

Partitioning Menu Items to Nudge Single-item Choice

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Introduction

People tend to spread out consumption. For instance, imagine visiting an ice cream parlor that offers three flavors (chocolate, vanilla, and strawberry), and a single order is comprised of three scoops of ice cream (in any combination). How do you choose? Most people opt for one flavor of each. This toy example is a demonstration of a general psychological tendency towards equal allocation (Benartzi and Thaler, 2001; Read and Loewenstein, 1995; Ratner et al., 1999). Such “naive diversification” is thought to arise from a desire for variety-seeking, to hedge against risky or uncertain prospects, and to minimize potential regret.

Although naive diversification can be a reasonable strategy in many contexts, decision makers also tend to be insensitive to how menus of options are subjectively grouped or partitioned. As a result people often display *partition dependence*, where revealed preferences are determined by the ad-hoc grouping of the menu space (Fox et al., 2005). For example, imagine an employee is asked to determine her 401(k) asset allocation from one of one of two menus. In menu A, the employee decides between domestic stocks, international stocks, and bonds; in menu B, she decides between stocks, domestic bonds, and international bonds. If employees are partition dependent, a bias towards even allocation will lead to a stock-heavy portfolio when presented with menu A and a bond-heavy portfolio when presented with menu B. Partition dependence has been demonstrated in both laboratory and field settings, with novice and expert decision makers alike, and across a broad range of psychological phenomenon — from retirement savings decisions to the elicitation of subjective beliefs, as well as motivation, cue weighting, and parental investment (Bardolet et al., 2011; Fox and Rottenstreich, 2003; Hertwig et al., 2002; Martin and Norton, 2009; Shah and Oppenheimer, 2011; Sonnemann et al., 2013; Wiltermuth and Gino, 2013).

In this paper we examine whether partition dependence extends to singular, fixed choices from a menu of options. Given that many important policy settings involve unitary decisions (e.g., voting for a governor or presidential candidate, deciding whether or not to become an organ donor, overturning or upholding an existing policy statute), the strategic partitioning of menu holds promise as an attractive tool for choice architects. Demonstrating partition dependence for single-item choice is also theoretically interesting, as the traditional explanation of bias towards equal allocation cannot

apply in any straightforward way to the selection of singular choices. Since individuals make a single selection from a menu which cannot be divided or diversified, there is not an obvious route for naive diversification to manifest itself.¹ If we observe partition dependence for single-item choice, those findings would suggest that other psychological processes besides naive diversification are also at play.

In what follows, we demonstrate that participants do in fact display partition dependence — often markedly so — for single-item choice. Along the way, we explore several psychological mechanisms that may explain these findings. To preview our later findings, we find that menu partitions are influential partly because they serve a curatorial function, in that the partitioning of the menu space is thought to convey payoff-relevant information to participants. In the final portion of this paper we discuss how these insights can be leveraged for effective policy design, as well as spur future theoretical work on the psychological underpinnings of partition dependence.

Study 1: Demonstrating Single-item Partition Dependence

We tested for single-item partition dependence in a simple consumer choice setting. Consumer choice settings naturally involve menus of items that are partitioned in some fashion (e.g., wine merchants often group their wines by either varietals or by winemaker region), and also because the choice task should be simple and familiar to virtually all participants.

We recruited a sample of 298 participants from the Amazon.com Mechanical Turk labor market² to participate in return for a flat cash payment (45% male, mean age = 35 years, range: 18–70 years). Participants were presented with menus of consumer goods, and were asked to indicate the item they would most prefer to receive. Participants made four choices in total, choosing from menus of (1) movie DVDs, (2) books, (3) one-year magazine subscriptions, and (4) charitable contributions made in their name. In order to incentive truthful responding, participants were notified up front that some respondents would be selected at random to receive one of their selected choices.

Each trial consisted of a menu of six options clustered into two categories. The movie menu was comprised of science fiction movies and romantic comedies; the magazine menu was comprised of popular science and world news magazines; the book menu was comprised of behavioral science

¹The fact that naive diversification cannot explain single-item choices has also been noted by Read and Loewenstein (1995). In their study, participants made consumption decisions over a three day period, with a single snack per day. One group was asked to choose all of their snacks in advance while another group chose a single snack on each of the three days. Participants showed a strong tendency to diversify when planning their snacks in advance, but tended to concentrate consumption on their favorite option when presented with choices sequentially (Simonson, 1990). In explaining this effect, they appealed to the idea that diversification is unlikely when the task is represented as a single, unitary choice: “simultaneous choices are presented to subjects in the form of a package, and perhaps the most straightforward choice heuristic applicable to such packages is diversification. In the sequential choice condition, in contrast, subjects are presented with the choices one at a time, and the natural choice heuristic applicable to a single choice is to choose the single most preferred option” (p. 38).

