Choice Bracketing and Construal Level Theory: The Effects of Problem Representation and Mental Representation on Sequential Risk-Taking

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Abstract

Two important theories in intertemporal choice are choice bracketing and construal level theory (CLT), but their relationship to each other is unexplored. Broad bracketing (considering many choices in a sequence) may induce a more holistic approach to decisions, suggesting overlap between choice bracketing and CLT. We attempt to integrate the theories and distinguish their effects on risk-taking. In three studies we demonstrate that construal level (manipulated through temporal distance) and choice bracketing have independent effects on risk-taking. Greater temporal distance and broader choice brackets both significantly increase risk-taking, even controlling for both manipulations simultaneously. We also test and find that temporal distance acts through mental construal, and its effect on risk-taking is mediated by risk perception, while bracketing acts through another mechanism. Taken together, our results indicate that choice bracketing, a well-accepted result in the decision-making literature, is independent from construal level theory. This finding has important implications for financial decision-making and other consumer-related choices that take place over time or wherein consumers must make decisions for the future.

Keywords: choice bracketing, construal level theory, intertemporal choice, behavioral economics

Introduction

Investigating risk-taking is important for consumer research because it directly relates to whether consumers try new or innovative products. For example, past research has found that consumers prefer products congruent with a product category schema in the face of high perceived risk (Campbell and Goodstein 2001); that the ease of recalling product failures is associated with higher perceived risk (Folkes 1988); that warranty quality and price can reduce consumers' financial risk perceptions about trying a new product (Shimp and Bearden 1982); and that consumers use brand loyalty as a risk reduction process (Sheth and Venkatesan 1968). In this sense, investigating risk preferences and perception can help researchers understand when and why consumers try new products and switch to different products, as well as how they mitigate product risk.

A consumer's decision process with regards to risk-taking and risk perception is multi-dimensional and complex. Bauer (1960) was the first to propose "consumer behavior as an instance of risk taking." Under this conceptualization, any decision that a consumer makes carries with it consequences that cannot be foreseen with complete certainty and which involve the potential for negative outcomes (Bauer 1960). However, we do not often see consumers paralyzed by uncertainty and unable to make product decisions quickly or easily. It is in understanding how individuals weight different consequences (or disregard some altogether) that risk perception and models of decision-making under risk can be especially important.

Perhaps the largest determinant of risk-taking and risk evaluation is the subjective judgment of risk known as risk perception. Individuals may appear comparatively risk averse or risk-seeking in a given situation, but if measurements of subjective risk perception are taken, most of the individual differences in risk-taking come down to how risky that individual

perceives that risk to be. Past research has highlighted that differences in risk-taking across individuals and domains (e.g., financial, gambling, ethical) are due to individual differences in risk perception, not risk attitude (Weber et al. 2002; Weber and Hsee 1998). Accordingly, individuals may be early adopters in one product category, but may wait to purchase in others, based on the risk perception they associate with different new products.

In considering risks, a consumer is often biased by various mental shortcuts used in decision-making. These include judging a risky prospect by the most readily available outcomes (availability), making decisions based on affect, and ignoring extremely unlikely outcomes irrespective of their magnitude (Kahneman and Tversky 1982; March and Shapira 1987; Slovic et al. 2002). Individuals often base their perceptions of risk on their own experiences or the relevant experiences of others. For this reason, individuals may overweight the probability of a rare event if they can think of many instances of its occurrence, and they may underweight or disregard the probability of a more common event for which they have received little or no feedback (Slovic 1987; Slovic et al. 1978; Slovic et al. 1982). Further, whether individuals consider risks in isolation or as part of a longer history of risk-taking can affect their decision to take a risk. For example, if a consumer only considers the immediate impact of trying a new product, he/she may decide not to buy, whereas if he/she was to consider using the product for several years, he/she may decide that the risk is minimal compared to the stream of benefits that could accrue over time (Benartzi and Thaler 1995; Read et al. 1999).

Underweighting the effect of time or temporal context also has important implications for consumer products that are inherently time-sensitive, such as financial products. For example, if an individual is allocating funds across a 401k, he/she may be influenced by the temporal distance inherent to the problem itself (i.e., considering a product that will not be consumed in

the foreseeable near future). Similarly, if an individual receives regular feedback about the performance of that 401k, he/she may overreact to short run changes in the value of the investment without considering the total amount of time that the product will be held. In other words, if each statement can be thought of as a single "trial" in which the individual receives investment feedback, the investor may underweight the number of trials that will occur over his/her lifetime and may change his/her allocation based on this insensitivity to the number of trials (the amount of time that will elapse). For this reason, understanding how individuals make decisions for the future and how the combination of several choices and feedback about those choices over time impacts the initial decision is especially important. Two theories of intertemporal choice, choice bracketing and Construal Level Theory (CLT), are important inputs into understanding these types of long-run consumer choices.

Theoretical Background

Choice Bracketing

When an individual encounters a choice, that choice can either be considered as a solitary decision or it can be linked to past or future choices, and this consideration can impact the individual's ultimate decision. Choosing differently depending on whether a choice is considered in isolation or as part of a longer choice history is called a bracketing effect (Read et al. 1999). Choices considered alone or as part of a very small set are referred to being in a narrow bracket, while choices that are considered together or as part of a larger set or sequence are referred to as being in a broad bracket. Broad bracketing induces a more holistic approach to decisions such that individuals view the consequences that each choice has on the other, as well as the potentially cumulative effects those choices can have. Choice bracketing can be found in many well-documented phenomena including myopic loss aversion (Benartzi and Thaler 1999; Gneezy

and Potters 1997); simultaneous and sequential choice effects (Simonson 1990); the evaluability hypothesis (Hsee 1996); partition dependence (Fox et al. 2005); and decision framing (Kahneman and Lovallo 1993).

Choice bracketing has specific implications for risk-taking. Broad brackets often shift the focus of risky decisions from local considerations, such as losses, to more gestalt considerations such as aspiration levels or diversification (Read et al. 1999). Further, when risks are combined, potential losses from one choice can be offset by potential gains from another choice. In their paper on choice bracketing, Read et al. (1999) suggest that risk aggregation may result in lower perceived risk for a series of gambles compared to any individual gamble. This holds especially when the gambles are uncorrelated or negatively correlated, but can also be found when the risks are positively correlated.

One of the better-known applications of risky choice and temporal bracketing is myopic loss aversion (Benartzi and Thaler 1995; Benartzi and Thaler 1999; Thaler et al. 1997). According to myopic loss aversion, individuals bracket their choices too narrowly and thus overweight losses. If, however, individuals are forced to broadly bracket those choices by considering a longer time horizon, the likelihood of losses diminishes and the overall distribution of aggregated outcomes emerges, reducing the focus on losses and the results of loss aversion.

In theorizing why individuals may bracket choices the way they do, Read et al. (1999) propose four possible determinants of bracketing: cognitive capacity limitations, cognitive inertia, pre-existing heuristics, and motivation. While these determinants describe situational factors that induce choice brackets, there has been little investigation into the process behind bracketing: how does bracketing change choices—is it simply situational or does it change the mental representation of objects and outcomes? Do different brackets change underlying beliefs

and perceptions, or do they just directly change choice preferences? More generally, these questions lead to an investigation of the overlap (if any) between choice bracketing and CLT. Do different brackets induce a different mental construal of choices? In other words, does construal level serve as a mediator for bracketing? Or, are the effects of construal level and bracketing separable? In this paper, we attempt to integrate the two theories and uncover where there may be overlap or distinction in their predictions.

Construal Level Theory (CLT)

An important theory in intertemporal choice is that of construal level. Construal Level Theory (CLT) finds that choices are influenced by psychological distance. Choices that are more distant psychologically are mentally construed in a different fashion than choices that are psychologically closer. Psychological distance can be manipulated in different ways—one common method being through the use of time. Under this conception of psychological distance, far future events are construed at a higher-level than near future events. Higher construal levels are associated with more schematic and abstract mental representations, while lower construal levels are associated with more concrete, less abstract representations (Morales et al. 2005).

An important aspect of the theory is that construal level does not inherently change anything about the choices or information being evaluated, rather, the same information is simply represented in a different way—either at a higher (more abstract) level or a lower (more concrete) level. Further, this construal effect can work in both directions such that a distant timeframe can induce a higher-level construal and a higher-level construal can induce the perception that objects or activities are more distant (Liberman et al. 2002).

CLT has been applied to many different situations including scale measurement (Krishna et al. 2008; Maglio and Trope 2011); moral judgment (Eyal et al. 2008); self-control (Fujita et al.

2006b); and categorization (Liberman et al. 2002). Another important area where CLT has made important contributions is that of risk-taking. This research has found that greater psychological distance increases the weight of payoffs relative to probability (Sagristano et al. 2002); that probability itself can influence mental construal such that lower probability events are construed at a higher level relative to more likely events (Todorov et al. 2007; Wakslak et al. 2006); and that high-level construals lead to lower probability assessments (Wakslak and Trope 2009).

More generally, the research on CLT has highlighted two main dimensions closely related to construal level: feasibility and desirability. Feasibility is associated with how an activity is completed or a goal is attained, which represent lower-level considerations. Conversely, desirability is associated with why an activity is completed or a goal is created, which represent higher-level considerations (Morales et al. 2005). This distinction between feasibility (low-level construal) and desirability (high-level construal) also fits in nicely with explorations of risk-taking preferences. Specifically, outcomes can be conceptualized as the desirability dimension, while probabilities coincide with the feasibility dimension. Thus, CLT predicts that when making decisions over risky prospects, individuals will weight probability (feasibility) higher in the near-future, and payoffs (desirability) higher in the far-future (Morales et al. 2005; Sagristano et al. 2002).

