Partitioning Menus to Nudge Single-item Choice

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We thank Stephanie Chen, Kristen Duke, Chris Olivola, Stephen Spiller, and Eric VanEpps for helpful comments on an earlier draft of this paper.

Abstract

Decision makers must often choose items from a menu of options. For instance, employees pick investments from a set of retirement savings plans, citizens select political representatives from a list of candidates, and physicians choose medical treatments from an order set. Options often need to be organized or grouped in some way, which raises the question of whether grouping menu items affects the options ultimately chosen by decision makers. In a series of experiments, we examine *partition dependence for single-item choice*, where individuals are more likely to choose options that are listed separately rather than as part of a group (holding the total set of options constant). Unlike prior work on multi-item allocation decisions, the traditional explanation of partition dependence — a bias towards even allocation — cannot apply to single-item choice, because singular choices are not divisible. Instead, our results suggest that menu partitions influence choice partly because decision makers view the grouping of options as a signal about what items are most frequently chosen (i.e., descriptive social norms). Partitioning of the menu space can strongly influence single-item choice, and may serve as a simple and effective tool for managers, policymakers, and choice architects.

Keywords: decision making, choice architecture, partition dependence, social norms

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Decisions are influenced by how options are presented, ordered, framed, and described. Based on this simple but powerful insight, governments around the world have become interested in designing behaviorally informed "choice architecture" policies to enhance public welfare and promote other public priorities (Sunstein, 2013; Thaler & Sunstein, 2008, 2021). Examples include policies that nudge employees to save more for retirement by automatically enrolling them into a savings plan, nudge homeowners to consume less energy by comparing electricity usage to that of their neighbors, and nudge students to take advantage of college federal loans by making financial aid forms less daunting (Allcott & Rogers, 2014; Bettinger, Long, Oreopoulos, & Sanbonmatsu, 2012; Madrian & Shea, 2001).

Once a choice architect has decided on which options to offer decision makers, two features of their presentation are unavoidable: the order in which those options appear and the way those options are partitioned into groups (including the possibility of not grouping options at all). In this paper we examine the impact of partitioning the option set on the selection of a single choice from a menu. Examples of single-item choice include citizens deciding which candidate to vote for public office from a ballot, managers choosing an employee as project lead from a roster, physicians selecting a medical prescription from an electronic order set, or restaurant patrons ordering an entree from a menu. For reasons we discuss below, the application of menu partitions to choice of a single option is both theoretically interesting and practically important.

Because options often need to be organized or grouped in some way, an important question is whether the partitioning of menu items affects the options ultimately chosen by decision makers. In a series of experiments, we provide evidence of *single-item partition dependence*, where decision makers are more likely to choose a single option from response categories that are more finely grouped or partitioned. While a few previous studies of hypothetical choices have noted a biasing impact of partitioning on single-item decisions (Brenner, Rottenstreich, & Sood, 1999; Feng, Liu, Wang, & Savani, 2020; Tannenbaum et al., 2015), the present studies demonstrate the robustness and generality of this effect across multiple theoretically distinct choice tasks and using real

incentives. Moreover, we directly test a novel mechanism underlying this phenomenon, namely that the grouping of menu items communicates information about their relative popularity. Our findings suggest that strategic partitioning of the menu space can strongly influence choice and behavior, and may constitute a simple and potent aspect of choice architecture.

Menu Grouping and Choice

When constructing a choice menu, there is often a need to group items in order to reduce complexity and organize options (Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). For instance, a wine merchant may group wines by the geographic region of production (California, Italian, and French wines), by grape varietal (Merlot, Pinot Noir, and Malbec wines), by price point (low-priced, medium-priced, and high-priced wines), or by color (red, rosé, and white wines). Similarly, an organization may group and distribute resources by specialization (product development, manufacturing, and marketing), by geography (domestic and international offices), or by market segment (retail, small business, and enterprise clients). Note that menus with three or more options necessarily require a decision to be made about grouping, including the decision to not group at all. As the number of options increase, so too do the number of potential groupings.

While the partitioning of options may help individuals navigate the option space more efficiently, such design elements can also serve to bias choice. Past research finds that for multi-item allocation decisions, in which a decision maker divides or distributes a fixed set of resources, choices are *partition dependent* because individuals tend to be biased towards even allocation regardless of how items are grouped (Fox, Ratner, & Lieb, 2005; Bardolet, Fox, & Lovallo, 2011; for a review see Fox, Bardolet, & Lieb, 2005). To illustrate, consider the following two firms. At firm A, an employee is asked to allocate earnings to a savings plan from a menu that groups options according to domestic stocks, international stocks, and bonds. At firm B, the employee is instead asked to allocate earnings from a menu that groups options according to stocks, domestic bonds, and international bonds. A bias towards even allocation over identified groups will lead to a relatively stock-heavy portfolio for employees at firm A (e.g., 1/3 to domestic stocks, 1/3 to international stocks, and 1/3 to bonds) but will lead to a relatively bond-heavy portfolio for employees at firm B

(e.g., 1/3 to stocks, 1/3 to domestic bonds, and 1/3 to international bonds). Partition dependence for allocation has been observed in both laboratory and field settings, and across a number of domains, including consumption decisions, judgment under uncertainty, motivation, cue weighting, budgeting, diversity hiring, corporate capital allocation, assessments of fairness, and parental investment (Bardolet et al., 2011; Bogard, Reiff, Caruso, & Hershfield, 2024; Feng et al., 2020; Fox & Clemen, 2005; Hertwig, Davis, & Sulloway, 2002; Lohmeier, Fox, & Langer, 2026; Martin & Norton, 2009; Shah & Oppenheimer, 2011; Sonnemann, Camerer, Fox, & Langer, 2013; West, Ülkümen, Arundel, & Fox, 2026).

Whereas previous research has demonstrated partition-dependence for allocation decisions, an open question remains whether menu partitions can also bias decisions when choosing a single item from a list of options — and if so why. To help motivate this question, consider political elections where voters are asked to vote for a single candidate. In such cases, election officials must decide whether to organize voter ballots, among other possibilities, according to political candidates or political parties. However, since multiple parties may run the same candidate, partitioning by political party can lead to multiple listings for the same candidate. For instance, in the 2025 New York mayoral race, Zohran Mamdani appeared on the ballot twice (once as the Democratic candidate and once for the Working Families Party) while his main opponent, Andrew Cuomo, appeared only once as an independent (see Glatsky & Beltran, 2024, for another example). Several prominent conservatives seized on this feature of the ballot, arguing that it had been deliberately structured to boost Mamdani's vote share (Myers, 2025).

The voting example above suggests the following form of partition dependence for single-item choice: decision makers are especially likely to choose from response categories that are more finely partitioned. Just as listing the same political candidate twice (rather than once) might increase their vote share, multiple listings for a category of items may increase choice share for that class of items. In fact, a small number of prior studies have documented related patterns using hypothetical choice scenarios. Using medical vignettes, Tannenbaum et al. (2015) found that physicians were more likely to prescribe aggressive treatment options (e.g., broad-spectrum antibiotics) when those

options were listed individually compared to when those options were grouped together. Similarly, using a hiring vignette, Feng et al. (2020) found that respondents were more likely to select a racial/ethnic minority job applicant when the candidate pool consisted of minorities from different specializations (and were thus not grouped together) than when the candidate pool consisted of minorities from the same specialization (and were thus grouped together). Finally, Brenner et al. (1999) found that choice shares for hypothetical consumer goods sum to greater than 100% in between-subjects designs where one item is listed separately (e.g., "Seafood restaurant") and all other remaining items are grouped together as an alternative compound option (e.g., "Your choice of either Italian, Mexican, or Thai restaurant").

Partition dependence for single-item choice represents a theoretical departure from prior work on allocation decisions. Existing accounts of partition dependence focus on explaining a bias toward even allocation — for example, through the use of a diversification heuristic, a general tendency to engage in variety seeking, and anchoring on $1/n$ with insufficient adjustment (Fox & Clemen, 2005; Ratner, Kahn, & Kahneman, 1999; Read & Loewenstein, 1995). By design, these mechanisms presuppose divisible resources and therefore do not readily extend to single choices from a menu, where there is nothing to diversify over. Consequently, the psychological processes underlying partition dependence in single-item choice are likely to differ from those that give rise to partition dependence in multi-item allocation.

Information Leakage from Menu Partitions

Common intuition suggests that menu partitions may affect choices by biasing attention toward more finely partitioned (i.e., more salient) options or through thoughtless responding that randomizes choices over the groups into which options are partitioned. Such accounts suggest single-item partitioning may be particularly likely when decision makers are not especially motivated or engaged (we explore these issues in greater detail in the General Discussion). Here, we examine a distinct mechanism that may drive single-item partition dependence even in situations where decision makers *are* highly motivated and engaged — specifically, we hypothesize that decision

makers infer task-relevant information from the way in which options are grouped.[1]

If categorization and grouping is often done in order to reduce complexity (Rosch et al., 1976), then decision makers may infer that such grouping is not done at random and thus carries useful information (e.g., Prelec, Wernerfelt, & Zettelmeyer, 1997). For instance, Benartzi and Thaler (2001) speculated that employees engage in naive diversification when saving for retirement partly because they recognize their lack of financial sophistication and trust their employer has curated a set of funds (i.e., constructed a menu of options) suited to employee needs. More generally, conversational norms imply that information should only be as fine-grained as necessary (the conversational maxim of quantity; Grice, 1975), and people appear to carry these assumptions about granularity into menu-based choice (Zhang & Schwarz, 2012). As a result, two extensionally equivalent menus can convey different information (see Krijnen, Tannenbaum, & Fox, 2017; McKenzie & Nelson, 2003; Sher & McKenzie, 2006, 2014).

