Choice bracketing and experience-based choice

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Abstract

We examine the effect of choice bracketing on expected value maximization in experience-based choice. Experience-based choices are a series of individual choices made sequentially, for which feedback follows each choice, and are thus naturally bracketed narrowly. Previous research broadly bracketed multiple experience-based choices for decision makers by aggregating choices (such that each choice pertained to multiple individual choices) or by reducing feedback frequency. We find that decision makers prompted to actively broad-bracket experience-based choices in the presence of immediate feedback on individual choices (which prompts narrow bracketing) are more likely to choose expected value maximizing options than decision makers prompted to narrow-bracket these choices. This pattern replicated across four studies, using different manipulations of choice bracketing, forms of feedback (partial or full), payoffs (hypothetical or incentive-compatible payoff), subject populations, and when the choices and outcome distribution involved prices or time. We discuss the theoretical and practical implications of our findings.

Keywords: Choice bracketing, experience-based choice, expected value maximization, feedback

Introduction

Sellers offer various reward schemes to attract customers. They can offer a reward (e.g., a discount) that applies to multiple purchases or once customers complete a minimum number of purchases or reward individual transactions. For example, American Express credit card holders must accumulate a minimum of 2,500 points before they can redeem them, a minimum that customers typically reach only after multiple purchases had been made. In contrast, Amazon Rewards Visa Signature Card holders may redeem any number of points with any purchase at Amazon.com. Reward schemes that require, or are applied to, multiple versus single purchases may influence whether customers simultaneously consider multiple purchases or focus on individual purchases. This paper examines how such external choice bracketing schemes influence decision makers' propensity to maximize expected value (henceforth, EV) when choosing between different outcome distributions.

Decision makers' preferences are systematically influenced by how they "bracket" choice (Read, Loewenstein, & Rabin, 1999). *Broad bracketing* occurs when decision makers take a long-term perspective by evaluating the consequences of a series of choices together; *narrow bracketing* occurs when decision makers take a short-term view, evaluating the consequence of each choice in isolation. Broad bracketing enables the consideration of the relationship between choices in addition to the evaluation of individual choices, and therefore often results in different choice than narrow bracketing. Indeed, broad bracketing tends to result in higher overall EV (Benartzi & Thaler, 1995; 1999; Read et al., 1999; Schurr, Rodensky, & Erev, 2014; Thaler, Tversky, Kahneman, & Schwartz, 1997; Webb & Shu, 2017; but see Read, Antonides, van den Ouden, & Trienekens, 2001 for instances in which narrow bracketing leads to higher EV) and in reduced loss aversion (Kahneman & Lovallo, 1993), compared to narrow bracketing. For example, more people choose to play a gamble

that offers a 50% chance to win $2,000 and a 50% to lose $500 when offered to play it five times as opposed to just once (Redelmeier & Tversky, 1992).

The robust choice bracketing effect (see Read et al., 1999 for a review) has been demonstrated primarily for description-based choices, where outcome distributions are explicitly described. In real life, however, many choices are based on experience, where decision makers must learn the outcomes of the available options and their respective probabilities by accumulating experience with these options. For example, commuters who choose daily between available routes learn the distribution of commute times per route as they gain experience taking these routes. Similarly, consumers choosing between retailers learn the retailers' price distributions by experiencing their prices.

Choices between the same set of options vary markedly as a function of whether they are based on experience, as in the examples above, or on descriptions, as in prior studies examining choice bracketing. Experience-based choices show a stronger preference for high-probability-low-payoff options over low-probability-high-payoff options than description-based choices (Hertwig, Barron, Weber, & Erev, 2004; Hertwig & Erev, 2009). For example, Hertwig et al. (2004) demonstrated that when decision makers were offered a choice between (a) a 10% chance to win $32 (and nothing otherwise) and (b) winning $3 for sure, 48% of decision makers preferred the risky option (a) when the outcome distributions were described, but only 20% preferred it when these outcome distributions were learned through experience by sampling from these distributions.

This paper examines whether externally imposed broad bracketing (as when sellers reward multiple purchases) promotes EV maximization in experience-based choice, as it does in description-based choice. The answer to this question is unclear because the immediate feedback that follows individual experience-based choices may draw decision makers' attention to the consequences of individual choices.

As described in more detail below, the few studies that examined the effect of choice bracketing on experience-based choice did so by aggregating the outcomes of multiple experience-based choices for decision makers, thereby reducing the number of choices or the frequency of the feedback decision makers received (Gneezy & Potters, 1997; Haisley, Mostafa, & Loewenstein, 2008; Thaler et al., 1997). We, however, examine whether and how broad bracketing influences EV maximization, holding constant choice and feedback frequency.

Theoretical background

Decision makers may bracket description-based choices either narrowly or broadly, depending on how those choices are presented (Read et al., 1999). For example, Redelmeier and Tversky (1992) reported that, most people prefer playing a gamble offering a 50% chance to win $2,000 and a 50% to lose $500 six times over playing it five times. However, while most people accepted playing this gamble five times, most rejected playing it for the sixth time when they were told that they had already played this gamble five times but did not yet know their wins and losses. The different choice pattern was attributed to a difference in bracketing of the sixth gamble – participants offered a choice between five and six plays of the gamble broadly bracketed the sixth gamble together with the five gambles that preceded it; however, participants offered to play a sixth gamble after participating in five gambles, narrowly bracketed the sixth gamble. Similarly, Read et al. (1999) had participants make five decisions whether or not to participate in a gamble offering a 50% chance to win $40 and 50% chance to lose $25, for the next five days. Participants in the narrow bracketing condition made five separate choices, for which they received feedback on the outcome of each gamble before making the next choice; participants in the broad bracketing condition made choices for all five days before learning the outcomes of the gambles. Comparing choices on the first day only (for which the information participants had in both conditions

was identical), 50% of the participants in the broad bracketing condition took the gamble, compared with only 32% in the narrow condition.