Risk Preference vs. Risk Perception

Before investigating the effects of CLT and bracketing on risk-taking, an important distinction related to risk must be made. When contemplating choices involving risk, individuals have two measurable inputs: preference and perception. Risk preference is measured through the likelihood or willingness to take a risk (a choice) and is thought to represent the actual utility that comes from taking or not taking the risk, including receipt of the outcome. Risk perception is

measured as a judgment about the risk and represents the beliefs or feelings that individuals have about the risk itself. Thus, risk perception is more of a gut-level assessment of the risk involved with a given activity or choice. It can be tied to outcomes or past experience, but it may also remain stable in the face of such contextual features. These two inputs are often highly correlated, but there are variables that can affect one and not the other. Past research has shown that individual differences in risk-taking across domains (e.g., financial, social, recreational) are primarily attributable to individual differences in risk perceptions for those risks (Blais and Weber 2006; Weber et al. 2002). For example, research demonstrates that individuals who are more likely to take financial risks see these risks as relatively less risky than other types of risk. Thus, there is a distinction made between a general risk attitude, and more specific risk beliefs.

The division between risk preference and risk perception is important when considering both choice bracketing and CLT. Neither theory has investigated whether the impact on risky choice is driven through changes in preferences or perception. While the theory on choice bracketing has posited that risk aggregation makes the combined risks appear less risky, little research has specifically addressed this question. In their research on risk categorization for sequential risks, Webb & Shu (2013) demonstrated that bracketing manipulations affected risk preferences but not risk perceptions. In other words, participants were more likely to take risks when considered under a broad bracket, but risk perception for such risks remained the same regardless of the bracket manipulation (Webb and Shu 2013). In research combining risk-taking and CLT, researchers have focused on risky choices made without specifically addressing whether higher-level construals change beliefs related to the risks being contemplated. While Sagristano et al. (2002) do demonstrate that temporal distance does not affect estimates of the likelihood of winning, this does not rule out the possibility that risk perception is changing (as

beliefs can be affected by factors other than probabilities and optimism). This question of how the two theories, choice bracketing and CLT, differentially affect risk preference and risk perception is the primary focus of this paper. Consistent with recent findings, we predict that choice bracketing will affect risk-taking propensity, but not risk perception, such that broader brackets will result in increased risk-taking relative to narrow brackets but no difference in risk perception will arise. For CLT, the prediction is less clear. When controlling for the effects of temporal bracketing, we predict that CLT will not have an additional effect on risk-taking; however, we do predict that construal level will impact risk perception. Since CLT affects the mental representation of risky activities, we posit that this representation affects risk perception such that higher-level construals result in lower risk perceptions (feelings and beliefs that the risks are less risky) relative to lower-level construals.

In the following sections we present three studies that examine the simultaneous and separable effects of temporal distance and choice bracketing on risk-taking. These studies are summarized in Table 1. In Study 1, we replicate a study from Benartzi & Thaler (1999) to demonstrate that choice bracketing and temporal distance have distinct effects on risk-taking preferences and that the effects of temporal distance are mediated by risk perception. Further, we show that temporal distance and mental construal each increase risk-seeking over mixed gambles, but decrease risk-seeking over pure-loss gambles. In Study 2, we use a different manipulation of choice bracketing to show that bracketing's effect on risk-taking is not enacted through mental construal. In other words, broader brackets are not inducing a more abstract mindset as they increase risk-taking. Finally, in Study 3, we combine two types of choice bracketing (problem bracketing and outcome bracketing) and temporal distance to directly show that bracketing and temporal distance work through different mechanisms to affect risk-taking.

We show that temporal distance affects mental construal to increase risk-taking, while choice bracketing does not significantly affect mental construal.

[INSERT TABLE 1 ABOUT HERE]

Study 1: Myopic Loss Aversion and Temporal Construal

In Study 1 we examine the intersection of temporal bracketing and temporal construal on risk-taking preferences and perception. Using a replication of the temporal bracketing manipulation used by Benartzi & Thaler (1999), we examine how bracketing and construal interact to differentially impact myopic loss aversion by adding a temporal distance manipulation. According to a temporal bracketing and myopic loss aversion hypothesis, we should see that individuals are more likely to take gambles presented in distributional format versus static format as they focus less on losses in the distributional format. According to a temporal construal hypothesis, individuals are more likely to take gambles in the distant-future than the near-future, but distributional format should not affect risk-taking as the underlying probability/outcome (feasibility/desirability) features of the risks are not changing based on format. Another important contribution of Study 1 is the investigation of pure-loss gambles. Neither temporal bracketing nor CLT has specifically addressed pure-loss gambles empirically. We add four pure-loss gambles—two in static format, and two in distributional format—to assess how each are affected by temporal construal and temporal bracketing. Further, we also ask participants for risk perception ratings for all risks. This will allow us to make a further distinction as to whether temporal bracketing and temporal construal affect preferences, perception or both.

Method

Study 1 was conducted online through Amazon's Mechanical Turk ("MTurk"). This study is a replication of Benartzi & Thaler (1999)'s Study 2 with the addition of a between-subjects temporal construal manipulation and four pure-loss gambles. In their Study 2, Benartzi & Thaler (1999) ask participants to consider N independent trials of a bet with a probability p of winning an amount x, and a probability $1 - p$ of losing an amount y. The bets were designed according to three types: (1) Gamble High Amount to Lose: 90% chance to win \$0.10, 10% chance to lose \$0.50, $N = 150$; (2) Gamble Medium Amount to Lose: 50% chance to win \$0.25, 50% chance to lose \$0.15, $N = 120$; and (3) Gamble Low Amount to Lose: 10% chance to win \$0.75, 90% chance to lose \$0.01, $N = 90$. These gambles have approximately the same payoff distributions, but different characteristics. In the questionnaire presented, some of the questions show the gambles in "static format" (described by probability, payoffs and number of trials) and some of the questions show the gambles in "distributional format" (a visual representation of the gamble with payoff amounts and probabilities of those payoffs shown visually).

143 participants ($M_{age} = 31.7$ years, 60% male) were randomly assigned to one of two temporal construal conditions: Near-Future or Far-Future. Participants in the Near-Future condition were asked to evaluate gambles that would be played today; participants in the Far-Future condition were asked to evaluate the same gambles, but were told that the gambles would be played out in one month. Participants in both conditions evaluated the same fourteen gambles. In the first twelve problems, participants were asked to choose between the gamble and a certain amount (or indifference between the two). The first eight of these twelve gambles were mixed gambles (outcomes included gains and losses), while the other four gambles were pure-loss gambles (outcomes were only over losses). For the last two questions, participants were asked to make estimates as to the likelihood of losing money after all trials were completed. To ensure

incentive compatibility, participants in both conditions were told that ten participants would be chosen at random to have one of their choices from the first eight questions played out. If a participant chose the certain amount, he/she would be paid the certain amount in addition to his/her payment for participation; if he/she chose the gamble, the gamble would be played out by a series of random draws and he/she would be paid that amount accordingly. Of course, playing a mixed gamble entails a very small probability of a loss. Participants were told that in the event of this unlikely outcome, they would be expected to payoff their losses by taking additional surveys at a rate of $8.00 per hour. Participants in the Near-Future condition were told potential bonus payments would be made today; participants in the Far-Future condition were told potential bonus payments would be paid in one month.

Results

Choice Bracketing

First, we compared our results to those of Benartzi & Thaler's (1999), collapsing across the time-construal manipulation. In Figure 1, looking at the choices across the three static format gambles, we find that there is no significant difference between the choice of the gamble and the certain amount. In their original study, Benartzi & Thaler (1999) found that more participants were willing to accept the gamble with the lower amount to lose compared to the higher amount to lose. In our study, we found that 38% of participants accepted the low amount to lose gamble, and the same number (38%) accepted the high amount to lose gamble. A chi-square test across all three gambles did not show a significant difference in willingness to accept the gamble ($\chi^2(4) = 4.323$, $p = 0.364$).

[INSERT FIGURE 1 ABOUT HERE]

Comparing the acceptance rates for the static gambles to that of the distributional format, we see a significant bracketing effect: while approximately 38% of participants were willing to accept any one of the three static format gambles,85% of participants were willing to accept the gamble when presented in distributional format (chi-square tests comparing each of the static-format gambles to the distributional format gamble are significant at the $p < 0.001$ level). This holds even when the distributional format includes the far left tail of the distribution (the very unlikely outcomes on both ends of the distribution were truncated for the first distributional format gamble): 74% of participants were still willing to accept the distributional format of the gamble even when the unlikely loss outcomes were displayed (again, chi-square tests comparing each of the static-format gambles to the distributional format gamble are significant at the $p < 0.001$ level). These results confirm Benartzi & Thaler's (1999) findings with regard to distributional format (a bracketing effect).

This result for distributional format versus static format still holds for the high-stakes version of the gambles (in the high-stakes gambles, the payoffs for the static format of the medium amount to lose gamble and the distributional format gamble are multiplied by 10). 36% of participants were willing to accept the high-stakes gamble when displayed in static format, while 83% of participants were willing to accept the high-stakes gamble when displayed in distributional format ($\chi^2(2) = 75.364$, $p < 0.001$).