We focus in particular on the possibility that menu partitions signal information about *descriptive social norms*. Decision makers may assume that choice architects and policymakers allocate menu space preferentially to options that are more popular, while clustering less popular options together or consigning them to a residual category (e.g., "all other options"). For instance, survey respondents often use the range of the response alternatives on a survey to infer typical and atypical behavior of others (e.g., the extremes of the response scale are assumed to correspond to extreme or atypical behavior in the population), which they then use as a frame of reference when estimating their own behavior (Menon, Raghubir, & Schwarz, 1995; Schwarz, Hippler, Deutsch, & Strack, 1985; Tourangeau & Smith, 1996). Similarly, if a retirement menu lists stock funds individually but groups bond funds into a single category, employees may infer that most of their colleagues invest primarily in stocks.

Stated more precisely, this information leakage account suggests that decision makers act as if menu partitions follow a "principle of maximum entropy" (Jaynes, 1957) over the distribution

[1]While others have speculated that menu partitions may signal task-relevant information (Fox & Clemen, 2005; Fox, Ratner, & Lieb, 2005; Kahneman & Tversky, 1982; Martin & Norton, 2009), to our knowledge no prior studies have directly tested this hypothesis.

of preferences in a population: among the feasible ways to carve up the menu, choice architects try to divide the menu in a way that most evenly allocates preferences across options (with more popular items listed separately rather than grouped). To the extent that people look to descriptive norms for guidance — because common choices are taken to signal option quality (Banerjee, 1992; Bikhchandani, Hirshleifer, & Welch, 1992) and/or normatively appropriate behavior (Bearden & Rose, 1990) — the way options are partitioned may reveal task-relevant information and thereby shape choice. Furthermore, this view implies that single-item partition dependence will be linked to the social and organizational context in which menus are encountered and will be especially influential for individuals who chronically rely on others' behavior to guide their own decisions (Krijnen et al., 2017; McKenzie, Sher, Leong, & Müller-Trede, 2018).

The Current Studies

In this paper we investigate the conditions that give rise to single-item partition dependence. We extend prior literature by studying this phenomenon across a diverse range of decision settings, including contexts with real stakes (incentive-compatible choice) and complete information about all options. More importantly, we examine a novel mechanism that can help explain when and why partition dependence is observed for single-item choice.

In Study 1, we test for single-item partition dependence across several workplace settings. In Studies 2A–2C, we show that these effects are robust to incentive-compatible choice and generalize across theoretically distinct task domains (riskless decisions, risky decisions, and nonstrategic social preferences). In Studies 3–5, we examine the extent to which single-item partition dependence is driven by inferences of descriptive social norms from menu partitions. We report an additional three studies (Studies S1–S3) in the Supplemental Material.

For all studies, we determined sample sizes prior to data collection. We preregistered hypotheses and analysis plans for all studies except Studies 3, 4, and S2. For each study, a small number of observations with duplicate IP addresses were excluded; the sample sizes reported below reflect the final samples after these exclusions. The only demographic information we collected was participant age and gender, always measured at the end of each study. Study material, data,

code, and preregistration documents can be found at https://researchbox.org/227&PEER_REVIEW_passcode=ZQVQIK.

Study 1: Single-item Partition Dependence

Study 1 tests for single-item partition dependence across several workplace contexts. Participants chose from menus in which options from one category were individually listed ("unpacked" options), while options from another category were grouped together ("packed" options).[2] This design mirrors common menu partitions in which a subset of possible choices are presented while remaining options are grouped together — for example, when a merchant lists out certain categories of goods (e.g., when a liquor vendor website partitions its selection of Bourbon, Scotch, and Rye whiskeys) while relegating other goods to a residual category (e.g., "all other spirits").

While this "featured subset + packed remainder" menu structure is commonplace, grouping options into a residual category reduces informational content and increases search or effort costs, as such options are harder to locate (e.g., buried deeper within a website). To rule out these confounds, we constructed our menu partitions so that information and effort costs were held constant across conditions. If participants exhibit partition dependence for single-item choice, then we should see greater choice share for options from more finely partitioned categories compared to options from more coarsely partitioned categories.[3]

[2]We distinguish our use of "packed" and "unpacked" categories here, which refers to whether options are grouped or listed separately, from a related stream of research that examines "unpacking effects" in which individuals assign greater weight to events that are delineated than they do to events that are not (Rottenstreich & Tversky, 1997; Tversky & Koehler, 1994). For example, one group of participants assigned higher probability to a person dying from "heart disease, cancer, or other natural causes" than a second group assigned to a person dying simply from "natural causes" (Tversky & Koehler, 1994). Note that unpacking effects are distinct from partition dependence — the former focuses on how the description of options or events affects judgment and choice, whereas the latter focuses on how options or events are subjectively grouped together. For instance, Fox and Clemen (2005) hold the description of events constant while varying the partitioning of the elicitation format, and find that a bias towards $1/n$ occurs independently of unpacking effects. In fact, *partitioning* a focal event into sub-events that are evaluated separately increases aggregate judged probabilities more strongly than merely *unpacking* the description of the same event into a disjunction of sub-events evaluated together (see Sloman, Rottenstreich, Wisniewski, Hadjichristidis, & Fox, 2004). In our studies, we describe all options in equal detail across menu partitions in order to rule out any role of traditional unpacking effects.

[3]In Section 1 of the Supplemental Material, we report the results from an additional study that compares menu partitions to a "control" condition in which all items are individually listed. Such a design allows us to examine whether packing focal versus nonfocal items into a single listing is the primary driver of single-item partition dependence. We find that,

Method

We recruited a sample of 400 respondents from CloudResearch Connect to participate in return for a flat cash payment (48% male, mean age = 38 years, age range: 19–83 years).

Participants responded to four hypothetical choices involving common workplace decisions. Each trial consisted of a menu of six options partitioned into two categories of three options each.[4] The four choice domains (and menu categories) were as follows: (1) undertaking an organizational project from a menu consisting of innovation-based and efficiency-based projects; (2) professional development opportunities from a menu consisting of trade conferences and training programs; (3) team building activities consisting of indoor and outdoor activities; and (4) office resources from a menu consisting of convenience-based and wellness-based amenities. For each trial, we randomly selected one category of options to be listed individually while the other category was grouped into a single listing (see Figure 1 for an example). Participants completed the four choice domains in random order and on separate pages.[5]

To equate effort costs across conditions, and to minimize random or thoughtless responding, participants wrote out their preference in an open text field.[6] We also note that regardless of the

relative to the control condition, both treatments have a reliable and roughly equal effect on choice (i.e., we do not observe a significant difference between the two treatments).

[4]All studies in this paper use menus consisting of six options from two product categories (three options each). However, single-item partition dependence is not limited to choice sets with six items, nor to choice sets with an equal proportion of packed versus unpacked items. For instance, Tannenbaum et al. (2015) presented a sample of physicians with menus of nine, ten, and fourteen treatment options, and where 7:3, 5:4, 6:4, and 8:6 items were packed versus unpacked.

[5]In Section 8 of the Supplemental Material, we examine whether trial order affects our results for all studies with multiple trials.

[6]We presumed that requiring participants to write out their answers, rather than to simply click on an option to register a response, would prompt greater cognitive effort and reduce thoughtless or random responding. Research in survey methodology suggests that open-ended response formats, compared to multiple-choice or closed-ended formats, can encourage more thoughtful responses by participants (e.g., Bernhard-Harrer & Pfaff, 2025).

Because participants in our studies wrote out their answers in an open text field, we exclude from the analysis participants who provided unusable responses. Such responses often involved writing an option not present in the menu (e.g., listing "Singapore" when the response options were France, Italy, Germany, China, Japan, and Vietnam). However, some of these omitted responses were cases where participants wrote the entire grouped category instead of a single item (e.g., a participant writing "an Asian country" instead of specifying a specific country). Because omitting such responses potentially biases results in favor of our hypothesis, we also examined the results when including *all* omitted responses and coding these observations to go *against* our hypothesis. Note that this represents a particularly conservative approach, as many unusable responses did not bias the results in a particular direction. In all studies we continue to observe robust menu partitioning effects even when using this more conservative approach. Full details and results for all studies are provided in Section 7 of the Supplemental Material.

Figure 1: Example of Menu Partition (Study 1)

Innovation-focused Projects Unpacked

Imagine your manager asks you to join one cross-functional project team. Which project would you prefer?

- New Product Development Team
- Market Expansion Initiative
- Digital Transformation Project
- An efficiency-focused project: your choice of either the Process Improvement Task Force, Cost Reduction Initiative, or Supply Chain Optimization Project

Which one project would you choose? _____

Innovation-focused Projects Packed

Imagine your manager asks you to join one cross-functional project team. Which project would you prefer?

- Process Improvement Task Force
- Cost Reduction Initiative
- Supply Chain Optimization Project
- An innovation-focused project: your choice of either the New Product Development Team, Market Expansion Initiative, or Digital Transformation Project

Which one project would you choose? _____

menu partition, participants were presented with the same set of options and selected only one option. To control for possible menu position effects, we also counterbalanced (at the participant-level) the position of the grouped category by placing it as either the first or last listing on the menu.