We propose that while description-based choices may be bracketed broadly or narrowly, decision-makers naturally bracket experience-based choices narrowly, as they are a series of choices made sequentially, for which feedback is given following each choice. Danziger, Hadar, & Morwitz's (2014) findings are consistent with this notion. Participants in their studies completed a series of choices between two retailers – one offering a small chance of a large discount (the depth retailer) and the other offering frequent but small discounts (the frequency retailer). Participants learned about the price distributions offered by the retailers only through the price feedback they received following every choice they made. Consistent with the literature on experience-based choice, participants chose the frequency retailer much more often than the depth retailer. Importantly, these experience-based choices were driven by participants' predictions of which retailer would be cheaper on the next single trial, rather than on their assessment of which retailer was cheaper on average, an estimate based on multiple choices aggregately. Schurr et al. (2014) provide additional support for the notion that experience-based choice is often guided by decision makers' predictions of which outcomes will be obtained on the next individual choice, and attribute this tendency to the immediate feedback inherent to experience-based choice.

As reviewed above, the effect of choice bracketing has been demonstrated by comparing conditions in which decision makers were prompted to consider a series of description-based choices either individually (i.e., narrow bracketing) *or* aggregately (i.e., broad bracketing). However, in experience-based choice such a comparison cannot be made, because, as explained above, decision makers naturally bracket experience-based choices narrowly. In previous research, broad bracketing in experience-based choices was imposed on decision makers, by aggregating choices for them: instead of completing multiple choices

and receiving feedback following each choice, each choice pertained to multiple future choices, and each feedback pertained to multiple outcomes. This research did not prompt decision makers to actively aggregate the consequences of multiple, individual choices. For example, Thaler et al. (1997) had participants make 200 allocations of a portfolio of 100 shares between a bond fund and a stock fund. Participants received no information regarding the distribution of returns of each fund, but had to learn about them through experience. Choice were bracketed for the participants by reducing choice and feedback frequency: participants in the *monthly* condition made 200 allocations, corresponding to 200 months; participants in the *yearly* condition made 25 allocations, each binding for eight months; participants in the *five-yearly* condition made five allocations, each binding for 40 months. Following each allocation, participants received feedback regarding the aggregated returns of each fund and of their portfolio for the period to which the allocation applied. Consistent with previous findings, more allocations were made to the stock fund (reflecting riskier behavior and associated with higher overall returns across long time periods; Benartzi & Thaler, 1995; 1999) as the length of the evaluation period increased and as the frequency of the feedback provided decreased. Gneezy and Potters (1997) had participants complete multiple choices and then revealed the outcomes of all choices simultaneously. Consistent with the results of Thaler at el., they found that participants who received feedback less frequently earned more money (see also Haisley et al., 2008; Webb & Shu, 2017).

Thus, studies examining the effect of broad bracketing in experience-based choice did so by presenting decision makers with broadly bracketed choices. However, these studies do not address whether decision makers voluntarily broad-bracket choices when feedback is provided for each single choice. This question is important because in many real life experience-based choices decision makers cannot change the number of choices and the feedback that follows each individual choice. For example, most commuters cannot change

the frequency with which they drive to work or drive their children to school, and people's choice where to buy lunch or which lunch dish to have is done on a daily basis. In this paper we examine whether a series of experience-based choices may be broadly bracketed without changing the number of choices made or the frequency of the feedback received. Per the above examples, we ask whether having commuters consider the outcome of multiple daily trips while learning the commute time per individual trips, and whether having people consider the overall price or nutritional value of multiple lunch boxes bought on several days while learning the price of an individual lunch box or its nutritional value on a daily basis, would result in maximization.

It remains an open question whether the provision of immediate feedback, inherent to experience-based choice, will draw decision makers' attention to the consequences of individual choices so strongly that it will dilute any potential effect of having them also consider the consequences of multiple choices, or whether joint consideration of the individual and the aggregate consequence of experience-based choices will result in broad bracketing. If broad bracketing is successful, decision makers should be more likely to choose the option that maximizes overall EV compared to a narrow bracketing condition (see Figure 1).

Our examination of whether broad bracketing may be achieved in experience-based choice is important for several reasons. First, whereas previous research on choice bracketing compared narrow to broad bracketing in description-based choice, the present paper examines the combined effect of narrow and broad bracketing in experience-based choices. Second, broad bracketing typically yields higher overall EV than narrow bracketing. Our research tests whether decision makers may be encouraged to maximize EV in a narrowly-bracketed experience-based choice by having them additionally consider the consequences of multiple choices. Third, the present results may aid managers who wish to influence decision makers'

valuation of the products or services they offer. For example, Danziger at el. (2014) found that consumers were more likely to choose a frequency retailer (offering frequent small discounts) over a depth retailer (offering infrequent large discounts) in a series of experience-based choices even when the frequency retailer, who was more likely to be cheaper on a given trial, was judged as being more expensive on average, suggesting that expected EV was not maximized. If having consumers are able consider both the aggregate and individual consequences of their choice results in EV maximization, retailers could increase their appeal by influencing consumers' perceptions of the aggregate prices they offer (e.g., average price) rather than consumers' perceptions of the likelihood that a discount is offered on a given shopping trip, by using different marketing messages or pricing strategies, for example (e.g., Alba, Broniarczyk, Shimp, & Urbany, 1994; Alba, Mela, Shimp, & Urbany, 1999).

We next present four studies that test the effect of choice bracketing in experience-based choice. Drawing on popular reward schemes, we encourage the aggregate consideration of multiple experience-based choices by offering decision makers rewards that pertain to decisions made over multiple choices while keeping the number of choices and feedback frequency unchanged.

Study 1

Study 1 examined the effect of choice bracketing in a series of consequential experience-based choices. If decision makers are able to favor long term considerations over their natural tendency to consider short term consequences in experience-based choice, they should be more likely to choose the option maximizing EV. By contrast, in the narrow bracketing manipulation, choice proportions should not be influenced by overall EV maximization considerations. If, however, the immediate feedback, inherent to experience-based choice, draws decision makers' attention to the consequences of individual choices so strongly to dilute any effect of having them also consider the consequences of multiple

choices, choices should not vary as a function of EV maximization in both the broad and the narrow bracketing conditions.

