. If the information is missing, that is because that product has not been randomly selected to be tested by the organization yet.”*

After reading the introduction, participants were given a similar choice task as in previous studies. Unlike in the previous studies, the information for the two milk products was presented in a grid, with stylized product images, one with a blue carton and the other a green carton, on the first row and the protein content information on the second row (see Web Appendix A, Figure A3), as in some online shopping environments. The order of the products was counterbalanced. Before making their decisions, participants were told that both products were from the same manufacturer. All participants were then given a comprehension check after the choice task in which they were asked to select the information source specified in the scenario they had read.

Results

Four hundred and nine participants participated in the study. Excluding three participants who failed the attention check and six participants who did not finish the study left 400 participants (48.5% females; $M_{\text{age}} = 33.38$). They received \$0.60 for their participation in the approximately 4-minute study (pre-registered at https://aspredicted.org/7ZJ_7CM). Although we did not pre-register exclusions based on the comprehension check (Web Appendix A, Figure A2), we report the results from participants who pass the comprehension check only, as a more conservative test, in all studies. We find similar results including the 7% of participants who failed the comprehension check question (see Web Appendix E).

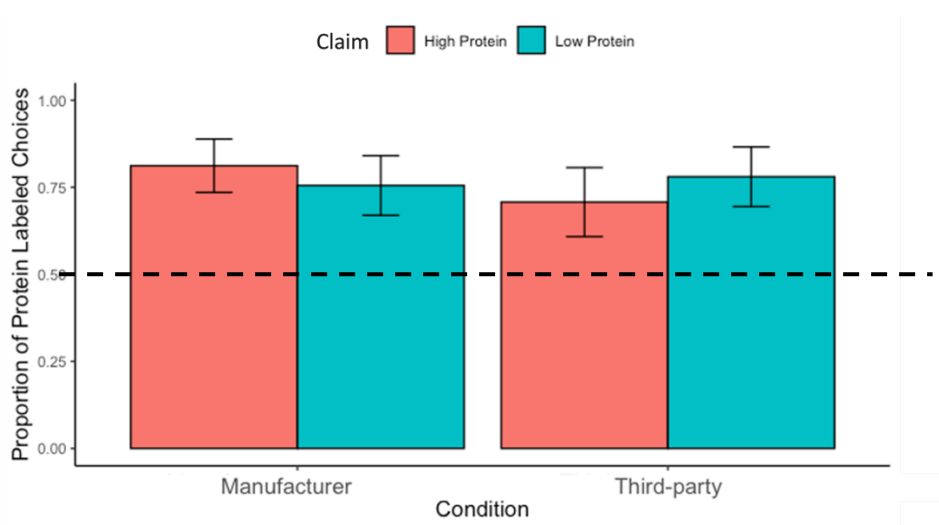
Descriptives. In the manufacturer condition, we found that 81.2% of the participants chose the high-quantity-claim product ($\chi^2 = 39.30$, 95%CI = [.72, .88], $p < .001$) over the no-claim same-brand alternative and 75.5% chose the low-quantity-claim product ($\chi^2 = 25.51$, 95%CI = [.66, .83], $p < .001$) over the no-claim alternative. These results replicate our prior findings of a mere presence effect (e.g., in study 1a) when the source of the claim was the manufacturer. However, contrary to a strategic inference account, even when the source of the claim was independent, a majority of participants chose the product with the claim over the alternative, whether the claimed level was high (69.9%; $\chi^2 = 13.12$, 95%CI = [.59, .79], $p < .001$) or low (78.0%; $\chi^2 = 28.58$, 95%CI = [.68, .85], $p < .001$).

Regressions. In a logistic regression, we predicted choice of the target (the green product) based on Claim Presence, Claim Quantity, Source (-1 = independent, 1 = manufacturer), the interaction between Source and Claim Presence, and the interaction between Source and Claim Quantity as predictors. The analysis confirmed an overall mere-presence effect: a significant main effect of Claim Presence, $b = 2.19$, $SE = .36$, Wald $\chi^2 = 6.13$, $p < .001$, and no significant

main effect of Claim Quantity, $b = -0.17$, $SE = .18$, $Wald \chi^2 = -0.93$, $p = .35$. Furthermore, Source did not have a main effect ($b = 0.19$, $SE = .36$, $Wald \chi^2 = .53$, $p = .59$) and, more importantly, did not significantly moderate either Claim Presence ($b = 0.40$, $SE = .50$, $Wald \chi^2 = .80$, $p = .42$), or between Claim Quantity ($b = 0.34$, $SE = .25$, $Wald \chi^2 = 1.36$, $p = .17$), contrary to the predictions of the strategic inference account.

In fact, splitting data by Source, we document a significant effect of Claim Presence in both the manufacturer ($b = 2.59$, $SE = .35$, $Wald \chi^2 = 7.47$, $p < .001$) and the independent information source conditions ($b = 2.19$, $SE = .36$, $Wald \chi^2 = 6.13$, $p < .001$). Conversely, we find no significant effect of Claim Quantity in either the manufacturer ($b = 0.17$, $SE = .17$, $Wald \chi^2 = .99$, $p = .32$; or independent ($b = -0.17$, $SE = .18$, $Wald \chi^2 = -0.93$, $p = .35$) condition. As shown in Figure 1-7, we fully replicated the mere-presence effect in both the manufacturer and independent conditions.

Figure 1-7 RESULTS OF STUDY 3



Discussion

Contrary to the strategic account, the mere-presence effect replicated even when consumers were explicitly informed that the information had come from an independent lab that was not related to the manufacturer of the product. This result distinguishes our findings from past findings that were explained by strategic inferences. In particular, Carpenter et al. (1994) explained consumers' preferences for products with meaningless descriptors based on the informativeness principle, that the assumed purpose of communication is to provide relevant information (e.g., Clark 1985), and therefore consumers assume that even meaningless descriptors are actually meaningful. However, in the independent conditions in our study, consumers were not only informed that the protein information was being provided by an independent lab, but also that the tested products had been randomly selected, making the presence of the claim explicitly non-informative. The fact that we nevertheless replicated the mere-presence effect rules out accounts involving inferences from norms of communication (Carpenter et al. 1994).

STUDY 4A: FACTUAL INFORMATION WEAKENS THE MERE-PRESENCE EFFECT FOR A DESIRABLE ATTRIBUTE

According to our overgeneralized heuristic account, consumers rely on an overlearned association between the valence of a featured attribute and the correspondingly valenced evaluation of the product. In our account, the use of the attribute-presence heuristic reflects an endorsement of attribute-presence as a useful strategy in decision-making (e.g., one that is

mentally associated with positive outcomes), as opposed to the effort-reduction motive for heuristic use (Shah and Oppenheimer 2008).

In study 4, we test two consequences of this account. First, when consumers are trying to make good decisions, they will rely on seemingly useful heuristic cues unless a better (e.g., more fully informed) strategy becomes feasible. This suggests that when consumers have access to the kind of factual information that enables them to evaluate claim quantity, they will switch from a reliance on cue presence to instead incorporate cue quantity. Second, if consumers are relying on cue presence as a useful-seeming (vs. effort-saving) heuristic for judging product quality, their use of the heuristic will not be limited to “System 1” (e.g., quick, low importance and low involvement) decisions.

In this study, we provided participants in one pair of conditions with factual information about the protein content of average milk products, prior to viewing the products and making a choice. By initially giving them factual and relevant information, we provided a salient reference point for their subsequent decision, enabling an alternative strategy of comparing the numeric attribute claim to the reference point to make a judgment regarding its relevant quality. Additionally, we measured multiple dimensions of consumer involvement and motivation, to test whether the mere presence effect is limited to fast, automatic thinking or represents a strategy that extends to more deliberative thinking (in the absence of sufficient information to use other strategies).

Another potential explanation for why consumers prefer a labeled option is that the additional information provided by the label could reduce the perceived risk of choosing it (vs. an unlabeled product). To test this explanation, we also measured the perceived risk associated with the labeled option.

Method

The study had a 2 (claim: high protein quantity – 12g protein per cup vs. low protein quality – 4g protein per cup) by 2 (condition: replication vs. information) design. Participants were randomly assigned to either the replication conditions or the factual information conditions. Participants in the factual information conditions were shown relevant information: *“Please read an introduction to milk below. Milk is a nutrient-rich liquid food. As an agricultural product, dairy milk is collected from farm animals. Throughout the world, more than six billion people consume milk and milk products. On average, there are around 8 grams of protein in a cup of milk.”*

Participants in the replication conditions were shown similar text except that the last sentence with the protein information was replaced with irrelevant product origin information: *“New Zealand, Germany and the Netherlands are the largest exporters of milk products.”* Participants in all conditions then chose between two milk products, one from Darigold and the other Lucerne, two U.S. milk manufacturers, represented by realistic milk cartons with different information on the packages (same as the stimuli in study 1a), one of which displayed the (high or low) protein information on the front of the carton. After making the choice, participants answered a few additional questions for our purpose of moderation and mediation analyses (see Web Appendix F for all additional measures and analysis in studies 4a and 4b). They also completed a comprehension check question to select one statement from four options that correctly describe the information they saw in the scenario (*“Based on what you read before, which of the following statements is true?”*).

Results

Six hundred and fifty-three participants participated in the study on Amazon's MTurk. Excluding 67 incomplete responses, eight responses from duplicate IP addresses and 37 participants who failed the comprehension check question left a total of 541 participants (48.4% females; $M_{\text{age}} = 44.97$). They received \$0.90 for their participation in the 6- to 8-minute study (pre-registered at aspredicted.org/5m9k-ckmg.pdf). They were given an opportunity to win an additional bonus of \$0.45 (totals a payment of \$1.35) for getting the comprehension check question correct.

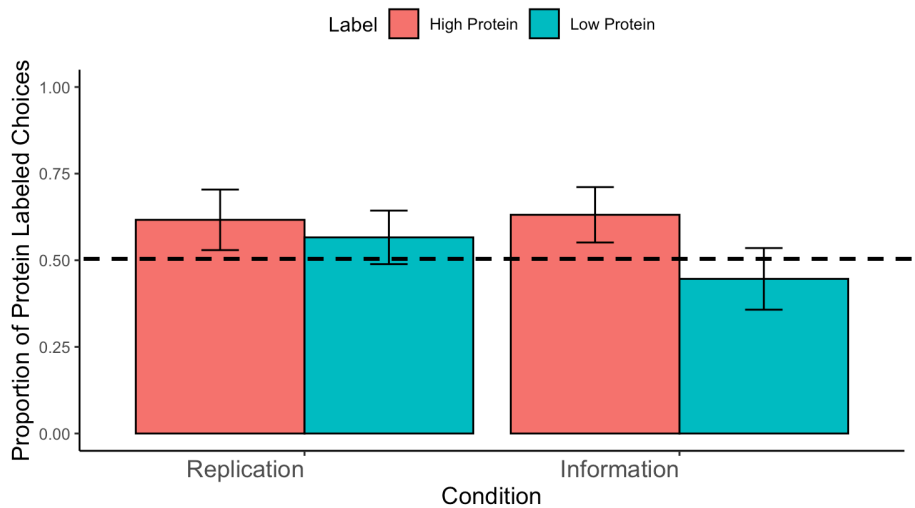
Descriptives. In the two replication conditions, consistent with our prior demonstrations of the mere presence effect, the majority of participants chose the high-quantity labeled product over the unlabeled product (61.7%; $\chi^2 = 6.53$, 95%CI = [.53, .70], $p = .011$) and directionally prefer the low-quantity labeled product over the unlabeled product (56.6%; $\chi^2 = 2.77$, 95%CI = [.49, .64], $p = .096$). However, in the factual information conditions, when participants were provided with factual information that made the protein claim evaluable, we no longer observed the mere-presence effect: 63.1% of the participants chose the high-quantity labeled product over the unlabeled product ($\chi^2 = 9.71$, 95%CI = [.55, .71], $p = .002$), but only 46.3% chose the low-quantity labeled product over the unlabeled product ($\chi^2 = 1.40$, 95%CI = [.36, .54], $p = .237$).

Regressions. We then fit a logistic regression predicting choice of the target (Darigold) based on Claim Presence, Claim Quantity, Condition (-1 = replication, 1 = information), the interaction between Condition and Claim Presence, and the interaction between Condition and Claim Quantity as predictors. There was a significant main effect of Claim Presence ($b = 0.70$, $SE = .25$, Wald $\chi^2 = 2.83$, $p < .001$). The interaction between Condition and Claim Presence ($b =$

-0.52, SE = .36, Wald $\chi^2 = -1.44, p = .15$) indicated that factual information directionally (but not significantly) reduced the impact of claim presence. Claim Quantity did not predict significantly predict choice ($b = 0.04, SE = .15, \text{Wald } \chi^2 = 0.24, p = .81$). Similarly, no significant interaction effect was found for Claim Quantity ($b = 0.26, SE = .21, \text{Wald } \chi^2 = 1.24, p = .21$).

Splitting data byc, in the replication conditions, consistent with prior findings, participants were significantly more likely to choose the target (Darigold) when a claim was present (Claim Presence), $b = 0.70, SE = .25, \text{Wald } \chi^2 = 2.83, p < .001$. However, Claim Quantity did not significantly predict choice, $b = 0.04, SE = .15, \text{Wald } \chi^2 = 0.24, p = .81$. In the information conditions, in contrast, the mere presence effect was not observed (Claim Presence: $b = 0.18, SE = .27, \text{Wald } \chi^2 = .67, p = .50$). There was a marginally significant pattern suggesting that Claim Quantity affects choice ($b = 0.30, SE = .15, \text{Wald } \chi^2 = 1.97, p = .05$).

Figure 1-8 RESULTS OF STUDY 4A



Mediation analysis. Next, we conducted mediation analysis to examine whether the perceived quality of the labeled option (“Which product do you think is better in terms of quality?” [*Likert scale: 1 Definitely Darigold to 7 Definitely Lucerne*]) partially mediated the relationship between Claim Presence and consumer choice. Using the mediation package in R (Tingley et al. 2014), we found that the effect of Claim Presence on product choice was significantly mediated by perceived quality (Indirect effect: $b = 1.52$, 95% CI = [1.24, 1.81], $p < .001$). We also conducted mediation analysis on whether participants thought perceived risk of the labeled option explained the effect, but did not find supportive evidence. See Web Appendix F for more detail on mediation analysis of perceived risk.

Additional analyses. We conducted additional analyses in the replication condition to test whether the mere-presence effect was moderated by nutritional concern. In our proposed account, the mere-presence effect for protein occurs because consumers who value protein content (but lack the knowledge to interpret the specific numeric level of protein) use the presence of the protein attribute as a cue signaling a better product. However, if it were the case that consumers high in nutritional concern were knowledgeable about specific levels (e.g., the average level) of protein, we would no longer predict a mere-presence effect. First, in a pilot study (see Web Appendix G), we confirmed that accuracy of beliefs about protein were only weakly higher for those with greater nutritional concern. In the study 4a results, we found that the presence of a protein claim influenced choice primarily for those with higher nutritional concern, as measured by three aspects (who were concerned about protein, interaction $b = 0.54$; $p < .001$; who reported greater protein knowledge, interaction $b = 0.37$; $p = .01$; who read nutrition labels more frequently, interaction $b = 0.83$; $p = .04$). These results suggest that consumers with

higher nutritional concern are more likely to exhibit the mere-presence effect than those with lower concern.

We also tested whether the mere-presence effect is stronger for those with low category involvement or lack of deliberation. None of the category involvement measures (interest in buying milk, frequency of milk purchase) or deliberation measures (need for cognition, seriousness in answering questions, or response time) significantly moderated the effect of Claim Presence. These results suggest that the mere-presence effect is not just a short-cut that consumers use to make quick low-involvement decisions (Shah and Oppenheimer 2008) but is instead an overgeneralized heuristic they rely on even when engaging in deliberation to make a choice that is relevant to their concerns.

Discussion

We again replicated the mere-presence effect in the replication conditions. Consistent with our theory, the mere-presence effect was reduced in the factual information conditions, when participants were provided with the average level of protein in milk products. In sum, providing factual information weakened the level-neglect aspect of the mere-presence effect, such that participants took the actual protein amount, particularly claims of low protein, into account when making their purchasing decisions.

While this study provides evidence that the mere presence effect no longer holds when the information provided helps consumers assess the numeric value of the attribute, there was only borderline significant sensitivity to Claim Quantity in the information conditions, and a directional interaction. This outcome is not entirely surprising, considering the conservativeness

of our manipulation. Participants in the information conditions were presented with multiple pieces of information and were not informed that they would need to incorporate the information presented in the scenario into a subsequent decision. To test whether a stronger (but potentially less realistic) intervention would eliminate the mere-presence effect, we conducted an additional study (Supplementary Study O, N = 399). In this study, we again used factual information as a manipulation, instructing participants to retype the average protein content information they read in the scenario. As predicted, this stronger intervention, which ensured attention to the average protein content, yielded a much more pronounced effect in eliminating the mere reliance on attribute presence (Claim Quantity \times Condition Interaction: $b = 0.30$, $SE = .11$, Wald $\chi^2 = 2.79$, $p = .01$). See Supplementary studies O and P (a similar approach for study 4b) for more detail.

STUDY 4B: FACTUAL INFORMATION WEAKENS THE MERE-PRESENCE EFFECT FOR AN UNDESIRABLE ATTRIBUTE

Study 4b tested for a debiasing effect of providing factual information about the typical level of an undesirable attribute (saturated fat). We used the same bacon package stimuli as study 2 and tested an information-based manipulation, conducted through a short reading task, as in study 4a.