Analysis Strategy

To test for partition dependence, we compare choice percentages for groups of items listed individually (unpacked items) to those same items grouped into a single listing (packed items). When combining responses across choice domains, we use logistic regression where the outcome variable is choosing an item from a focal group (e.g., for the organizational projects domain, 0 = not choosing an innovation-based project, 1 = choosing an innovation-based project) and our predictor variable is whether the menu is partitioned such that the focal group is packed or unpacked (0 = packed, 1 = unpacked). The particular group we designate as focal does not affect the analysis, since each domain contains only two groups of items. Our model also includes domain fixed-effects

Table 1: Percentage of Participants Choosing an Option from Group A (Study 1A)

Domain	Group A	Group B	Group A Unpacked	Group A Packed	Difference
Organizational Projects	Innovation-focused	Efficiency-focused	89.7	20.6	69.1***
Professional Development	Training Programs	Trade Conferences	91.2	38.9	52.3***
Team Building	Outdoor Activities	Indoor Activities	74.8	15.2	59.6***
Office Resources	Wellness Amenities	Convenience Amenities	77.2	17.8	59.4***

Notes: "Difference" represents the difference in choice share for choosing an option from Group A when that category is unpacked versus packed. *** $p \leq 0.001$.

and robust standard errors clustered by participants. For all analyses in this paper using logistic regression, we report the average marginal effect across experimental treatments.

Results

We find clear evidence of single-item partition dependence. Across domains we observed a 60 percentage point increase in choosing unpacked items compared to packed items (see Table 1). In all four domains, choices reliably varied as a function of menu partition (all p-values < 0.001). Furthermore, the size of the menu partitioning effect was not reliably influenced by whether the grouped option was positioned as the first or last listing on the menu ($p = 0.216$ for the interaction term between menu partition and grouped-item position).[7]

Studies 2A–2C: Extending Single-item Partition Dependence to Incentive-compatible Choice

Study 1 documents clear evidence of single-item partition dependence across a range of workplace settings. However, by necessity, the choices in Study 1 were hypothetical, and participants may have had limited information or familiarity with such decisions. In Studies 2A–2C we examine whether single-item partition dependence also arises in choices with real consequences

[7]When examining interaction effects from binary choice data, we report p-values from the interaction term of the logit model. An alternative approach is to examine the difference in average marginal effects when the packed category is positioned at the bottom versus top of the menu. While these two approaches are identical for ordinary least squares, they are not equivalent for models that make nonlinear transformations to predictor variables (such as when using logistic regression; see McCabe, Halvorson, King, Cao, & Kim, 2022). For all results reported in this paper, coefficient signs for the interaction are the same across the two approaches, and p-values that are statistically significant/nonsignificant using one approach (at $p < 0.05$) are also significant/nonsignificant using the other approach.

— particularly in contexts where participants possess high task familiarity or are provided with complete information.

We report three additional studies that test whether single-item partition dependence generalizes across substantively distinct decision domains and under conditions that incentivize thoughtful and honest responding.[8] Study 2A examines riskless decisions involving familiar consumer goods and products. Study 2B examines decisions under risk, where participants are provided with complete information about option attributes (in this case, lottery payoffs and probabilities). Study 2C examines nonstrategic social preferences, in which individuals consider their own material payoffs relative to those of others. Because these studies share the same basic design as Study 1, we report only design features unique to each study below to keep things brief.

Study 2A: Riskless Consumption Decisions

Method We recruited a sample of 299 participants from Amazon.com's Mechanical Turk labor market (MTurk; 46% male, mean age = 35 years, age range: 19–74 years). Participants were presented with menus of consumer goods, and indicated the item they would most prefer to receive. We notified participants up front that some respondents would be selected at random to receive one of their chosen options, and that we would follow-up with these participants so they could claim their prize.

Participants made four choices across different consumer goods, in random order and on separate pages. Each trial consisted of a menu of six options partitioned into two categories of three options each (see Figure S2 in the Supplemental Material for an illustration). The four choice domains (and menu categories) were as follows: (1) a menu of DVD movies consisting of science-fiction and romantic comedy movies; (2) a menu of books consisting of behavioral science and life science books; (3) a menu of magazine subscriptions consisting of popular science and world news magazines; and (4) a menu of charitable donations consisting of animal and environmental charities.

[8] In Studies 2A–2C, participants were incentivized by randomly selecting a subset and implementing their decisions for real payouts. This approach can be contrasted with incentive schemes that pay out all participants with smaller stakes. Although findings on experimental incentives are mixed, the evidence overall indicates that paying only a subset of participants is at least as effective, and sometimes more effective, than a "pay all" approach (see Charness, Gneezy, & Halladay, 2016).

Table 2: Percentage of Participants Choosing from Group A

	Group A Unpacked	Group A Packed	Difference
Study 2A: Consumer Goods			
(A) Animal vs (B) Environmental charities	85.4	52.9	32.5***
(A) Science fiction vs (B) Romantic comedy movies	78.1	54.2	23.9***
(A) Behavioral science vs (B) Life science books	79.1	31.7	47.4***
(A) Popular science vs (B) World news magazines	70.0	28.2	41.8***
Study 2B: Chance Gambles			
(A) More risky vs (B) Less risky gambles	28.6	13.0	15.7***
Study 2C: Social Preferences			
(A) More generous vs (B) Less generous offers	72.9	53.7	19.2***

Notes: Study 2A reports the percentage of participants selecting an item from Group A according to menu partition. Study 2B reports the percentage of participants choosing a more risky gamble according to menu partition. Study 2C reports the percentage of participants in a dictator game transferring $2 or more according to menu partition. The rightmost column reports the difference in choice share between the two menu partitions. *** $p \leq 0.001$.

For each trial, we randomly selected one category of items to be listed individually while the other category was grouped into a single listing, and participants wrote their preference in an open text field. We also counterbalanced (at the participant-level) the position of the grouped category by placing it as either the first or last listing on the menu.

Results We find clear evidence of single-item partition dependence for riskless consumption decisions. Across domains we observed a 36 percentage point increase in choosing unpacked items compared to packed items (see Table 2). In all four domains, choices reliably varied as a function of menu partition (all p-values < 0.001). Furthermore, the size of the menu partitioning effect was not reliably affected by whether the grouped option was positioned as the first or last listing on the menu ($p = 0.411$ for the interaction term between menu partition and grouped-item position).

Study 2B: Chance Gambles

Method We recruited a sample of 199 participants from MTurk (53% male, mean age = 36 years, age range: 18–76 years). Participants were presented with a single menu of six chance gambles (labeled A–F). The gambles were constructed to be roughly equal in value based on typical prospect theory parameters (for details, see Section 5 of the Supplemental Material). Half of participants chose from a menu where the three relatively risky gambles were unpacked while the

other half of participants chose from a menu where the three relatively safe gambles were unpacked (see Figure S3 in the Supplemental Material for an illustration). Participants were told up front that five of them would be randomly selected to play their gamble for additional bonus money. Participants wrote their preference in an open text field. We also counterbalanced the position of the grouped category by placing it as either the first or last listing on the menu.

Results We find clear evidence of single-item partition dependence for risky decisions. Only 13% of participants selected a more risky gamble when those gambles were grouped into a single listing, compared to 29% when riskier gambles were individually listed ($z = 3.84$, $p < 0.001$). Thus, while participants were generally risk averse, preferences for more risky gambles increased threefold when they were partitioned separately compared to when those same gambles were partitioned into a single grouping. Furthermore, our results were not reliably affected by whether the grouped category was positioned at the top or bottom of the menu ($p = 0.935$ for the interaction term between menu partition and grouped-item position).

Study 2C: Social Preferences

Method Participants played a dictator game in which they were asked to split $10 between themselves and an anonymous recipient from the same subject pool. Because the dictator game involves no strategic interaction with the recipient, such decisions serve as a straightforward measure of self-regarding versus other-regarding behavior (Forsythe, Horowitz, Savin, & Sefton, 1994; Kahneman, Knetsch, & Thaler, 1986).

We recruited a sample of 801 participants from CloudResearch Connect in return for a flat cash payment (48% male, mean age = 38 years, age range: 18–75 years). Participants were told they had been paired with another respondent, and that the interaction would remain anonymous (i.e., the identities of both participants would remain concealed from one another throughout the entirety of the study). Participants were told they had been randomly assigned to the role of Player A, and that another participant had been assigned to the role of Player B. As Player A, they were endowed with an additional $10 (USD) and could decide what amount, if any, to transfer to Player B. Participants first indicated a range of money to give to Player B, and on a follow-up page indicated an exact

amount.

Half of participants selected from an initial choice range where four of the five options were less than $2 (less than $0.50; $0.50–$0.99; $1.00–$1.49; $1.50–$1.99; $2.00 or more), while the other half of participants selected from a choice range where only one of the five options was less than $2 (less than $2.00;$2.00–$2.99; $3.00–$3.99; $4.00–$4.99; $5.00 or more). This design parallels our previous studies, in which one category of options was partitioned into multiple listings or into a single listing (see Figure S4 in the Supplemental Material for an illustration). On a follow-up page, participants then specified an exact transfer amount to give to Player B in an open text box.[9] Before making their decisions, participants were told that 10 pairs of respondents would be randomly selected to have their choices honored for real money. When the study was complete, we assigned payoffs by randomly pairing 20 participants (half as Player A, and half as Player B) and paid them bonus amounts based on the decisions made by Player A.