Method

College students (N = 120; mean age = 23; 39% women) participated in this online experiment for course credit and an incentive-compatible payoff (see below). The study used a 2 × 2 × 2 mixed design with one within-subjects factor (Pricing pattern: Frequency vs. Depth), and two between-subject factors (Bracketing: Narrow vs. Broad and Cheaper average price: Frequency vs. Depth), to which participants were randomly assigned. Coffee shop title (Coffee Bar vs. IDC Coffee) and coffee shop location on the computer screen (left vs. right) were counterbalanced across participants.

Similar to previous studies on experience-based choice (e.g., Barron & Erev, 2003; Hertwig et al., 2004), participants made 30 choices between two fictitious coffee shops. Choices were made on a daily basis. We did not expect the fact that choices were made daily to influence choice (Danziger et al., 2014), but chose this paradigm to increase external validity. Participants were informed that the two coffee shops sold the same quality coffee and were encouraged to choose between the coffee shops based on price. They were explicitly told their goal was to spend as little money as possible.

In the beginning of the study, each participant received a credit of 430 New Israeli Shekels (NIS). Participants were informed that, on the next 30 days, the daily cost of coffee would be deducted from that amount. The amount left in the account at the end of the study was paid to each participant.

Participants received no prior information regarding the price distribution offered by each coffee shop, but learned about them through the price feedback they received following each choice. The price feedback pertained to the chosen coffee shop only, as in many real life

choices where decision makers first choose which store to visit and only then learn the daily price of the chosen store (upon arriving at the store).

Unbeknownst to participants, one coffee shop offered frequency pricing, selling the coffee for 14 NIS on 30% of the days, and for 11 [9] NIS in the frequency [depth] cheaper condition on 70% of the days. The other shop offered depth pricing, selling the coffee for 14 NIS on 80% of the days, and for 9 [5] NIS in the frequency [depth] cheaper condition on the remaining 20% of the days (see Table 1). All of the participants saw the same price sequence which was constructed such that both shops' discount prices were randomly distributed in each 20-trial block. Both shops could offer a discount on the same day.

---Insert Table 1 about here---

A pretest study confirmed that participants perceived the average price differences as expected. Participants from the same subject pool (N = 77; 38% female; M_{Age} = 22.7) completed the same first 20 choices as did participants in the actual study and then judged each shop's average coffee price. An ANOVA revealed the expected interaction ($F(1, 75) = 11.37$; $p = .001$). When the depth distribution was cheaper on average, the average price of the depth distribution was judged as lower than that of the frequency distribution (M_{Depth} = 11.55 vs. M_{Freq} = 12.43, $F(1, 75) = 6.42$; $p = .013$), and when the frequency distribution was cheaper on average, the pattern reversed (M_{Depth} = 12.00 vs. M_{Freq} = 11.27, $F(1, 75) = 4.96$; $p = .029$). The finding that the judged average price of the depth distribution was lower than the actual average is consistent with previous literature suggesting that judgments are influenced by the salience (Alba et al., 1999).

In the main study, the first 20 trials were designed to familiarize participants with the price distributions. We manipulated choice bracketing after the 20th choice by offering participants rewards that pertained to single versus to multiple purchases. Participants in the *narrow bracketing* condition received 10 coupons, each offering a 10% discount on the daily

price of the coffee. Each coupon could be redeemed at any of the coffee shops on a given day. In contrast, participants in the *broad bracketing* condition received a single 10% discount coupon that could be applied to the next 10 purchases at *one* of the coffee shops. Participants indicated, in advance, for which of the two coffee shops they would like to receive the coupon, and they could not change their preference later on. If they chose to buy coffee at the other store on a given day, the coupon discount was not applied to the price they paid. Therefore, in order to maximize EV, participants needed to consider whether they are likely to pay less overall if they were to make the next 10 purchases at one of the coffee shops and choose the coupon for the overall cheaper shop. Note that participants in the broad bracketing condition still needed to make daily choices between the two coffee shops and received daily price feedback. In this sense, the broad bracketing condition involved the consideration of both individual choices (i.e., *where should I buy coffee today?*) and multiple choices aggregately (i.e., *which coffee shop will be cheaper overall across the next 10 days?*). These two types of choices did not necessarily perfectly match. For example, decision makers could choose the coupon for coffee shop A because they thought it would offer a cheaper price across the next 10 days, but choose to buy coffee at coffee shop B on day 3 because they thought that, on that particular day, coffee shop B's price would be so low to justify choosing it despite not being able to use the 10% discount.

Similar to Read et al. (1999), although participants were originally informed that they would complete 30 daily choices between the two coffee shops, we terminated the study after the 21st choice because this was the only choice that was affected only by the bracketing manipulation and not by the feedback that followed it. After participants received feedback regarding the price they paid on the 21st day they were informed that the study had terminated. They were debriefed about the reason for the early termination of the study and about how the incentive-compatible payoff was calculated. For calculating the incentive-

compatible payoff, we considered the cost of coffee for days 22 through 30 as the average cost each participant actually paid on trials 1-20. The credit left in each participants account was calculated and participants received it in cash.

Results

The responses of six participants who failed to complete the study were omitted from the following analyses. Consistent with previous research (e.g., Danziger et al., 2014), we also omitted the responses of 30 participants who were not exposed to the entire price distributions due to sampling almost exclusively from one distribution. Since price feedback was only provided for the chosen coffee shop, participants who rarely or never chose one of the coffee shops, could not make informed choices between the two coffee shops. The following analyses are thus based on the responses of the remaining 84 participants. Note that including the omitted responses in the analysis does not qualitatively change the results in Study 1 as well as in the following studies.

Pre-bracketing choices

On average, participants chose to buy coffee at the depth shop on 42% of the trials (median = 40%, SD = 14%). Choice was not significantly affected by which distribution offered cheaper prices, on average ($M_{Depth\ cheaper}$ = 44% vs. $M_{Freq\ cheaper}$ = 40%, $t(82) = 1.39$; $p = .17$).