Method

As in study 4a, participants were randomly assigned to the replication conditions or the factual information conditions. Participants in the factual information conditions were first asked

to read a short paragraph about bacon, including the sentence “*On average, there are 33 grams of saturated fat in a pack of 12-oz raw bacon.*” Participants in the replication conditions were also asked to read the same paragraph except that the above sentence was replaced with information irrelevant to saturated fat content, “*Meat from other animals, such as beef, lamb, chicken, goat, or turkey, may also be cut, cured, or otherwise prepared to resemble bacon.*” After the reading task, all participants were then shown the same bacon stimuli (one of which had a label with either 66 g or 22 g of saturated fat, varied between-subjects) and made the same choice between an Oscar Mayer option and a Hormel option as in study 2. After making the choice, participants completed additional measures to be used in moderation and mediation analyses. They also completed a comprehension check question, selecting one of four statements, one of which correctly described the information they had seen in the scenario.

Results

Six hundred and sixty-two participants participated in the study on Amazon’s MTurk. Excluding 72 incomplete responses and 49 participants who failed the comprehension check question left a total of 541 participants (48.4% females; $M_{\text{age}} = 44.97$). They received \$0.75 for their participation in the 5- to 7-minute study (pre-registered at aspredicted.org/s4jv-mqd7.pdf). They were given an opportunity to win an additional bonus of \$0.45 (for a total payment of \$1.20) for getting the comprehension check question correct.

Descriptives. As shown in Figure 1-9, In the replication conditions, 35.7% of participants chose the unlabeled option over the labeled option in the high-quantity claim condition ($\chi^2 = 11.43$, 95% CI = [0.28, 0.44], $p < .001$), while 43.5% of participants chose the unlabeled option

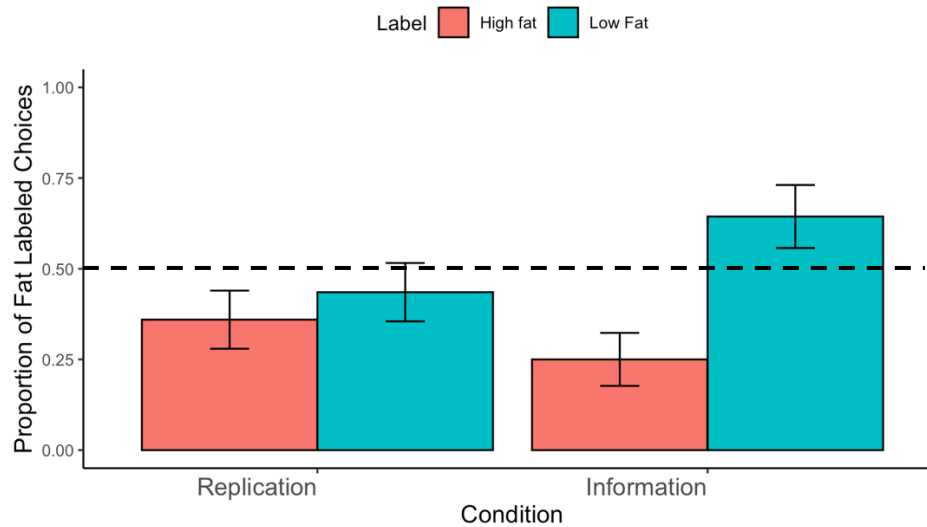
in the low-quantity claim condition ($\chi^2 = 2.46$, 95% CI = [0.36, 0.52], $p = .12$). However, when participants were provided with factual information that made the claim quantity evaluable, only 25.0% of participants chose the unlabeled option in the high-quantity claim condition ($\chi^2 = 34.00$, 95% CI = [0.18, 0.33], $p < .001$), whereas 64.4% chose the unlabeled option in the low-quantity claim condition ($\chi^2 = 9.80$, 95% CI = [0.55, 0.72], $p = .002$).

Regressions. We then analyzed the data using a logistic regression, predicting purchase of the target product (Hormel) based on Claim Presence, Claim Quantity, Condition (-1 = replication, 1 = information), the interaction between Condition and Claim Presence, and the interaction between Condition and Claim Quantity. In addition to a significant main effect of Claim Presence ($b = -0.81$, $SE = .24$, $Wald \chi^2 = -3.35$, $p < .001$), we found a significant interaction between Claim Quantity and Condition ($b = -0.96$, $SE = .27$, $Wald \chi^2 = -3.52$, $p < .001$), but no significant interaction between Claim Presence and Condition ($b = 0.29$, $SE = .37$, $Wald \chi^2 = 0.80$, $p = .42$). No significant main effect was found for Claim Quantity ($b = -0.04$, $SE = .18$, $Wald \chi^2 = -0.25$, $p = .80$) or Condition ($b = -0.02$, $SE = .24$, $Wald \chi^2 = -0.09$, $p = .93$). These results suggest that providing factual information significantly moderated the mere-presence effect by increasing consumers' sensitivity to Claim Quantity.

Splitting the data by condition, we found that the option labeled with saturated fat content was significantly less likely to be chosen when the claim was present in the replication conditions ($b = -0.81$, $SE = .24$, $Wald \chi^2 = -3.35$, $p < .001$), but this preference was much weaker in the information conditions ($b = -0.52$, $SE = .27$, $Wald \chi^2 = -1.90$, $p = .06$). Conversely, consumer choices of the target were not affected by Claim Quantity ($b = -0.04$, $SE = .18$, $Wald \chi^2 = -0.25$, $p = .80$) in the replication conditions, but consumers were significantly more likely to

choose the lower-saturated-fat option in the information conditions ($b = -1.00$, $SE = .21$, Wald $\chi^2 = -4.84$, $p < .001$).

Figure 1-9 RESULTS OF STUDY 4B



Mediation analysis. As in study 4a, analysis in the replication conditions found that perceived quality of the labeled option helped explain consumers' choices (Indirect effect: $b = -0.20$, $p < .001$; Direct effect: $b = 1.55$, $p = .002$). See Web Appendix F for more detail.

Additional analyses. We also conducted moderation analyses in the replication conditions (as in study 4a) to test whether nutritional concern, category involvement, and deliberation moderated the mere presence effect. As in study 4a, the mere presence effect was (marginally) stronger for those higher in nutritional concern (who were concerned about saturated fat, interaction $b = 0.48$; $p = .02$; who reported greater knowledge of saturated fat, interaction $b = 0.28$; $p = .08$; who read nutrition labels more frequently, interaction $b = 0.60$; $p = .08$). However, none of the measures related to either category involvement or deliberation significantly

moderated the effects of Claim Presence (all $ps > .33$). These results, consistent with the results in study 4a, suggest that the mere-presence effect is an overgeneralized heuristic that consumers rely on even when engaging in deliberation to make a choice that is relevant to their concerns, rather than a short-cut of convenience only used when making unimportant choices.

Discussion

These results suggest that asymmetric disclosure of undesirable quantitative attributes reduces consumers' purchase intent *unless* they know the average level. When consumers were provided with the factual information about the average saturated fat level, disclosing a high level of saturated fat reduced purchasing, but disclosing a low-level of saturated fat increased purchasing.

In sum, the results of studies 4a and 4b show that providing factual information eliminated the level-neglect aspect of the mere-presence effect. After receiving average-level information, participants took the disclosed amount of protein or saturated fat into account when making their purchasing decisions, favoring products with more attractive levels on both positive and negative attributes. These results provide strong support for the overgeneralized heuristic account, which predicts that providing relevant factual information will be a boundary condition of the mere presence effect. Given that the factual information and the labeled numeric claim remain equally distinctive in the information conditions, the boundary condition cannot be explained by a direct effect of distinctive cues on preference (e.g., Carpenter et al. 1994). Furthermore, our moderation and mediation analyses suggest that the mere presence effect is

unlikely to happen due to differences in perceived risk of the labeled product and is robust to high consumer involvement and motivation when making the decision.

STUDY 5: GENERALIZATION TO OVERALL PRODUCT RATING

Our theory builds on prior theories of evaluability, identifying a novel effect in which a single product attribute is treated as two distinct components when presented on a product package, presence (which is evaluable) and quantity (which often is not). We have proposed that consumers do not evaluate the quantity when it is not evaluable, but nevertheless process (and rely on) the presence of the attribute, which is evaluable. Study 5 directly tested the precondition implied by our theory and identifies a theoretically important boundary condition, that claim quantity must be nonevaluable for the mere presence effect to happen.

In this study, we extended the effect from specific numeric attributes to more general star rating-based numeric information about products. Specifically, we hypothesized that the mere-presence effect would be replicated when a lower value (4.1) or higher value (8.1) star rating was provided for one of two products, without providing information about the underlying rating scale (i.e., rendering the information nonevaluable). By contrast, adding scale range information would weaken the mere-presence effect by making the rating evaluable, resulting in sensitivity to the difference between lower and higher ratings.

Method

This study had a 2 (rating: high: 8.1 vs. low: 4.1) by 2 (scale range: present vs. absent) design. All participants were first shown a scenario in which they were shopping online at the

website of a fictitious retailer, SHOPCLIQUE (see Web Appendix A). Participants were instructed: *“Imagine that you are shopping for a tumbler cup online, and you see the following.”*

As in study 3, information about the products was presented in a grid format. To mimic a typical online shopping environment, we provided product images for both options, the availability of each item (both available) and product origin information (one from Belgium and the other from France), along with an independent star rating for one of the options only (counterbalanced). When the scale-range information was present, participants saw the star ratings expressed as either “8.1 out of 10” (high rating condition) or “4.1 out of 10” (low rating condition), respectively. When the scale-range information was absent, the ratings were presented as either “8.1” (high rating condition) or “4.1”(low rating condition), respectively.

In addition, as in study 3, the following information was presented below the grid, *“The retailer posts product information provided by a nonprofit consumer organization dedicated to independent product testing. The lab chooses which products to test at random. If the information is missing, that is because that product has not been randomly selected to be tested by the organization yet.”* We included this note to avoid participants inferring that whether or not a rating was present had been strategically decided by the sellers of the products.

Participants were asked to choose between the two options, specifying that the price and size of both options was the same. After choosing between the two tumblers, participants rated relative quality, *“Which tumbler do you think is better in terms of quality, the black one or the gray one?”* (from 1: *Definitely the black one* to 7: *Definitely the gray one*). We also measured interest in category-level purchasing and the self-rated degree of deliberation.

Results

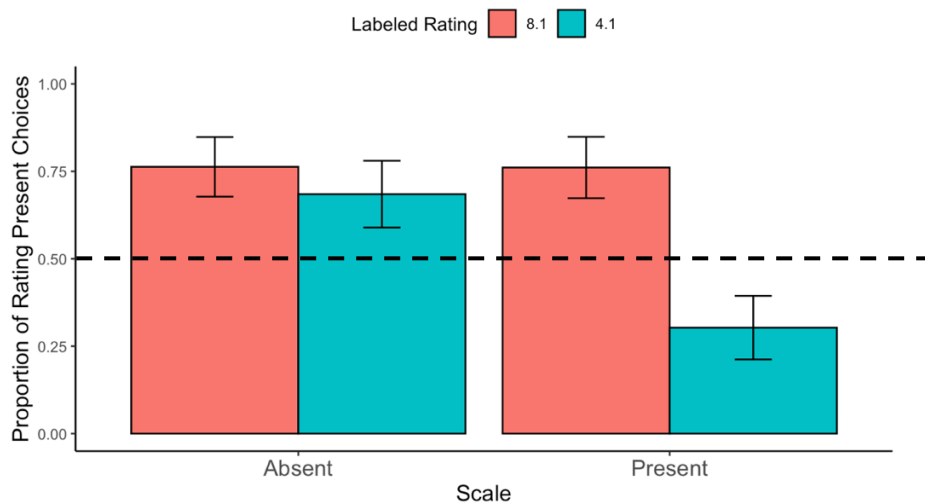
Four hundred and one participants participated in the study. Excluding 13 participants who did not finish the study left 388 participants (49.2% females; $M_{\text{age}} = 45.93$). They received \$0.60 for the 4-minute study (pre-registered at <https://aspredicted.org/y436-ysmd.pdf>).

Descriptives. As shown in Figure 1-10, we replicated the mere-presence effect in the scale-absent condition, but not in the scale-present condition. In the scale-absent condition, we found that the majority of the participants chose the rated product over the no-rating alternative, both when it had a higher rating (76.3%, $\chi^2 = 26.81$, 95%CI = [.67, .84], $p < .001$) and when it had a lower rating (68.5%, $\chi^2 = 12.57$, 95%CI = [.58, .77], $p < .001$). These results replicated our prior findings of a mere presence effect, specifically when a scale to enable evaluation of the rating is absent. However, in the scale-present condition, we found that participants became sensitive to the numeric value of the rating: 76.1% of the participants chose the higher-rated product ($\chi^2 = 25.04$, 95%CI = [.66, .84], $p < .001$) over the unrated alternative, while only 30.3% chose the lower-rated product ($\chi^2 = 15.36$, 95%CI = [.22, .40], $p < .001$).

Regressions. In a logistic regression, we predicted choice of the target (the black tumbler) based on Rating Presence, Rating Magnitude, Scale-Range Presence (0 = Absent, 1 = Present). We document a significant effect of Rating Presence when a scale was absent ($b = 1.96$, $SE = .33$, Wald $\chi^2 = 5.94$, $p < .001$), but such an effect is eliminated when a scale was present ($b = 0.31$, $SE = .33$, Wald $\chi^2 = .94$, $p = .35$). Conversely, we found no significant effect of Rating Magnitude in the scale-absent ($b = 0.31$, $SE = .33$, Wald $\chi^2 = .94$, $p = .35$) condition, but a significant effect in the scale-present ($b = 1.00$, $SE = .16$, Wald $\chi^2 = 6.08$, $p < .001$) condition, suggesting that consumers think based on Rating Magnitude when a scale was present, but not

when it was absent. To test for moderation, we ran a logistic regression on the full data, adding interactions between Scale-Range Presence and Rating Presence, and between Scale-Range Presence and Rating Magnitude as predictors. The analysis confirmed that Scale Presence had a significant interaction with Rating Presence ($b = -1.65$, $SE = .47$, $Wald \chi^2 = -3.53$, $p < .001$) and with Rating Magnitude ($b = 0.80$, $SE = .23$, $Wald \chi^2 = 3.45$, $p < .001$), suggesting that the mere-presence effect was significantly reduced when the scale range was presented.

Figure 1-10 RESULTS OF STUDY 5



Mediation analysis. Mediation analysis was conducted separately for the scale-absent condition and the scale-present condition. Results in the scale-absent condition confirmed that the total effect of Rating-Range Presence on choice of the target (Total effect: $b = 0.45$, $p < .001$; Direct effect: $b = 0.29$, $p < .001$) was partially mediated by perceived quality of the target. In the scale-present condition, consistent with our theory, we did not observe any mediating effect of perceived quality (Total effect: $b = 0.06$, $p = .38$; Direct effect: $b = 0.05$, $p = .37$).

Discussion

The findings of study 5 provide compelling evidence that the mere-presence effect generalizes to broader evaluations and identifies evaluability as a key moderator. In the base case, without scale range information, participants could not directly evaluate the star ratings and perceived both high and low ratings as relatively favorable, choosing the rated product over an unrated alternative, which replicated the mere presence effect. However, when participants were told that the star ratings were on a 10-point scale, making the ratings evaluable, participants became sensitive to the rating magnitude, preferring the higher-rated product, but not the lower rated product, over an unrated alternative.

In fact, the use of rating scales in study 5 yields additional insight into the underlying psychological process. We have proposed that when consumers see either high or low numeric attribute values, they interpret the presence of either a high- or low-valued attribute claim as signaling quality (as shown in studies 4a and 4b). In our account, consumers interpret the attribute claim in a way that reconciles both low and high numeric values with a high attribute-value interpretation of the product. In the scale-absent condition, we asked an additional question that directly tested the interpretation: participants were asked what scale-range (i.e., out of what number) they had thought the rating had been measure on. Consistent with our prediction that participants would reconcile both numeric values with a high-quality interpretation, participants most commonly assumed a maximum-10 scale when presented with an 8.1 rating and instead assumed a maximum-5 scale when presented with a 4.1 rating. Furthermore, participants were quite confident about their interpretation, with higher-than-midpoint confidence ratings in both

conditions ($M_{\text{high_rating}} = 5.29$ vs 4.00 , $t(96) = 7.83$, $p < .001$; $M_{\text{low_rating}} = 5.21$ vs. 4.00 , $t(91) = 7.82$, $p < .001$). This suggests that consumers demonstrate the mere-presence effect by inferring a high attribute value from the mere presence of a numeric attribute and then back-fit a belief-consistent interpretation of the numeric value, when that value is not evaluable.

GENERAL DISCUSSION

In seven pre-registered studies testing different products and different quantified attributes, we found a robust mere-presence effect of asymmetric disclosure: consumers prefer to buy a product with a quantified attribute claim over a similar product without such information when the attribute is desirable, regardless of the quality conveyed by the claim. Our results are consistent with sensitivity to attribute presence and either quantity insensitivity or very low sensitivity to the attribute level. Conversely, consumers prefer to buy a product without a quantified attribute claim over a similar product with such information when the attribute is undesirable, again regardless of the quantity conveyed by the claim. The mere-presence effect cannot be explained by alternative accounts, such as consumers' market metacognition inferences about firms' strategic motives for presenting information (Wright 2002; study 3, studies 4a and 4b), perceived risk of the available options (studies 4a and 4b), or a penalty for non-disclosure (Johnson and Levin 1985; John et al. 2016; study 2, studies 4a and 4b). Our findings also cannot be explained by Carpenter et al. (1994)'s theory of reliance on meaningless attributes, because the effect persists regardless of the information source (study 3), is debiased by providing reference information despite remaining distinctive (studies 4a and 4b) and does not generalize to another non-numeric distinctive attribute (study J in the online supplement).