Results We find clear evidence of single-item partition dependence for social preferences. A greater proportion of participants gave $2 or more in the high transfer partition than in the low transfer partition (73% vs. 54%; $z = 5.64$, $p < 0.001$). When looking at final transfer amounts, participants also sent more money to Player B in the high transfer partition ($M = \$3.45$, $SD = 2.25$) than in the low transfer partition ($M = \$2.88$, $SD = 2.30$; $t(798) = 3.52$, $p < 0.001$, $d = 0.25$).

When examining the distribution of dictator responses, past studies find response spikes at complete profit-maximization (i.e., giving nothing) and complete fairness (i.e., giving exactly half; Engel, 2011). Such responding is thought to arise partly because giving nothing or giving half serve as focal points that are often applied in a heuristic manner (Chen & Fischbacher, 2020; Peysakhovich & Rand, 2016). In our sample, 48% of participants transferred exactly $0 or $5. We surmised (and preregistered in our analysis plan) that the effects of partitioning the menu space would be most pronounced among those who demonstrate non-heuristic responding, and thus have

[9]For the open text box, participants were restricted to stating an amount within the initial choice range they had specified on the previous page. For instance, a participant selecting a transfer amount of "less than $2.00" was required to give a response between $0 and $1.99. However, due to a programming error, one participant that had selected "less than $2.00" was able to register a response of $121, which is clearly outside the range of potential transfer amounts. We recorded this answer as a missing observation.

not yet "made up their mind" before being exposed to the menu of options.[10] Restricting the data to only those participants who provided nonheuristic responses (i.e., any transfer amount besides \$0 or \$5), we again see that a greater proportion of respondents gave \$2 or more in the high transfer partition than in the low transfer partition (76% vs. 32%; $z = 9.08$, $p < 0.001$). When looking at final transfer amounts, participants also sent more money to Player B in the high transfer partition ($M = \$3.43$, $SD = 2.20$) than in the low transfer partition ($M = \$1.97$, $SD = 2.09$; $t(412) = 6.92$, $p < 0.001$, $d = 0.68$). Thus, while we observe single-item partition dependence regardless of our analysis, the effects roughly double in size when restricting the data to participants who likely did not engage in heuristic responding.

Study 3: Do Menu Partitions Communicate Information?

Studies 1-2 document robust evidence for single-item partition dependence across substantively distinct decision domains and under conditions that incentivize thoughtful and honest preference reporting. In the remaining studies, we examine a potential mechanism for this phenomenon. In particular, we examine whether partitioning the menu space signals information concerning *descriptive social norms*. Since beliefs about how other people decide are a powerful influence on one's own behavior (Bearden, Netemeyer, & Teel, 1989; Cialdini & Goldstein, 2004; Cialdini, Kallgren, & Reno, 1991), menu partitions may exert their influence by structuring beliefs about what options are commonly chosen.

According to this information-leakage account, participants should view an item as relatively more popular (i.e., more frequently chosen by others) when individually listed than when grouped with other items. Also, to the extent that inferences about descriptive norms causally influence consumption decisions, beliefs about item popularity should statistically mediate menu partitioning

[10] We obtain similar results if we also exclude participants who gave \$10 (which along with giving nothing and giving half, may serve as a third focal point). Only 2% of respondents in our sample gave the entire endowment to Player B. When excluding participants who gave \$0, \$5, or \$10, we again see a greater proportion of respondents giving \$2 or more in the high transfer partition (75% vs. 29%; $z = 9.18$, $p < 0.001$). Looking at final transfer amounts, participants also sent more money to Player B in the high transfer partition ($M = \$3.10$, $SD = 1.68$) than in the low transfer partition ($M = \$1.64$, $SD = 1.33$; $t(412) = 9.50$, $p < 0.001$, $d = 0.96$).

Figure 2: Example of Choice and Judgment Task (Study 3)

Example choice trial

Imagine you win an all expenses paid trip to one country of your choice. Which of the following countries would you prefer to visit?

A. France
B. Germany
C. Italy
D. Asian country (your choice of either China, Japan, or Vietnam)

Which country would you choose? (Please list one country name) _____

Example estimation trial

Other respondents to this survey will be presented with the following:

Imagine you win an all expenses paid trip to one country of your choice. Which of the following countries would you prefer to visit?

A. France
B. Germany
C. Italy
D. Asian country (your choice of either China, Japan, or Vietnam)

What percentage of other respondents of this survey would you estimate answer each of the following? (Please give numbers between 0 and 100 so that your numbers sum to 100%)

France	_____ %
Germany	_____ %
Italy	_____ %
Asian country (your choice of either China, Japan, or Vietnam)	_____ %

effects.

Method

We recruited a sample of 154 participants from MTurk (69% male, mean age = 28 years, range: 18–72 years). Similar to Study 2A, participants chose a single item from a menu of consumer choices. We also asked participants to judge the relative popularity of each menu item as an empirical measure of inferred descriptive norms.

Choices and judgments were elicited in separate blocks. For the choice block we presented participants with four hypothetical choice menus; for each menu, half of the items were listed individually and the other half of items were clustered into a single response option. As in our previous studies, we counterbalanced (at the participant-level) the position of the packed category to be either the first or last listing. For the judgment block, we presented participants with the

same menu partitions they viewed in the choice block and asked them to estimate the percentage of respondents in the study who would choose each option, with all estimates summing to 100 (see Figure 2 for an example). We randomized the order of domains within each block, and also counterbalanced the order of the two task blocks: half of participants completed the choice block first and judgment block second, while the other half completed the study in the reverse order. Participants were not given any upfront information that they would be evaluating the same menu item on different dimensions. Counterbalancing the task blocks allowed us to compare response tendencies between the first and second blocks in order to examine potential spillover effects (for instance, judgments of item popularity being influenced by prior choices; e.g., Ross, Greene, & House, 1977).

Analysis Strategy

To test for partition dependence, we compare choice percentages between unpacked and packed items. When combining responses across choice domains, we conduct a logistic regression where the outcome variable is choosing an item from a focal group and our predictor variable is whether the menu is partitioned such that the focal group is packed or unpacked (0 = packed, 1 = unpacked). Similar to previous studies, we include domain fixed-effects and cluster standard errors by participants. When examining judgments of item popularity we use OLS regression instead of a logit model.

Results

Table 3 provides a summary of the results. Again, we find a robust partitioning effect on single-item choice. Across domains, we observe a 36 percentage point increase in choosing unpacked items compared to packed items ($p < 0.001$). In all four domains, choices reliably varied as a function of the menu partition (p-values < 0.010). Consistent with an information-based account, menu partitions also influenced inferences about descriptive norms. On average, there was a 23 percentage point increase in judged popularity for unpacked items compared to packed items ($p < 0.001$). In all four domains, judgments reliably varied as a function of the menu partition (p-values < 0.001).

Table 3: Study 3 Results

			Choices (%)			Judgments (mean estimate)		
Domain	Group A	Group B	Group A Unpacked	Group A Packed	Difference	Group A Unpacked	Group A Packed	Difference
Vacations	Europe	Asia	71.8	51.3	20.5**	69.8	54.3	15.5***
Entertainment	Sports	Cultural	62.7	27.8	34.8***	77.5	56.5	21.0***
Weekend trip	West Coast	East Coast	81.3	51.9	29.4***	61.9	41.9	20.1***
Desert	Cookies	Ice Cream	83.7	23.0	60.8***	65.0	30.8	34.2***

Notes: "Difference" represents the difference in choice share (or for judgment blocks, the difference in average estimated percentages) for choosing an item from Group A when that category is unpacked versus packed. Any discrepancies in difference scores shown in the table are due to rounding error. ** $p \leq 0.01$, *** $p \leq 0.001$.

Unlike our previous studies, we also find an (unexpected) interaction between menu partition and grouped category position (p-values were 0.006 and 0.024 for the interaction terms on choices and judgments, respectively). For choices, the partitioning effect was reliably larger when the packed category was placed at the bottom of the menu (50 percentage point marginal effect; $p < 0.001$) compared to when it was placed at the top of the menu (24 percentage point marginal effect; $p < 0.001$). Likewise, for judgments, menu partitions had a larger effect on judgments of item popularity when the packed category was placed at the bottom of the menu (28 percentage point marginal effect; $p < 0.001$) than when it was placed at the top of the menu (18 percentage point marginal effect; $p < 0.001$). We return to the issue of positioning effects in the general discussion.

Menu partitions strongly influenced both choices and beliefs about item popularity, and we next examine the relationship between the two. Consistent with an information-based account, the correlation between choice and judged popularity was positive and significant ($r = 0.41$, $p < 0.001$ across participants and domains). The average correlation within participants and across domains was $r = 0.35$; the average correlation across participants and within domains was $r = 0.46$. Since one's choices can affect beliefs about how others choose (e.g., Ross et al., 1977), we also examined whether block order (i.e., choosing first and then estimating item popularity, or vice versa) influenced our results. Neither choices nor judgments of item popularity were reliably affected by the order of task block (for the interaction between menu partition and block order, p-values were 0.511 for choices and 0.602 for judgments). Furthermore, we found qualitatively identical results when restricting the analysis to only the first block that participants completed, where spillover effects cannot occur (see Section 9 of the Supplemental Material).