Post-bracketing choice

We regressed participants' choices on trial 21 (1 = Depth shop, 0 = Frequency shop) on Bracketing condition (1 = Broad, 0 = Narrow), on Cheaper distribution (1 = Depth, 0 = Frequency), and on their interaction. We added the average proportion of depth choices on pre-bracketing trials as a covariate to the analysis, to control for the variance associated with an overall preference for the coffee shop associated with a depth versus a frequency price distribution. The Bracketing by Cheaper distribution interaction was significant ($\chi^2(1) = 4.95$;

p = .026): participants were more likely to choose the cheaper (on average) coffee shop (regardless of which of the two it was) in the broad ($\chi^2(1) = 1.9$, b = 1.4, p = .057), but not in the narrow bracketing condition ($\chi^2(1) = -1.3$, b = -.97, p = .184). The main effect of Bracketing was marginally significant ($\chi^2(1) = -1.81$; p = .071): participants in the broad bracketing condition were less likely to choose the depth option. The main effect of Cheaper distribution ($\chi^2(1) = -1.33$; p = .184) was not significant. The effect of the proportion of pre-bracketing depth choices positively influenced the propensity to choose the depth option ($\chi^2(1) = 3.39$; $p < .001$). Tables 1 & 2 summarize the results.

--- Insert Tables 1 and 2 about here ---

Discussion

The results show for the first time that despite the natural tendency to consider individual experience-based choices, when prompted to consider the aggregate consequences of these choices, decision makers prefer the option that maximizes EV (i.e., the option with the cheaper average price). Importantly, we find this effect when the number of choices participants made and the number of times they received feedback did not change.

Although we attributed participants' choices under broad bracketing to EV maximization, it may instead be due to loss aversion or risk preferences. As described in the introduction, broad bracketing may reduce loss aversion and promote risky choice. Depth pricing is riskier than frequency pricing because it's distribution has more variance, and thus, if loss aversion were operating, broad bracketing should increase choice of the frequency shop. In contrast, we find that broad bracketing encouraged choice of the option that was cheaper on average – whether that option is the depth or the frequency shop. Thus, we dismiss the loss aversion account. The provision of feedback following individual choices in our study may explain why broad bracketing did not necessarily result in riskier choice.

Study 2

Previous research suggests that when outcome distributions are not explicitly described, decision makers form judgments about these distributions, which often deviate from the actual outcome distributions (e.g., Fiedler & Armbruster, 1994; Hollands & Dyre, 2000), and base their choices on these judgments (Fox & Tversky, 1998; Tversky & Fox, 1995). Therefore, in this and the following studies we examine the effect of choice bracketing on choice of the option *judged* to offer the higher EV.

Additionally, in Study 1, our attempts to simulate a realistic choice environment led to the provision of feedback regarding the chosen option only. As a result, participants who rarely or never chose one of the coffee shops were not exposed to the entire price distributions, and their responses were omitted. To avoid such data loss going forward, in the following studies we provide feedback regarding the outcomes of the chosen as well as the forgone options (Danziger et al., 2014; Erev & Haruvy, 2008).

Finally, while participants in Study 1 chose between two risky options - depth and frequency outcome distributions, in Study 2 we offered choice between risky (Depth) and sure (constant) distributions.

Method

U.S. adults were recruited through Amazon Mechanical Turk (MTurk) platform to participate in this online study ($N = 202$; 51.5% female; $M_{Age} = 36.2$, $SD_{Age} = 11$). Sample sizes, here and in the following studies, were similar to (or larger than) those used in prior online studies on experience-based choice (e.g., Danziger et al., 2014; Hadar, Danziger, & Hertwig, 2018). The study used a 2 × 2 mixed design with one within-subjects factor (Pricing pattern: Constant vs. Depth), and one between-subject factor (Bracketing: Narrow vs. Broad), to which participants were randomly assigned. Retailer title (A vs. B) and retailer location on the computer screen (left vs. right) were counterbalanced across participants.

Participants were asked to imagine that every Monday they prepare Mac and Cheese

for dinner, and that every weekend they buy the ingredients for the Mac and Cheese they will prepare on the following Monday. They were further told that two grocery stores sell these items and offer the brands they prefer, and that they should therefore choose a grocer based on price only. Next, they were informed that on the first part of the study they would make 20 choices between the two grocers, simulating 20 weekly choices, and that their goal was to spend as little money as they could. Following every choice, they were shown the weekly prices of the chosen and the forgone grocers. Unbeknownst to participants, one of the grocers' price was always $8.39 (constant grocer). The other grocer's price was $9.89 on 70% of the trials and $4.89 on 30% of the trials (depth grocer).

Next, choice bracketing was manipulated. Participants were asked to complete another 20 choices between the same two grocers. Following Read et al. (1999), participants in the *narrow bracketing* condition were informed that, as in the first 20 choices, following each choice they would learn the weekly prices offered by the chosen and the forgone grocer. Participants in the *broad bracketing* condition were informed that, in contrast to the first 20 choices, they would first make the next 20 choices between the two grocers and only then they would learn the weekly prices offered by the chosen and by the forgone grocers. In other words, while participants in the narrow bracketing condition would receive price feedback following each choice, which could potentially influence their subsequence choices, participants in the broad bracketing condition would receive that same feedback, but only after completing the entire set of 20 choices. Upon completing the second set of 20 choices, participants judged the average price offered by each grocer (although they were not instructed they would be asked to do so at the beginning of the study).

Results and discussion

The responses of 17 participants whose average price judgments fell outside the rounded range of prices (i.e., above $10) were excluded from the following analyses, which

included 185 participants.

Average price judgments

An ANOVA with Bracketing condition as an independent variable and Pricing pattern as a repeated variable revealed that the average price judgments were lower for the depth grocer (M_{Depth} = 7.86) than for the constant grocer ($M_{Constant}$ = 8.20, F(1, 183) = 10.86; p = .001). The simple main effect of Bracketing was marginally significant (M_{Broad} = 7.91 vs. M_{Narrow} = 8.16 F(1, 183) = 3.03; p = .084). The interaction was not significant (F(1, 183) = 1.92; p = .17).

Pre-bracketing choices

On average, participants chose the depth grocer on 51% of the trials (median = 50%, SD = 22%). Choice proportion was unaffected by bracketing conditions (M_{Narrow} = 49%, M_{Broad} = 52%, t(183) = 0.95; p = 0.34).

Depth post-bracketing choice

Similar to Read et al. (1999), we analyze the data of the 21st choice only, because this was the only choice where participants in the narrow and the broad bracketing conditions had the same information. Starting from this choice and on, only participants in the narrow bracketing condition received price feedback following every choice.