The evidence was most consistent with our proposed overgeneralized heuristic account. The mere presence effect was eliminated when the use of a heuristic was made unnecessary by providing information about the average quantity of the attribute (studies 4a and 4b) or the range of a rating scale (study 5). These results are consistent with reliance on an overgeneralized association between valence of a claim and quality, which is actively relied on as a heuristic when consumers are motivated to incorporate the information but lack the context to evaluate the numeric claim (tested via moderation and mediation in studies 4a, 4b and 5).

The mere presence effect can be understood as a result of stable lay beliefs that consumers develop over time, rooted in how they learn to process and apply information in decision-making. Importantly, because these beliefs operate at a fundamental cognitive level when consumers are trying to use seemingly relevant information, we predicted that they are unlikely to be influenced by motivational factors like category involvement or depth of processing, or by inferential factors such as the motives of information source. Consistent with our prediction, we found that the mere presence effect replicates regardless of whether consumers are highly involved in the decision or are evaluating information provided by different sources. In fact, consistent with the idea that the mere-presence effect occurs as a heuristic way of incorporating seemingly relevant information, we find that the effect is stronger among consumers with greater concern about the attribute (studies 4a and 4b). We show that the way to preclude such an overgeneralized heuristic is to provide directly relevant information that over-rides the associated belief and makes the quantity conveyed evaluable.

Implications for Research on Consumer Decision-making

Our work extends the literature on how consumers interact with the disclosure of cues that they cannot fully evaluate. Previous research on evaluability posits that attributes which are not inherently evaluable to a consumer will be edited out in separate evaluation (when options are considered individually) but considered in joint evaluation (when comparison between options facilitates evaluability; Hsee 1996). However, our studies examine a novel situation in which joint evaluation itself becomes challenging—specifically, when consumers choose between two products, one with a stated numeric claim and the other without. This situation, not anticipated in the prior evaluability literature, reveals a distinct judgment process: consumers decompose the numeric attribute into two components—its presence and its quantity. When the quantity is difficult to assess, they may primarily rely on the attribute’s presence, making quality judgments based on the valence of the attribute, while neglecting the quantity.

Our research also broadens the current literature on how consumers think about irrelevant attributes. The two-component aspect of the mere-presence effect extends previous marketing literature which had identified effects based on the presence of irrelevant information, but which either did not consider the level or quantity conveyed (e.g., Hsee et al. 2009; Baskin and Liu 2021) or conveyed a comparison between a superior vs. regular attribute (Carpenter et al. 1994). While Carpenter et al. proposed that even irrelevant attributes that are distinctive can be differentiating (because they attract attention through novelty, and consumers then infer value signaled by the seller), their studies specifically test irrelevant attributes that were positioned as *enhanced* features (e.g., “Alpine class,” “authentic Milanese” or “studio-designed” vs. “regular”). As a result, these constitute irrelevant but evaluable attributes to the consumer. Unlike the attributes tested in Carpenter et al. (1994), we test objectively informative attributes that are different enough in value to be potentially relevant, but which are independently

nonevaluable (Web Appendix B). By studying how the underutilization of meaningful nonevaluable attributes affect decisions under asymmetric information disclosure, we focus on the opposite of Carpenter et al.'s overutilization of meaningless differentiating claims under comparable information disclosure.

To further test the alternative explanation that the mere presence effect is driven by attention or distinctiveness of the asymmetrically disclosed claim, we conducted an additional study (see Supplementary study J for detail; $N = 397$), in which participants chose between a product with a numeric protein claim, and either an unlabeled competitor product (control condition, replicating the prior studies) or a competitor product with a visually salient but uninformative “new product” claim (new-product condition). We replicated the preference for the quantitatively-labeled option regardless of quantity conveyed, both in the replication conditions (high value: 58%, $p = .120$; low value: 69%, $p < .001$) and found an even stronger mere-presence effect when the competitor option featured a “new product” label (high value: 70%, $p < .001$; low value: 76%, $p < .001$). Making the competitor product similarly visually distinctive did not reduce the mere-presence effect, contrary to the visual distinctiveness explanation in Carpenter et al. (1994).

Implications for Consumers and Practitioners

Our findings have significant practical implications for both marketers and consumers. Specifically, the findings imply that consumers may process the presence, but not the level, of many meaningful product attribute claims, such as food nutrition and ingredient claims, product ratings and quantitative usage information. For marketers, our findings suggest that the first

product to introduce a claim for a desirable attribute can benefit, even when the content of the claim is objectively non-differentiating or even inferior to competitors. Leveraging the mere-presence effect can potentially increase the market share of the product featuring the claim, at least until competitors respond by also featuring the claim, making it comparable. As a result, the mere-presence effect may contribute to “label clutter,” because firms are motivated to match positive-attribute competitor claims to preclude a mere-presence effect. Conversely, the mere-presence effect can disincentivize marketers from providing information about negative attributes. An attempt to attract consumers by disclosing a lower-than-average quantity of negative attribute may be simply overgeneralized as “bad” and discourage purchase, unless the claim is framed in a way that fosters evaluability (e.g., “Low in saturated fat - only 22g”, when legally permissible, Beales III 2011).

For consumers and policymakers, our results highlight a potential mistake that consumers may make, making decisions that are *contrary to* the factual information in asymmetric disclosure. Companies are often advised to provide consumers with more information, based on the assumption that consumers will be well-calibrated in using the information, which will support informed decision-making (e.g., Bettman, Luce and Payne 1998). However, throughout our studies (see Web Appendix D), a low-quantity claim on a positive attribute *never significantly decreases* the percentage of consumers choosing the product (compared to the unlabeled product). A claim specifying a low-quantity level of a positive attribute may paradoxically *attract* consumers to buy a product, despite the factual disclosure of the attribute, unless consumers have a frame of reference for evaluating the attribute level. Conversely, disclosure of even low levels of a negative attribute (such as saturated fat) may be

disincentivized by negative consumer responses. In sum, asymmetric information disclosure can result in mistaken decisions arising from a nondeceptive marketing strategy.

This highlights a potentially under-appreciated benefit of universal labeling regulations, such as the Nutrition Facts panel in the U.S., which provides comparability across products. As a consumer education strategy, it may be useful to teach consumers that although they may assume that the mere presence of a claim conveys higher quality of a product, featured claims may not represent strengths of that product relative to competitors. In supplementary studies, however, we find that prompting or nudging consumers not to use the overgeneralized heuristic may not be successful. Neither nudging consumers to generate their own reference point nor giving consumers experience with asymmetric disclosure followed by full disclosure eliminated the mere presence effect (Supplementary studies D, E, F, and K). Similarly, exposing consumers to an unavailable third product that shows a different viable quantity labeled does not reduce the effect (Supplementary study Q). Consistent with our results in study 4a and 4b, this suggests that the mere presence effect represents a decision rule that consumers find useful (consistent with an illusion of validity, Tversky & Kahneman 1974), which is therefore difficult to teach consumers not to use, rather than a decision short-cut that consumers can recognize as nonoptimal.

In considering the generalizability of the mere presence effect, it is important to consider how much other information is available to consumers in the decision environment. On the one hand, we have found that the mere-presence effect can persist even when consumers tradeoff an asymmetrically disclosed attribute (e.g., protein) against another evaluable product attributes (e.g., vitamin D, a pre-tested desirable attribute; see a study testing this in Web Appendix C). This suggests that consumers do not only use asymmetric attribute claims as tiebreakers when no other distinguishing attributes exist.

However, our theory does predict, and we have empirically identified, important boundary conditions. First, the mere presence effect should not occur when the quantity labeled is evaluable to consumers either because of familiarity or because the attribute range is known (enabling sensitivity to quantity, as shown in supplementary studies M and R). Second, the mere-presence effect requires that consumers notice the claim and judge it to be relevant. Given the combination of consumers' reliance on prior preferences (e.g., Dube, Hitsch and Rossi 2010) and the proliferation of claims on product packaging in some categories, sometimes consumers may not notice a non-comparable claim. We find less of a mere presence effect when the target attribute competes for consumers' attention with other information, potentially including strong cues (e.g., brand) of consumer preferences (see Supplementary studies C, H, I, and N for more detail). We also found that when consumers are exposed to all sides of nutrition facts panels, they no longer display a mere presence effect, potentially due to information overload (Supplementary study H).

While it is important to recognize these boundary conditions, the mere-presence effect is likely to be relevant in a variety of important marketing situations, even when additional information is available. For example, a salient front-of-package asymmetric nutritional claim may influence consumers, despite the presence of the Nutrition Facts Panel on the side or back of all products. Research has shown that many consumers do not look at nutrition labels (Graham, Orquin, and Visschers 2012), or only spend a very small amount of time doing so (Graham and Jeffery 2011). When products are sold in small individual packages and in vending machines, consumers will not have access to nutrition facts of the products they are interested in purchasing. In general, even when a great deal of information is available, consumers may rely on the mere presence of a sufficiently salient asymmetric disclosure.

To sum, we document a robust mere-presence effect, such that consumers rely on the presence of asymmetric numeric attribute claims to judge product quality despite a failure to incorporate the level of the attribute conveyed by the claim. The mere-presence effect poses a challenge both to marketers attempting to efficiently convey the most relevant product information and to consumers attempting to efficiently navigate an information-overloaded marketplace. We demonstrate that asymmetric information disclosure can sometimes paradoxically impede, rather than facilitate, consumers' judgments of product quality and their ability to make well-calibrated decisions.

**Chapter 2 OUTWARD VS. INWARD THINKING USE DIFFERENT HEURISTICS:
HOW REFRAMING PREVALENCE SHAPES INDIVIDUALS' IMPACT JUDGMENTS
AND CHOICES**

ABSTRACT

Information on prevalence is commonly provided in communications, including but not limited to the contexts of advertising and public policy. Across ten pre-registered studies, we show that how individuals infer impact from prevalence information depends on framing cues. We introduce a distinction between outward thinking (inferential heuristics based on generalized relationships) vs. inward thinking (inferential heuristics based on the specifics of one's situation). While general framing and word-based cues prompt outward thinking, with individuals drawing inferences from broad patterns encountered in the outside world (e.g., tradeoffs between attributes), specific framing and numeric cues prompt inward thinking, a focus on local inferences from the focal instance (e.g., conflation of attributes). As a result, higher level of impact (e.g., high severity of a problem) is more likely to be associated with lower prevalence (e.g., a rare occurrence) when prevalence information is framed generally and in words, and is more likely to be associated with higher prevalence (e.g., a common occurrence) when prevalence information is framed in specific terms and numerically. We show that this effect has consequences for decision-making, reversing individuals' decisions to repair (vs. to replace) a product with a problem and impacting individuals' real donation decisions.

Keywords: communication, framing, numerical decision making, prevalence, risk

It is common for consumers to encounter product descriptions or marketing messages describing the prevalence of product benefits or harms. For example, a type of product recall may be described as “common” in the news by reporters, or the service provided at a restaurant may be described as “rare” by its customers, in comparison with what other restaurants offer. Beyond the literal frequency, what connotation does such prevalence information convey? The current research studies how consumers infer the impact of an outcome or event (e.g., the severity of a computer problem) from prevalence information and how such inferences shape product judgments and decisions. This is an important question to study, as subjective impact can have a profound influence on consumer decisions, including but not limited to domains such as medical communications (e.g., Buller and Buller 1987; Franic and Pathak 2000), crisis communications (e.g., Laufer et al 2005; Xiao et al. 2018; Wodak 2021), advertising, and service interactions. It is common for consumers to encounter news reports, company statements, marketing messages, or consumer reviews describing the prevalence of product benefits or harms (see examples in Web Appendix A).

As an example, imagine that one day, a couple, Taylor and Alex, found that their computer was not working properly and brought it to a technician. The technician examined their computer and then told the couple that their computer had a common problem that occurs about 60% of the time. After hearing this, Taylor felt relieved and concluded that the problem was unlikely to be serious. Surprised, Alex responded to Taylor, “What? It’s obviously a huge issue!” Despite being exposed to the same substantive information about prevalence, the couple disagreed with each other, arriving at opposite conclusions about the likely impact.

Why might this happen? In our hypothetical example, the couple realized that they had been thinking about the message from the technician in very different ways. Taylor explained,

“This is a common issue, and since the computer is still sold on the market, it must mean that it’s no big deal – otherwise the company would have already found a solution for it. The kinds of computer problems that I hear about people having that are really bad are rare.” Alex explained, “If the problem happens to our brand of computer 60% of the time, that sounds like a big deal. This manufacturer probably has bad quality control – our computer might have other issues too!”

In this research, we investigate when and why people may make opposite inferences about problem severity from prevalence information. We propose that consumers do infer impact, or the magnitude of a consequence, from prevalence, but that the way prevalence is framed and communicated determines the direction of consumers’ impact inferences. We present an outward vs. inward thinking framework, in which consumers’ way of thinking prompts reliance on different heuristics, leading to opposite inferences.

In our framework, Taylor is thinking *outwardly*, reasoning about general patterns in the outside world. This thinking style prompts consumers to consider tradeoffs between attributes and, as we will show, is cued by framing prevalence in general terms, which tends to trigger a Rare = Severe lay belief. Conversely, Alex is thinking *inwardly*, or focusing on one’s specific situation. This thinking style prompts consumers to conflate attributes and is cued by framing prevalence in specific terms, which we show tends to trigger the opposite Common = Severe belief. We further show that this distinction in how prevalence is related to impact is also influenced by whether severity information is presented in words or numerically, as well as by self vs. other-focus. Our framework is useful for resolving seemingly contradictory results in the prior literature, and predicting how simple differences in information framing can change or reverse consumer inferences and influence decisions, even when the objective information remains unchanged.

THEORETICAL DEVELOPMENT

Prevalence and Impact

Existing literature on consumers' associations between prevalence and impact shows seemingly paradoxical findings. Some research documents associations between *higher* prevalence and more extreme (negative or positive) magnitude. In the negative domain, the literature on severity bias, which has been mostly investigated in the health context, claims that high severity is associated with high probability. Bonnefon and Villejoubert (2006) asked participants to estimate the probability of suffering from either deafness (seen as high in severity) or insomnia (seen as low in severity). Participants estimated a higher probability of deafness than insomnia, suggesting an inferred positive correlation between high probability and high severity. Weber and Hilton (1990) found a similar relationship between perceived severity and prevalence even controlling for participants' knowledge of base rates of medical conditions.

Beyond the inferred severity of negative outcomes, research has found corresponding effects in the positive domain. Bandwagon effects, which have been documented in politics, economics, and other social domains, occur when people behave as if the most commonly supported beliefs are therefore better (Henshel and Johnston 1987; Schmitt-Beck 2015). The bandwagon effect is often referred to as a "winner-take-all" phenomenon, such that actual prevalence (or even just the illusion of prevalence; Lange et al. 2023) of a positive attitude may be interpreted as evidence of the strength of the attitude. For "search goods," consumers may therefore infer quality from frequency, such as judging that a restaurant with more customers provides higher quality (Granovetter and Soong 1986). Recent research has found that

consumers tend to expect products with a higher probability of providing benefits to also provide larger magnitudes of benefits, due to a belief that larger magnitudes and higher probabilities are both caused by more powerful perceived or assumed causal antecedents (Kupor and Laurin 2020). More generally, research on halo effects shows that unavailable attributes of a product or experience are judged to be more positive when other attributes (potentially including the frequency of a product benefit) are more positive (e.g., Beckwith and Lehman 1975).

However, other research in different contexts has documented associations in the opposite direction, between *lower* prevalence and more extreme values. This research suggests that when a problem is less common, it will be judged as less severe. For example, Folkes (1988) found that incidents from products and brands that are more unusual or distinctive are usually judged to be more serious, because they are more easily accessible in one's memory. In the social domain, Eskreis-Winkler, Peres, and Fishbach (2024) documented a "Big Problem Paradox," such that providing prevalence information about a problem made the problem seem less severe, which in turn lead people to be less likely to provide help to address the problem.

On the positive side, some research on social interaction has found that rarer shared preferences between individuals are assumed to be stronger (Vélez, Bridgers and Gweon 2019). Conversely, Dai, Wertenbroch, and Brendl (2008) document a value heuristic, such that consumers judge a class of objects or events that are higher in value as scarcer, even when value is nondiagnostic of frequency. The literature on scarcity and consumption also finds that items that are scarce are usually perceived as more valuable (Verhallen and Robben 1994). Food that are scarce are also perceived to have higher calories, a motivated perception explained by an increased perceived value of food (Salerno and Sevilla 2019).

Outward vs. Inward Thinking

In the literature discussed above, both directions of findings (i.e., associating either lower prevalence or higher prevalence with high level of impact) have largely been explained in terms of heuristics and lay beliefs (e.g., Bonnefon and Villejoubert 2006; Dai, Wertenbroch, and Brendl 2008). To reconcile these differing findings, it is useful to think of overgeneralized heuristics as having two general types.

One type of heuristics generally arises from overlearned relationships between attributes across different instances in the world (including those that may be relevant to others and not oneself), typically in the presence of constraints. So, for example, a consumer may have a general sense that computer problems are not catastrophic – severe problems exist but are typically rare, and common computer problems are not a big deal to resolve. This makes sense based on an outward-facing understanding of how the world works – if there was a common and severe problem in a product category, it would become the highest priority to develop solutions for it and if solutions were not found, adoption of products in that category would be low. Given an outward-facing understanding of tradeoffs based on the consequences for a wide range of people, the presence of cues signaling greater frequency or likelihood would tend to result in inferences of *less extremity* for a given instance.