Lastly, we examined whether beliefs about descriptive norms statistically mediate participant choice. In other words, does the menu partitioning effect reduce in size when we statistically adjust for beliefs about how frequently items are chosen by others? To examine this, we performed a Sobel-Goodman mediation test using bootstrapped standard errors based on 10,000 resamples clustered at the participant level, along with domain fixed effects and adjustments to the test procedure to account for potential scaling artifacts that can arise when using binary choice data (Karlson, Holm, & Breen, 2012; Preacher & Hayes, 2008; Shrout & Bolger, 2002).[11,12] Using this procedure we find a reliable mediation effect, with inferences of item popularity mediating 51% of the menu partitioning effect on choice ($b_{indirect} = 0.92$, SE = 0.20, 95% CI [0.57, 1.33]). Furthermore, we find a reliable indirect effect both when restricting the analysis to only participants that provided choices first ($b_{indirect} = 0.95$, SE = 0.28, 95% CI [0.50, 1.58]), or to only participants that provided judgments of item popularity first ($b_{indirect} = 0.95$, SE = 0.32, 95% CI [0.46, 1.64]).

Study 4: Blocking Inferences

The results of Study 3 suggest that menu partitions influence beliefs — when confronted with a set of options, decision makers tend to infer that unpacked items are more popular than packed items. The results of Study 4 also suggest that the shift in beliefs caused by partitioning of the option set may help to explain single-item partition dependence. However, a limitation of Study 3 is that its design does not allow one to definitively conclude that the causal chain flows from menu partitions to judged popularity, and then from judged popularity to choice. Both our putative mediator (judgments of descriptive social norms) and outcome variable (choice) were exposed to the experimental treatment (the partitioning of the menu), and so we cannot decisively

[11] All bootstrapping procedures reported in this paper use bias-corrected confidence intervals (Efron, 1987).

[12] We report tests for mediation using the standard framework based on linear structural equation models (e.g., Preacher & Hayes, 2008). Recently, researchers have suggested an alternative test of statistical mediation based on the potential outcomes framework to causal inference (Imai, Keele, & Tingley, 2010). This procedure also returns a reliable mediation effect, with inferences of item popularity mediating 50% of the menu partitioning effect on choice. Another advantage of the potential outcomes approach is that it allows us to test the degree to which our results are robust to potential violations of confounding between the mediator and outcome variable (i.e., to violations of sequential ignorability). We report the results of this sensitivity test, along with the full details for the potential outcomes mediation procedure, in Section 10 of the Supplemental Material.

rule out the reverse causal pathway (i.e., that participant choice is causally prior to beliefs about item popularity; Imai, Tingley, & Yamamoto, 2013; Pieters, 2017; Spencer, Zanna, & Fong, 2005) or that an unobserved third variable influences both item popularity and choice (see Simonsohn, 2022).

In Study 4 we directly manipulate beliefs about descriptive norms independent of menu partitions. If the information gleaned from a menu partition plays a causal role in determining choice, then partitioning effects should be attenuated whenever decision makers fail to extract information provided by the menu partition. To block information extraction, we asked participants to state their beliefs about item popularity of each group *before* exposing them to the menu partition. We anticipated that having participants first state their descriptive norm beliefs would inoculate any informational effects provided by the partition, and should therefore attenuate observed partitioning effects on choice. Thus, Study 4 uses a "blockage" design (Pirlott & MacKinnon, 2016) to test the hypothesis that menu partitions are causally mediated by beliefs about descriptive norms.

Method

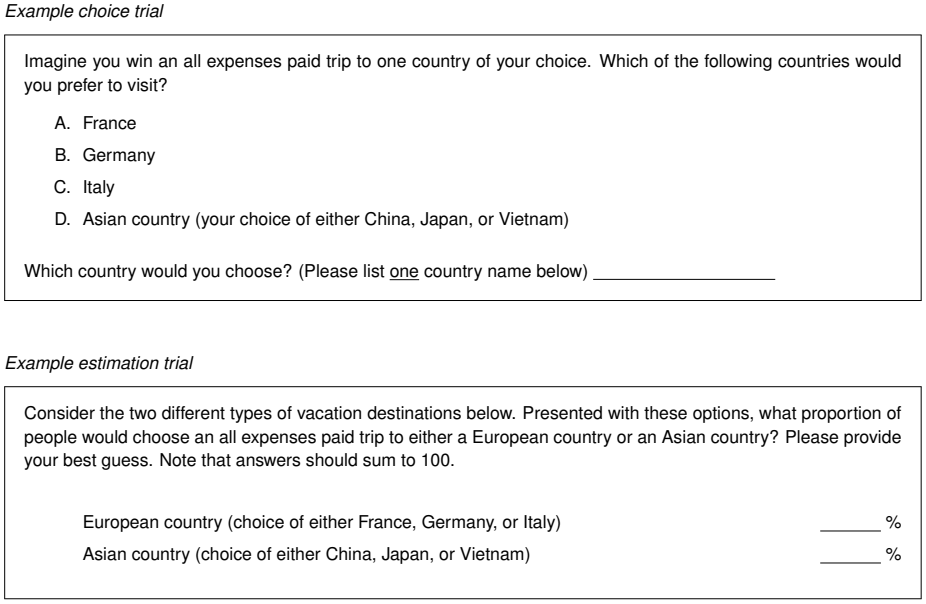
We recruited a sample of 302 participants from MTurk[13] (65% male, mean age = 29 years, range: 18–60 years). Participants first responded to a simple attention check (Oppenheimer, Meyvis, & Davidenko, 2009), and only those who passed the attention check were allowed to continue participating in the study.

Participants were presented with the same four choices as in Study 3. At the start of the study, participants were told they would make "a series of judgments and choices." For each menu, half of the items were listed individually and the other half of items were clustered into a single response option.

Unlike Study 3 where choices and judgments were elicited in separate blocks, participants were randomly assigned to either estimate the relative popularity of the two grouped categories on the page immediately before or after exposure to the menu partition (see Figure 3 for an example).

[13] One participant reported their age as 520 years old; we assume this was a typo, and omit this response when calculating age statistics for the sample.

Figure 3: Example of Choice and Judgment Task (Study 4)



In other words, choice and judgment trials were interleaved by domain. Also different from Study 3 is that participants estimated the relative popularity of category groupings, rather than for each response option. Thus, some participants provided estimates of popularity for a category of items before exposure to a specific menu partitioning of those categories (estimate-first condition), while others provided popularity estimates after viewing and responding to the menu partition (partition-first condition). We expected that single-item partition dependence would be attenuated in the estimate-first condition compared to the partition-first condition, because participants in the latter condition would assess descriptive norms for themselves before being exposed to a partition that might otherwise leak such information.

Analysis Strategy

To test for partition dependence, we compare choice percentages between unpacked and packed items. To examine whether partitioning effects are attenuated in the estimation-first condition, we use logistic regression in which choices are regressed onto menu partition (0 = packed, 1 = unpacked), elicitation sequence (0 = partition-first condition, 1 = estimate-first condition), and the interaction between the two. When combining responses across choice domains, we include domain

Table 4: Study 4 Results

			Choose, then Estimate (choice %)			Estimate, then Choose (choice %)		
Domain	Group A	Group B	Group A Unpacked	Group A Packed	Difference	Group A Unpacked	Group A Packed	Difference
Vacations	Europe	Asia	73.0	49.4	23.6**	73.4	54.4	19.5*
Entertainment	Sports	Cultural	76.0	38.7	37.3***	67.1	32.4	34.7***
Weekend trip	West Coast	East Coast	83.3	44.2	39.2***	73.0	56.2	16.8*
Desert	Cookies	Ice Cream	84.4	20.5	63.9***	76.5	31.6	44.8***

Notes: "Difference" represents the difference in choice share for choosing an item from Group A when that category is unpacked versus packed. Any discrepancies in difference scores shown in the table are due to rounding error. * $p \leq 0.05$, ** $p \leq 0.10$, *** $p \leq 0.001$.

fixed-effects and cluster standard errors by participants. When examining judgments about grouped category popularity we used OLS regression instead of a logit model.

Results

Table 4 provides a summary of the results. We again find a robust partitioning effect on choice. Across choice domains and elicitation sequence, we observed a 35 percentage point increase in choosing unpacked items compared to packed items ($p < 0.001$). In all four domains, choices reliably varied as a function of the menu partition (p-values < 0.001). Furthermore, the size of the menu partitioning effect was not reliably impacted by whether the grouped category was placed as the first or last listing on the menu ($p = 0.972$ for the interaction between menu partition and grouped category position).

Our primary prediction was that partitioning effects would be attenuated (compared to our standard treatment) when participants provided their judgments about descriptive norms before being exposed to menu partitions. As expected, we observe a reliable attenuation effect: in the partition-first condition we observed a 41 percentage point difference in choices for unpacked items versus packed items, whereas the marginal effect decreased to 29 percentage points in the estimate-first condition. This 12 percentage point decrease was reliably different from chance ($p = 0.036$ for the interaction term between menu partition and elicitation sequence on choices). As shown in Table 4, this pattern of an attenuated partitioning effect was directionally consistent in all four domains.

Next, we examined judgments of item popularity (as noted earlier on, this was measured at the

category level rather than at the item level as in Study 3). We predicted that popularity judgments would not be affected by the menu partition in the estimate-first condition (since participants had not yet been exposed to the menu partition), but would shift in the direction of the menu partition in the partition-first condition (as in Study 3). As expected, participants who first made judgments of item popularity and then viewed the menu partition did not reliably differ across conditions ($b = -0.16$, SE = 1.39, $p = 0.908$), whereas participants who were first exposed to the menu partition rated items from the unpacked category as more popular than those from the packed category ($b = 3.49$, SE = 1.36, $p = 0.011$). The difference in the size of this "judgment gap" as a function of elicitation sequence was marginally significant ($p = 0.062$ for the interaction between elicitation sequence and menu partition on judged popularity).