We computed a judged average price difference variable (average constant judgment – average depth judgment). Higher values of this variable indicate the depth grocer's average price was judged as lower than the constant grocer's average price. Next, we performed a moderation analysis (PROCESS model 1; Hayes 2013) in which the independent variable was judged average price difference, the dependent variable was likelihood of choosing the depth grocer (1= depth, 0 = constant), and the moderator was Bracketing condition (1 = Broad bracketing, 0 = Narrow bracketing). The proportion of pre-bracketing depth choices was added as a covariate.

The interation between the Bracketing and judged average price difference was significant ($\chi^2(1) = 5.09$; $p = .024$). The average price difference predicted choice in the broad bracketing condition ($b = .34$; 95% CI = .05, .64), such that the cheaper the judged average price of the depth grocer, relative to the constant grocer, the higher the likelihood that the depth grocer was chosen. The average price difference did not predicted choice in the narrow bracketing condition ($b = .004$; 95% CI = -.01, .02).

We found a main effect for bracketing ($\chi^2(1) = 4.06$; $p = .044$): depth's choice share was lower in the Broad (43%) than in the Narrow bracketing condition (53%). The direction of this simple main effect is driven by the fact that 49% of the participants in the Broad bracketing condition judged the average price of the depth grocer as similar to or higher than the average price of the constant grocer (leading them to choose the constant grocer). The main effect for the judged average price difference was significant ($\chi^2(1) = 5.32$; $p = .026$): the depth's choice share was higher the lower the depth grocer's average price was judged relative to the constant grocer's average price. Finally, the proportion of pre-bracketing depth choices was positively associated with the depth's post-bracketing choice share ($\chi^2(1) = 8.06$; $p = .005$). Tables 3 & 4 summarize the results.

--- Insert Tables 3 and 4 about here ---

Study 2's results extend those of Study 1 by demonstrating that choice under broad bracketing, but not under narrow bracketing, is driven by average price judgments.

Study 3

Study 3 extended our investigation in several ways: first, we examined the effect of choice bracketing on EV maximization in the context of time, rather than money. Time is an important consideration in many choices with customers usually preferring to wait less time to receive service or to complete a task (unless it is pleasurable). For example, realizing this, many companies offer expedited service at a cost (e.g., Amazon Prime or United Airline's

Premier Access services). In this study we asked participants to make repeated choices between two toll roads, providing them with feedback regarding the commute time to a fixed location. Consistent with the typical goal of commuters, we asked participants to minimize their commute time. We examined the effect of choice bracketing on choice of the road judged by participants to be faster on average. Naturally, time was only symbolic, as participants did not wait the allotted commute times.

Second, Study 3 examined whether the bracketing effect replicates with multi-outcome distributions. Previous research has demonstrated that judgments vary as a function of whether the outcome distributions include only two possible outcomes or multiple outcomes, because multi-outcome distributions are more complex and thus require more cognitive processing resources (Alba et al. 1999).

Third, participants in Study 3 chose between two roads, one consistent with a frequency distribution (offering many relatively shorter commute times) and the other offering a relatively constant and low commute time. Finally, Study 3 examined the effect of bracketing on maximization in a series of choices instead of only in the single choice that immediately followed the bracketing manipulation. To allow for this, we provided the same feedback to participants in the Broad and in the Narrow bracketing conditions (the methods section below explains how we were able to provide the same feedback across bracketing condition in more detail).

Method

Participants ($N = 201$; mean age = 37.7; 48% women) were recruited through MTurk. The study used a 2 × 2 mixed design with one within-subjects factor (Time distribution: Constant vs. Frequency), and one between-subject factor (Bracketing: Narrow vs. Broad), to which participants were randomly assigned. The location of the time distributions on the computer screen (left vs. right) and road title (A vs. B) were counterbalanced across

participants.

Participants were asked to imagine that, when driving to work, they choose between two roads. They were informed they would make 20 choices, simulating 20 daily rides to work, and were instructed their goal was to minimize commute time. Following each choice, participants learned the commute time of the chosen and the forgone roads. We incentivized participants by informing them that the two participants with the lowest overall commute time would receive an additional compensation of $5 each.

Next, choice bracketing was manipulated, similarly to the manipulation used in Study 1. Participants were informed they were about to perform another 20 choices between the same roads. Participants in the *narrow bracketing* condition received 20 vouchers, each offering a single free pass to drive on a fast-lane. They were told both roads had fast-lanes and that using a fast-lane can reduce the daily commute time by *up to* 5 minutes. Participants in the *broad bracketing* condition received a single fast-lane voucher that they could use on either Road A or Road B on the next 20 days. Before completing the next 20 choices, they indicated for which road they wanted to receive a voucher. If they chose the other road on a given day, the voucher was not applied to their commute time. After completing another 20 daily choices between the roads, participants judged the average driving time at each road (although they did not expect to make these judgments).

The time distribution of one road was relatively constant, with an average of 37-43 minutes (SD = 1.5). The time distribution of the other road (frequency road) offered shorter commute times of 23-27 minutes on 70% of the trials but longer commute times of 73-77 minutes (SD = 23.5) on 30% of the trials. On the post-bracketing 20 choices the commute times were cut by *up* to 5 minutes upon applying a fast lane voucher (see Table 5). The sequence of driving times across the first and the second 20 trials was random, and was identical for all of the participants.

---Insert Table 5 about here---

In order to analyze all post-bracketing 20 choices, we controlled the observed time distributions: in the broad condition, up to 5 minutes were deducted from the commute time whenever the chosen road was the one participants chose the voucher for. However, in the narrow condition, while participants were informed that the time reduction would be applied to whichever road they chose on a given day, in reality, for the half of the participants the fast lane voucher was applied only when they chose Road A, and for the other half the voucher was applied only when they chose Road B. Therefore, in practice, the same time reduction rule was applied to participants in both bracketing conditions. Participants in the narrow condition were debriefed at the end of the study regarding the time reduction that was actually applied to their choices and the reason why it was done. None of the participants in this condition reported suspecting that the time reduction was not as was described in the study instructions.