The other type of heuristic arises from taking a more inward perspective of one's own situation and of a specific instance. When focusing on one's own circumstances in light of a particular computer problem, for example, the consumer is likely to engage in spontaneous categorization, assessing whether they are facing a serious or minor problem. Based on their holistic judgment, they will then make spontaneous inferences about omitted information (e.g.,

Beckwith and Lehmann 1975; Nisbett and Wilson 1977; Loken 2006). Given an inward-facing goal of categorizing a specific instance in terms of the consequences for one's self, the presence of more self-impacting higher frequency or likelihood cues would tend to result in corresponding inferences regarding *more extremity* (e.g., and therefore also more impact) of the instance.

Outward vs. Inward Framing Shifts the Use of Heuristics

We propose that the differences in the way prevalence is framed and communicated may resolve the two streams of seemingly paradoxical findings, predicting when consumers rely on which heuristic. Specifically, we argue that outward thinking is suggested by general framing, while inward thinking is suggested by specific framing.

Describing prevalence in general terms prompts consumers to think about general patterns that account for relationships across different items and different people's experiences in the outside world. Such tendencies have even been observed in young children, when encouraged to generalize what they have learned in a particular exercise (e.g., via summarization, Crowley and Siegler 1999; McKeough, Lupart and Marini 2013). Thinking in general terms would bolster the tendency to apply broad rules, such as lay beliefs, that they have learned across contexts to make decisions. Notably, such strategies can be detrimental, when attempts to develop broad principles for making future inferences lead to overgeneralization (Williams, Lombrozo and Rehder 2013), applying principles that are valid in one context to others in which the principle does not apply (Tversky and Kahneman 1974; Arkes and Ayton 1999; Yeung and Soman 2007; Haws, Reczek and Sample 2017; Goswami and Urminsky 2020).

An association between low prevalence and high impact, prompted by thinking in terms of general principles, would constitute one such overgeneralized lay belief. Overgeneralized lay beliefs are common in the consumption context (Raghunathan, Naylor, and Hoyer 2006; Mukhopadhyay and Yeung 2010; Cheng, Mukhopadhyay, and Schrift 2017). An association between rarity and severity of computer problems, for example, could be learned via patterns of media coverage and online discussion, in which rare problems are discussed even when not extreme and extreme problems are discussed even if relatively common, but common non-extreme problems do not merit discussion. As another potential basis, seeking out others coping with same problem as one's own (e.g., Leavy 1983; Stroebe and Stroebe 1996; Barrera 2000) can make the problem seem both more common and more manageable (e.g., less severe). This coping strategy may result in a perceived norm that seemingly common things that more people face together are less severe.

Conversely, describing frequency or likelihood in specific terms prompts consumers to focus on the event or the product being described at the moment and on the consequences or implications for themselves in particular. Past literature on halo effects has found that when judging missing attributes for a specific product, consumers tend to make inferences by extrapolating from relevant attributes that are already available to them (Huber and McCann 1982; Kardes, Posavac and Cronley 2004; Boatwright, Kalra and Zhang 2008). Under inward thinking, judgments of one dimension (e.g., disliking a specific person's accent) can spill over to judgments on another dimension (e.g., assuming that person is incapable of performing a task; Nisbett and Wilson 1977), even when people might not endorse the general rule.

An association between high prevalence and high impact, prompted by inward thinking about specific instances, would constitute one such type of extrapolation-based inference. When

prevalence is described in specific terms or is provided in the context of a specific instance, consumers will tend to use that prevalence information to make a holistic judgment, and then infer the omitted attribute (e.g., severity) from the holistic judgment. For example, when consumers learn that their computer model rarely encounters a particular problem, they will be likely to conclude that this problem does not pose a serious risk to them, and from that holistic judgment, will then infer that the severity of the problem is low.

In addition to directly conveying information as general (vs. specific), we propose that other cues that are associated with general (vs. specific) information can promote outward (or inward) thinking. In this research, we test one such commonly encountered set of cues, the use of words vs. numbers to convey prevalence information. Past research has also shown that language expressions differentially affect the inferences and decisions made by listeners and readers (Sanford and Moxey 2003). When thinking about probability in words (rather than numbers), consumers are more likely to use intuitive and associative thinking (Windschitl and Wells 1996).

In particular, word expressions are more general and less precise than numeric expressions (Budescu, Weinberg and Wallsten 1988; Weber and Hilton 1990; Dhimi and Mandel 2022). The lower precision when expressing probabilities or frequencies in words carries a “face-saving” function, allowing for potential mistakes by the speaker (Dhimi and Mandel 2022). Words (vs. numbers) are therefore generally favored when conveying (vs. receiving) information (Wallsten et al.1988; Jaffe-Katz et al 1989), implying a conversational norm of the speaker, rather than the listener (Weber and Hilton 1990). As a result, when prevalence is described in words, consumers will be more likely to think from an outward perspective (e.g., about other people in general), whereas numbers would be more likely to promote inward thinking about the specifics of the quantified instance.

Current Studies

Based on our proposed outward vs. inward thinking framework, we make two predictions:

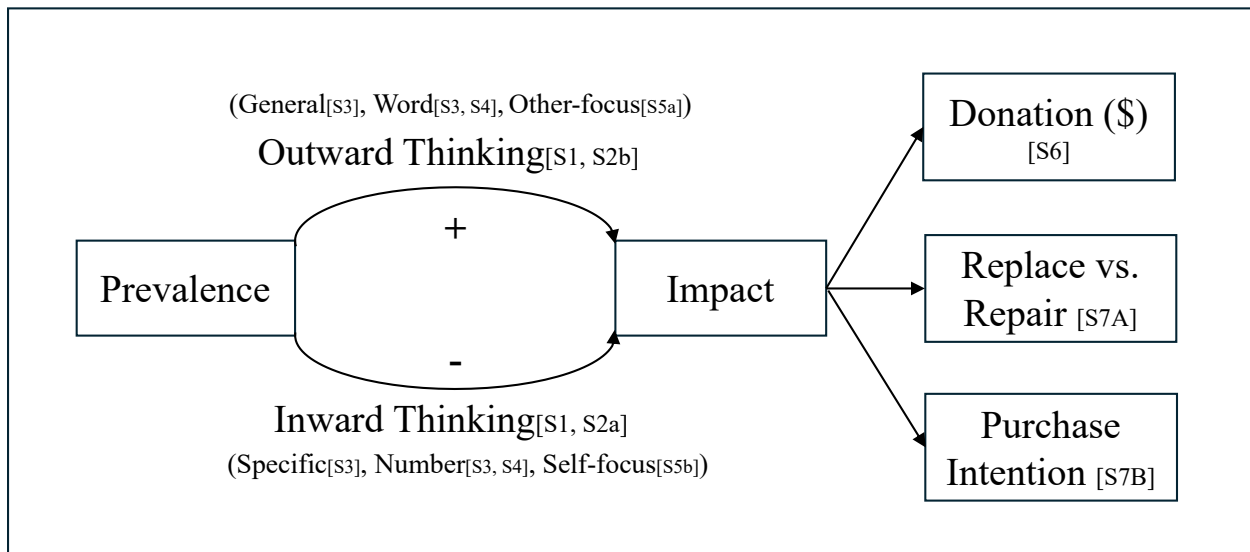
H1a: When prevalence is framed generally and expressed in terms of words, consumers will be more likely to think rare (vs. common) events have higher level of impact.

H1b: When prevalence is framed specifically and expressed in terms of numbers, consumers will be more likely to think common (vs. rare) events have higher level of impact.

Next, we report tests of the proposed outward vs. inward thinking framework (illustrated in Figure 2-1) across a series of ten studies. First, we demonstrate that different ways of presenting prevalence information results in opposite consumer inferences of impact, across various consumer contexts (study 1). We then demonstrate both the Common = Severe heuristic (study 2a) and the Rare = Severe heuristic (study 2b). Study 3 explains the reversal in impact judgment using the outward vs. inward thinking framework, contrasting inferences from prevalence framed in general terms using words to inferences from prevalence framed in specific terms using numbers. Study 4 tests an alternative account based on precision of information provided. Next, we test interventions based on the proposed framework, and show that the effects of using numbers on impact inferences when prevalence is framed specifically can be reduced by prompting consumers to think outwardly (study 5a), and the effects of using words when prevalence is framed generally can be reduced by prompting consumers to think inwardly (study 5b). Lastly, we test the consequences for inference-based decisions, finding that

prevalence framing influences consumers' real decisions on whether to donate to a cancer-research charity (study 6), consumers' preferences to repair (vs. to replace) a computer (study 7a), and consumers' purchase intention in a non-negative domain (study 7b). We summarize the conceptual framework of the paper in Figure 2-1.

Figure 2-1 CONCEPTUAL FRAMEWORK AND ROADMAP



NOTE. “S” in terms such as “S1” and “S2B” in the figure refers to “study.”

We pre-registered all experiments, including sample sizes and main analyses. We report all conditions and measures. Exploratory and secondary measures are included in the Online Supplement, with a few of the most relevant ones discussed at the end of some of the studies. All study materials, pre-registrations, data, code to replicate analyses, the Web Appendix, and the Online Supplement are available in a public OSF repository:

https://osf.io/rcz4k/?view_only=57a5414c36bb4135a5fcc70a033ea16d.

STUDY 1: CONTRARY IMPACT INFERENCES IN CONSUMER SCENARIOS

Study 1 tests whether consumers' perception of impact is affected by prevalence framing. Specifically, we presented multiple everyday consumer scenarios to participants in one of two randomly assigned framing versions. In each scenario, we presented side-by-side a higher prevalence case (e.g., a product with more recalls) and a lower prevalence case (e.g., a product with fewer recalls), and asked participants to choose the option that they think has higher level of impact (e.g., which of the two products has a more severe problem).

Method

Participants were randomly assigned to either the outward-framing or the inward-framing condition. The specific differences between outward and inward versions of the scenarios varied across the scenarios. However, the prevalence information was conveyed in more general terms using words in the outward condition, and the prevalence information was conveyed in more specific terms using a number in the inward condition. Participants in both conditions read five scenarios (encompassing both consumer problems and benefits) in which they were presented with two options, one more prevalent and the other less prevalent. The scenarios include 1) learning about a more vs. a less frequently chosen gift and judging which option is a better choice of gift; 2) learning about a common vs. a rare product recall and judging which one is more serious; 3) learning about a more vs. a less frequently experienced restaurant service and judging which restaurant provides better service; 4) learning about a common vs. a rare laptop issue and judging which issue is more severe; 5) learning about a more vs. a less frequently encountered battery performance of cellphones and judging which cellphone has better battery

performance. For example, the scenario about product recall was introduced in both conditions as:

“Imagine you recently learned about two product recall notices from the news. You remember the two recalls like the following, as described by the reporters:”

In the outward condition, participants then read the following two descriptions of the two product recall notices:

Recall with product A: “Such recalls rarely happen in recent years.”

Recall with product B: “Such recalls are common in recent years.”

By contrast, in the inward condition, participants instead read the following two descriptions of the two product recall notices:

Recall with product A: “This product has had 2 recalls in recent years.”

Recall with product B: “This product has had 10 recalls in recent years.”

Participants were then asked to choose the option that they thought conveyed a higher level of impact (e.g., “Based on the descriptions above, which recall do you think is more serious?”). The order of the five scenarios was randomized for each participant. See Web Appendix B for a full list of scenarios in both conditions.

Results

Two hundred and four U.S. participants above 18 years-old from Prolific participated in the pre-registered study. Excluding two responses from participants who did not finish left 202 valid responses (97 females, $M_{\text{age}} = 38.94$). This study was pre-registered at https://aspredicted.org/GY2_8NZ.

We tested the proportion of participants who chose the less prevalent option as having a higher level of impact differed across conditions. Across all scenarios, participants in the outward condition were more likely to choose the less prevalent option, associating lower prevalence with *higher level of impact or severity*, than those in the inward condition, who were more likely to associate lower prevalence with *lower level of impact or severity* (table 1; all $ps < .007$).

Table 1 JUDGING THE LESS PREVALENT OPTION AS HIGHER IMPACT, BY
CONDITION (STUDY 1)

Scenario	Outward Framing	Inward Framing	Chi-squared	P-value
Battery Performance (benefit)	87.1%	42.6%	42.05	<.001
Laptop Issue (problem)	94.1%	26.7%	92.91	<.001
Product Recall (problem)	73.3%	14.9%	67.57	<.001
Restaurant Service (benefit)	71.3%	51.5%	7.54	.006
Wine as a Gift (benefit)	37.6%	14.9%	12.38	<.001

Discussion

The results of study 1 support the proposed distinction between outward and inward framing, showing that that across everyday consumer contexts in both positive (e.g., gift giving)

and negative (e.g., product issue) domains, consumers infer relative impact differently depending on how prevalence is communicated. Next, we systematically vary aspects of prevalence framing in between-subjects tests, to better understand how differences in framing affect perceived impact.

STUDY 2A: COMMON = SEVERE INFERENCES UNDER INWARD FRAMING

In studies 2a and 2b, we focused on one of the marketing-relevant scenarios tested in study 1, laptop problems, in a more detailed scenario, using a between-subjects design. Study 2a tested for Common = Severe inferences using inward framing.

Method

All participants were shown a detailed scenario in which they were told that a laptop they own has some issues and was brought to a technician to be fixed (Figure 2-2). Participants were then randomly assigned to read about either high-prevalence information provided by the technician (“*As far as I am aware, 85% of the laptops of this model may experience this issue.*”) or low-prevalence information (“*As far as I am aware, 5% of the laptops of this model may experience this issue.*”). Note that the prevalence information in study 2a is both framed in specific terms (e.g., “laptops of this model”) and conveyed in numbers (e.g., 85% vs. 5%), consistent with our characterization of framing that prompts inward thinking.

Figure 2-2 SAMPLE SCENARIO IN STUDY 2A (High prevalence version)

Imagine that you have recently purchased a laptop from a brand you never bought from before.



After using it for a while, one day, you found that you were unable to boot your laptop. You had no idea what was going on, so you brought the laptop to a technician.

The technician examined your laptop and then said to you, "**As far as I am aware, 85% of the laptops of this model may experience this issue.**"

After reading the scenario, participants answered three questions (on 1 to 9 Likert scales) about how severe they thought the laptop problem was: "*How likely do you think it is that this problem will cause irreparable damage to your computer?*", "*How likely do you think it is that this problem will damage your files?*", and "*How likely do you think it is that you will need to replace your laptop entirely within the next six months, because of the problem that happened today?*" See the Online Supplement for other exploratory measures.

Results

Two hundred and five U.S. participants above 18 years-old from Prolific participated in the pre-registered study. Excluding two responses from participants who did not finish left 203

valid responses (47.3% females, $M_{age} = 38.90$). This study was pre-registered at https://aspredicted.org/9FH_994.

We averaged the answers to the three questions about the impact of the laptop issue into a Severity Index ($\alpha = .86$) and conducted a t-test comparing the Severity Index across prevalence conditions. Results show that participants in the high-prevalence condition rated the laptop issue as more severe than those in the low-prevalence condition ($M_{high} = 6.72$, $SD = 1.57$; $M_{low} = 5.74$, $SD = 1.87$; $t(193) = 4.00$, $95\%CI = [0.49, 1.56]$, $p < .001$), consistent with a Common = Severe inference.

Discussion

Under inward framing, participants in study 2a rated the laptop issue as more severe when shown the more concerning high-prevalence information about their own laptop model compared to the less personally relevant low-prevalence information, consistent with extrapolating from a low-quality prevalence cue to a low-quality severity judgment. Next, we test whether this finding is reversed when the information is instead conveyed using outward framing.

STUDY 2B: RARE = SEVERE INFERENCES UNDER OUTWARD FRAMING

This study used the same consumer scenario about computer repair, but instead conveyed the prevalence information in a way that is consistent with outward thinking.

Method

This study had the exact same design as study 2a except that the message from the technician communicated the prevalence information in general terms using words. Participants were randomly assigned to see the high-prevalence message from the technician (“*This is actually a very common problem. I have seen many problems like this.*”) or the low-prevalence message (“*This is actually a very rare problem. I don't see many problems like this.*”).

Results

One hundred and ninety-seven U.S. participants above 18 years-old (49.2% female, $M_{age} = 42.07$) from Prolific participated in the pre-registered study. This study was pre-registered at https://aspredicted.org/6PY_FPL.

We averaged the answers to the three questions about the impact of the laptop issue into a Severity Index ($\alpha = .87$) and conducted a t-test comparing the Severity Index across prevalence conditions. In contrast to study 2a, results show that participants in low-prevalence condition rated the laptop issue as more severe than those in high-prevalence condition ($M_{high} = 4.30$, $SD = 1.92$; $M_{low} = 6.10$, $SD = 1.68$; $t(189) = -6.98$, $95\%CI = [-2.31, -1.29]$, $p < .001$), consistent with a Rare = Severe inference.

Discussion

While participants in study 2a (who saw inward-framed prevalence information) made inferences consistent with a Common = Severe belief, participants in study 2b (who saw outward-framed prevalence information) instead made inferences consistent with a Rare =

Severe belief. The opposite results in studies 2a and 2b replicates the differences in inferences from prevalence information found in study 1, using a between-subjects design and holding constant the scenario wording (other than the prevalence framing).