Last, we conducted mediation tests using the same analysis strategy outlined in Study 3, but this time we performed separate mediation analyses depending on whether judgments of popularity were elicited before or after exposure to the menu partition.[14] As in Study 3, judgments of item popularity reliably mediated the effect of menu partitions on choice for participants who were first exposed to the menu partition ($b_{indirect} = 0.10$, SE = 0.05, 95% CI $[0.02, 0.22]$). Also, as expected, judgments of popularity did not reliably mediate the partitioning effect on choice when participants first reported their estimates before exposure to the menu partition ($b_{indirect} = -0.01$, SE = 0.08, 95% CI $[-0.17,\ 0.14]$). Thus, beliefs about descriptive norms only reliably mediated menu partitioning effects when participants had previously been exposed to menu partitions, and could extract information from them.

Taken together, Studies 3 and 4 suggest that menu partitions convey information about descriptive social norms. Individually-listed options are viewed as more popular (i.e., more frequently chosen by others) than options that are grouped together, and participants tended to choose options they thought were more popular. Such a strategy may be reasonable to the extent that (a) menu

[14] As in Study 3, we can also test for mediation using the potential outcomes framework outlined by Imai et al. (2010). Similar to the results reported above, we find a reliable indirect effect through judged popularity in the partition-first condition, but no reliable indirect effect in the estimate-first condition. Full details are provided in Section 10 of the Supplemental Material.

partitions accurately reflect majority preference, (b) majority preference is positively correlated with an option's consumption utility for the targeted individual, and (c) decision makers do not have more diagnostic sources of task-relevant information available to them when making a decision (assuming such alternative sources of information are no more costly to acquire).

Study 5: Moderation by Social Motivations

Studies 3 and 4 suggest that menu partitions influence beliefs about descriptive social norms, and beliefs about descriptive social norms influence choice. In Study 5 we test a corollary of this hypothesis, namely that single-item partition dependence should be especially pronounced for individuals most sensitive to descriptive norms. We administer a susceptibility to interpersonal influence scale (Bearden et al., 1989), which measures the extent to which consumption decisions are driven by feelings of social approval from others (i.e., *normative* social influence) and by beliefs that others' decisions provide information about option quality (i.e., *informational* social influence). Since descriptive norms usually signal both what is commonly done and what is socially appropriate (Deutchman, Kraft-Todd, Young, & McAuliffe, 2024; Eriksson, Strimling, & Coultas, 2015), we can expect that either form of interpersonal influence may moderate the influence of menu partitions on choice. Stated differently, both scales may represent different shades of a generalized receptiveness by individuals to seek external social cues to guide their decisions. If so, then single-item partitioning should be especially pronounced among individuals relatively high in susceptibility to social influence.

In Study 5 we use the same design as in Study 3, where participants were asked to provide choices and infer the popularity of menu items, and also measure individual differences in susceptibility to interpersonal influence. By measuring both choices and beliefs, we can also isolate where in the causal chain any potential moderation effects occur. That is, we can examine whether participants high in susceptibility to interpersonal influence show pronounced partitioning effects because they are especially likely to infer item popularity from menu partitions (i.e., the *menu partition* $\longrightarrow$ *judged descriptive norm* pathway) and/or because these individuals give greater

weight to considerations of item popularity when making a consumption decision (i.e., the *judged descriptive norm* $\longrightarrow$ *choice* pathway).

Method

We recruited a sample of 601 participants from MTurk (46% male, mean age = 41 years, range: 18–83 years). The procedure was virtually identical to that in Study 3, in which participants responded to the same four choice domains, and completed both choice and judgment blocks in counterbalanced order.[15]

After completing both choice and judgment blocks, participants responded to an 8-item measure of susceptibility to interpersonal influence (Bearden et al., 1989). Participants completed four items from the susceptibility to normative influence (NSI) subscale, rating their agreement with each statement on a 7-point scale from *strongly disagree* (-3) to *strongly agree* (3). Example items were "it is important that others like the products and brands I buy" and "when buying products, I generally purchase those brands that I think others will approve of." We averaged the four items to create an index of NSI ($\alpha = 0.93$). Participants also completed four items from the susceptibility to informational influence (ISI) subscale. Example items were "to make sure I buy the right product or brand, I often observe what others are buying and using" and "I often consult other people to help choose the best alternative available from a product class." We averaged the four items to create an index of ISI ($\alpha = 0.88$). We counterbalanced across participants whether the four items from the NSI came first or second, and also randomized the order of statements within each subscale. The correlation between the two subscales was 0.44.

Analysis Strategy

We use the same analysis strategy as in Study 3. We use logit regression when examining choices, and use OLS regression when examining judgments of item popularity. Similar to our previous studies, when pooling across trials we include domain fixed effects and cluster standard errors by participants.

[15] Study 5 included a few small differences from Study 3. In Study 5 the menu options were separated by bullet points instead of letters, and Study 5 used slightly different labels for the packed listing (e.g., "European country (your choice of either France, Germany, or Italy)" instead of "Europe (your choice of either France, Germany, or Italy)").

Table 5: Study 5 Results

			Choices (%)			Judgments (mean estimate)		
Domain	Group A	Group B	Group A Unpacked	Group A Packed	Difference	Group A Unpacked	Group A Packed	Difference
Vacations	Europe	Asia	74.8	55.2	19.6***	77.6	54.1	23.5***
Entertainment	Sports	Cultural	63.4	38.1	25.3***	80.3	52.2	28.1***
Weekend trip	West Coast	East Coast	69.9	49.0	20.9***	63.2	40.2	23.0***
Desert	Cookies	Ice Cream	67.6	34.8	32.8***	63.0	32.6	30.4***

Notes: "Difference" represents the difference in choice share (or for judgment blocks, the difference in average estimated percentages) for choosing an item from Group A when that category is unpacked versus packed. Any discrepancies in difference scores shown in the table are due to rounding error. *** $p \leq 0.001$.

Results

Before turning to our moderation analysis, we examined whether our earlier findings from Study 3 replicate. We again observed a reliable menu partitioning effect, with an average 25 percentage point increase in choosing unpacked items over packed items ($p < 0.001$). We also again found that menu partitions influenced beliefs about social norms, with an average 26 percentage point increase in judged popularity for unpacked items compared to packed items ($p < 0.001$). Finally, we again found that judgments of item popularity statistically mediate the menu partitioning effect on choice ($b_{indirect} = 1.26$, SE = 0.09, 95% CI [1.09, 1.44]). Table 5 presents the main results (see Section 6 of the Supplemental Material for complete details).

We next examined whether menu partitioning effects were reliably moderated by NSI scores, ISI scores, or both. We report all moderation analyses in Table 6. To facilitate interpretation, in the Table we report unstandardized OLS coefficients but report p-values using logistic regression. Thus, coefficients can be interpreted as the percentage point increase in choosing from a given category of items as a linear function of an explanatory variable, and a positive coefficient for the interaction term represents the increase in menu partitioning effects as a linear function of the moderating variable. For instance, in Model 1 (column 1 of Table 6) the "partition" coefficient indicates a 28.1 percentage point increase in choosing unpacked items compared to packed items (when NSI scores are set to 0), and that the size of this partitioning effect increases by 2.7 percentage points for every 1-point increase in NSI scores (as represented by the "partition $\times$ NSI" interaction term).

We begin by examining moderation of overall partition effects by susceptibility to normative social influence (Model 1) and informational social influence (Model 2). Shown in Model 1, we find

Table 6: Study 5 Results

	moderation of basic effect (partition → choice)		moderation of pathway 1 (partition → judgment)		moderation of pathway 2 (judgment → choice)	
	(1)	(2)	(3)	(4)	(5)	(6)
Partition	0.281^{***}	0.242^{***}	0.287^{***}	0.259^{***}	-0.004	-0.004
	(0.029)	(0.022)	(0.013)	(0.010)	(0.024)	(0.024)
NSI	-0.005		-0.012^{*}		-0.012	
	(0.010)		(0.005)		(0.014)	
Partition × NSI	$0.027^{\dagger}$		0.019^{***}			
	(0.015)		(0.006)			
ISI		-0.007		$-0.008^{\dagger}$		-0.017
		(0.011)		(0.005)		(0.015)
Partition × ISI		0.019		0.013^{*}		
		(0.015)		(0.006)		
Judged Item Popularity					0.977^{***}	0.920^{***}
					(0.046)	(0.040)
Judged Item Popularity × NSI					0.040^{*}	
					(0.022)	
Judged Item Popularity × ISI						0.035
						(0.024)
Domain Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2331	2331	2404	2404	2331	2331
Participants	601	601	601	601	601	601
R^2	.080	.078	.376	.374	.218	.216

Notes: OLS estimates, with participant-clustered standard errors in parentheses. For Models 1, 2, 5, and 6 the outcome variable was choosing an item from a focal category (e.g., for the charity domain, 0 = not choosing an animal-based charity, 1 = choosing an animal-based charity). The outcome variable in models 3 and 4 was "Judged Item Popularity," or the estimated percentage of other participants selecting an item from the focal category (rescaled to fall between 0 and 1). "Partition" indicates whether the menu was partitioned such that the focal category was packed or unpacked (0 = packed, 1 = unpacked). "NSI" and "ISI" represent a participant's susceptibility to normative social influence and informational social influence score, respectively. Scores on the NSI and ISI range from –3 to 3, with higher numbers reflecting greater susceptibility. All models include domain fixed effects. For Models 1, 2, 5, and 6 we use significance stars based on logit regressions. † $p \leq 0.10$, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

a positive and marginally significant interaction term ($p = 0.060$), indicating that menu partitioning effects grew in size for those higher in susceptibility to normative social influence. Shown in Model 2, although partitioning effects grew in size as a function of ISI scores, the interaction term was not statistically significant ($p = 0.195$). Thus, menu partitioning effects were more pronounced for those most susceptible to interpersonal influence, especially normative social influence.