Results and discussion

The responses of 41 participants whose average time were higher than the highest or lower than the lowest time possible were omitted from the following analyses. The following analyses are thus based on the responses of 160 participants.

Average time judgments

An ANOVA with Bracketing condition as an independent variable and Time distribution as a repeated variable revealed that the average time judgments were lower for the frequency road (M_{Freq} = 34.74) than for the constant road ($M_{Constant}$ = 38.90, $F(1, 158)$ = 24.46; $p < .0001$). The effect of Bracketing ($F(1, 158) = 2.16$; $p = .14$) and the interaction were non-significant ($F(1, 158) = 2.68$; $p = .1$).

Pre-bracketing choices

On average, participants chose the frequency road over the constant road on 62% of the trials (median = 65%, Standard deviation = 18%), which was not significantly different across the Bracketing conditions (M_{Narrow} = 64%, M_{Broad} = 61%, $t(158) = 0.89$; $p = 0.38$).

Post-bracketing choices

We computed a judged average time difference variable (average constant judgment – average frequency judgment). Higher values of this variable indicate that the frequency road's average time was judged as lower than the constant roads' average time. Next, we performed a moderation analysis (PROCESS model 1; Hayes 2013) in which the independent variable was judged average time difference, the dependent variable was the proportion of frequency choices on trials 21-40, and the moderator was Bracketing condition (1 = broad bracketing, 0 = narrow bracketing). The proportion of pre-bracketing frequency choices was added as a covariate.

The Bracketing condition by judged average time difference interaction was significant (b = .008; 95% CI = .002, .01; p = .013). Judged average time difference predicted choice in the broad bracketing condition (b = .012; 95% CI = .008, .017; $p < .001$): the lower the judged average time of the frequency road (relative to the constant road) the higher the choice proportion of the frequency road. In the narrow bracketing conditon, however, the effect of judged average time difference was only marginally significant (b = .004; 95% CI = -.001, .009; p = .082).

The main effects of choice bracketing (b = .015; 95% CI = -.059, .089; p = .692) and judged average price difference (b = -.004; 95% CI = -.014, .006; p = .417) were not significant. The proportion of pre-bracketing frequency choices was positively associated with the frequency roads' post-bracketing choice share (b = .53; 95% CI = .337, .717; $p <$ .001). Tables 6 & 7 summarize the results.

--- Insert Tables 6 and 7 about here ---

These results replicate the effect of broad bracketing in experience-based choice on maximization using multi-outcome distributions of time and when examining multiple choices.

Study 4

Many firms nowadays offer customers a reward contingent upon completing a minimum number of purchases. In Study 4 we manipulate choice bracketing by varying the number of purchases required to receive a reward. Additionally, we manipulate average prices and measure average price judgments.

Method

Participants (N = 400; mean age = 34.7; 39% women) were recruited through MTurk for this online study. The study used a 2 × 2 × 2 mixed design with one within-subjects factor (Pricing pattern: Frequency vs. Depth), and two between-subject factors (Bracketing: Narrow vs. Broad and Cheaper price: Frequency vs. Depth), to which participants were randomly assigned. Grocer title location on the computer screen were.

The procedure was similar to Study 2, only participants completed 40 choices before choice bracketing was manipulated. The frequency grocer priced the items at $13 on 50% of the trials and at $8 [$12] in the frequency [depth] cheaper condition on 50% of the trials. The depth grocer priced the items at $13 on 80% of the trials and at $5.5 on 50% of the trials (see Table 8).

After completing 40 choices, participants were told they were to complete another 15 choices between the same grocers. They were further told they had received two rewards debit cards - one from each grocer, and that the two cards provide similar benefits. Participants in the *narrow bracketing* condition were told that every time they shop at one of the grocers (using the grocer's debit card) they would automatically receive $0.70 cash-back on their card. In contrast, participants in the *broad bracketing* condition were told that every

time they complete 10 purchases at one of the grocers (using the grocer's debit card) they would automatically receive $7 cash-back on their card.

In the 15 post-bracketing trials participants received feedback regarding the price offered by the chosen and forgone grocer, and feedback regarding reward accumulation – in the narrow bracketing condition - a $0.70 cash-back per purchase; in the broad bracketing condition - the number of purchases completed at the chosen grocer or, once they reached 10 purchases, a $7 cash-back. After completing the additional 15 choices, participants were asked, unexpectedly, to judge the average price offered by each grocer (excluding the rewards they received on the last 15 trials).

Results and discussion

The responses of 26 participants whose average price judgments fell outside the price ranges were omitted from the following analyses, which are based on the responses of 374 participants.

Average price judgments and manipulation check

An ANOVA with Cheaper price as an independent variable and Pricing pattern as a repeated variable revealed a significant interaction ($F(1, 372) = 153.56$; $p < .001$). The depth grocer's average price was judged as lower when the depth was cheaper ($M_{Freq} = 12.55$ versus $M_{Depth} = 10.07$, $F(1, 372) = 415.56$; $p < .0001$), and when the frequency grocer was cheaper, though to a lesser extent ($M_{Freq} = 10.38$ versus $M_{Depth} = 10.03$, $F(1, 372) = 8.54$; $p = .004$). The main effects of Pricing pattern ($M_{Freq} = 11.47$ versus $M_{Depth} = 10.05$, $F(1, 372) = 272.72$; $p < .001$) and Cheaper price ($M_{Freq\ cheaper} = 10.21$ versus $M_{Depth\ cheaper} = 11.31$, $F(1, 372) = 118.13$; $p < .001$) were also significant.

Pre-bracketing choices

On average, participants chose the depth grocer on 47% of the trials (median = 45%, SD = 26%). This choice share was higher when the depth grocer was cheaper than when the

frequency grocer was cheaper ($M_{Depth\ cheaper}$ = 57% versus $M_{Freq\ cheaper}$ = 36%, $t(372) = 8.30$; $p < .001$).