After reviewing the gambles used by Benartzi & Thaler (1999), we turn to the pure-loss gambles, which were not previously evaluated in their paradigm. In Study 1, we asked about four pure-loss gambles. Loss Gamble 1 had a 90% chance of a loss of $0.10, a 10% chance of a loss of $0.50, and was repeated 50 times. Loss Gamble 2 had a 50% chance of a loss of $0.15, a 50% chance of a loss of $0.25, and was repeated 35 times. Loss Gamble 3 had a 10% chance of a loss

of $0.75, a 90% chance of a loss of $0.01, and was repeated 80 times. The distribution of outcomes across all loss gambles is the same and the certainty equivalent offered for each gamble was -$4. Finally, we also asked participants whether they would accept a pure-loss gamble that was displayed in distributional format. The distribution of this gamble represents the distribution of the pure-loss gambles (all three of which have an equivalent distribution, though different attributes). According to prospect theory (Kahneman and Tversky 1979), participants should be risk-seeking for pure-loss gambles. Thus, we predict that translating the gamble to distributional format should reduce risk-seeking, as participants underweight the number of repeated plays as they did with the positive expected-value gambles. In the case of pure-loss gambles, however, underweighting the number of trials results in exposure to greater losses (rather than gains) and significantly fewer participants should be willing to take the gamble.

The results, shown in Figure 2, confirm our predictions: comparing the willingness to accept for the static-format loss gambles to the distributional format, we see a significant reduction in risk-seeking for the distributional representation of the gambles: while 43%-59% of participants were willing to accept the loss gambles in static format, only 13% of participants accepted the loss gamble when displayed in distributional format (pairwise comparisons between all loss gambles and the distributional format loss gamble are significant at the $p < 0.001$ level). It should be noted that the distribution displayed to participants was truncated to exclude extremely unlikely outcomes on both sides of the distribution.

[INSERT FIGURE 2 ABOUT HERE]

Temporal Construal

So far, the results have only focused on comparisons across gamble types and decision frames (i.e., broad or narrow bracketing). Next, we turn to the results related to temporal

construal. Half of participants were asked to rate gambles that would take place today (Near-Future), while the other half of participants were asked to rate gambles that would take place one month from today (Far-Future). According to CLT, individuals should be more likely to accept Far-Future gambles than Near-Future gambles. As shown in Figure 3, this is what we see: 47% of participants are willing to accept mixed gambles in the Far-Future condition, while only 30% of participants are willing to accept these gambles in the Near-Future condition ($\chi^2(2) = 13.032$, $p < 0.001$).

[INSERT FIGURE 3 ABOUT HERE]

We can also look at the static format gambles individually to confirm that individuals in the Near-Future condition focus on feasibility (probability) while participants in the Far-Future condition focus on desirability (outcomes). According to CLT, participants in the Near-Future condition should be more willing to take the high amount to lose gamble because it has the highest probability of winning and the lowest probability of losing compared to the low amount and medium amount to lose gambles. For the low amount to lose gamble, 30% of participants are willing to accept this gamble in the Near-Future condition, compared to 46% of participants in the Far-Future condition ($t(135.10) = 1.97$, $p = 0.05$). This implies that participants in the Far-Future condition are more focused on potential payoffs than participants in the Near-Future condition since this gamble offers the highest potential payoff, but at the lowest probability. For the high amount to lose gamble, we should see a reversal, however, we do not see a significant difference between the two conditions: 33% of participants accept this gamble in the Near-Future condition, compared to 43% in the Far-Future condition ($p = 0.21$). The most significant difference between the two conditions is for the medium amount to lose gamble: 28% of participants in the Near-Future condition accept this gamble compared to 51% in the Far-Future

condition ($t(133.44) = 2.88$, $p < 0.005$). While this could suggest that participants in the Far-Future condition are more focused on the payoffs (the win payoff is greater than the lose payoff), we would expect this focus on payoffs to also be confirmed in the comparison for the high amount to lose gamble. Overall, these results imply that the Near-Future condition (a concrete mindset) decreases myopic loss aversion relative to an abstract mindset by shifting the focus to probabilities instead of payoffs.

Previous CLT studies have also never addressed pure-loss gambles. From prospect theory, we know that individuals are risk-seeking, or more likely to gamble over pure-losses than over mixed or pure-gain gambles. If increased temporal distance shifts the focus from concrete to more abstract features of the gamble, this would imply that individuals in the Far-Future condition should be less likely to accept the pure-loss gambles than participants in the Near-Future condition. If we evaluate choices across the pure-loss gambles, this is exactly what we see: participants in the Far-Future condition accept the gamble less on average (and the certainty equivalent more) than participants in the Near-Future condition ($\chi^2(2) = 8.29$, $p = 0.016$).

We can also look at the individual gambles to see how contemplating pure-loss gambles changes the relative weights of probabilities versus payoffs. If temporal distance leads to a focus on desirability, how does this play out in gambles over pure losses? A focus on outcomes could lead to a relative increase in the choice of either the gamble with the smallest possible loss (the lowest loss option, e.g., a loss of \$0.01) or the gamble that minimizes the largest possible loss (e.g., a maximum loss of \$0.25 vs. a maximum loss of \$0.75). If we look at the choices across loss gambles in the Far-Future condition, we can attempt to answer this question. For the first loss gamble, in which participants have a 90% chance of losing \$0.10 and a 10% chance of losing \$0.50, 49% participants in the Far-Future condition chose to accept this gamble; for the

second loss gamble, in which participants have a 50% chance of losing $0.15 and a 50% chance of losing $0.25, 39% of participants chose to accept this gamble; and finally, in the third loss gamble, in which participants have a 10% chance of losing $0.75 and a 90% chance of losing $0.01, 55% of participants chose this gamble. While the distribution of choices across the three gambles in the Far-Future condition is not significantly different, it does imply that participants in the Far-Future condition focused on the smallest possible loss (90% chance of $0.01) versus minimizing the largest possible loss.

Evaluating the loss gambles in the Near-Future condition we see that 57% of participants chose loss gamble 1, 47% chose loss gamble 2, and 62% chose loss gamble 3. This choice pattern replicates that of the Far-Future condition. As with the Far-Future condition, the distribution of choices across these gambles is not significantly different. This choice pattern suggests that participants focused on the probability of the lowest possible loss, as the most frequently selected gamble (loss gamble 3) has the highest probability of the lowest loss (90% chance of losing $0.01). Thus, the results seem to confirm that less psychological distance increases the weight of feasibility (probability) over desirability (payoffs), though the reverse (focusing on desirability as temporal distance increases) cannot be said for pure-loss gambles.

Bracketing & Construal Combined

We've now analyzed the separate effects of CLT and bracketing, but how do the two manipulations interact? To investigate this question, we have to look at the effects of temporal construal on bracketed versus non-bracketed questions. First we look at the results for the mixed gambles. Table 2 shows the results of several ordered logistic regressions. In Model 1, we ran an ordered logistic regression of choice (-1 = prefer certain outcome, 0 = indifferent between gamble and certain outcome, 1 = prefer gamble) on problem format (1 = distributional format, 0

= static format). This regression shows a significant positive effect of distributional format (β = 2.05, $p < 0.001$). In Model 2, we performed an ordered logistic regression of choice on construal level (0 = Near-Future, 1 = Far-Future). This regression also shows a significant positive effect of temporal distance (β = 0.49, $p < 0.01$). In Model 3, an ordered logistic regression with both distributional format and construal level shows that both variables are still significant and positive ($\beta_{temporal\_construal}$ = 0.60, $p < 0.01$, $\beta_{distributional\_format}$ = 2.09, $p < 0.001$). Finally, in Model 4, an ordered logistic regression with an interaction between distributional format and construal level does not show a significant effect: $\beta_{interaction}$ = -0.41, p = 0.38). The simple effect of both construal level (β = 0.72, $p < 0.01$) and distributional format (β = 2.26, $p < 0.001$) remain positive and significant. Further, a comparison of the two coefficients demonstrates that the simple effect of bracketing on willingness to gamble is over three times as great as the independent simple effect of temporal distance. The results from these regressions confirm that temporal distance and bracketing have separate and distinct effects on risk-taking.

[INSERT TABLE 2 ABOUT HERE]

While temporal distance and broad bracketing have significant positive effects on risk-seeking for mixed gambles, these variables have different effects on pure-loss gambles. Again, we ran a series of logistic regressions on the pure-loss gambles, with the results shown in Table 3. First, in Model 1, an ordered logistic regression of choice on problem format shows a significant negative effect of distributional format (β = -1.78, $p < 0.001$). This is opposite the effect for mixed gambles. In Model 2, an ordered logistic regression of choice on construal level shows a marginally significant negative effect of temporal distance on risk-seeking over losses (β = -0.38, p = 0.07). In Model 3, an ordered logistic regression with both distributional format and construal level shows a significant negative effect for broad bracketing and a marginally

significant negative effect of temporal distance ($\beta_{temporal\_construal}$ = -0.44, p = 0.07, $\beta_{distributional\_format}$ = -1.80, p < 0.001). Again, this shows that temporal distance and broad bracketing have significant independent effects on risk-taking over pure-loss gambles, though broad bracketing has a larger and more significant impact on risk aversion over losses. Finally, in Model 4, an ordered logistic regression of choice on the interaction between construal level and distributional format is similar to the results for the mixed gambles: $\beta_{interaction}$ = -0.24, p = 0.60). The simple effect for distributional format remains negative and significant (β = -1.71, p < 0.001), while the simple effect for temporal distance is no longer significant (β = -0.40, p =0.13). Again, for pure-loss gambles, the effect of broad bracketing is greater and, in this case, more significant than the impact of temporal distance.