Notably, the inference of severity from infrequency in study 2b is not limited to the specific word pair of “common” and “rare.” In a follow-up pre-registered study (N = 399, reported in Web Appendix C), we replicated the same finding using other word pairs (many vs. few, and likely vs. unlikely). Participants rated the issue as more severe when it was described using “few” (vs. “many”), $M_{\text{many}} = 4.43$, $SD = 1.99$; $M_{\text{few}} = 5.80$, $SD = 1.71$; $t(195) = -5.19$, $95\%CI = [-1.89, -0.85]$, $p < .001$, and when it was described as “unlikely” (vs. “likely”), $M_{\text{likely}} = 4.92$, $SD = 1.82$; $M_{\text{unlikely}} = 5.98$, $SD = 1.74$; $t(195) = -4.25$, $95\%CI = [-1.56, -0.57]$, $p < .001$. The Rare = Severe inference persists when communicating prevalence in general terms with various wordings.

Overall, the finding in study 2b suggests that the Rare = Severe inference is consistent with an overgeneralized association across different computer problems, in which rare computer problems that consumers know about are generally severe and the common problems they are familiar with are generally not severe. In the next study, we separately manipulate the two aspects of outward vs. inward framing we have identified (general vs. specific and words vs. numbers) as well as the prevalence conveyed.

STUDY 3: GENERAL VS. SPECIFIC FRAMING INFLUENCES IMPACT INFERENCES FROM PREVALENCE

This study tests the individual components of the proposed outward vs. inward framing distinction. Our results thus far suggest that framing an event in general terms and using words

prompts consumers to think in terms of tradeoff between prevalence and impact and make inferences, consistent with a Rare = Severe lay belief. Conversely, framing an event in specific terms and using numbers prompts consumers to extrapolate the implications of prevalence to impact, and thereby to make inferences consistent with a Common = Severe holistic judgment. To test the entire framework in a single study, we used the same laptop issue scenario and framed the prevalence information using a fully between-subjects design, varying both the generality (general vs. specific) and the information format (word vs. number) along with prevalence to decompose the factors that could contribute to outward vs. inward thinking and influence consumers' impact inferences.

Method

This study had a 2 (generality: general vs. specific) by 2 (information format: word vs. number) by 2 (issue prevalence: high vs. low) between-subjects design. Participants were randomly assigned to one of the eight conditions. To vary the generality of the issue, prevalence was framed either in terms of the prevalence of laptops experiencing the issue (as in study 2b) in the general conditions or in terms of the prevalence of *this* laptop *model* experiencing the issue (as in study 2a) in the specific conditions. In the word conditions, low prevalence was described as “rare” and high prevalence was described as “common”; while in the number conditions low prevalence was conveyed as 5% and high prevalence was conveyed as 60% of described laptops having the problem. The numeric information (60% or 5%) was calibrated to be roughly equivalent to the corresponding word-based information based on a pre-test. We used common and rare (instead of “very common” and “very rare”, in study 2b) to test generalizability.

Participants were then asked to rate the same severity questions as in studies 2a and 2b for the laptop. See the Online Supplement for additional exploratory questions.

Results

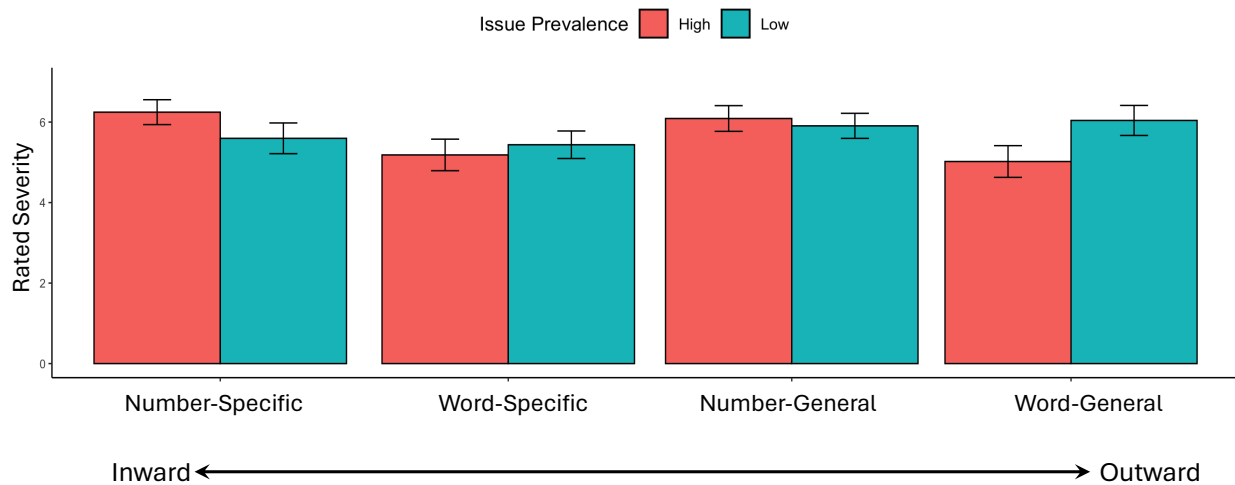
Eight hundred and twelve U.S. participants above 18 years-old from Prolific participated in the pre-registered study. Excluding 12 participants who did not finish the survey and 10 responses from duplicate IP address left 790 valid responses (49.4% females, $M_{\text{age}} = 39.24$). This study was pre-registered at https://aspredicted.org/PKK_42P.

The rated severity across all eight conditions is shown in Figure 2-3. Inferred severity was significantly *higher* for low (vs. high) prevalence when framed in general terms with words ($M_{\text{low}} = 5.85$, $SD = 1.77$; $M_{\text{high}} = 4.89$, $SD = 2.01$; $t(160) = -3.24$, 95% CI = [-1.54, -0.37], $p = .001$; replicating study 2b's outward thinking findings). Conversely, inferred severity was significantly *lower* for low (vs. high) prevalence when framed in specific terms with numbers ($M_{\text{low}} = 5.40$, $SD = 1.87$; $M_{\text{high}} = 6.24$, $SD = 1.57$; $t(163) = 3.23$, 95%CI = [0.33, 1.36], $p = .002$; replicating study 2a's inward thinking findings). In the other two pairs of conditions, which mixed cues of outward and inward thinking, severity did not significantly differ by prevalence (General-number: $p = .411$; Specific-word: $p = .154$).

We then conducted a linear regression predicting the Severity Index ($\alpha = .84$) based on Generality Framing (General = 1, Specific = 0), Information Format (Number = 1, Word = 0) and Issue Prevalence (High prevalence = 1, Low prevalence = 0), the two-way interaction terms between Generality Framing and Issue Prevalence, as well as between Information Format and Issue Prevalence. Consistent with the outward vs. inward thinking framework, both the interaction between Format and Issue Prevalence, $b = -0.62$, $SE = .27$, $t(698) = -2.30$, $p = .022$,

and between Generality and Issue Prevalence, $b = -1.17$, $SE = .27$, $t(698) = -4.34$, $p < .001$, were significant. We also found significant main effects of Information Format, $b = 0.41$, $SE = .20$, $t(698) = 2.08$, $p = .038$, and Issue Prevalence, $b = 0.90$, $SE = .23$, $t(698) = 3.87$, $p < .001$, but not Generality Framing, $b = 0.03$, $SE = .20$, $t(698) = 0.17$, $p = .869$. The two significant interactions suggest that both of the proposed elements of outward vs. inward thinking, Generality Framing and Information Format, independently moderate how prevalence information affects judged severity.

Figure 2-3 THE DIRECTION OF SEVERITY INFERENCES FROM PREVALENCE ARE DETERMINED BY GENERALITY FRAMING AND INFORMATION FORMAT (STUDY 3)



Discussion

Consistent with study 2b, participants showed a Rare = Severe belief when prevalence was framed outwardly, by communicating in general terms using words. This Rare = Severe belief was eliminated by either reframing in specific terms or using numbers instead of words.

Conversely, consistent with study 2a, participants showed a Common = Severe belief when prevalence was framed inwardly, by communicating in specific terms using numbers. The Common = Severe belief was eliminated by either reframing in general terms or using words instead of numbers.

Overall, the results of study 3 support our hypotheses that general framing of prevalence using words prompts consumers to think outwardly, while specific framing of prevalence using numbers prompts consumers to think inwardly. Furthermore, we consistently replicated the reversal between outward and inward thinking in a follow-up study (N = 772, reported in Web Appendix D) that instead used a within-subjects prevalence comparison (i.e., measuring relative perceived severity between a common and a rare option) and tested other wordings between-subjects (common vs rare, many vs. few, and likely vs. unlikely).

STUDY 4: COMPARING INFORMATION FORMATS

The results of study 3 suggest that merely presenting prevalence information using words vs. numbers can result in different impact inferences. In study 4, we test different information formats, holding constant the generality of the scenario. Comparing inferences across different information formats enables us to test between competing explanations of a word vs. number difference in impact judgment.

The first explanation is our proposal, discussed in the theoretical development, that because words specifically are used in interpersonal communication, they prompt outward thinking. However, an important alternative explanation, is that words such as “common” or “rare” convey less precise information than equivalent numbers. Thus, the second explanation is that precise information facilitates extrapolation, while less precise information (whether in

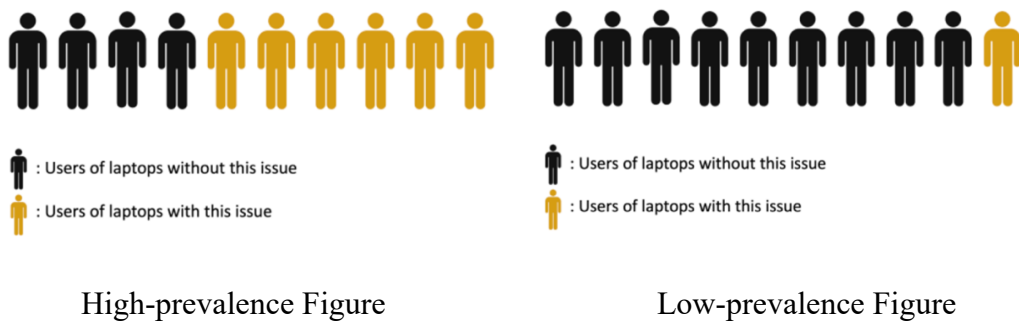
number or words) will make consumers more likely to rely over overgeneralized heuristics. A third potential explanation is that numbers are unique, prompting a different and potentially more objective and less inferential approach to making judgments. In this explanation, the mere presence of numbers when conveying prevalence reduces the reliance on overgeneralized heuristics. To investigate these possibilities, we vary whether the prevalence information is precise or represents a range of values (Lembregts and Pandelaere 2019) and whether the information is conveyed using numbers, words or a visual representation. We also varied percentage vs. frequentist representations, which have been hypothesized to influence judgments in prior research (Gigerenzer and Hoffrage 1995; Bodemer, Meder and Gigerenzer 2014).

Method

This study used a two (issue prevalence: high vs. low) by five (information format: word vs. visual figure vs. range vs. number in percentage vs. number out of 10) design using the same laptop scenario as in study 2b. The word (common vs. rare) and number in percentage (60% vs. 10%) information formats were similar to the prior studies, while the other three information formats introduced additional distinctions. The range condition presented imprecise information in a numeric format (55% to 65% vs. 5% to 15%), disassociating precise vs. imprecise from number vs. word. The figure condition presented precise frequentist information in a non-numeric format (using cartoon people in different colors; Figure 2-4), which disassociates precise quantities from numeric format. Finally, the number out of 10 condition presented the same information as the number in percentage condition in a frequentist format (e.g., “6 out of 10” vs. “1 out of 10”).

The numeric information (60% or 10%) in the number in percentage condition was calibrated to be roughly equivalent to the corresponding word-based information (“common” or “rare”), using median prevalence estimates based on the text information in a pilot study (see Online Supplement Study B for the procedure of the pilot study). Doing so ensured that the median interpretation of the frequency conveyed in the word and the number in percentage conditions should be the same. The numbers used in the number out of 10 condition and the range condition were both calibrated based on number in percentage condition.

Figure 2-4 FIGURE CONDITION IN STUDY 4



Participants then completed the same severity ratings as in the prior studies. See the Online Supplement for additional exploratory measures.

Results

Participants. One thousand and eighty-two U.S. participants above 18 years-old from Prolific participated in the pre-registered study. Excluding 15 responses from duplicate IP

addresses and 79 participants who did not finish the survey left 988 valid responses (48.0% females, $M_{\text{age}} = 38.13$). This study was pre-registered at https://aspredicted.org/WLZ_TMG.

Effect of prevalence across conditions. The difference in perceived severity between the low- and high-prevalence conditions are shown for each of the five information formats in Figure 2-5. Participants rated the low-prevalence issue as significantly more severe than the high-prevalence issue in the word condition ($M_{\text{high}} = 4.87$, $SD = 1.76$; $M_{\text{low}} = 6.03$, $SD = 1.86$; $t(188) = -4.45$, 95% CI = [-1.68, -0.65], $p < .001$), consistent with a Rare = Severe belief. The opposite pattern, the high-prevalence issue being rated as more severe than the low-prevalence issue, was significant in the figure condition ($M_{\text{high}} = 6.26$, $SD = 1.54$; $M_{\text{low}} = 5.05$, $SD = 1.96$; $t(189) = 4.84$, 95% CI = [0.71, 1.70], $p < .001$) and marginally significant in the number in percentage condition ($M_{\text{high}} = 5.46$, $SD = 1.95$; $M_{\text{low}} = 4.93$, $SD = 1.86$; $t(194) = 1.94$, 95% CI = [-0.008, 1.07], $p = .053$). No other significant differences between high- and low-prevalence conditions within information formats were observed (Number out of 10: $p = .18$; Range: $p = .16$).

Number vs. Word replication. We first compared the word and the number in percentage conditions, the same word vs. number comparison as in study 3. We conducted a linear regression on Severity Index ($\alpha = .86$) by the Issue Prevalence (High prevalence = 1, Low prevalence = 0), Information Format (Word = 1, Number = 0), and their interaction term. The significant interaction between Information Format and Issue Prevalence, $b = 1.69$, $SE = .38$, $t(385) = -4.48$, $p < .001$, replicated our prior findings (along with significant main effects of Information Format, $b = 1.10$, $SE = .27$, $t(385) = 4.07$, $p < .001$, and Issue Prevalence, $b = 0.53$, $SE = .27$, $t(385) = 1.99$, $p = .047$).

Test of Precise vs. Imprecise information. We then compared an imprecise numeric framing condition, range (Information Format = 1), to the otherwise equivalent precise numeric

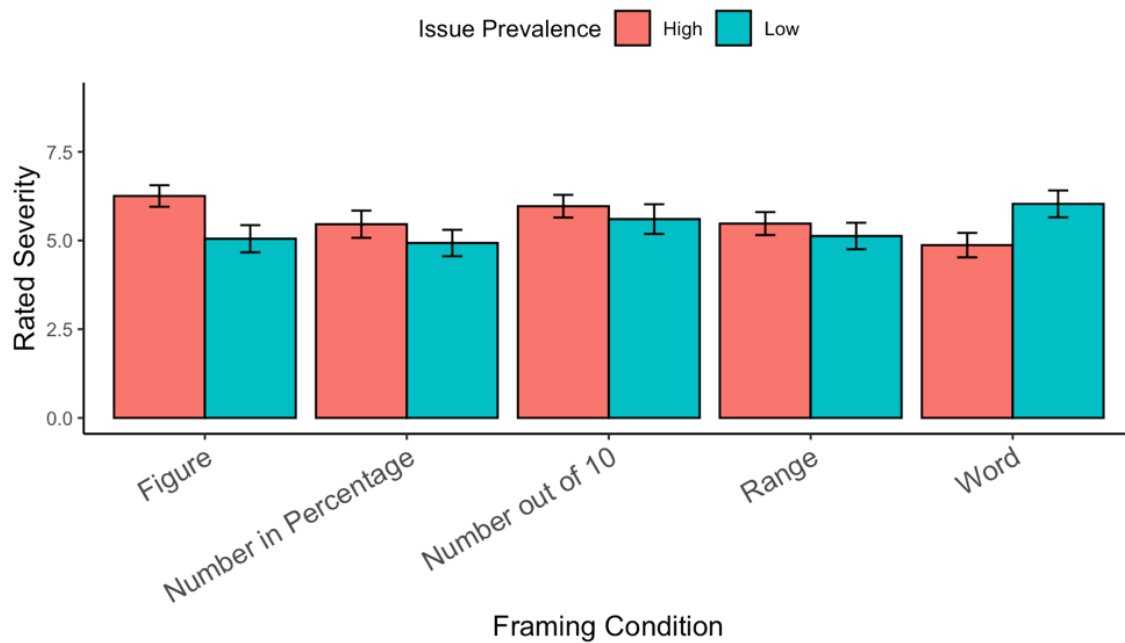
framing condition, number in percentage (Information Format = 0). Linear regression results show a significant main effect of Issue Prevalence, $b = 0.53$, $SE = .26$, $t(391) = 2.01$, $p = .045$, but no significant main effect of Information Format, $b = 0.20$, $SE = .26$, $t(391) = 0.74$, $p = .457$, and no interaction, $b = -0.18$, $SE = .37$, $t(391) = -0.48$, $p = .632$. The nonsignificant interaction suggests that inferences from prevalence were not significantly moderated by precision, holding constant the use of percentages.