²Seven participants completed the survey more than once, and we only included their initial set of responses in the analysis. Four participants were also excluded from the analyses for not responding to any of the choice trials.

Animal Charities Unpacked

From the following menu of items, which charitable organization would you like to have \$10 donated in your name?

- Humane Society
- Animal Legal Defense Fund
- Society for Prevention of Cruelty to Animals (SPCA)
- Natural Resource Defense Council, or Sierra Club, or Environmental Defense Fund

Please choose ONE charity: _____

Animal Charities Packed

From the following menu of items, which charitable organization would you like to have \$10 donated in your name?

- Natural Resource Defense Council
- Sierra Club
- Environmental Defense Fund
- Humane Society, or Animal Legal Defense Fund, or Society for Prevention of Cruelty to Animals (SPCA)

Please choose ONE charity: _____

Figure 1: Example of Menu Partition (Study 1)

and life science books;³ the charity menu was comprised of animal and environmental charities. In each case, one category of items was listed individually while the other category was grouped into a single listing. Figure 1 illustrates an example of the charity menu, and the Appendix provides a complete list of items. In order to prevent random or thoughtless responding, we asked participants to choose one item and write out that item in an open text field.

Participants responded to the four trials in random order, and the position of the packed category was counter-balanced across subjects such that it appeared as the last option in the menu (as in Figure 1) or as the first option in the menu. This was done to control for possible order-effects.

Study 1 Results

We compared the percentage of choices for items from a given category when those items were individually listed (“unpacked” category) versus when those same items were grouped together (“packed” category). This was done using logistic regression, which also included trial fixed effects and clustered standard errors by participants.⁴ Including trial fixed effects removes idiosyncratic

³Due to a programming error, data for roughly half of participants ($n = 132$) was not recorded for their choice of book.

⁴For this study and all subsequent studies that use repeated trials, we implement the following logit model:

$$Choice_{ij} = \alpha + \beta_1 Unpacked_{ij} + Trial_j + \epsilon_{ij} \tag{1}$$

where $Choice_{ij}$ represents the choice by participant i for trial j , which takes a value of 1 if the item belongs to Category A and 0 if the item belongs to Category B. $Unpacked_{ij}$ is an indicator taking a value of 1 if Category A is unpacked and 0 if Category A is packed; a positive coefficient indicates that participants are more likely to choose an item from Category A when those items are listed individually (unpacked) compared to when those items are grouped together (packed). $Trial_j$ is a vector of indicator variables for each choice trial. We implement robust standard errors clustered by participants (ϵ_{ij}).

Table 1: Study 1 Results: Percentage of participants choosing an item from Group A

Domain	Group A	Group B	Group A Unpacked	Group A Packed	Difference
Magazines	Popular science	World news	67.2	44.0	23.2***
Movies	Science fiction	Romantic comedies	79.3	49.7	29.7***
Books	Behavioral science	Life science	62.4	28.1	34.3***
Charities	Animal charity	Environmental charity	84.8	56.7	28.2***

Notes: *** $p < .001$

variance in choices from trial to trial, and clustering standard errors by participants accounts for the non-independence of observations within participants. We use a similar analysis strategy for all subsequent studies that involve repeated measures.

As illustrated in Table 1, we observe pronounced partition dependence. On average, participants were roughly 60% more likely to choose an item from a category when that category was unpacked compared to when it was packed (75% vs 47%). In all four cases, choices reliably varied as a function of the menu partition (p -values $< .001$) and in three cases we found that the unpacked category captured the majority of market share.

Study 2: Do partitions bias attention?

Our first study found pronounced evidence of partition dependence for single-item choice. One possible explanation is that menu partitions guide attention — when a category of items is unpacked, participants spend relatively more time attending to and elaborating upon those items, which increases their appeal. Stated differently, participants allocate attention over menu partitions rather than over menu items. Such an account makes a clear and testable prediction, namely that our pattern of findings should reverse whenever participants are asked to choose from options they find unpleasant. The increased attention or elaboration that comes with unpacking a category of unpleasant options, so the logic goes, should make them especially unappealing and least likely to be selected.