We next turn to where in the causal chain that such moderation effects occur. Models 3 and 4 examine moderation for the first part of the causal chain (i.e., the *menu partition* $\longrightarrow$

descriptive norm beliefs pathway). We find a reliable interaction effect for both NSI scores (Model 3: $p = 0.001$) and ISI scores (Model 4: $p = 0.039$). On average, the size of the "judged popularity" gap across menu partitions increased by 1.9 percentage points for every 1-point increase in NSI scores, and by 1.3 percentage points for every 1-point increase in ISI scores. Thus, participants high in susceptibility to interpersonal influence were especially likely to view unpacked menu items as more frequently chosen by others.

Models 5 and 6 examine the second part of the causal chain (i.e., the *descriptive norm beliefs* $\longrightarrow$ *choice* pathway). We find a positive reliable interaction between judgments of item popularity and NSI scores (Model 5: $p = 0.045$) but no reliable interaction effect between judgments and ISI scores (Model 6: $p = 0.194$). Thus, participants higher in susceptibility to normative social influence also placed greater weight when making a consumption decision (compared to low NSI participants) on how frequently chosen they thought an option was.

In summary, the results of Study 5 suggest that, like earlier studies, menu partitions are more likely to communicate information about descriptive social norms. Furthermore, participants most susceptible to social norms (especially normative social influence) also tended to show more pronounced single-item partition dependence. Participants high in susceptibility to social norms appear to be both especially likely to interpret menu partitions as a signal of descriptive norms, and give greater weight to descriptive norms (i.e., item popularity) when selecting an item to consume. While these findings were modest in magnitude, we have directly replicated them and report those results in Section 2 of the Supplemental Material.

General Discussion

Given that many important organizational decisions involve single-item choice rather than multi-item allocation, strategic partitioning of the menu space holds promise as an attractive tool for managers, policymakers, and choice architects. Our results demonstrate that single-item choice is often highly sensitive to how menus are partitioned — participants are more likely to choose items that are individually listed compared to when those same items are grouped together. This was true

Table 7: Menu Partitioning Effects Across Studies

	Target Behavior Unpacked (choice %)	Target Behavior Packed (choice %)	Difference
Study 1	83.4 (1.6)	23.2 (1.8)	60.2 (2.5)***
Study 2A	78.2 (1.7)	41.8 (2.3)	36.4 (3.1)***
Study 2B	28.6 (3.2)	13.0 (2.4)	15.7 (4.0)***
Study 2C	72.9 (2.2)	53.7 (2.5)	19.2 (3.3)***
Study 3	75.0 (2.9)	38.6 (3.1)	36.4 (4.4)***
Study 4	75.8 (2.0)	40.8 (2.1)	35.0 (3.0)***
Study 5	68.9 (1.5)	44.2 (1.5)	24.7 (2.1)***
Study S1	63.9 (2.0)	43.7 (1.8)	20.2 (2.7)***
Study S2	75.2 (1.7)	42.1 (2.0)	33.1 (2.8)***
Study S3	81.7 (4.3)	44.0 (5.4)	37.7 (6.9)***
Combined	71.2 (2.0)	39.0 (2.1)	32.2 (1.0)***

Notes: Percentage choosing an item from a focal category when the menu is partitioned such that the focal group is packed or unpacked. For Study 2C, we use the percentage transferring $2 or more to an anonymous recipient in a dictator game. Parentheses represent robust standard errors for Studies 2B, 2C, and S3, and participant-clustered standard errors for all other studies. "Difference" represents the average marginal effect estimated from the logit model specified in the results section of each study. Combined results are estimated using study fixed-effects, with weights proportional to the inverse variance of the average marginal effect of each study. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

across a wide range of choice settings, including contexts with real stakes (incentive-compatible choice) and complete information over option attributes. The effect of partitioning the menu set was rather large, shifting choices by an average of 32 percentage points across studies (see Table 7 for an aggregated summary). Our findings suggest that the strategic partitioning of menus can be used as a simple, flexible, and potent policy tool to affect behavior change (Johnson et al., 2012). Menu partitioning can be used by policymakers and managers to supplement more traditional forms of choice architecture, such as setting defaults and ordering options, or alternatively as a substitute in cases where traditional choice architecture techniques are less well-suited (e.g., Keller, Harlam, Loewenstein, & Volpp, 2011).

Our results indicate that partitioning effects occur partly because menu partitions are seen as communicating task-relevant information. The current study contributes to a growing body of research suggesting that choice menus can influence behavior in non-obvious ways through the information they signal to the public (Bogard et al., 2024; Krijnen et al., 2017; McKenzie et al., 2018; Tannenbaum, Valasek, Knowles, & Ditto, 2013). For example, individuals are sensitive to how options are framed (e.g., whether a medical treatment is described as having a 90% survival

rate or a 10% mortality rate) partly because the framing of an option is thought to communicate information about salient reference points and, more generally, about options endorsed by the choice architect (Keren, 2007; McKenzie & Nelson, 2003; Sher & McKenzie, 2006). Here we suggest that, in a similar fashion, individuals approach choice menus with the tacit assumption that managers, marketers, and other choice architects usually provide a range of options that roughly match the distribution of preferences in the population. As a result, the more finely a set of options is partitioned, the more those options will be viewed as relatively popular in terms of market share.

If menu partitions communicate information about social norms, then policymakers may wish to consider additional (and less obvious) decision costs that arise when designing menu partitions (see Krijnen et al., 2017). For example, choosing an option from a packed category may suggest that such a response is relatively uncommon or atypical, and as such has the potential to induce feelings of social disapproval or stigma (Krishna, Herd, & Aydınoğlu, 2019). Conversely, listing items individually may unwittingly communicate to decision makers that those options are more popular than they actually are. Furthermore, if individuals distrust policymakers or view the menu partition as an intentional act of manipulation on the part of the choice architect, then those individuals may engage in reactive behaviors as a way of asserting their agency and autonomy (Brehm, 1966; Friestad & Wright, 1994; Krijnen et al., 2017).

Positioning Effects

In all studies (with the exception of Study 2C), we experimentally varied menu partitions and also independently varied the position of the packed category to be placed at the top or bottom of the menu. In a subset of studies (Studies 3, S2, and S3), we found a statistically significant interaction between the two factors, in which partitioning effects were larger when the packed category was placed at the bottom of the menu rather than at the top. One possibility is that participants infer descriptive norms from both menu partitions and the ordering of items, and that the two inferences reinforce each other. Specifically, decision makers may be especially likely to infer that items are unpopular when they are both grouped together and placed at the end of a menu (consistent with the judged popularity results in Study 3), and as a result menu partitioning effects are especially large

Table 8: Menu Partitioning Effects by Packed Category Position

	Packed Category Placed on Bottom	Packed Category Placed on Top	Difference
Study 1	63.3 (3.4)***	57.6 (3.9)***	5.7 (5.2)
Study 2A	34.1 (4.5)***	38.7 (4.2)***	−4.5 (6.2)
Study 2B	15.6 (5.6)**	15.7 (5.6)**	−0.1 (8.0)
Study 3	50.1 (6.3)***	24.5 (5.7)***	25.6 (8.5)**
Study 4	34.9 (4.3)***	35.2 (4.3)***	−0.3 (6.0)
Study 5	27.3 (3.0)***	21.9 (3.0)***	5.4 (4.3)
Study S1	21.1 (3.7)***	19.2 (3.8)***	2.0 (5.3)
Study S2	39.1 (3.7)***	26.7 (4.0)***	12.4 (5.5)*
Study S3	53.7 (9.2)***	22.2 (10.0)*	31.4 (13.5)*
Combined	36.6 (1.4)***	30.2 (1.4)***	6.4 (2.0)***

Notes: The first two columns display the average marginal partitioning effect when the packed category is the bottom or top listing, estimated from the logit model specified in the results section of each study. We exclude Study 2C because we did not vary of the position of the packed category in this study. Parentheses represent robust standard errors for Studies 2B and S3, and participant-clustered standard errors for all other studies. "Difference" displays the difference in average marginal effects as a function of packed category position. Combined results are estimated using study fixed-effects, with weights proportional to the inverse variance of each study. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

under these conditions. Another possibility is that attention is biased towards items at the top of the menu, especially when those items are unpacked (e.g., Dellaert, Johnson, Duncan, & Baker, 2024).

To explore this finding more thoroughly, we aggregate data across all applicable studies. Table 8 displays the menu partitioning effect (i.e., the percentage point difference in choice across menu partitions) when the packed category was placed at the bottom or top of the menu. The last column of the Table also reports the difference between the two partitioning effects, with positive difference scores reflecting a larger effect when the packed category is placed at the bottom of the menu. As shown in the Table, the difference score was positive in six of the nine studies, and the three negative difference scores were negligible in size. Weighting each study by the inverse of its variance (i.e., using study fixed-effects),[16] we find a combined menu partitioning effect of 36.6 percentage points when the grouped category was placed at the bottom of the menu, and 30.2 percentage points when placed at the top of the menu. This 6.4 percentage point difference between

[16]If we instead use a random-effect model, which weights studies according to both their degree of precision and as a function of the variability in effect size found across studies, we fail to find a statistically significant aggregate positioning effect ($\chi^2(1) = 1.31, p = 0.252$). The random effects model estimates a 7.9 percentage point difference across menu positions (i.e., a larger difference than that estimated by the fixed effects model), but also contains more uncertainty in that estimate.

partitioning effects for bottom and top listings was statistically reliable ($\chi^2(1) = 10.34, p = 0.001$). Thus, while menu partitioning effects were large and statistically significant regardless of grouped item position, they were slightly larger when grouped items were placed at the end of the menu. As mentioned earlier, this may be due to inferences of descriptive norms being reinforced by the ordering of options or by biased attention. We hasten to add, however, that such positioning effects were not predicted a priori and relatively small in size. As such, they should be treated as tentative and in need of further corroboration. We leave this as an avenue for future research to explore.

