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Temporal Distance Reduces the Attractiveness of P-bets Compared to $-bets

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Abstract

Although people normally prefer a more certain option over a riskier option of equal expected value, sometimes they are tempted to choose the riskier, but more rewarding one. Such temptation is even stronger when people decide for the distant future as compared with the near future. In experiments 1 and 2 we showed that increasing temporal distance makes people more likely to choose a high risk $-bet (€400, 0.02;0) over a low risk p-bet (€14, 0.60;0). Furthermore, the risk aversion shift increased proportionally to the time delay and persisted even for long delays (6 months). In experiment 3, we showed that this temporal effect is associated with a decrease in positive feelings towards the p-bet, and with a decrease in the positive evaluation of the high-probability (60%) of the p-bet, but not with an increase of the positive evaluation of the high-payoff (400 euro) of the p-bet. In experiment 4, we showed that increasing the salience of the probability feature tended to decrease the temporal effect, while increasing the salience of the prize did not vary the strength of the effect. Results are in line with an affect-based explanation of the temporal effect.

Keywords: psychological distance; risk taking; probability.

Classification Codes: Risk Taking; Psychological Distance; Cognitive Processes; Intertemporal Choice.

1. Introduction

Decisions often involve a trade-off between a more certain option and a less certain but more tempting one. Faced with such a trade-off, most people are generally risk-averse, that is, they prefer the more certain option when it is compared to a gamble of equal expected value (Bernoulli, 1954). People's behavior, however, seems to be much less cautious when the decision has to do with the future rather than the present: When people are told that the outcome of the decision will be resolved in a future time, they act as if they were more tempted by the riskier and richer option, (Abdellaoui, Diecidue, & Öncüler, 2011; Lovallo & Kahneman, 2000; Noussair & Wu, 2006; Sagristano, Trope, & Liberman, 2002). In the present article we generalize the temporal effect to real choices with substantial incentives, in a between-subjects design. In experiments 1 and 2 we investigated whether increasing temporal distance makes people more or less likely to choose a high risk $-bet (€400, 0.02;0) over a low risk p-bet (€14, 0.60;0) in a between-subjects experimental design, with real substantial incentives. Furthermore, in experiments 2 and 3 we explored the psychological underpinnings of this phenomenon. We tested predictions derived from two explanations proposed for the effect: The Construal Level Theory (CLT) explanation (Sagristano et al., 2002) and the affect-based reasoning explanation (Abdellaoui et al., 2011).

Our findings show that the effect is robust and can be generalized to a real choice in a between-subjects design with substantial incentives. Furthermore, the risk aversion shift increases proportionally to the time delay and persists even for long delays (6 months). Additionally, the temporal delay does not increase the attractiveness of the $-bet, but instead, decreases the positive feelings towards the p-bet, and decreases the positive evaluation of the certainty feature of the p-bet (the high probability of winning). These findings only partially support CLT predictions (Sagristano et al., 2002) but are in line with the affect-based reasoning explanation (Abdellaoui et al., 2011).

1.1 *The effect of temporal distance on risky choice*

Only a few studies in intertemporal choice focused directly on the influence of delay on risk attitudes and analyzed if risk preferences are time-dependent (Abdellaoui et al., 2011; Lovallo & Kahneman, 2000; Nisan & Minkowich, 1973; Noussair & Wu, 2006; Öncüler, Onay, & Onculer, 2009; Sagristano et al., 2002) despite the fact that many risky decisions in the real world entail a temporal delay (Arora, Peterson, Krantz, Hardisty, & Reddy, 2012; Hansen & Wänke, 2011; Leiser, Azar, & Hadar, 2008).

In an early study, Nisan and Minkowich (1973) found that participants were less risk-averse when the gamble was immediate than when the gamble was delayed. That is, they preferred high payoff-low probability gambles ($-bets) to low payoff-high probability gambles (p-bets) when the betting results were expected immediately but they showed the reverse preference when the betting results were expected in a week. The authors explained their findings by proposing that payoffs became less salient as delay increased but probabilities were not affected by delay since they were more abstract constructs.