To test this account, we asked a new sample of 132 MTurk participants to imagine performing one of six hour-long household chores. Half of participants responded to a menu with the indoor activities unpacked (kitchen cleaning, vacuuming, folding laundry) and half responded to a menu with the outdoor activities unpacked (cleaning rain gutters, lawn-mowing, weeding). As in Study 1, we counterbalanced across participants the serial position of the packed-unpacked items in order to rule out order effects.

Contrary to the biased-attention account, we found a large partitioning effect similar to that observed in Study 1. Participants were more likely to choose indoor chores when those items were listed individually, compared to when those same items were grouped together (87% vs. 58%; $p < .001$). Such a result suggests that menu partitions exert an influence on choice that cannot be sufficiently explained by the biased allocation of attention.

Study 3: Do partitions communicate information?

In Study 3 we test another explanation of single-item partition dependence, namely that menu partitions communicates pay-off relevant information. Menu sets may tacitly communicate or “leak” information to decision makers, and this information leakage process may help to explain context and framing effects such as partition dependence. For example, Benartzi and Thaler (2001) speculated that 401(k) participants might recognize their lack of financial sophistication, and rely on their employer to put together a selection of funds that make sense given their needs. Similarly, McKenzie and colleagues have shown that single-attribute frames can communicate information about salient reference points and, more generally, implicit recommendations (McKenzie and Nelson, 2003; Sher and McKenzie, 2006). More to the point, the construction of a menu or attribute space can communicate information about the general range of preferences, which can potentially explain context effects and joint-separate evaluation preference reversals (Prelec et al., 1997; Sher and McKenzie, 2014). The possibility that menu partitions may communicate information has been discussed by Kahneman and Tversky (1982) and Fox et al. (2005).

If menu partitions provide information, what might they communicate? We surmise that unpacking a set of options can reveal information about the relative popularity of items. For example, it has been shown that choice architects select the particular “granularity” of options in ways that abide by conversational maxims of relevance (Jerez-Fernandez et al., 2014; Mason et al., 2013; Yaniv and Foster, 1995; Zhang and Schwarz, 2012, 2013). More generally, Gricean conversational norms dictate that a speaker’s contribution (e.g., a choice architect decision to present a menu in a particular way) be made appropriately informative for the task at hand Grice (1975). In many choice settings, it seems plausible that menus are constructed by choice architects who attempt to maximize the fit in preferences among their constituents. That is, participants may tacitly assume that menu partitions roughly follow a “principle of maximum entropy” over preferences (Jaynes, 1957). If so, menu partitions should signal information about descriptive norms, with greater granularity indicating greater popularity. Thus, partitions may influence choice to the extent that individuals tacitly adsorb information about descriptive social norms from menu partitions.

In Study 3 we measured judgments of item popularity alongside choice, to examine whether menu partitions leak information about descriptive social norms. We recruited sample of 148 participants from Mechanical Turk (68% male, mean age = 28 years, range: 18–72). The study consisted of a choice and judgment task. For the choice task participants were presented with hypothetical choices similar to Study 1, with half of the items listed individually and the other half packed together. As in Study 1, we counterbalanced the position of the packed category to be in either first or last position. For the judgment task, participants were presented with the same menu partition and asked to estimate the percentage of participants in the study who would choose each option, with all options summing to 100 (see Figure 2 for an example). We randomized the order of trials within each block, and also counterbalanced the order of the task blocks: participants completed the choice task first and the judgment task second, or vice versa. Counterbalancing the task blocks allowed

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?

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

Which country would you choose? _____

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?

- France
- Germany
- Italy
- 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)	_____ %

Figure 2: Example of Choice and Estimation task (Study 3)

us to examine the basic partitioning effect (without first prodding for popularity judgments), and also whether participants glean information from the menu partition (without first stating their preferences).

Study 3 Results

Table 2 provides a summary of the results. On average, there was a 34% marginal increase in choices for items when those items were listed individually compared to when they were grouped into a single list. In all four cases, choices reliably varied as a function of the menu partition (p -values $< .05$). We also found that the menu partition influenced participants' beliefs about descriptive norms. On average, there was a 23% increase in judged popularity for items listed individually compared to when those items were grouped together. In all four cases, judgments reliably varied as a function of the menu partition (p -values $< .001$). Neither choices nor judgments were reliably affected by the order of the task blocks (for the interaction terms between menu partition and block order, p -values were .919 for choices and .551 for judgments).