Additional Mechanisms

In this paper we have documented robust evidence of partition dependence in single-item choice across a range of theoretically distinct tasks. We have further shown that this phenomenon can be partly attributed to inferences concerning the relative popularity of options that vary systematically with the way in which they are grouped. Naturally, we acknowledge that this is only a partial explanation, and other possible mechanisms may also play a role. In particular we discuss biased attention, random responding, and other forms of information leakage as potential contributing factors.

Biased Attention One possibility is that menu partitions bias the allocation of attention. By dividing options into smaller units, menu partitions may induce individuals to spend more time attending to and elaborating on items that are listed separately than when the same items are grouped with other options (Dellaert et al., 2024). Closely related, partitions may also shape the options actively considered during choice (i.e., composition of consideration sets; Hauser & Wernerfelt, 1990; Shah & Ludwig, 2016). Because options that receive greater attention are often more likely to be chosen, menu partitioning may increase the appeal of desirable options by redirecting attention toward them (Bhatnagar & Orquin, 2022).

We suspect that attention may play some role in how menu partitions influence choice, but what form this takes is unclear. According to some attention-based accounts of choice (e.g., Krajbich, 2019), our core findings should reverse when participants are asked to choose between a set of unpleasant options. In such contexts, attention is expected to lead to aversion rather than

attraction: negative stimuli that receive disproportionate attention are often avoided rather than chosen (Armel, Beaumel, & Rangel, 2008; Janiszewski, Kuo, & Tavassoli, 2013). The increased attention or elaboration due to unpacking a menu of unpleasant options should, according to this account, make those options especially unappealing and less likely to be selected (see also Brenner, Rottenstreich, Sood, & Bilgin, 2007).

We tested this prediction using a new sample of participants ($N = 201$) who chose one of six hour-long household chores to perform. The menu included three indoor chores (kitchen cleaning, vacuuming, washing and folding laundry) and three outdoor chores (cleaning rain gutters, mowing the lawn, weeding). As in our other studies, participants chose from menus in which either the indoor chores were listed individually and the outdoor chores were grouped, or the reverse (see Section 3 of the Supplemental Material for details). Contrary to attention-based accounts that predict a negative partitioning effect, participants were in fact more likely to choose household chores that were individually listed compared to when those chores were grouped together (38 percentage point difference; $p < 0.001$).

This result, of course, should not be taken as evidence that attention plays no role in the impact of menu grouping on choice. The relationship between attention and choice is complex, and there are instances in which researchers have found that increased attention positively affects choice for unpleasant stimuli (e.g., Pärnamets et al., 2015). As such, clarifying how menu partitions interact with attention in shaping choice is a promising direction for future research.

Random Responding A second possibility is that menu partitions capitalize on random, thoughtless, or haphazard responding. If some participants are indifferent between options or are not sufficiently motivated to think through their decision, then the options they select may be essentially chosen at random. To the extent that some participants choose at random over partitions (and then perhaps randomly choose within partitions), this would produce a pattern of results similar to those that we observe here.[17]

[17] As a point of clarification, both the attention and random responding accounts still assume some form of partition dependence (i.e., that participants are biased by the grouping of options). For instance, if participants in our studies were unaffected by how menu items were grouped but respond randomly over all items, this could not explain our results as the menu partitions in our studies are symmetric across treatment conditions (three unpacked items versus

As with attention, it seems plausible that random responding could play a role in how menu partitions influence choice, especially in many naturalistic contexts. This said, in our studies we took active steps to minimize the influence of random responding. In all studies we asked participants to explicitly write out their preference rather than select a response from a list, and such prompts are thought to reduce mindless responding (e.g., Bernhard-Harrer & Pfaff, 2025). Further, in Studies 2A-2C we used incentive-compatible tasks which also tend to reduce thoughtless responding (Camerer & Hogarth, 1999). We nevertheless observe sizable menu partitioning effects.

While such steps may minimize the role of random responding, they do not definitively rule out its contribution to our results. To investigate this issue more directly, we performed an audit of all studies to examine whether empirical proxies of random or thoughtless responding were correlated with menu partitioning effects. For instance, participant completion times serve as one indirect measure of potentially mindless responding — those who speed through a study are perhaps more likely to answer in a random or cursory manner. If random responding contributes to our results, then we should see especially large menu partition effects among those who complete a study relatively quickly. However, when looking across studies we failed to find support for this account (for full details, see Section 11 of the Supplemental Material). In most studies, proxies of random responding were not reliably correlated with menu partition effects, and in all studies we continue to observe single-item partition dependence across the entire range of our sample (i.e., even among those least likely to be responding randomly). Thus, the current analysis suggests that random responding may not be necessary to observe single-item partition dependence.

Alternative Forms of Information Leakage Another avenue for future research is whether menu partitions signal decision-relevant information other than descriptive norms. One natural candidate is whether menu partitions also communicate information about injunctive norms, since descriptive and injunctive norms often travel together (Deutchman et al., 2024; Eriksson et al., 2015; Yip & Schweitzer, 2022). For instance, the default option in a choice set is often viewed as recommended or endorsed by the choice architect (Dinner, Johnson, Goldstein, & Liu, 2011;

three packed items).

McKenzie, Liersch, & Finkelstein, 2006; Tannenbaum & Ditto, 2021), and perhaps items that are packed or grouped together are seen as a signal that the choice architect views these items as less suitable for most individuals. One implication is that if unpacked menu items are viewed as tacit endorsements, then decision makers will likely only find such endorsements persuasive to the extent they trust the choice architect (see Krijnen et al., 2017; Tannenbaum & Ditto, 2021).

Relatedly, packing or clustering a set of options may also signal to individuals that such options are relatively similar to each other, compared to unpacked items in the choice set (e.g., Murphy & Brownell, 1985). To the extent that perceptions of similarity reduce attractiveness of all items (perhaps by inducing within-cluster comparisons; see Brenner et al., 1999), it is possible that menu partitioning effects also operate through this channel. However, we note that while other types of menu-based inferences may contribute to partitioning effects, such additional mechanisms are unlikely to account for our complete set of results. For instance, in Study 2B all features of each option (i.e., the payoffs and probabilities associated with each gamble) were transparent, and so it is unlikely that inferences of similarity can explain the results we observe. Likewise, in Study 2C, where participants were asked to split a fixed amount of money with another participant, it is not clear how perceptions of similarity of dollar amounts would affect final decisions.

Future Directions

Beyond the list of candidate mechanisms discussed above, an open question is whether single-item partition dependence is only observed among novice decision makers, who may be uncertain how to best choose for themselves. In a related project (Tannenbaum et al., 2015), we found that partitioning the response menu had a significant effect on prescription decisions among practicing physicians. In hypothetical medical vignettes that described a patient's symptom history, physicians were more likely to prescribe "aggressive" treatment options when those treatment options were unpacked. Although these effects were smaller than those observed in the current paper (on average, physicians in that sample showed an 11 percentage point difference), the findings suggest that partitioning effects can be found even among experienced decision makers, in a domain with considerable consequences for public health. A fruitful avenue for future research would be to

examine whether single-item partition dependence is less pronounced among those with greater task expertise or better-defined preferences, who are therefore less in need of such guidance or nudging (Camerer, Issacharoff, Loewenstein, O'Donoghue, & Rabin, 2003; Thaler & Sunstein, 2003).

An important direction for future research is in applying single-item partitioning to field settings. For instance, choice architects often wish to nudge consumers on a binary decision (such as Yes/No decisions on whether to donate to charity, or to be vaccinated). Instead of simply asking whether an individual, say, wishes to donate or consents to vaccination, choice architects can more finely partition the desired response option as a way of nudging compliance. Taking the donation example, charitable organizations could provide respondents with many ways of saying "yes" to donation while providing only one way of saying "no" (e.g., "Yes, I would like to donate $10/$20/$30/$40/$50 dollars" vs. "No, I would not like to donate"; Moon & VanEpps, 2023). Similarly, to increase vaccination rates, public health officials could individually list out the different types of vaccines available for inoculating against a particular virus (e.g., "I consent to receiving the Pfizer/Moderna/Johnson & Johnson vaccine" vs. "I do not consent to vaccination"). Our results suggest that to the extent single-item partition dependence generalizes to other settings, interventions such as these are likely to help increase participation rates. Indeed, recent research has found that quantity-integrated selling formats, under which decision makers simultaneously consider whether and how much to buy, often increase consumption rates compared to selling formats where purchasing and quantity decisions are resolved separately (Duke & Amir, 2023; Tavassoli & Visentin, 2021). One reason why this may occur is because quantity-integrated formats more finely partition the ways that decision makers can say "yes" to consumption. We look forward to research that examines how partitioning of menu items shapes participation and consumption decisions in applied settings, and can be used to enhance public welfare.

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