Post-bracketing choices

An ANOVA with Cheaper Price and Bracketing as independent variables and the proportion of depth choices on trials 41-55 as the dependent variable revealed a marginally significant interaction ($F(1, 370) = 3.11$; $p = .08$): when the depth grocer was cheaper, the choice share of the depth grocer was higher in the broad (70%) than in the narrow bracketing condition (67%, respectively), but when the frequency grocer was cheaper the choice share of the depth grocer was lower in the broad (28%) compared to the narrow bracketing condition (36%). The main effect of Cheaper Price was significant: the choice share of the depth grocer was higher when the depth grocer was cheaper than when the frequency grocer was cheaper ($M_{Depth\ cheaper}$ = 69% versus $M_{Freq\ cheaper}$ = 32%, $F(1, 370) = 131.6$; $p < .0001$). The main effect of Bracketing was not significant $F(1, 370) = 0.47$; $p = .49$).

We computed a judged average price difference variable (average frequency price judgment - average depth judgment). Higher values of this variable indicate that the depth grocer's average price was judged as lower than the frequency grocer's average price. Next, we performed a moderated mediation analysis (PROCESS model 14; Hayes 2013; see Figure 1) in which the independent variable was Cheaper retailer, the mediator was judged average price difference, the dependent variable was the post-bracketing depth choices, and the moderator was Bracketing condition. The pre-bracketing depth choice proportion was added as a covariate to the analysis.

Replicating out previous results, there was a signifcaint Bracketing by judged average price difference interaction ($b = .03$, 95% CI = .01, .05; $p = .008$) and a significant moderated mediation effect ($b = .05$, 95% CI = .01, .11). Specifically, the average price difference mediated the effect of Cheaper price on choice in the broad bracketing condition ($b = .037$,

95% CI = .005, .072): the judged average price difference was lower when the depth grocer was cheaper than when the frequency grocer was. The lower the average price of the depth grocer was judged (relative to the frequency retailer), the more the depth grocer was chosen. In contrast, in the narrow bracketing condition, the judged average price difference did not mediate the effect of Cheaper price on choice on post-bracketing choice (b = -.018, 95% CI = -.066, .021).

The choice share of the depth grocer was higher when the depth retailer was cheaper than when the frequency retailer was cheaper (b = .17; 95% CI = .11, .22; p < .001), in the narrow than in the broad brcaketing condition (b = -.05, 95% CI = -.11, .002; p = .059), and with higher pre-brcaketing choice proportions (b = .86, 95% CI = .76, .96, p = .271). The main effect of judged average price difference was not significant (B = -.01, 95% CI = -.03, .01; p = .27). Tables 8 & 9 summarize the results.

--- Insert Tables 8 and 9 about here ---

General discussion

This research makes an important theoretical contribution by extending the investigation of choice bracketing from description- to experience-based choice. We examined whether broad bracketing may occur in experience-based choice, which is typically characterized by narrow bracketing (e.g., Danziger et al., 2014), without changing choice or feedback frequency. We were concerned that the provision of feedback following individual experience-based choices may dilute any effect of considering multiple choices aggregately (i.e., broad bracketing), and thus interfere with EV maximization. The results of four studies, using different choice bracketing manipulations, providing partial or full feedback, hypothetical or incentive-compatible payoff, and different subject populations, consistently demonstrate that decision makers are more likely to choose EV maximizing options under broad bracketing than under narrow bracketing. These findings suggest that participants were

able to considered multiple experience-based choices aggregately, as well as individually.

While research in experience-based choice has emphasized the risk level of the available options in influencing choice, the present results demonstrate that when choices are broadly-bracketed, choices are guided by average price judgments, regardless of the risk level of the available options (see the discussion of Study 1). This interesting finding calls for more research examining additional conditions under which average (or other) judgments are the main driver of choice under risk and uncertainty rather than risk level.

Our findings also highlight the importance of understanding judgment bias in experience-based choice. Very few studies of experience-based choice examined judgment bias because of its limited role in explaining the experience-description choice gap (Fox & Hadar, 2006; Hau, Pleskac, Kiefer, & Hertwig, 2008). Our results indicate that broad bracketing increases the choice share of options judged as offering the best overall outcome. Understanding what influences judgment bias in experience-based choice is therefore crucial for explaining and predicting choice in environments that promote the consideration of multiple choices (e.g., when offered rewards pertain to a set of choices).

Our results have several important practical implications. First, our findings suggest that investors who are encouraged to consider the long term or aggregate consequences of their choices may allocate more to stocks over bonds (i.e., to maximize EV, see Benartzi & Thaler, 1995; 1999) even without changing the number of choices made and the number of times feedback is received (Gneezy & Potters, 1997; Thaler et al., 1997). For instance, regulators may implement a procedure whereby investors are prompted to indicate their preferred portfolio allocation for the next 20 years before being allowed to change their current asset allocation, or to imagine themselves in 20 years before making current changes to their asset allocation. Future research could examine the effectiveness of such a manipulation on maximization.

The present findings may also help managers optimize reward programs. Specifically, firms using a depth pricing strategy, which typically leads to relative low average prices perceptions (Alba et al., 1999; Danziger et al., 2014), should benefit from reward programs that reward customers for completing multiple purchases or provide rewards that may be applied to multiple purchases (i.e., encourage broad bracketing). However, firms using a frequency pricing strategy, which typically leads to relative high perceptions of average prices, should benefit from reward programs that reward individual purchases (i.e., encourage narrow bracketing).

Future research may examine additional methods for prompting broad bracketing in experience-based choice. For example, broad bracketing may be primed through psychological distance, by portraying experience-based choice as pertaining to distant time, places, people or hypothetical scenarios (Trope & Liberman, 2010).

One limitation of this research is the fact that the outcome distributions were fixed. In reality, outcome distributions are dynamic. For example, retailers change their pricing schemes (e.g., during the holidays season) and speed on fast lanes my change with the time of the day. Future research may examine the robustness of our findings to dynamic outcome distributions.

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Table 1

Price distributions and choice shares (Study 1)

			Choice share of the Depth option		
Cheaper distribution	**Frequency**	**Depth**	**Baseline choice**	**Broad bracketing**	**Narrow bracketing**
Frequency	-11, .7; -14 [a] -11.9 [b]	-9, .2; -14 -13	40	30	50
Depth	-13, .7; -14 -13.3	-5, .2; -14 -12.2	44	58	44

[a]. Outcome distribution.