We next correlated the group-level percentages of choices with the group-level means of judgments for each condition and trial, using only data from the first task block that participants responded to. Doing so allowed us to examine the relationship between judgment and choice without concerns of possible measurement effects (e.g., estimating item popularity first affects choices later on). As

Table 2: Study 3 Results

Domain	Group A	Group B	Choices (%)			Judgments (mean estimate)		
			Group A Unpacked	Group A Packed	Diff.	Group A Unpacked	Group A Packed	Diff.
Vacations	Europe	Asia	70.3	52.7	17.6*	70.0	54.2	15.8***
Desert	Cookies	Ice cream	82.7	23.3	59.4***	65.3	30.5	34.9***
Weekend trip	West Coast	East Coast	80.3	53.3	27.0***	61.3	42.5	18.8***
Entertainment	Sports	Cultural	61.1	29.0	32.1***	76.6	55.8	20.8***

Notes: * $p < .05$, *** $p < .001$

expected, there was a strong positive relationship between beliefs about item popularity and actual choices ($r = .86$, $p = .006$). The menu partition strongly influenced participants' beliefs about descriptive norms, and beliefs about descriptive norms was highly correlated with choice.

Lastly we examined for statistical mediation using bootstrapped clustered standard errors (1,000 resamples; Shrout and Bolger, 2002), and with necessary adjustments to the mediation procedure for binary choice data (Karlson et al., 2012). Judgments of item popularity mediated 45% the effect of the menu partition on choice, $b_{indirect} = 0.70$, $SE = 0.15$, 95% CI [0.44, 1.00]. In other words, the partitioning effect on choices was reduced from a 34% to an 18% marginal effect after statistically controlling for beliefs about item popularity. Furthermore, we found reliable mediation when separately examining each of the block orderings (i.e., whether choices were made before or after judgments of item popularity).

Study 4: Causally Perturbing Inferences

Study 3 suggests that menu partitions can communicate information about the relative popularity of items. If information gleaned from the partition plays a causal role in determining choice, then partitioning effects should be attenuated whenever participants fail to glean or use information provided by the partition. In Study 4 we aimed to do this by first asking participants to state their beliefs about item popularity before viewing 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 thus attenuate partitioning effects on choice.

We recruited a sample of 283 participants from Mechanical Turk (64% male, mean age = 29 years, range: 18–60) and presented them with the same four choices as in Study 3. Immediately before or after responding to each choice, participants estimated the popularity of the two categories comprising each choice set (see Figure 3 for an example). In other words, some participants provided estimates of item popularity before viewing the menu partition, while others provided these estimate only after viewing and responding to the menu partition. We expected an attenuated partitioning effect if participants first stated their beliefs about descriptive norms before choosing.

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?

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

Which country would you choose? _____

Example estimation trial

Consider the two different types of vacation destinations below. Presented with these options, what proportion of people would choose an all expenses paid trip to either a European country or an Asian country? Please provide your best guess. Note that answers should sum to 100.

European country (choice of either France, Germany, or Italy) _____ %

Asian country (choice of either China, Japan, or Vietnam) _____ %

Figure 3: Example of Choice and Estimation task (Study 4)

Study 4 Results

As in the two previous studies, we found a pronounced partitioning effect. Across trials and conditions, there was a 33% marginal increase in choices for items listed individually compared to when those items were grouped together ($p < .001$). More importantly, this partitioning effect was attenuated when participants first stated their beliefs about item popularity. Participants who first chose from the menu partition before providing their estimates served as our baseline, and in this condition we found a 39% marginal effect for the menu partition. For participants who first estimated item popularity before choosing, this reduced to a 25% marginal effect. This reduction in the partitioning effect, which amounted to a 36% decrease from the baseline condition, was reliably different from chance ($p = .025$). In all four choice settings, the partitioning effect was attenuated when participants first stated their beliefs about item popularity before choosing.

Next we examined for judgments of item popularity (recall that this was measured at the category level, rather than at the item level). Judgments should not be affected by the menu partition in the estimate-first condition (since participants had yet to be exposed to the menu partition), but should shift in the direction of the partition in the choose-first condition (similar to Study 3). As expected, participants rated unpacked items as more popular if they had first been exposed to the menu partition ($b = 3.81$, $SE = 1.40$, $p = .007$), but not if they had yet to view the partition ($b = -.31$, $SE = 1.45$, $p = .831$; $p = .042$ for the interaction between order and menu partition). Furthermore, popularity judgments mediated the effect of menu partition on choice only if participants had first been exposed to the menu partition, $b_{indirect} = 0.088$, $SE = 0.45$, 95% CI [0.00, 0.18]. When participants first stated their beliefs before viewing the partition, judgments of popularity did not reliably mediate choice, $b_{indirect} = 0.02$, $SE = 0.06$, 95% CI [-.09, 0.14].