Numeric vs. Non-numeric information format. To test whether the Common = Severe belief is specific to communicating prevalence using numbers, we compared the non-numeric figure condition (Information Format = 1) to the otherwise equivalent number out of 10 condition (Information Format = 0) using a linear regression. We find a significant main effect of Information Format, $b = -0.55$, $SE = .26$, $t(396) = -2.14$, $p = .033$, a significant interaction between Information Format and Issue Prevalence, $b = 0.84$, $SE = .37$, $t(396) = 2.30$, $p = .022$, and no main effect of Issue Prevalence, $b = 0.36$, $SE = .26$, $t(396) = 1.40$, $p = .162$. The significant interaction suggests that use of a figure instead of numbers out of 10 to convey prevalence has a *stronger* effect than the numeric prevalence information on prompting consumers to infer high severity from high prevalence. This result is the opposite of what would have been predicted by the alternative explanation in which numbers uniquely prompt extrapolation-based inference.

Words vs. Non-word information formats. We lastly compared the word condition (Information Format = 1) to all other non-word conditions combined (Information Format = 0) using a linear regression. The interaction between Information Format and Issue Prevalence was highly significant, $b = -1.77$, $SE = .30$, $t(984) = -5.97$, $p < .001$, along with significant main effects of Information Format, $b = 0.85$, $SE = .21$, $t(984) = 4.01$, $p < .001$, and Issue Prevalence,

$b = 0.61$, $SE = .13$, $t(984) = 4.66$, $p < .001$. The significant interaction supports the explanation that communicating prevalence using words is unique in comparison to all the other quantitative information formats in triggering an outward thinking tendency to generalize. In fact, we found that the inferred severity from prevalence expressed in words was significantly different from all of the other information formats tested ($ps < .001$).

Figure 2-5 SEVERITY RATINGS DIFFER BETWEEN WORD AND OTHER INFORMATION FORMATS IN STUDY 4



In sum, the Word vs. Number in Percentage comparison replicated in the findings of study 3, such that merely changing the information format can cause a difference in how severity is inferred from prevalence. More generally, we find a significant difference between communicating prevalence using words compared to the other quantitative information formats

tested, consistent with our proposition that because words are used more in interpersonal communication, words prompt people to think from the speaker's (i.e., another person's) point of view and engage in outward thinking (Weber and Hilton 1990). This pattern of results is not consistent with alternative explanations (e.g., based on precision or number-related norms) and supports the notion that word vs. number is a meaningful distinction in prevalence framing that causes consumers to perceive impact differently.

STUDY 5A: OUTWARD-THINKING INTERVENTION

The results of studies 2 to 4 have shown that consumers tend to think a rare computer problem is more severe when prevalence is conveyed in general terms using words, and this effect is reversed when prevalence is instead conveyed in specific terms using numbers. Next, we tested whether an intervention based on our proposed framework of outward vs. inward thinking can eliminate these effects. First, in study 5a, we investigated whether an intervention prompting outward thinking via focusing on other people would reduce the tendency to perceive a rarer computer problem as less severe when the prevalence is conveyed in specific terms using numbers.

The outward-thinking intervention is based on our assumption that general framing using words prompts the use of heuristics that are more consistent with situations in which people convey information to others and possibilities are compared broadly. The goal of the intervention, then, is to prompt consumers to think in terms of other people and broad patterns in the world even when prevalence information is presented in numbers (e.g., as they would spontaneously when prevalence information is instead presented in words). To this end, we use a

perspective-taking intervention, asking participants questions that require thinking from the computer technician's perspective.

Method

Building on the scenario used in study 2a, this study employed a 2 (information format: word vs. number) by 2 (issue prevalence: high vs. low) by 2 (control vs. outward-thinking intervention) between-subjects design. Participants were randomly assigned to one of the eight conditions. All participants first read the same specific-framed laptop issue scenario from study 2a. In the number conditions, the technician either stated that “*60% of this laptop model experience this problem.*” (high prevalence) or “*10% of this laptop model experience this problem.*” (low prevalence). In the word conditions, the technician in the scenario either informed them that “*This is a common problem for this laptop model.*” (high-prevalence) or “*This is a rare problem for this laptop model.*” (low prevalence).

After reading the scenario, participants in the control conditions rated the severity as in previous studies. Participants in the outward-thinking intervention conditions were first asked two perspective-taking questions (on 9-point Likert scales in randomized order) before rating the severity questions: “*How do you think the technician feels about the problem that happened to your laptop in terms of the difficulty to fix it?*” and “*How confident do you think the technician feels about fixing the problem that happened to your laptop?*” Participants in the intervention conditions were then also asked to explain their answers to the two perspective-taking questions, to prompt further outward deliberation. Participants in the control conditions instead completed the intervention task after rating the severity.

Results

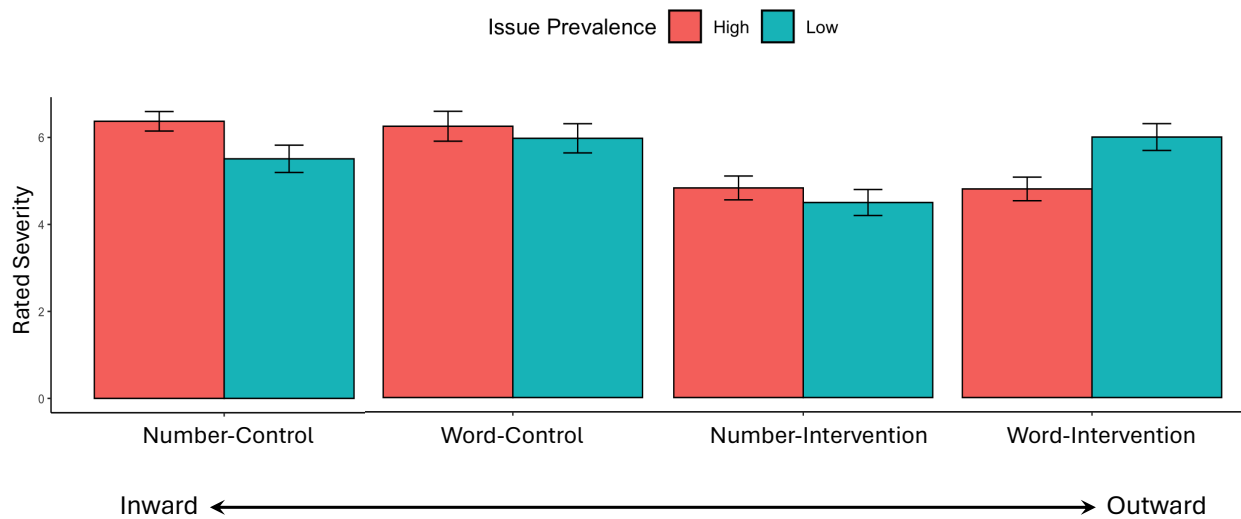
Participants. One thousand five hundred and six U.S. participants above 18 years-old from Amazon's MTurk participated in the pre-registered study. Excluding 96 responses from duplicate IP addresses and 230 responses from those who did not finish the survey left 1180 valid responses (51.0% females, $M_{\text{age}} = 43.42$). This study was pre-registered at https://aspredicted.org/88N_ZD3.

Effect of prevalence across conditions. The differences in perceived severity between the low- and high-prevalence conditions are shown for each of the conditions in Figure 2-6. In the control condition, where prevalence is described in specific terms using a number, participants rated the high-prevalence issue as significantly more severe than the low-prevalence issue ($M_{\text{high}} = 6.37$, $SD = 1.40$; $M_{\text{low}} = 5.51$, $SD = 1.92$; $t(260) = -4.38$, 95% CI = [-1.25, -0.48], $p < .001$) and no difference was found when using words ($p = .26$). Among participants who completed the perspective-taking intervention, however, the effect of numeric prevalence information was no longer significant ($p = .11$) and instead participants rated the low-prevalence issue as significantly more severe than the high-prevalence issue when it was described in words ($M_{\text{high}} = 4.35$, $SD = 1.54$; $M_{\text{low}} = 5.43$, $SD = 1.75$; $t(295) = 5.70$, 95% CI = [0.71, 1.46], $p < .001$).

In particular, looking only at the number conditions, a linear regression revealed a significant interaction between Issue Prevalence and Intervention, $b = -0.83$, $SE = .35$, $t(391) = -2.39$, $p = .017$, in addition to a main effect of Intervention ($b = -0.69$, $SE = .26$, $t(391) = -2.69$, $p = .007$). This confirms that consumers' tendency to infer higher severity from higher prevalence,

when conveyed in specific terms using numbers, was debiased by the outward-thinking intervention.

Figure 2-6 INFERENCES FROM SPECIFIC-NUMERIC PREVALENCE INFORMATION ARE DEBIASED BY AN OUTWARD-THINKING INTERVENTION IN STUDY 5A



As an overall test, we conducted a linear regression on the Severity Index ($\alpha = .87$) by Issue Prevalence, Information Format, Intervention, the two-way interaction between Issue Prevalence and Information Format, and the two-way interaction between Issue Prevalence and Intervention. Both two-way interactions were significant, as well as the main effects of Information Format, $b = -0.41$, $SE = .14$, $t(1187) = -2.85$, $p = .004$, and Intervention, $b = -0.48$, $SE = .14$, $t(1187) = -3.32$, $p = .001$, but not Prevalence, $b = 0.04$, $SE = .18$, $t(1187) = 0.24$, $p = .814$. The significant interaction between Issue Prevalence and Information Format, $b = 1.02$, $SE = .20$, $t(1187) = 5.02$, $p < .001$, suggests different severity inferences from number vs. word prevalence information. Mostly importantly, the significant interaction between Issue Prevalence

and Intervention, $b = -0.94$, $SE = .20$, $t(1187) = -4.63$, $p < .001$, suggests that the intervention shifted people's thinking to be more outward, resulting in inferences more consistent with a general framing (as in study 2b) even though the specific framing was used.

Discussion

These results show that a perspective-taking intervention that prompted participants to think outwardly about specific-framed prevalence information shifted their inferences to what would have been expected with a more general framing. The outward-thinking intervention eliminated the Common = Severe inference in the number condition and increased a Rare = Severe association in the word condition, consistent with our outward vs inward thinking framework.

STUDY 5B: INWARD-THINKING INTERVENTION

Study 5b was designed to test the corresponding question to study 5a. We investigated whether an intervention prompting consumers to think about their own specific situation (i.e., prompting inward thinking) would reduce the Rare = Severe association when prevalence is conveyed in general terms using words. If Rare = Severe is an overlearned heuristic that consumers rely on when they are trying to explain broad patterns in the world, then focusing on the specific and self-relevant situation should reduce this tendency.

Method

Procedure. We again used a 2 (information format: word vs. number) by 2 (issue prevalence: high vs. low) by 2(intervention vs. control) design. All participants first read the same laptop issue scenario, this time with a general prevalence framing, as in study 2b. In the word conditions, the technician in the scenario either informed them that “*This is a common problem for laptops.*” (high prevalence) or “*This is a rare problem for laptops.*” (low prevalence). Conversely, in the number conditions, the technician either stated that “*60% of laptops experience this problem.*” or “*10% of laptops experience this problem.*”

The manipulation consisted of two parts, in randomized order. In one part, participants answered two questions, “*How frustrated would you personally feel about the booting problem that happened to your laptop?*” and “*How confident would you personally feel about navigating through the situation in which you still would need to complete the computer-based project on time?*” on two 9-point Likert scales from 1 (*Not at all frustrated/confident*) to 9 (*Extremely frustrated/confident*). Participants were then asked to briefly explain their answers. In the other part, participants were instructed to “*...estimate a number in percentage (%) to describe the frequency of this laptop issue that you think best applies to you personally in your own specific situation.*” After entering a numeric value, participants were likewise asked to explain their answers. Participants in the intervention conditions then proceeded to read the laptop issue scenario as in study 5a and rated the severity of the issue. Participants in the control conditions first rated the severity and then completed the intervention task afterwards.

Results

Participants. One thousand three hundred and thirty-four U.S. participants above 18 years-old from Amazon’s MTurk participated in the study. Excluding 124 participants who did

not finish the survey and 20 responses from duplicate IP addresses and left 1190 valid responses (53.9% females, $M_{age} = 38.72$). This study was pre-registered at https://aspredicted.org/CGM_RK4.

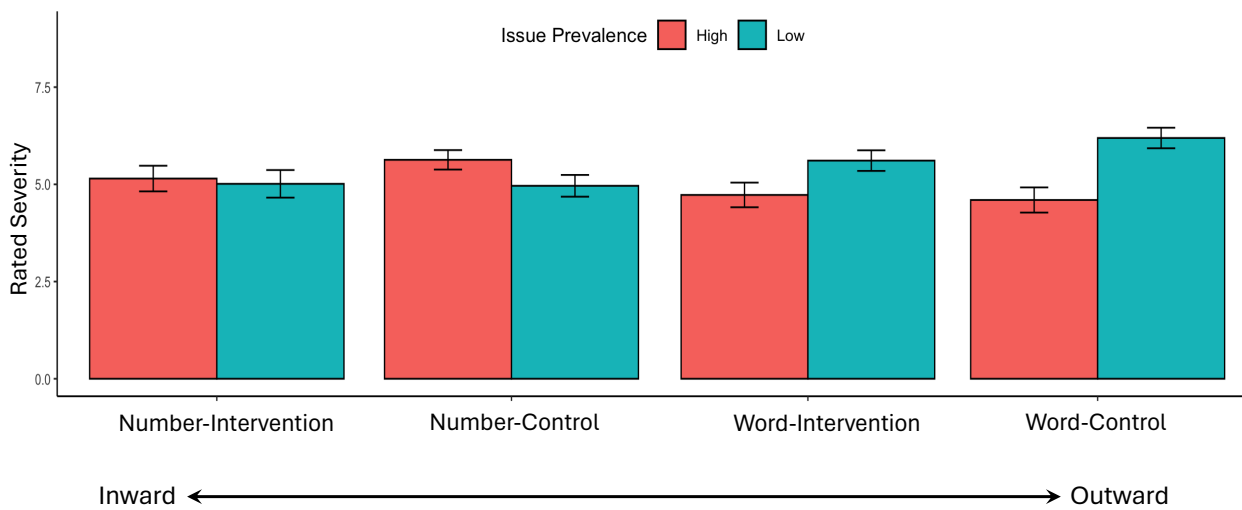
Effect of prevalence across conditions. The differences in perceived severity between the low- and high-prevalence conditions are shown for each of the conditions in Figure 2-7. In the control condition, where prevalence was described in general terms using words, participants rated the low-prevalence issue as significantly more severe than the high-prevalence issue ($M_{high} = 4.60$, $SD = 1.99$; $M_{low} = 6.19$, $SD = 1.58$; $t(272) = 7.48$, 95% CI = [1.18, 2.01], $p < .001$). Conversely, when the scenario was described in numbers in the control condition, participants rated the high-prevalence issue as significantly more severe than the low-prevalence issue ($M_{high} = 5.63$, $SD = 1.70$; $M_{low} = 4.96$, $SD = 1.75$; $t(314) = -3.49$, 95% CI = [-1.05, -0.29], $p < .001$).

Among participants who completed the self-focus intervention, participants' belief that the low-prevalence issue was significantly more severe than the high-prevalence issue when described in words was weaker ($M_{high} = 4.73$, $SD = 1.93$; $M_{low} = 5.61$, $SD = 1.86$; $t(298) = 4.19$, 95% CI = [0.47, 1.30], $p < .001$). When prevalence was conveyed in numbers, there was no difference in impact ($p = .583$).

In particular, looking only at the word conditions, a linear regression confirmed a significant interaction between Intervention and Issue Prevalence, $b = 0.71$, $SE = .30$, $t(610) = 2.36$, $p = .018$, as well as significant main effects of Issue Prevalence, $b = -1.59$, $SE = .22$, $t(610) = -7.23$, $p < .001$, and Intervention, $b = -0.58$, $SE = .21$, $t(610) = -2.81$, $p = .005$. This confirms that consumers' tendency to infer higher severity from lower prevalence, when conveyed in general terms using words, was significantly reduced by the inward-thinking intervention.

As an overall test, we conducted a linear regression on the Severity Index ($\alpha = .86$) by Issue Prevalence, Information Format, Intervention, the two-way interaction between Issue Prevalence and Information Format, and the two-way interaction between Issue Prevalence and Intervention. The two-way interaction between Information Format and Issue Prevalence was significant, as well as the main effects of Information Format, $b = -0.91$, $SE = .15$, $t(1184) = -5.97$, $p < .001$, and Issue Prevalence, $b = -1.27$, $SE = .19$, $t(1184) = -6.73$, $p < .001$. The main effect of Intervention was marginally significant, $b = -0.29$, $SE = .15$, $t(1184) = -1.91$, $p = .056$. The significant interaction between Information Format and Issue Prevalence, $b = 1.66$, $SE = .22$, $t(1184) = 7.72$, $p < .001$, suggests different severity inferences from number vs. word prevalence information. The overall interaction between Intervention and Issue Prevalence was not significant, $b = 0.11$, $SE = .22$, $t(1184) = 0.52$, $p = .604$.

Figure 2-7 INFERENCES FROM GENERAL-WORD PREVALENCE INFORMATION ARE DEBIASED BY AN INWARD THINKING INTERVENTION IN STUDY 5B



Discussion

These results show that a self-focus intervention that prompted participants to think inwardly about general-framed prevalence information shifted their inferences in the direction that would have been expected with a more specific framing. The inward-thinking intervention reduced the Rare = Severe inference in the word condition, consistent with our outward vs inward thinking framework.

It is noteworthy that the effects of the outward-thinking intervention seemed stronger in study 5a than the effects of the inward thinking intervention in study 5b (e.g., which did not promote stronger inward thinking in the number conditions). This could either mean that a more effective intervention was used in study 5a or that outward thinking is more of a default mode, and therefore it is more difficult to shift consumers to inward thinking.