[INSERT TABLE 3 ABOUT HERE]

Risk Perception

Thus far we have only looked at the results for risk preference (choice) without considering any potential effects on risk perception (judgment). We asked for a risk perception rating for each risk that participants encountered using a 7-point scale from 1 (Not at all Risky) to 7 (Extremely Risky). The results of several ordered logistic regressions across all gamble types are shown in Table 4. As would be expected, risk perception has a significant negative effect on risk-taking across all gambles. In line with our predictions, the results further show that temporal construal affects risk perception, while choice bracketing does not. In Model 1, an ordered logistic regression of choice on problem format and risk perception shows a significant negative effect of risk perception (β = -0.38, p < 0.001) and a significant positive effect of the distributional problem format (β = 0.58, p < 0.001). However, an ordered logistic regression of

choice on construal level shows only a negative effect for risk perception (β = -0.38, $p < 0.001$), with the effect of temporal distance no longer significant ((β = 0.09, p = 0.43). Further, an ordered logistic regression of choice on risk perception and both problem format and construal level shows that with all variables included, risk perception has a significant negative effect on choice (β = -0.37, $p < 0.001$), and problem format continues to have a significant positive effect on choice (β = 0.58, $p < 0.001$), while temporal construal no longer has a significant effect (β = 0.09, p = 0.40). This confirms that risk-seeking is decreased as risk perception increases and is increased for broader bracketing, even controlling for the effect of risk perception. The latter cannot be said for temporal construal—once risk perception is controlled for, temporal distance no longer increases risk-seeking.

[INSERT TABLE 4 ABOUT HERE]

These results suggest that risk perception mediates the effect of temporal construal. We investigated this possibility by running the Preacher & Hayes (2008) bootstrapped mediation analysis, with choice as the dependent variable, temporal construal as the independent variable, and risk perception as the mediator (Zhao et al. 2010). The results from this analysis show a significant indirect-only mediation ($a \times b$ = 0.04, p = 0.018, bias-corrected 95% confidence interval: 0.006, 0.065). Other results from the mediation analysis are reported in Figure 5 below. These results confirm that risk perception mediates temporal construal.

[INSERT FIGURE 5 ABOUT HERE]

Study 2: Outcome Bracketing & Temporal Construal

In Study 2, we attempt to determine whether bracketing and temporal construal are completely separable, or whether there may be overlap in their effects. In other words, while we know from Study 1 that choice bracketing and temporal construal act in different ways to affect

risk-taking, we cannot rule out the possibility that choice bracketing may be simultaneously affecting problem framing and mental construal. It may be that choice bracketing leads to a different type of mental construal that compounds the effect of the temporal construal manipulation used in Study 1. To rule out this possibility and demonstrate that bracketing and construal have independent and separable effects, we use a replication of Gneezy & Potters' (1997) bracketing experiment with the addition of a dependent measure (rather than a manipulation) of mental construal. We hypothesize that choice bracketing and mental construal are unrelated—that choice bracketing should not have a significant effect on mental representation (abstract vs. concrete) nor will construal level mediate the effect choice bracketing has on risk-taking. Note that since construal level is a measured variable in this study, we may not have enough variance in this metric to find a significant effect of individual differences in construal level on risk-taking propensity, nor is this question of individual differences in construal a focus of this study.

Method

Study 2 was conducted online using 153 participants (M_{age} = 31.4 years, 54% male) on Amazon's MTurk. This study is a replication of Gneezy & Potters' (1997) study of bracketing effects with the addition of the complete Behavior Identification Form (BIF) (Vallacher and Wegner 1989), which is designed to measure individual differences in the identification of different actions. Under the BIF, individuals are asked to indicate which description of a target action they prefer. As an example, one item from the BIF asks participants to indicate which description of reading they prefer: "[f]ollowing lines of print" or "[g]aining knowledge." Past research on CLT has used the BIF to measure differences in mental construal (Fujita et al. 2006a). Following the use of the BIF by these researchers, we code preferences for low-level

descriptions as a 0, and preferences for high-level descriptions as a 1. This means the total score on the BIF can range from 0 to 25, with higher scores indicating a preference for higher-level identifications and a more abstract mental construal. In addition to the BIF, we also asked for a risk perception rating of the risk used in the investment task so we could control for risk perception and evaluate whether it is impacted by bracketing, mental construal or both. Consistent with the results of Study 1, we expect that risk perception will not be affected by choice bracketing, and we also expect that bracketing will not affect construal level.

In Gneezy & Potters' (1997) study, participants are randomly assigned to one of two bracketing conditions: Narrow (high frequency) and Broad (low frequency). All participants, regardless of condition, participate in 12 betting rounds where they are asked to bet part of a 100-cent endowment in a bet. The bet is identical across all rounds and has a 33% chance of winning 2.5 times the amount bet and a 67% chance of losing the amount bet. The participants carry forward any part of their 100-cent endowment that they do not bet. For rounds 1-9, participants in both conditions are asked to bet anywhere between 0 and 100 cents for each round. For rounds 10-12, participants are asked to bet using their earnings from rounds 1-9. These earnings are a cumulative total of the amount won and lost in each round, and any amount from the 100-cent endowment for each round that was not gambled. For example, if an individual bet 50 cents in round 1 and won, they would carry forward 150 cents (winnings from the bet), plus an additional 50 cents from the endowment not gambled. For each round, the outcome of the gamble was determined by a random number generator where participants won if a number less than or equal to 33 was drawn, and lost if a number greater than or equal to 34 was drawn. For participants in the Narrow condition, they determined a betting amount and received outcome feedback after each of the 12 rounds. For participants in the Broad condition, they determined a constant betting

amount for three rounds at a time (e.g., rounds 1-3) and then were presented with aggregated outcome information across all three of those rounds.

Following the set-up of Gneezy & Potters (1997), we hope to replicate their findings regarding bracketing and risk-taking: participants should bet more under the Broad condition than the Narrow condition, assuming they are myopically lose averse. This is because participants in the Broad condition see fewer single losses than a participant in the Narrow condition. The gamble has a positive expected value, but involves a high chance of loss in each undertaking. When played repeatedly, participants should come out ahead except in a small proportion of cases.[1] Participants in the Broad condition are more likely to see aggregated outcomes that are positive and, thus, should experience less loss aversion than participants in the Narrow condition. It is also possible that the bracketing manipulation affects subjective beliefs about the gamble such that participants in the Broad condition believe that the gamble is less risky than participants in the Narrow condition as a result of the bracketing effect. To rule out this alternative explanation and to demonstrate that bracketing acts through decision framing and not by changing beliefs related to the risk, we measure risk perception at the end of the 12 trials. Risk perception is measured using a 7-point scale from 1 (Not at all Risky) to 7 (Extremely Risky) as in Study 1.

Finally, after the 12 trials have been completed, all participants fill out the 25-item BIF and provide answers to demographic variables (gender and age). To ensure incentive compatibility on the gambling task, participants were told that 10% of participants completing

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[1] In our study, participants could not earn less than $0, they could only lose money that was endowed to them or earned through gambling. Given this, only 6 participants (4% of the sample) gained nothing by the conclusion of round 12.

the survey would be randomly selected to receive their total earnings as a bonus payment at the completion of the survey. All participants received a base payment regardless of whether they were chosen in the random drawing at the conclusion of the survey.

Results

Choice Bracketing

First we examine how our results compare to Gneezy & Potters' (1997) findings. As shown in Figure 6, we find that our results are in line with Gneezy & Potters' (1997) findings regarding the bracketing effect. Evaluating the amount bet across rounds (in blocks of three), we see that participants in the Broad bracketing condition bet significantly more than participants in the Narrow bracketing condition for most rounds. While Gneezy & Potters (1997) found significant differences between conditions for all rounds evaluated, we did not find a significant difference for the later rounds (rounds 7-9), though the results are directionally equivalent to the authors' findings. Further, a Wilcoxon-Mann Whitney test across all rounds (1-9) confirms a significant treatment effect: there is a statistically significant difference between the underlying distributions of betting amount between the Narrow bracketing group and the Broad bracketing group ($z = 4.861$, $p < 0.001$). Further, the betting amount for the Broad condition is higher on average compared to the Narrow condition. This confirms that individuals experience myopic loss aversion and that this is attenuated when forced to bracket more broadly. In other words, broader brackets lead to more risk-seeking in the gambling domain.