[b]. EV.

Table 2

Regression results (Study 1)

	Coefficient (std error)	*p*-value	Odds ratio
Predictor variables:			
Cheaper option (0 = frequency, 1 = depth)	-0.97 (0.73)	0.184	0.247
Choice bracketing (0 = narrow, 1 = broad)	–1.42 (0.79)	0.071	0.389
Cheaper option x Choice bracketing	2.37 (1.06)	0.026	10.686
% depth choices on pre-bracketing manipulation trials (1-20)	6.92 (2.04)	<.001	1014.502
Intercept	–2.51 (0.88)	0.005	0.079
Decomposition of Interaction term:			
Effect of Cheaper price at Broad bracketing	1.40 (0.74)	0.057	
Effect of Cheaper price at Narrow bracketing	-0.97 (0.73)	0 .184	

Table 3

Price distributions, average price judgments, and choice shares (Study 2)

				Choice share of the Depth option		
Options	**Constant**	**Depth**	**Judged as cheaper[a]**	**Baseline choice**	**Broad bracketing**	**Narrow bracketing**
Distribution	-8.39	-4.89, .3; -9.89	Constant	43	22	44
EV	-8.39	-8.39	Same	54	39	67
Judgment	-8.20	-7.86	Depth	56	59	58

[a] We classified the continuous variable of the judged average price difference variable to three categories for illustrative purposes. "Constant" ["Depth"] denotes that the average price of the constant [depth] option was judged as lower that the average price of the depth [constant] option. "Same" denotes that the average price judgments of the two options were the same.

Table 4

Regression results (Study 2)

	Coefficient (std error)	*p*-value	Odds ratio
Predictor variables:			
Choice bracketing (0 = narrow, 1 = broad)	-0.65 (0.32)	0.044	1.917
Judged average price difference (Constant – Depth)	–0.34 (0.15)	0.026	1.411
Choice bracketing x Judged average price difference	0.34 (0.15)	0.024	0.712
% depth choices on pre-bracketing manipulation trials (1-20)	2.12 (0.74)	0.005	8.349
Intercept	–2.27 (0.60)	0.66	0.208
Decomposition of Interaction term:			
Effect of Judged average price difference at Broad bracketing	0.34 (0.15)	0.022	
Effect of Judged average price difference at Narrow bracketing	0.004 (0.01)	0 .572	

Table 5

Time distributions (Study 3)

Trials		**Frequency distribution**			**Constant distribution**
		Regular trials (30%)	Fast trials (70%)	Total	
1 - 20	Time range	73 - 77	23 - 27	23 - 77	37 - 43
	Average time	75	25	40	40
	Time SD	1.5	1.2	23.5	1.5
21 - 40	Time range	72 - 75	20 - 25	20 - 75	34 - 43
	Average time	74	23	38	38
	Time SD	1	1.7	24	2

Table 6

Average time judgments and choice shares (Study 3)

			Choice share of the Frequency option		
Options	**Judgment**	**Judged as faster[a]**	**Baseline choice**	**Broad bracketing**	**Narrow bracketing**
Constant	38.90	Constant	58	37	50
Frequency	34.74	Same	57	70	65
		Frequency	64	80	71

[a] We classified the continuous variable of the judged average time difference variable to three categories for illustrative purposes. "Constant" ["Frequency"] denotes that the average time of the constant [Frequency] option was judged as lower (faster) that the average time of the depth [Frequency] option. "Same" denotes that the average time judgments of the two options were the same.

Table 7

Regression results (Study 3)

	Coefficient (std error)	*p*-value
Predictor variables:		
Choice bracketing (0 = narrow, 1 = broad)	0.15 (0.04)	0.692
Judged average time difference (Constant – Frequency)	–0.004 (0.01)	0.417
Choice bracketing x Judged average time difference	0.008 (0.003)	0.013
% frequency choices on pre-bracketing manipulation trials (1-20)	0.53 (0.10)	<.001
Intercept	0.29 (0.09)	0.001
Decomposition of Interaction term:		
Effect of Judged average time difference at Broad bracketing	0.012 (0.002)	<.001
Effect of Judged average time difference at Narrow bracketing	0.004 (0.002)	0 .082

Table 8

Price distributions, average price judgments, and choice shares (Study 4)

						Choice share of the Depth option		
Cheaper			**Judgment**		**Judged as**	**Baseline**	**Broad**	**Narrow**
option	**Freq.**	**Depth**	**Freq.**	**Depth**	**cheaper[a]**	**choice**	**bracketing**	**bracketing**
Freq.	-8, .5; -13[b]	-5.5, .2; -13	-10.4	-10.0	Freq.	26	16	24
	-10.5[c]	-11.5			Same	47	23	27
					Depth	35	44	48
Depth	-12, .5; -13	-5.5, .2; -13	-12.6	-10.1	Freq.	29	60	27
	-12.5	-11.5			Same	-[d]	-	-
					Depth	58	70	69

[a] We classified the continuous variable of the judged average price difference variable to three categories for illustrative purposes. "Freq." ["Depth"] denotes that the average price of the frequency [depth] option was judged as lower that the average price of the depth [frequency] option. "Same" denotes that the average price judgments of the two options were the same.

[b]. Outcome distribution.

[c]. EV.

[d]. None of the participants judged the average price of both options as the same when the depth option was actually cheaper.

Table 9

Regression results (Study 4)

	Coefficient (std error)	*p*-value
Predictor variables:		
Cheaper option (0 = frequency, 1 = depth)	0.168 (0.028)	<.001
Choice bracketing (0 = narrow, 1 = broad)	-0.054 (0.028)	0.059
Judged average price difference (Frequency - Depth)	–0.010 (0.009)	0.271
Choice bracketing x Judged average price difference	0.031 (0.012)	0.008
% depth choices on pre-bracketing manipulation trials (1-40)	0.858 (0.050)	<.001
Intercept	0.037 (0.028)	0.187
Decomposition of the moderated mediation:		
Effect of Judged average price difference at Broad bracketing	0.037 (0.017)	95% CI = [.005, .072]
Effect of Judged average price difference at Narrow bracketing	-0.018 (0.022)	95% CI = [-.066, .021]