STUDY 6: EFFECT ON A CONSEQUENTIAL DONATION DECISION

The studies so far have focused on consumers' impact-related judgments, and studies 2-5 all used a similar computer problem scenario. In study 6, we generalize to a very different domain (disease severity) and test the implications of outward vs. inward inferences from prevalence for consumers' real donation decisions. Using data from the American Cancer Society (Siegel et al. 2023), we confirmed that prevalence (cases per 100K individuals) and severity (five-year relative survival rates) were not significantly correlated across different types of cancer ($r = 0.098$). Nevertheless, in a pilot study ($N = 183$; see Online Supplement Study S)

incentivizing participants for accuracy, we found that when prevalence was presented in general terms using words, consumer judgments of relative severity reflected a Rare = Severe lay belief, consistent with our findings thus far, despite the true near-zero correlation. The current study was conducted to investigate if expressing cancer prevalence in words vs. numbers affects donation decisions.

Method

The study employed a between-subjects design, varying the information format (word vs. number). In each condition, two cancers, throat cancer and bladder cancer, were described side-by-side, along with their prevalence information. We selected these two cancers using data provided by American Cancer Society, such that the two cancers have roughly the same five-year-survival rates, but bladder cancer is much more prevalent than throat cancer (Siegel et al. 2023).

Participants in both conditions were first informed that they would make a real decision in the study, and that they had an opportunity to donate to two charities to help fight cancers. In the word condition, participants read “*This is a common cancer*” about bladder cancer and “*This is a rare cancer*” about throat cancer. In the number condition, participants read “*Every 25 out of 100,000 people contracts this cancer*” about bladder cancer and “*Every 5 out of 100,000 people contracts this cancer*” about throat cancer.

After seeing the cancer names and their prevalence information, participants were asked to choose between a list of options for allocating an actual 100-cent donation between a charity combatting throat cancer and a charity combatting bladder cancer. Participants also answered

three questions related to cancer severity, including “Which cancer do you think is more serious in terms of its death rate,” “Which cancer do you think is more likely to cause damage to the overall health of human body,” and “Which cancer do you think will result in more hospital visits in the next six months if contracted,” all answered on 7-point scales from “Definitely throat cancer” to “Definitely bladder cancer.” The order of the severity questions and the money allocation choice was counterbalanced. Within the money allocation choice, which cancer appeared on the left (vs. right) was also counterbalanced.

Results

Participants. Two hundred and thirteen U.S. participants above 18 years-old from Prolific participated in the pre-registered study. Excluding 14 participants who did not finish the survey left 199 valid responses (48.7% females, $M_{\text{age}} = 39.48$). This study was pre-registered at https://aspredicted.org/SYR_GPX.

In describing the results, we refer to throat cancer as the rare cancer and bladder cancer as the common cancer. We confirmed that the amount that participants decided to allocate to help fight the rare (vs. common) cancer did not differ by either the order of the task (i.e., whether the money allocation choice was before the severity questions; $M_{\text{donation_first}} = 42.26$, $SD = 26.37$; $M_{\text{rating_first}} = 43.37$, $SD = 23.59$; $t(189) = -0.31$, 95% CI = [-8.12, 5.92], $p = .757$) or which cancer was presented on the left (vs. right), $M_{\text{bladder_left}} = 44.38$, $SD = 27.38$; $M_{\text{throat_left}} = 41.37$, $SD = 22.33$; $t(185) = 0.85$, 95%CI = [-4.00, 10.02], $p = .398$. Therefore, we collapse across these counter-balanced conditions in our analysis.

Donation. Overall, participants donated significantly more to help fight the common cancer when the prevalence information was expressed in numbers than in words ($M_{\text{word}} = 53.5$

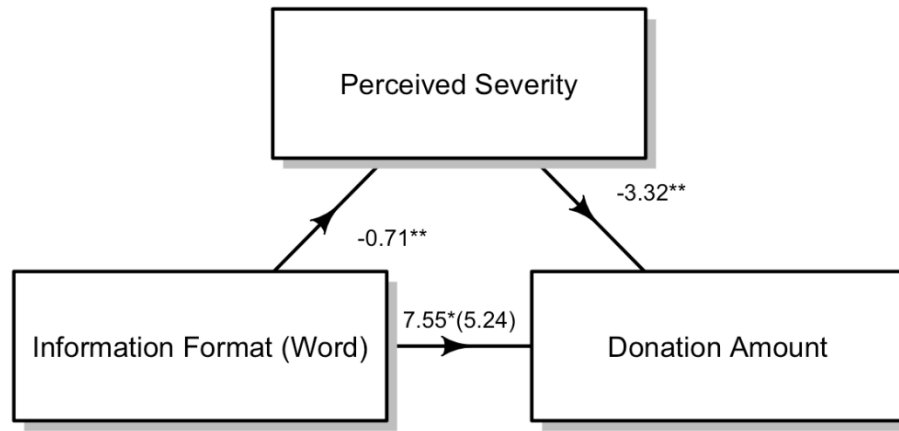
cents, $SD = 24.32$; $M_{\text{number}} = 61.2$, $SD = 25.03$; $t(194) = -2.21$, $95\%CI = [-14.66, -0.84]$, $p = .028$). In particular, the significant preference to donate to help fight the more common cancer in the number condition ($t(94) = -4.37$, $95\%CI = [33.69, 43.89]$, $p < .001$) was eliminated in the word condition ($t(103) = -1.45$, $95\%CI = [41.81, 51.27]$, $p = .150$).

Perceived severity. Unlike in the prior studies conducted in the context of computer repair, the three rated severity questions had insufficient internal consistency ($\alpha = .64$, compared to all $\alpha s > .82$ in prior studies). We therefore focus on the question that most directly asks about severity: “Which cancer do you think is more severe?” We find that participants were more likely to see the more common cancer as more severe when prevalence was asked in numbers rather than words ($M_{\text{word}} = 4.01$, $SD = 1.78$; $M_{\text{number}} = 4.72$, $SD = 1.61$; $t(197) = 2.94$, $95\%CI = [0.23, 1.18]$, $p = .004$).² This comparison was significant even after a Bonferroni correction for multiple comparisons using all three measures (e.g., $p = .004$ vs. a critical value of $.05/3 = .017$).

Mediation analysis. We conducted mediation analysis using donation amount as the dependent variable, Information Format (Word = 1, Number = 0) as the independent variable, and perceived severity as measured by the single severity question rating as the mediator (Figure 2-8). The total effect of information format on donation amount (Total effect: $b = 7.55$, $95\%CI = [0.90, 13.97]$, $p = .03$) was significantly mediated by perceived severity (Indirect effect: $b = 2.31$, $95\%CI = [0.46, 4.85]$, $p = .012$), such that after controlling for perceived severity, the direct effect of information format on donation amount was weaker and no longer significant (Direct effect: $b = 5.24$, $95\%CI = [-1.81, 12.06]$, $p = .144$).

² The pre-registered comparison using the low-consistency Severity Index showed a directional but non-significant effect in the same direction ($M_{\text{word}} = 4.44$, $SD = 1.33$; $M_{\text{number}} = 4.66$, $SD = 1.25$; $t(197) = 1.23$, $95\%CI = [-0.14, 0.58]$, $p = .22$).

Figure 2-8 MEDIATION ANALYSIS IN STUDY 6



Discussion

Consistent with the outward vs. inward thinking framework, consumers were willing to donate more to help fight the more-common cancer when prevalence was presented in numbers rather than words, and the effect was at least partially explained by participants' higher perceived severity of the more common cancer when prevalence was presented in numbers. It is noteworthy that both perceived severity and donation amounts were not significantly different from the midpoint in the word condition, which could simply reflect baseline beliefs about bladder vs. throat cancer. However, this result is also consistent with the fact that the prevalence information was presented in specific terms in both the number and word conditions, resulting in a consistently inward framing in the number condition, and a more mixed framing in the word condition. Overall, the results of this study show that the framing of prevalence information can

influence consumers' consequential choices in a direction consistent with our outward vs. inward thinking framework.

STUDY 7A: REVERSING PRODUCT REPAIR VS. REPLACE DECISION

Study 7a tested a consumer decision, the choice of whether to replace or to repair a durable product when it has a problem. This choice hinges at least in part on inferred severity, because a consumer who thinks the problem with the durable product is more severe would be more pessimistic about the future lifetime value they would receive, and would therefore be more likely to replace the product entirely rather than repairing it.

Method

This study manipulated issue prevalence (high vs. low) and framing (inward: specific/number vs. outward: general/word) in a 2x2 between-subjects design using a computer scenario. In the inward condition, participants were either informed that “*60% of this laptop model experience this problem*” (high prevalence) or “*10% of this laptop model experience this problem*” (low prevalence). Correspondingly, in the outward condition, participants were either informed that “*This problem is common for laptops*” or “*This problem is rare for laptops.*”

After reading the scenario, participants were presented with a choice “*The technician later told you that you need to either replace your current laptop or repair it to prevent the problem from happening again. Repairing the laptop will cost you around \$240.*” Participants then selected one of two options: “*Repair the laptop for around \$240*” or “*Replace the laptop with a new one.*” and were asked to briefly explain their answers. The repair cost of \$240 was the

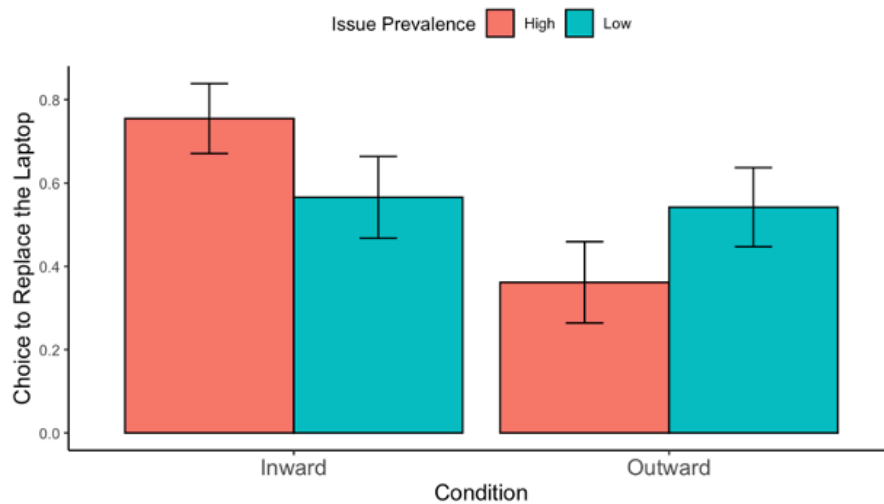
median estimated repair cost in a pilot study ($N = 99$) in which participants were shown the same scenario. Next, participants were asked the same severity ratings as in previous studies.

Results

Participants. Four hundred and sixteen U.S. participants above 18 years-old from Prolific participated in the pre-registered study. Excluding 14 participants who did not finish the survey left 402 valid responses (48.0% females, $M_{\text{age}} = 36.10$). This study was pre-registered at https://aspredicted.org/HSC_9Q6.

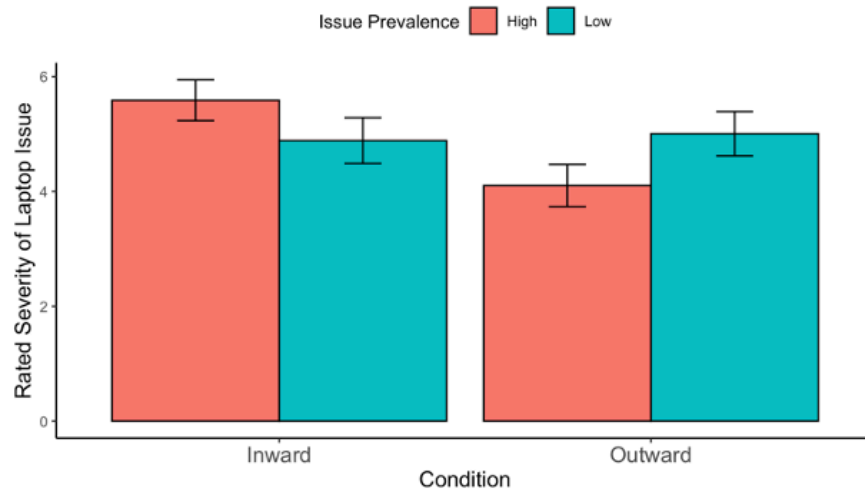
Choice to replace vs. repair. The choices by condition are shown in Figure 2-9. We first conducted a logistic regression, predicting participants' choice (Replace = 1, Repair = 0) based on Framing, Issue Prevalence, and the interaction term. We found a significant interaction between Issue Prevalence and Framing, $b = 1.60$, $SE = .42$, $Wald \chi^2 = 3.79$, $p < .001$ (along with a significant main effect of Issue Prevalence, $b = -0.74$, $SE = .29$, $Wald \chi^2 = -2.55$, $p = .011$, but no significant main effect of Framing, $b = 0.10$, $SE = .28$, $Wald \chi^2 = .34$, $p = .734$). Pairwise tests show that when prevalence is communicated using inward framing (i.e., in specific terms using numbers), participants were significantly more likely to replace (vs. repair) the laptop when the issue was highly prevalent ($b = -0.85$, $SE = .31$, $Wald \chi^2 = -2.76$, $p = .006$). More importantly, this pattern was reversed when prevalence was instead communicated using outward framing (i.e., in general terms using words), such that participants were significantly less likely to replace the laptop when the issue was highly prevalent ($b = 0.73$, $SE = .29$, $Wald \chi^2 = 2.51$, $p = .012$).

Figure 2-9 CHOICE TO REPLACE BY FRAMING AND PREVALENCE IN STUDY 7A



Severity Index. The values of the Severity Index ($\alpha = .83$) across conditions show a similar full reversal (Figure 2-10) as in participants' choices. We conducted a linear regression, predicting the Severity Index based on Framing (Inward = 1, Outward = 0), Issue Prevalence (High prevalence = 1, Low prevalence = 0), and the interaction. We find a significant interaction between Issue Prevalence and Framing, $b = 1.61$, $SE = .39$, $t(398) = 4.16$, $p < .001$ (along with a significant main effect of Issue Prevalence, $b = -0.90$, $SE = .27$, $t(398) = -3.31$, $p = .001$, but no significant main effect of Framing, $b = -0.12$, $SE = .27$, $t(398) = -0.45$, $p = .654$).

Figure 2-10 SEVERITY RATING BY FRAMING AND PREVALENCE IN STUDY 7A



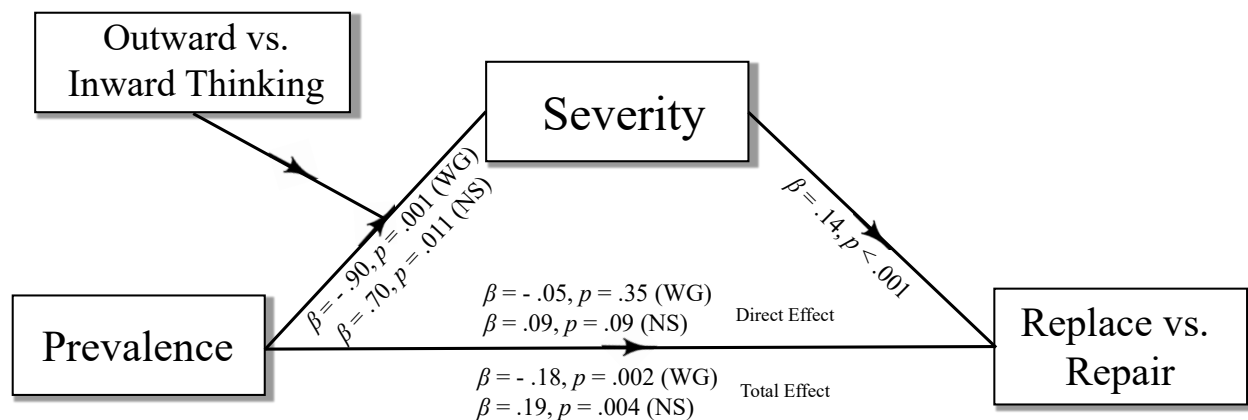
Mediation analyses. We conducted mediation analysis for the two framing conditions (Outward vs. Inward) separately, with the proportion of choices to replace the laptop as the dependent variable, Issue Prevalence as the independent variable, and Severity Index as the mediator. In the outward conditions, the total effect of Issue Prevalence on choosing to replace the laptop (Total effect: $b = 0.19$, 95%CI = [0.07, 0.32], $p = .004$) was significantly mediated by Severity Index (Indirect effect: $b = 0.10$, 95%CI = [0.02, 0.18], $p = .006$), such that after controlling for Severity Index, the direct effect of Issue Prevalence on proportion of choices to replace the laptop was weaker and only marginally significant (Direct effect: $b = 0.09$, 95%CI = [-0.01, 0.21], $p = .09$). These results suggest that when consumers are prompted to think in outward terms, low-prevalence (i.e., rare) laptop problems are seen as more severe and therefore consumers with rare problems will be *more* likely to replace their laptops.

In the inward conditions, the *opposite* total effect of Issue Prevalence on choosing to replace the laptop (Total effect: $b = -0.18$, 95%CI = [-.32, -.06], $p = .002$) was also significantly

mediated by Severity Index (Indirect effect: $b = -0.13$, 95%CI = $[-.21, -.05]$, $p < .001$). After controlling for Severity Index, the direct effect of Issue Prevalence on choosing to replace the laptop was no longer significant (Direct effect: $b = -0.05$, 95%CI = $[-.17, .06]$, $p = .35$). These results suggest that when consumers are prompted to think in inward terms, low prevalence (i.e., low numeric probability) laptop problems are seen as less severe and therefore consumers with low probability problems will be *less* likely to replace their laptops.