[INSERT FIGURE 6 ABOUT HERE]

We also ran an ordered logistic regression of betting amount on round (1-9), bracketing condition (1 = Narrow, 0 = Broad), a dummy variable for whether a loss was experienced in the previous round (Lost Last Round), an interaction term between bracketing condition and loss

experienced in the last round (Narrow Bracket*Lost Last Round) and an indicator for participant gender (0 = female, 1 = male). The results of this regression (shown in Table 5, column 1) show a significant negative effect of being in the Narrow bracketing condition (β = -0.742, p = 0.005), such that being in the Narrow bracketing condition (where the participant receives more outcome feedback and makes each decision in isolation), results in a significantly lower amount bet each round compared to the Broad bracketing condition. We find no effect of round on betting amount (p = 0.216), which coincides with Gneezy & Potters' (1997) findings. While we do not find a significant simple effect for outcome experienced in the last round (p = 0.765), we do find a significant interaction effect between condition and this variable (β = 0.396, p = 0.048). This interaction suggests that individuals in the Narrow bracketing condition bet more in a given round if they experienced a loss in the immediately preceding round, while participants in the Broad bracketing condition bet less following a preceding loss.

[INSERT TABLE 5 ABOUT HERE]

Construal Level

After looking at the effects of bracketing on risk tolerance, we turn to the effect of bracketing on mental construal. To measure mental construal, we used the Behavior Identification Form (BIF) developed by Vallacher & Wegner (1989). Following the practice of previous researchers (Fujita et al., 2006), we code high-level descriptions as a 1, and low-level descriptions as a 0. This provides an index for each participant ranging from 0 to 25, with higher scores indicating more abstract mental construals. Looking at our results for the BIF, we found the scale to be highly reliable (α = 0.916). Thus, we created a BIF Index for each individual. The average score across subjects was 15, with scores running the entire range from 0 to 25.

To test our hypothesis that bracketing is not affecting mental construal, we measured the effect of bracketing (Narrow vs. Broad) on a participant's BIF Index. We found that the bracketing manipulation did not have a significant effect on BIF Index (M_{Narrow} = 15.12 vs. M_{Broad} = 14.94, z = -0.496, p = 0.620). This suggests that there is not a direct relationship between bracketing and construal level: bracketing does not appear to affect mental construal. In other words, broader (narrower) brackets do not cause an increase (decrease) in risk tolerance by creating a more (less) abstract mental construal of risk.

In our Study 1, we found that mental construal (operationalized using temporal distance) had a significant effect on risk perception, which, in turn, affected risk-taking. In other words, risk perception mediated the effect of mental construal on risk-taking. Consistent with this finding, a Kruskal-Wallis test shows that risk perception is significantly different by BIF Index score ($\chi^2(24)$ with ties = 389.13, p = 0.0001). Thus, mental construal has a significant effect on risk perception (across bracketing groups).[2] Again, this suggests that mental construal impacts beliefs and perceptions about risks, while bracketing affects preferences for risk-taking.

Study 3: Simultaneous Effects of Bracketing & Temporal Distance on Construal

In Studies 1 and 2 we have demonstrated that choice bracketing—both in terms of aggregating problems and outcomes—has affected risk-taking separately from temporal distance. In Study 2, we specifically demonstrated that choice bracketing did not have a significant effect on the Behavioral Identification Form, suggesting that choice bracketing was not changing

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[2] A separate Kruskal-Wallis test on each subpopulation (High evaluation group vs. Low evaluation group) shows that risk perception is significantly different by BIF Index for both conditions ($\chi^2(22)$ with ties = 253.85, p = 0.0001 for the Low evaluation group and $\chi^2(22)$ with ties = 339.66, p = 0.0001 for the High evaluation group).

mental construal and affecting risk-taking through this mechanism. However, in Studies 1 and 2, we have not yet explicitly tested whether a temporal distance manipulation affects mental construal while choice bracketing does not. Moreover, in Study 2 we used a bracketing manipulation that confounded problem and outcome bracketing. Thus, in Study 3, we introduce two independent manipulations of bracketing that independently aggregate either the choices (problem bracketing) or the outcomes (outcome bracketing). This way we can demonstrate that neither form of choice bracketing affects mental construal. Study 3 also provides a manipulation check for the temporal distance conditions, demonstrating that increased temporal distance leads to a more abstract construal, while simultaneously showing that choice bracketing is not impacting this variable.

Method

Study 3 was conducted online using 119 participants (M_{age} = 30.8 years, 52% male) from Amazon's MTurk. As with Study 1, we used an incentive compatible lottery task at the beginning of the survey to induce participants to express their true gambling preferences; participants were told that ten individuals would be chosen at random to have one of the gambles (also chosen at random) played out for them. Participants were randomly assigned to one of four conditions using a 2 (Temporal Distance: Near, Far) x 2 (Bracketing: Problem, Outcome) between-subjects design. All participants were then asked whether they would take two gambles. These gambles were a subset of the ones used in Study 1. Gamble 1 offered a 90% chance to win $0.10 and a 10% chance to lose $0.50, played 150 times; and Gamble 2 offered a 50% chance to win $0.25 and a 50% chance to lose $0.15, played 120 times. As in Study 1, these gambles have approximately equal payoff distributions across the multiple trials, but different characteristics. After completing the gambling task, participants were asked a single-item behavioral

identification question related to gambling. This question was designed to test participants' preferences for a more abstract or concrete construal of a gambling task.

For the temporal distance manipulation we used a writing task in addition to manipulating the timeframe in which the gambles would occur (as in Study 1). For the Near condition, we told participants to imagine they are going about their daily activities today and they are offered a chance to gamble. We then tell them that before getting into the details of the gamble, we would like them to write about their daily activities and how they plan to spend their day, as well as how they imagine a gamble fitting into their schedule for today. In the Far condition, we used a similar prompt but referenced a year from now. Following the writing task, we also referenced different timeframes for the gambles by condition, such that participants in the Near condition were asked about gambles taking place today, while participants in the Far condition were asked about gambles taking place one year from now.

For the bracketing manipulation we created images to represent the gambles and aggregated either the number of trials in the Problem bracketing conditions (displaying each choice to the participant) or the distribution of possible outcomes across all trials in the Outcome bracketing conditions (similar to the distributional format gambles in Study 1). For the Problem bracketing condition, we represented each gamble as a block with red dots for potential losses and black dots for potential gains. For example, one trial of Gamble 1 would be represented by a block with nine black dots and one red dot. We also described the gamble in words so the participants knew what monetary amount each dot represented. To convey the number of trials, we showed the participants 150 (for Gamble 1) or 120 (for Gamble 2) blocks. Participants were then asked to choose between taking the gamble, being indifferent between the gamble and the certainty equivalent, or taking the certainty equivalent. The certainty equivalent for both gambles

was $3 as in Study 1. For the Outcome bracketing condition, we used the same format as the distributional format problems in Study 1, except we represented the distribution with black dots (for gains) and red dots (for losses), whereas no distinction was made using color in the stimulus for Study 1. All stimuli are available in our Supplemental Online Materials.

The main purpose of this study is to examine the effects of the bracketing manipulations and the temporal distance manipulation on the behavioral identification question. Based on CLT research, we expect that temporal distance will have a significant impact on the measure, such that participants in the Far condition will have higher scores than participants in the Near condition. This would demonstrate that temporal distance does affect mental construal and that temporal distance is acting through a changed mindset. We also predict, based on Studies 1 and 2, that bracketing will not have a significant effect on the behavioral identification measure such that its effect on willingness to gamble cannot be attributed to changes in mental construal.

Results

Willingness to Gamble

Though not central to the hypotheses being tested in Study 3, we did find that the results for willingness to gamble replicated our findings from Studies 1 and 2. Participants were significantly more likely to gamble in the Far future condition than in the Near future condition (71% vs. 57%, $\chi^2(1) = 4.09$, $p = 0.043$). We also found that participants were significantly more likely to accept the gamble in the Outcome bracketing condition compared to the Problem bracketing condition (79% vs. 51%, $\chi^2(1) = 17.11$, $p < 0.001$). This implies that individuals still underweight the effect of the multiple trials when the total number of choices is made more salient. Again, this suggests that individuals are still overweighting the probability of a loss when

problems are bracketed together, and that they have a difficult time determining the distribution of payoffs they may face over several trials of a gamble.

To confirm that both bracketing and construal have an effect on gambling that is independent of the other, we ran a logistic regression of gambling (0 = did not choose gamble, 1 = chose gamble) on a dummy variable for temporal distance (0 = Near condition, 1 = Far condition), a dummy variable for bracket type (0 = Problem bracket, 1 = Outcome bracket), and demographic variables (gender and standardized age). The results from this regression are shown in Table 6 (Model 1). The coefficient on temporal distance was significant and positive (β = 0.865, p = 0.024) as was the coefficient on bracket type (β = 1.440, p = 0.001). Thus, participants were significantly more likely to gamble if they were contemplating gambles taking place next year compared to participants contemplating gambles taking place today. Further, participants were significantly more likely to gamble if they saw the gambles in an outcome bracket versus a problem bracket. The significance of each variable in the presence of the other suggests that both manipulations have an independent effect on gambling even when controlling for the effect of the other (in other words, bracketing induces risk-seeking even controlling for the increased willingness to gamble resulting from an abstract mindset).

[INSERT TABLE 6 ABOUT HERE]

Finally, we also confirmed that an interaction effect between temporal distance and bracketing for gambling was not significant by running a logistic regression of gambling on the dummy variable for temporal distance, the dummy variable for bracket type, an interaction between temporal distance and bracket type and demographic variables. The results of this regression are shown in Table 6 (Model 2). We found that with the interaction effect included in the regression, the simple effect of temporal distance was no longer significant (β = 0.682, p =

0.116); while the simple effect of outcome bracketing remained significant and positive (β = 1.231, p = 0.017). Further, the interaction term was not significant (β = 0.702, p = 0.488). This result implies that the effects of bracketing are not moderated by construal.