Studies 3 and 4 suggest that menu partitions convey information about the relative popularity of a set of items. Individually listed items are thought to be more popular than items that are

Table 3: Study 4 Results

Domain	Group A	Group B	Choose, then Estimate (choice %)			Estimate, then Choose (choice %)		
			Group A	Group A	Diff.	Group A	Group A	Diff.
			Unpacked	Packed		Unpacked	Packed	
Vacations	Europe	Asia	73.9	51.3	22.6**	71.2	56.9	14.3 [†]
Desert	Cookies	Ice cream	84.7	21.9	62.8***	74.6	33.3	41.3***
Weekend trip	West Coast	East Coast	82.9	45.3	37.6***	71.8	56.7	15.1 [†]
Entertainment	Sports	Cultural	75.7	41.3	34.4***	65.3	33.3	32.0***

Notes: * $p < .05$, *** $p < .001$

grouped together, and participants tend to choose items they thought were popular. Such a strategy may be reasonable to the extent that (a) participants are uncertain about their preferences, (b) menu partitions actually reflect majority preference, (c) majority preference is positively correlated with optimal choices, and (d) participants do not have better sources of task-relevant information available to them.

General Discussion

We document that individual choice can be substantially influenced by the manner in which a menu of items is partitioned or subjectively grouped. In particular, participants were more likely to choose items that were individually listed compared to when those same items were grouped together. This was true across a wide range of choice settings, both real and hypothetical. The effect of partitioning the menu set was sizable, often shifting choices by 30 percentage points or more.

An open question is whether such partitioning effects are only observed amongst novice decision makers, who are uncertain how to best choose for themselves. In a related project (Tannenbaum et al., 2014), we found that partitioning the response menu had a significant effect on prescription decisions among practicing physicians. In medical vignettes that described a patient’s symptom history, physicians were less likely to prescribe treatments consistent with major clinical guidelines (e.g., over-the-counter drugs rather than antibiotics for acute respiratory infections) when “inappropriate” treatment options were unpacked. Although these effects were smaller than those found in the current paper (physicians in that sample showed an 11% partition effect on average), the findings suggest that partitioning occurs even among experienced decisions makers in a domain with considerable consequences for public health.

Given the robustness and large effect size of the results, such partitioning effects are likely to be multiply-determined. We focused on one potential explanation, namely that menu partitions convey information about descriptive social norms. However, in our experiments a reliable partitioning effect was observed even after statistically controlling for (Study 3) and experimentally manipulating (Study 4) beliefs about item popularity. Future work should explore other possible mechanisms, and the relative role of such psychological processes in explaining partitioning effects depending on the characteristics of the choice environment.

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Appendix: Choice items

Study 1

Movies

Group A: Science Fiction (2001: A Space Odyssey, Star Wars: Episode IV, E.T.: The Extra Terrestrial)

Group B: Romantic Comedies (Sleepless in Seattle, You've Got Mail, When Harry Met Sally)

Magazines

Group A: Popular Science (Psychology Today, Scientific American, Discover)

Group B: World News (Time, U.S. News & World Report, Newsweek)

Books

Group A: Behavioral Science (Outliers, SuperFreakonomics, The Wisdom of Crowds)

Group B: Life Science: (Guns, Germs, and Steel, The Selfish Gene, A Short History of Nearly Everything)

Charity

Group A: Animal charities (Humane Society, Animal Legal Defense Fund, Society for Prevention of Cruelty to Animals)

Group B: Environmental charities (Natural Resource Defense Council, Sierra Club, Environmental Defense Fund)

Study 2

International Vacations

Group A: European countries (France, Germany, Italy)

Group B: Asian countries (China, Japan, Vietnam)

Entertainment

Group A: Sporting events (NFL game, NBA game, MLB game)

Group B: Cultural events (Opera, Theater, Musical)

Weekend Trips

Group A: West coast cities (San Francisco, Portland, Seattle)

Group B: East coast cities (Boston, Philadelphia, Washington D.C.)

Dessert

Group A: Cookies (Chocolate chip, Peanut butter, Oatmeal raisin)

Group B: Ice cream (Chocolate, Vanilla, Strawberry)