To assess whether framing moderates the indirect effect of Issue Prevalence on choosing to replace the laptop through the Severity Index, we conducted a moderated mediation analysis (Muller et al. 2005). We found a significant first stage moderated mediation index, $b = 0.11$, 95% CI = $[0.06, 0.17]$ (Monte Carlo simulation, 5000 simulations; Yzerbyt et al. 2018). These results are consistent with our proposal that outward vs. inward framing prompts opposite severity judgments from the same prevalence information, resulting in opposite effects of prevalence on choices to replace rather than repair a laptop (figure 2-11).

Figure 2-11 MODERATED MEDIATION IN STUDY 7 A



NOTE. WG in the figure stands for the word-general condition. NS stands for the numeric-specific condition.

Discussion

The results of this study replicate our prior findings regarding the effects of outward vs. inward framing on problem severity judgments and show that these findings extend to consumer choices between replacing vs. repairing a laptop. In particular, consumers interpret the same information in two different ways depending on the framing: expressing prevalence in specific terms using numbers yields severity inferences and replacement choices consistent with a Common = Severe extrapolation, while expressing prevalence in general terms using words results in severity inferences and replacement choices consistent with a Rare = Severe overgeneralized heuristic. Framing the same information in different ways can reverse not only consumers' inferences, but also their choices.

It is noteworthy whether the effect of framing only exists in a conversational context. That is, the effect of framing may occur (at least in part) because of consumers' inference of the speaker's intention. To test this explanation, we conducted a separate study with the same scenario as study 7a, but removing the conversational context (see Web Appendix E). The results show the same pattern as in study 7a, such that when consumers are prompted to think in inward terms, low prevalence problems are seen as less severe, and *vice versa* when consumers are prompted to think in outward terms (Interaction $b = -1.47$, $SE = .35$, $t(384) = -4.23$, $p < .001$), even though the prevalence information is not provided by a conversational partner.

STUDY 7B: REVERSING CELLPHONE QUALITY PERCEPTION AND PURCHASE INTENTION

Study 7b tested a different consumer decision in a positive inference domain: consumers' purchase intention for a cellphone based on the inference of its battery quality. This study extends the framework to inferences outside the domain of problems or issues, where consumers mainly make negative inferences. We predict that in a cellphone purchase scenario where consumers are told to care about battery performance, framing the prevalence of battery performance based on our framework can change consumers' inference about the quality of the batteries, which in turn changes their purchase intention for the cellphone.

Method

Procedure. As in study 7a, this study also manipulated prevalence (high vs. low) and framing (inward: specific/number vs. outward: general/word) in a 2×2 between-subjects design. Participants were instructed to read a scenario in which they needed to buy a new cellphone and were told that they cared about the battery performance of the cellphone. See Figure 2-12 for a sample scenario. In the inward condition, participants were either informed that “70% of cellphones of this model have batteries with this level of performance” (high prevalence) or “30% of cellphones of this model have batteries with this level of performance” (low prevalence). Correspondingly, in the outward condition, participants were either informed that

“Many cellphones have batteries with this level of performance” or “Few cellphones have batteries with this level of performance.”

Figure 2-12 SAMPLE SCENARIO IN STUDY 7B

Imagine that you are shopping for a new cellphone. You care a lot about the battery of a cellphone.



While looking around, a shop assistant told you more information about a cellphone that you are interested in.

They said the following about the battery in the phone: **“Many cellphones have batteries with this level of performance.”**

After reading the scenario, participants were asked about their purchase intention, *“How likely are you to purchase this cellphone?”* (9-point Likert scale, from 1 [*Not at all likely*] to 9 [*Extremely likely*]) followed by *“What do you think of the quality of the battery used in this cellphone?”* (9-point Likert scale, from 1 [*Not good at all*] to 9 [*Extremely good*]). Next, participants were asked exploratory measures including the PANAS-SF scale (Watson, Clark and Tellegen 1988), the 10-item BIF scale (Study 1 in Slepian, Masicampo and Ambady 2015), and a five-item fluency measure (Graf, Mayer and Landwehr 2018).

Results

Participants. Four hundred and fifty-three U.S. participants from Amazon's MTurk participated in the pre-registered study. Excluding responses from 43 participants who did not finish the survey, two responses from duplicate IP addresses, and nine participants who were below 18 years-old left 399 valid responses (52.6% females, $M_{\text{age}} = 41.92$). This study was pre-registered at <https://aspredicted.org/qgp9-ncnh.pdf>.

Purchase intention. The ratings of purchase intention by condition are shown in Figure 2-13. We first conducted a linear regression, predicting participants' purchase intention based on Framing (Outward = 1, Inward = 0), Prevalence (High prevalence = 1, Low prevalence = 0), and the interaction term. We found a significant interaction between Prevalence and Framing, $b = -1.99$, $SE = .38$, $t(395) = -5.28$, $p < .001$ (along with a significant main effect of Prevalence, $b = 0.79$, $SE = .26$, $t(395) = 2.99$, $p = .003$, and a significant main effect of Framing, $b = 2.38$, $SE = .27$, $t(395) = 8.98$, $p < .001$). Pairwise tests show that when prevalence is communicated using inward framing (i.e., in specific terms using numbers), participants were significantly more likely to purchase the cellphone when its battery performance level was highly prevalent ($b = -0.79$, $SE = .26$, $t(395) = -2.99$, $p = .003$). More importantly, this pattern was reversed when the prevalence was instead communicated using outward framing (i.e., in general terms using words), such that participants were significantly *less* likely to purchase the cellphone when its battery performance level was highly prevalent ($b = 1.21$, $SE = .27$, $t(395) = 4.46$, $p < .001$).

Perceived quality of battery. The values of perceived quality across conditions show a similar full reversal (Figure 2-14) as in participants' purchase intention. We conducted a linear

regression, predicting perceived quality based on Framing, Prevalence, and the interaction. We find a significant interaction between Prevalence and Framing, $b = -2.58$, $SE = .37$, $t(395) = -6.92$, $p < .001$ (along with a significant main effect of Prevalence, $b = 0.89$, $SE = .26$, $t(395) = 3.42$, $p < .001$, as well as a significant main effect of Framing, $b = 2.71$, $SE = .26$, $t(395) = 10.30$, $p < .001$).

Figure 2-13 PURCHASE INTENTION BY FRAMING AND PREVALENCE IN STUDY 7B

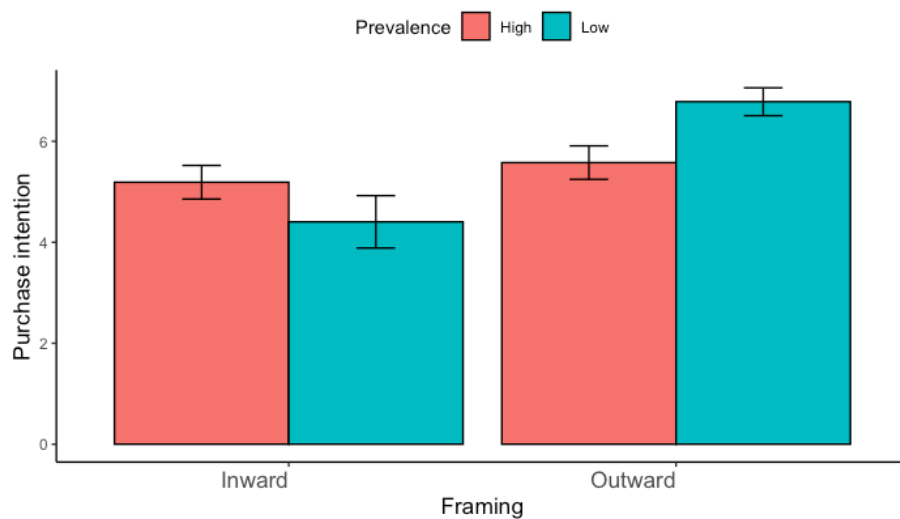
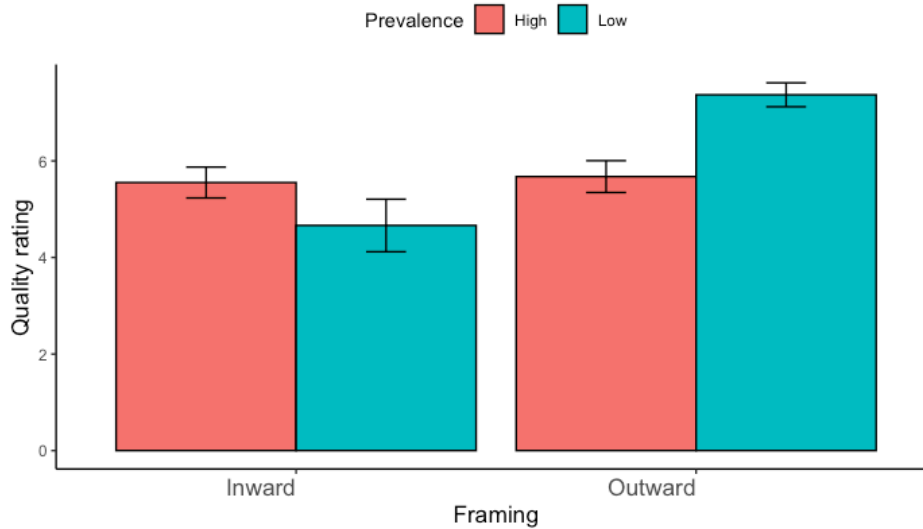


Figure 2-14 PERCEIVED QUALITY BY FRAMING AND PREVALENCE IN STUDY 7B



Mediation analyses. We also conducted mediation analysis for the two framing conditions (Outward vs. Inward) separately, with the purchase intention as the dependent variable, Prevalence as the independent variable, and Perceived Quality as the mediator. In the outward conditions, the total effect of Prevalence on purchase intention (Total effect: $b = -1.21$, $95\%CI = [-1.66, -0.77]$, $p < .001$) was significantly mediated by Perceived Quality (Indirect effect: $b = -1.29$, $95\%CI = [-1.67, -0.93]$, $p < .001$), such that after controlling for Perceived Quality, the direct effect of Prevalence on purchase intention is no longer significant (Direct effect: $b = 0.08$, $95\%CI = [-0.26, 0.43]$, $p = .68$). These results suggest that when consumers are prompted to think in outward terms, batteries with low-prevalence (i.e., rare) performance is seen as having better quality and therefore consumers are more likely to purchase a cellphone with such batteries.

In the inward conditions, the *opposite* total effect of Prevalence on purchase intention (Total effect: $b = 0.77$, 95%CI = [0.19, 1.34], $p = .006$) was also significantly mediated by Perceived Quality (Indirect effect: $b = 0.76$, 95%CI = [0.25, 1.25], $p < .001$). After controlling for Perceived Quality, the direct effect of Prevalence on purchase intention was no longer significant (Direct effect: $b = 0.01$, 95%CI = [-0.27, 0.32], $p = .902$). These results suggest that when consumers are prompted to think in inward terms, batteries with low prevalence (i.e., low numeric probability) performance are seen as worse in quality and therefore consumers will be *less* likely to purchase a cellphone with such batteries.

Overall, results in study 7b suggest that the outward vs. inward thinking framework does not only affect consumers' inferences and judgments in the negative domain (e.g., issues, disasters, and problems) but also similarly affect inferences and judgments in a domain whether negative inferences are not necessarily made.

GENERAL DISCUSSION

Across ten studies, we showed that how prevalence information is conveyed has a significant effect on consumers' perceptions of impact. Specifically, consumers think rare events are more extreme when prevalence is framed in general terms using words, and that common events are more extreme when prevalence is instead framed in specific terms using numbers (studies 1 and 2). We more directly test the proposed outward vs. inward framework by separately manipulating the generality vs. specificity of the prevalence information, and whether it is conveyed in words or numbers in study 3. We find that the Rare = Severe lay belief is eliminated when general framing is substituted by specific framing, and a reversed inference, Common = Severe, emerges when we further replace words by numbers. We identify expressing

prevalence in words as uniquely affecting the inferential heuristic used and rule out alternative explanations in study 4.

This framing difference can be explained and manipulated by our outward vs. inward thinking framework: prompting consumers to think in more outward terms via a perspective-taking intervention eliminates the Common = Severe inference that is otherwise observed with specific numeric information (study 5a) and conversely, prompting consumers to think in more inward terms via a self-focus intervention reduces the Rare = Severe inference observed with general word information (study 5b). These findings influence consumer behavior because differences in perceived severity can cause consumers to make different decisions. Using an incentivized design, we found that consumers' real donation allocations to charitable cancer foundations were also influenced by how prevalence information was framed (study 6). We further showed that manipulating prevalence framing reversed consumers' decisions to replace vs. to repair a product, which in turn was explained by the differences in perceived severity of the product issue (study 7a), as well as consumers' quality inference and purchase intention in a non-negative domain (study 7b).

Our findings can help to resolve the seeming contradictions in past research on topics such as severity bias and inferences from scarcity. For example, the scarcity literature suggests that consumers tend to perceive an item as higher in value when it is less available, consistent with inferring extremity from rareness. On the other hand, the severity bias literature suggests an opposite relationship, between extremity and perceived commonness. We argue that such differences are not paradoxical and will vary systematically depending on how the information is framed when consumers make judgments, resulting in different heuristics being used.

In particular, in the severity bias literature, probabilities were mostly estimated by prompting respondents to think about numeric ranges (e.g., Weber and Hilton 1990; Bonnefon and Villejoubert 2006), and scenarios were framed specifically about the patient themselves (instead of focusing respondents on more general patterns). On the other hand, the findings that linked rarity to high impact usually involved general framing. For example, in demonstrating the rare preference effect, descriptions of preferences were all expressed in general terms (e.g., “I like X!”) rather than through specific ways (Vélez, Bridgers, and Gweon 2019). It is also noteworthy that our research focuses on the effects of different ways of communicating prevalence information (e.g., comparing “60% vs. “10%”; “common” vs. “rare”), instead of contrasting when consumers have vs. lack prevalence information (e.g., Eskreis-Winkler, Peres, and Fishbach 2024), which is an important but quite different question.

In addition, we demonstrate that describing an event with substantively the same prevalence information but different framing can cause opposite attitudes or judgments. Whether consumers perceive a common (vs. a rare) event as having a higher level of impact depends on the way prevalence is framed, which in turn can influence their behaviors. In particular, verbal and general thinking is more likely to prompt reliance on overgeneralized lay beliefs that involve contrasts across different exemplars, while numeric and specific thinking can instead prompt consumers to use a different set of heuristics, extrapolating from known to unknown information about specific cases.

It is worth noting that the outward vs. inward thinking framework we propose is distinct from prior research on the benefits of taking an outside rather than inside view (Lovallo and Kahneman 2003; Koehler and Harvey 2008; Lovallo, Clarke, and Camerer 2012). An inside view, which is the spontaneously adopted default perspective, focuses on cues of a specific case

at hand, while an outside view takes into account a broader range of cases and results in predictions that incorporate the full probability distribution of outcomes relevant to a reference case. An outside view is generally seen as more fully using the available information, and thereby yielding more accurate predictions than an inside view. By contrast, our outward vs. inward thinking framework focuses less on the breadth of information incorporated into prediction, but more on how contextual cues *shift* people's way of thinking and the heuristics used. In particular, because we find that different cues prompt people to rely on different types of fallible heuristics, our results suggest that outward thinking is not necessarily better than inward thinking. Given that people using outward thinking consider the associations between instances, they may rely on an overgeneralized heuristic that is not applicable in a given instance, leading to suboptimal decisions.

Our findings suggest that marketers, policy makers and others involved in risk communication should consider how the means of conveying information could impact the heuristics used to reason about that information in light of their communication goals. For example, a firm attempting to reassure consumers by describing product defects in general terms as "rare" may inadvertently lead to a higher severity judgment inferred from a tradeoff-based lay belief, even if that is not the case and not what the marketer had intended to convey. On the other hand, when a policy advocate instead provides numeric data showing the low incidence rate of a specific product defect, the information may instead lead to conflation and a low severity judgment, even when that is not the case and contrary to the advocate's intentions. Prevalence information prompting under-estimation of severity can reduce the motivation to take necessary actions, while prevalence information prompting over-estimation of severity can lead to unnecessary stress and wasteful behaviors. Therefore, we advocate more attention to and

understanding of how the ways in which prevalence is communicated can affect inferred severity. Similarly, marketers should also pay attention to how consumers may communicate prevalence information to each other (e.g., through word of mouth or online reviews) and the severity signals that may be thereby conveyed, depending on how the prevalence information is framed.

Finally, our outward vs. inward thinking framework provides a starting point for needed future research on when consumers will rely on which heuristics with potentially contradictory implications. While a great deal of research has been conducted documenting the occurrence of different particular heuristics in different decision contexts, less is known about how consumers shift from relying on one relevant heuristic to another. Our findings suggest that when information is provided in general terms, using words and prompting perspective taking, consumers will be more likely to use heuristics that capture correlations or tradeoffs they have learned (or over-learned) in the world. Conversely, when information is provided in specific terms, using numbers and prompting self-focus, consumers will be more likely to use heuristics that involve extrapolation from known information to equivalent judgments of unknown information. This framework is useful for both researchers and practitioners to develop initial hypotheses about which heuristic a consumer will rely on in a given situation.

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