Construal Measures

While we replicated our findings related to gambling, we have yet to show that temporal distance and choice bracketing act through different mechanisms. The previous literature has demonstrated that temporal distance affects mental construal, with greater temporal distance leading to a more abstract mindset. Through this paper, we have attempted to demonstrate that choice bracketing acts through a different, independent mechanism. While Study 2 confirmed that bracketing (problem and outcome combined) did not significantly affect the BIF, we have not shown that temporal distance does (and that bracketing, simultaneously, does not). To test these hypotheses, we asked all participants to respond to a single-item behavioral identification measure. For this measure, we asked participants to indicate their preference for the way a lottery can be described. The two options were: (a) a large cash prize or (b) small chances of winning. The first option represents the more abstract construal as individuals in an abstract mindset have been shown to focus more on payoffs than probability; the second option represents the more concrete construal, since a concrete mindset leads to an increased focus on probabilities. To summarize our hypotheses, we predict that temporal distance will have a significant positive effect on the behavioral identification measure (such that greater temporal distance will increase the probability of choosing the abstract description), while choice bracketing will not have a significant effect on preferences for the two description options.

Comparing the average scores on the behavioral identification measure across conditions, we find that the measure is significantly different by temporal distance condition (M_{Near} = 0.17

vs. M_{Far} = 0.36, $\chi^2(1)$ = 11.47, p = 0.001). This result suggests that individuals contemplating gambles with a greater temporal distance (one year from now) think in more abstract terms than individuals contemplating gambles with a smaller temporal distance (today). In some sense this finding also acts as a manipulation check for the temporal distance manipulation—we have now demonstrated that temporal distance is in fact affecting mental construal as postulated and suggested by the extant literature.

A similar comparison of the average behavioral identification measure scores for the bracketing conditions does not show a significant effect of bracket type on mental construal ($M_{Problem}$ = 0.23 vs. $M_{Outcome}$ = 0.28, $\chi^2(1)$ = 0.691, p = 0.406). This implies that bracketing type does not have a significant effect on mental construal (or at least not a differential impact for problem versus outcome bracketing), and that outcome bracketing is not affecting risk-taking through changes in mental construal. Though not directly tested in Study 1, this suggests that the effect of the distributional format on risk-taking propensity was not being driven through changes in mental construal.

To test that temporal distance and bracketing have independent effects on mental construal (and that the effect of temporal distance is significant even partialling out any effect of bracketing), we ran a logistic regression of behavioral identification score on a dummy variable for temporal distance (0 = Near, 1 = Far), a dummy variable for bracket type (0 = Problem, 1 = Outcome) and participant demographics (gender and standardized age). The results from this regression are shown in Table 7 (Model 1). As the table shows, the coefficient on temporal distance is significant and positive (β = 1.14, p = 0.016), while the coefficient on bracketing type is not significant (β = 0.41, p = 0.371). These regression results further confirm that temporal distance leads to a more abstract mental construal while outcome bracketing does not.

[INSERT TABLE 7 ABOUT HERE]

As we did with the gambling results, we also wanted to confirm that temporal distance and bracketing are not interacting and, therefore, having a potential combinatorial effect on mental construal. To test this, we ran a logistic regression of behavioral identification score on temporal distance, bracket type, an interaction term for temporal distance and bracket type, and participant demographics. The results from this regression are shown in Table 7 (Model 2). As the table shows, none of the coefficients in this regression are significant. There is no significant simple effect of temporal distance ($\beta = 0.41$, $p = 0.371$); nor is there a simple effect of bracketing type ($\beta = 0.04$, $p = 0.957$). In addition, there is no significant effect of the interaction term ($\beta = 0.67$, $p = 0.466$). This latter result suggests that the effect of temporal distance on mental construal is not moderated by bracket type.

General Discussion

Across three studies we have demonstrated that (a) choice bracketing and temporal distance have independent effects on risk-taking; (b) temporal distance acts through mental construal while bracketing does not; and (c) the effect of temporal distance is mediated by risk perception. We were able to confirm these effects using two types of bracketing (problem and outcome) and across two gambling types (mixed and pure-loss).

Our main finding is that mental construal (as manipulated through temporal distance) and choice bracketing have separable effects on risk-taking. Across all three studies we demonstrate that temporal distance and choice bracketing have significant positive effects on risk-taking, such that greater temporal distance and broader choice brackets increase risk-taking, even when controlling for both manipulations. These results imply that even if there is a correlation between the two effects, there is an independent effect for each that is separate from any similar or

coinciding result between the two. This is an important distinction since both theories posit affecting risk-taking by enacting a more holistic, gestalt or abstract view of the problem. However, our results suggest that there is a distinct mechanism involved for each. We have also shown that these variables do not have a moderating effect on each other such that the presence of one changes the effect of the other. This is also an important finding suggesting that the effects of temporal distance and choice bracketing are additive.

In Study 1, we were also able to show that temporal distance, and not choice bracketing, is mediated by risk perception. Thus, as temporal distance increases, the individual perceives less risk, which, in turn, increases the willingness to accept a gamble. This finding implies that temporal distance changes the internal representation of a problem. However, choice bracketing is not mediated by risk perception and still has a significant effect when controlling for changes in perceived risk, which implies that choice bracketing acts through risk preferences and is an external factor affecting risk-taking. Choice bracketing may make certain characteristics more or less salient through decision framing, but these differences do not significantly impact risk perception; participants still find the risks to be as risky regardless of presentation, which cannot be said for temporal distance.

In addition to examining different types of bracketing, we also used different types of gambles. In Study 1 we used mixed gambles and pure-loss gambles. In the current research on construal level theory, most studies do not use mixed gambles (most research has focused on gambles of the type: win \$X with probability p, win \$0 with probability $1 - p$) and pure-loss gambles have not been explored at all. We find that over pure-loss gambles the standard effects of both temporal distance and choice bracketing reverse: instead of increasing risk-seeking over losses, greater temporal distance and broader choice brackets decrease risk-seeking over losses.

Our studies suggest that greater research into the effects of temporal construal over different gamble types is needed to understand how temporal distance and mental construal interact with probabilities and payoffs over both gains and losses.

Taken together our findings have interesting implications for decisions that must be made over time and for the future. First, our findings suggest that making choices for the future (choices removed in time) have a separate and independent effect on decision-making than making several decisions across time or making a decision for which feedback or outcomes are received across time. Both removing a decision in time, and having the effects of a decision accrue over time have a positive effect on risk-taking, suggesting that an individual making investment decisions for the future will take greater risk the farther removed it is and the more individual risky choices are aggregated together. The former effect works through a change in mindset, while the latter effect works through a decisional frame (as aggregated outcomes or the impact of several trials over time are made more salient). These findings also suggest that investment advisors should work to take advantage of the fact that many financial products' consumption does not take place until the future—highlighting this fact may encourage more investment or more optimal investing. Similarly, investment advisors should consider framing investments that accumulate earnings and losses over time in a more aggregated form that reduces the underweighting of time—as suggested by Benartzi & Thaler (1999)—or highlights the multiple decisions being aggregated together.

Conclusion

Our investigation of the relation between construal level theory and choice bracketing has demonstrated that both have independent and separate effects on risk-taking, affecting risk preferences through separate mechanisms. Further, we have found that temporal distance is

mediated by risk perception, suggesting that temporal distance, which acts through mental construal, affects beliefs and perceptions about prospective risks, while choice bracketing affects risk preferences. These findings suggest that temporal distance and mental construal act through manipulating the internal representation of the risk for the individual, while choice bracketing is more of a framing effect that affects constructed preferences for risky decisions.

By using both mixed gambles and pure-loss gambles we have also demonstrated that construal and bracketing have opposite effects depending on gamble type: broader choice bracketing increases risk-seeking over mixed gambles, but decreases risk-seeking over pure-loss gambles. Similarly, temporal distance increases risk-seeking over mixed gambles and decreases risk-seeking over pure loss gambles. For temporal distance, this represents one of the first investigations of the effect on mixed gambles, and the first study to look specifically at pure-loss gambles. By examining multiple types of gambles and bracketing types, we have been able to show that temporal distance and choice bracketing are two independent factors affecting risk-taking.

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Figures

Figure 1

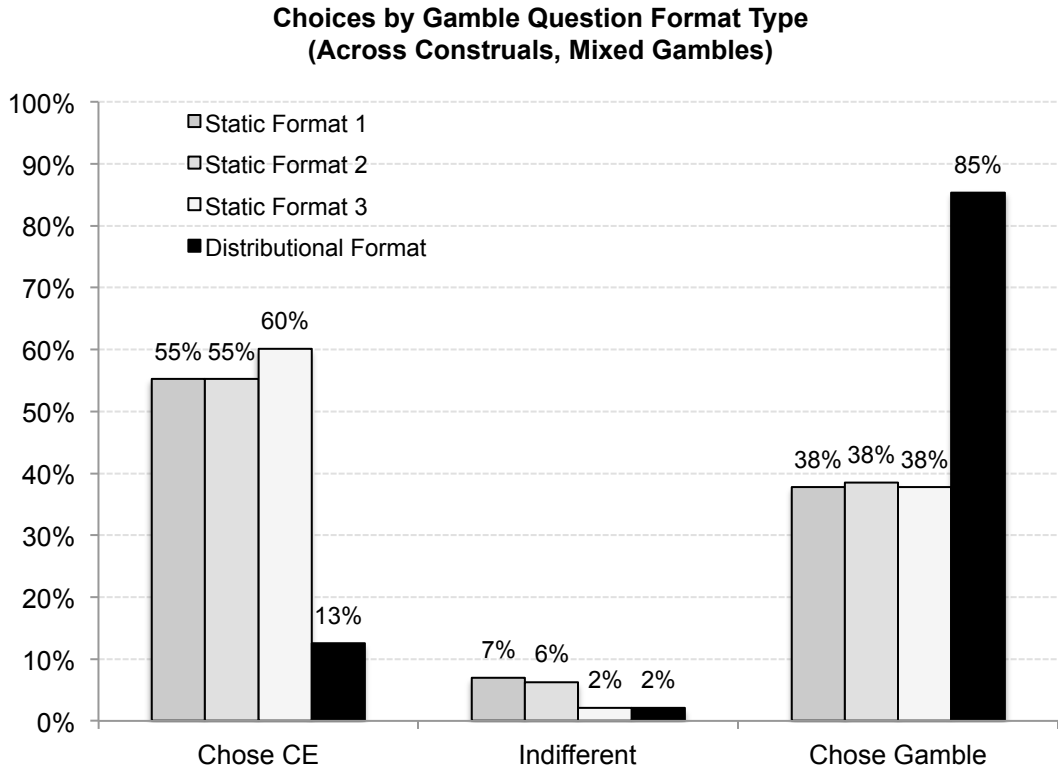


Figure 2

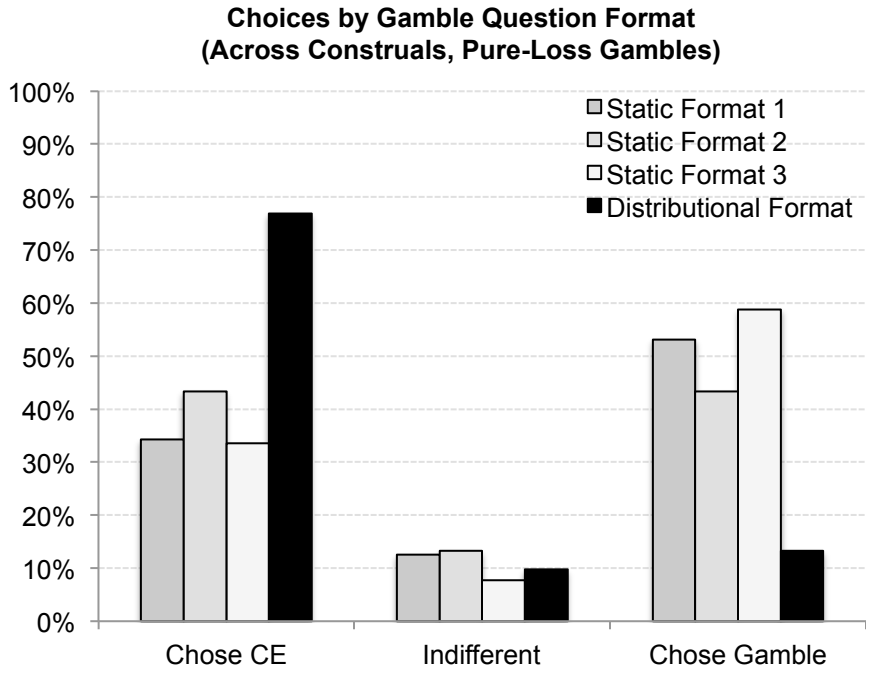


Figure 3

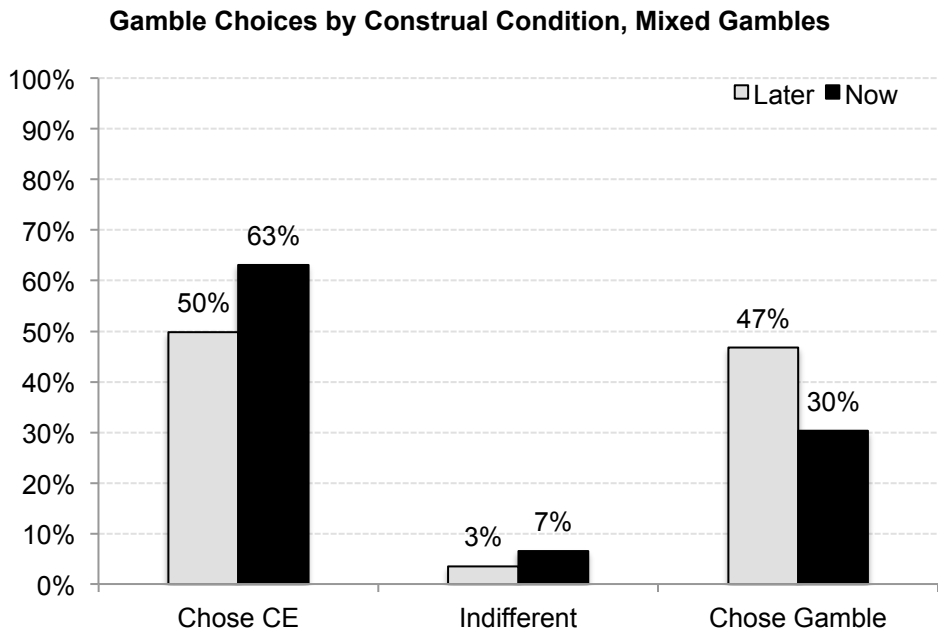


Figure 4

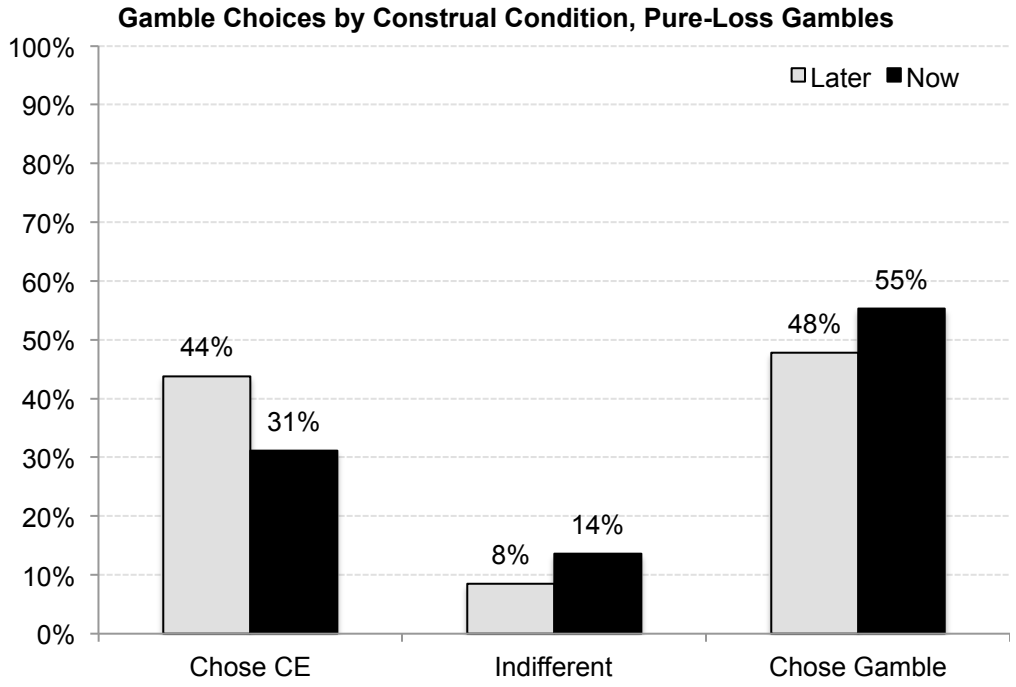
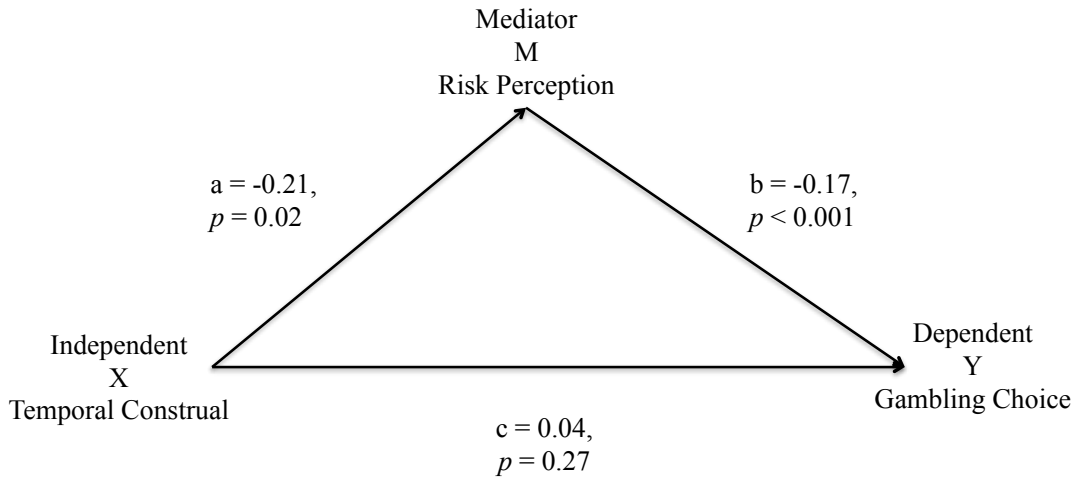
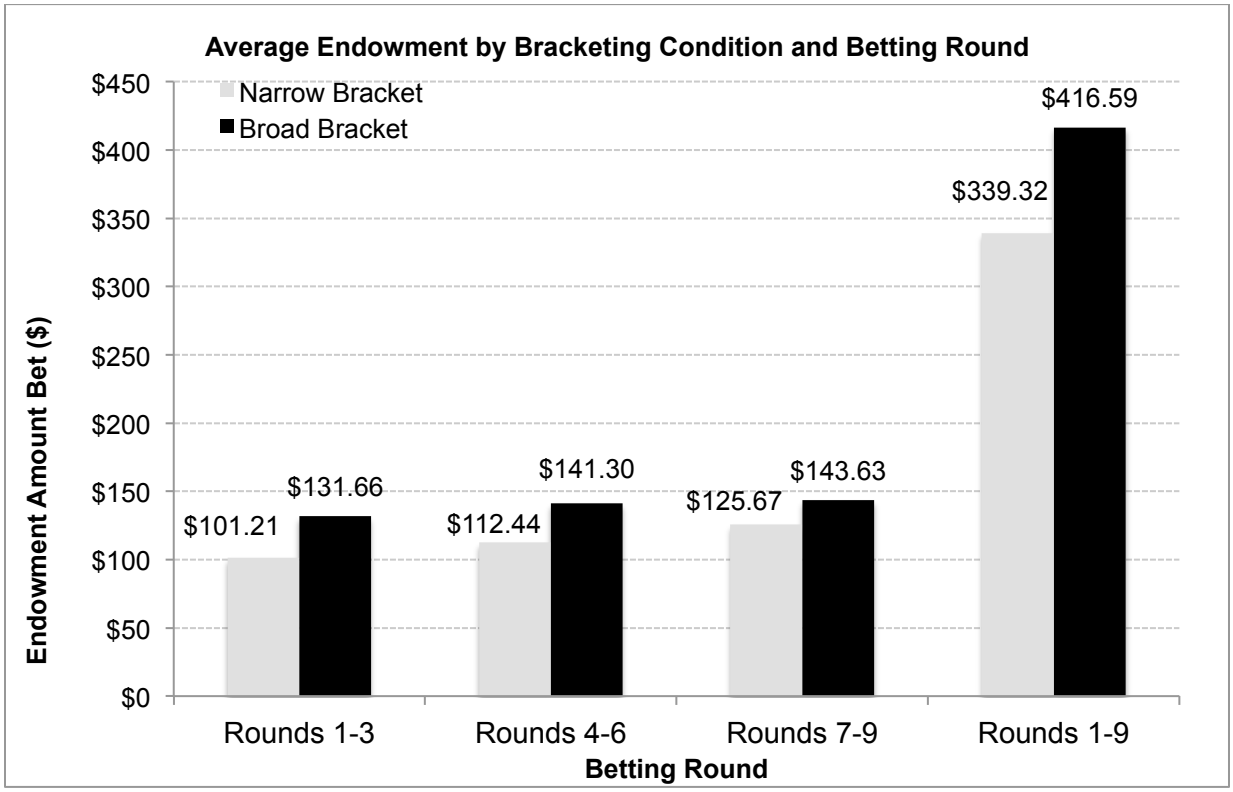


Figure 5



(*a x b)* = 0.04, *p* = 0.018, bias-corrected 95% confidence interval: [0.006, 0.065]

Figure 6



Tables

Table 1

Summary of Studies

	Study 1	Study 2	Study 3
Bracketing	Broad vs. Narrow	Broad vs. Narrow	Broad vs. Narrow
Construal	Manipulated by temporal distance	Measured with BIF	Manipulated by temporal distance and measured with BIF
Type of Aggregation	Outcome	Outcome & Problem (combined)	Outcome & Problem (separate)
Type of Gamble	Mixed & Pure-Loss	Mixed	Mixed

Table 2

Ordered Logistic Regression Results for Risk-Taking Across Mixed Gambles

	Model 1	Model 2	Model 3	Model 4
Problem Format	2.05****		2.09****	2.26****
(1 = Distributional, 0 = Static)	(0.184)		(0.191)	(0.265)
Temporal Construal		0.49***	0.60***	0.72***
(1 = Distant/Abstract, 0 = Near/Concrete)		(0.176)	(0.220)	(0.246)
Problem Format * Temporal Construal				-0.41
				(0.386)
Age	-0.01	-0.01	-0.01	-0.01
	(0.011)	(0.008)	(0.010)	(0.010)
Gender	0.93****	0.73****	0.89****	0.90****
(1 = Male, 0 = Female)	(0.223)	(0.180)	(0.223)	(0.225)

**** $p < 0.001$, *** $p < 0.01$

Notes: (1) Numbers reported are coefficients from the ordered logit model; (2) Standard errors are reported in parentheses and are robust and clustered on participant.

Table 3

Ordered Logistic Regression Results for Risk-Taking Across Loss Gambles

	Model 1	Model 2	Model 3	Model 4
Problem Format (1 = Distributional, 0 = Static)	-1.78**** (0.207)		-1.80**** (0.209)	-1.71**** (0.274)
Temporal Construal (1 = Distant/Abstract, 0 = Near/Concrete)		-0.38* (0.213)	-0.44* (0.239)	-0.4 (0.265)
Problem Format * Temporal Construal				-0.24 (0.451)
Age	0.002 (0.011)	0.002 (0.010)	0.003 (0.011)	0.003 (0.011)
Gender (1 = Male, 0 = Female)	-0.18 (0.231)	-0.15 (0.207)	-0.15 (0.233)	-0.15 (0.233)

**** $p < 0.001$, * $p < 0.10$

Notes: (1) Numbers reported are coefficients from the ordered logit model; (2) Standard errors are reported in parentheses and are robust and clustered on participant.

Table 4

Ordered Logistic Regression Results for Risk-Taking Across All Gambles

	Model 1	Model 2	Model 3	Model 4
Problem Format (1 = Distributional, 0 = Static)	0.58**** (0.103)		0.58**** (0.103)	0.66**** (0.136)
Temporal Construal (1 = Distant/Abstract, 0 = Near/Concrete)		0.09 (0.108)	0.09 (0.109)	0.14 (0.116)
Problem Format * Temporal Construal				-0.17 (0.209)
Risk Perception	-0.38**** (0.043)	-0.38**** (0.044)	-0.37**** (0.043)	-0.37**** (0.043)
Age	0.004 (0.006)	0.004 (0.006)	0.004 (0.006)	0.004 (0.006)
Gender (1 = Male, 0 = Female)	0.40*** (0.115)	0.39*** (0.114)	0.39*** (0.115)	0.39*** (0.115)

**** $p < 0.001$, *** $p < 0.01$

Notes: (1) Numbers reported are coefficients from the ordered logit model; (2) Standard errors are reported in parentheses and are robust and clustered on participant.

Table 5

Ordered Logistic Regression of Betting Amount, Rounds 1-9

	(1)
Evaluation Group	-0.742***
(0 = Low, 1 = High)	(0.265)
Lost Last Round	0.041
(0 = Won, 1 = Lost)	(0.136)
High Evaluation*Lost Last Round	0.396**
	(0.200)
Round Number	0.021
(1-9 only)	(0.017)
Risk Perception	
BIF Index	
Gender	0.435*
(0 = female, 1 = male)	(0.252)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Notes: (1) The coefficients shown above are for an ordered logit regression; (2) Standard errors are reported in parentheses below coefficients and are robust and clustered on participant.

Table 6

Logistic Regression Results for Risk-Taking Across Gambles

	Model 1	Model 2
Bracket Type	1.44***	1.23**
(1 = Outcome, 0 = Problem)	(0.418)	(0.515)
Temporal Construal	0.87**	0.68
(1 = Distant/Abstract, 0 = Near/Concrete)	(0.383)	(0.434)
Bracket Type * Temporal Construal		0.70
		(1.012)
Age	-1.50	-1.66
	(2.287)	(2.351)
Gender	0.37	0.37
(1 = Male, 0 = Female)	(0.390)	(0.387)

*** p < 0.01, ** p < 0.05

Notes: (1) Numbers reported are coefficients from the logit model; (2) Standard errors are reported in parentheses and are robust and clustered on participant; (3) Age is standardized to have mean of zero and standard deviation of 1.

Table 7

Logistic Regression Results for Behavioral Identification Measure

	Model 1	Model 2
Bracket Type (1 = Outcome, 0 = Problem)	0.41 (0.463)	0.04 (0.680)
Temporal Construal (1 = Distant/Abstract, 0 = Near/Concrete)	1.14** (0.472)	0.81 (0.644)
Bracket Type * Temporal Construal		0.67 (0.924)
Age	-4.17 (3.397)	-4.47 (3.619)
Gender (1 = Male, 0 = Female)	0.16 (0.485)	0.15 (0.487)

** $p < 0.05$

Notes: (1) Numbers reported are coefficients from the logit model; (2) Standard errors are reported in parentheses and are robust and clustered on participant; (3) Age is standardized to have mean of zero and standard deviation of 1.