Several other subsequent studies found the opposite pattern. Lovallo & Kahneman (2000) for first demonstrated that people's evaluation of the attractiveness of hypothetical gambles was positively related to their willingness to delay those gambles (i.e., people paid more to speed up the resolution of the gamble for less attractive gambles than more attractive ones). They argued that participants savored the positive outcomes and that the extent of savoring was proportional to the positivity of the outcomes.

Sagristano et al. (2002) directly manipulated temporal distance in a between-subjects experimental design where some participants evaluated near-future gambles, and other participants evaluated distant-future gambles. In their experiment Sagristano et al. (2002), used hypothetical choices. The authors asked participants to rate the desirability of each of 20 games on a 7-point scale, saying that these ratings were to determine which game participants would get to play, and then asked participants how much money they would be hypothetically willing to bid and risk losing for a chance to play each of the 20 games. Results showed that temporal distance increased the desirability and willingness to pay for the low probability of winning a large prize bet ($-bet), and decreased the desirability and willingness to pay for the high probability of winning a small prize bet (p-bet).

The results were explained using the Construal Level Theory (Liberman & Trope, 1998; Trope & Liberman, 2000, 2003, 2010). According to Construal Level Theory (Trope & Liberman, 2010) psychological representation of information depends on whether it is near or distant in time and space, i.e. on its psychological distance. Liberman and Trope (1998) suggest that temporal distance modifies people's mental representation of the event so that the representation of distant future events is more abstract, broad, and structured (high-level construal) than is the representation of near future events, which is more peripheral, concrete and focused on the local features of the event (low-level construal). Sagristano et al. (2002) explain their results assuming that temporal distance shifts the overall attractiveness of an option closer to its high-level feature (payoff) than to its low-level feature (probability). That is, temporal distance increases the weight of information about payoffs and decreases the weight of information about the probability of winning those payoffs. Sagristano et al. (2002) found that both the weight of probability and the weight of payoffs changed with temporal distance from a gamble: Payoffs became more influential and, independently, probability became less influential as temporal distance increased.

Noussair and Wu (2006) replicated and generalized the effect by using real cash incentives (min 0.00$ max 19.25$), and manipulating temporal distance in a within-subjects design on a set of lotteries.

Öncüler et al. (2009) focused on the type of elicitation path used to obtain the present value of a lottery to be resolved and paid in a future time period. The authors found that when the present value of the lottery was elicited under a time-risk task (eliciting the present value of the risky prospect and then determining the certainty equivalent of this current lottery) or under a direct path (eliciting directly the present certainty equivalent of the future lottery), the value obtained was higher than when the value was elicited under a risk-time task (eliciting the future certainty equivalent and then discounting this amount to the present). The authors explained this path-dependency assuming that in evaluating the two sources of uncertainty (time and risk), individuals first discount for time and then for risk.

Abdellaoui et al. (2011) replicated Noussair & Wu (2006) results by manipulating temporal distance in a within-subjects design, as the latter, but using a different elicitation technique. The authors elicited the certainty

equivalent at time x, that is, the sure amount payable at time x that the decision maker considers as equivalent to a particular lottery. The authors confirmed the basic finding that subjects exhibited more risk tolerance for delayed lotteries as compared to non-delayed lotteries, but also reported a novel finding, that is, that temporal distance had no impact on utilities but had a considerable impact on the probability weighting function. They argued that this change in probability weighting function might be caused by a decrease in the strength of anticipated affective reactions to the gambles caused by the temporal delay. More specifically, as the time delay increases, they assume that the strength of the anticipated emotional reaction (joy or disappointment) will decrease, leading to a more linear probability transformation. This affect-based reasoning explanation was proposed after the studies by Rottenstreich & Hsee (2001) who found that the sensitivity for changes in probabilities near certainty and impossibility is grater for affect-rich prizes (e.g., the opportunity to meet and kiss your favorite movie star) than for affect-poor prizes (e.g., winning $50 in cash).

1.2. *Overview of the present study*

The aim of the present study is two-fold. First, we aim at replicating the temporal effect in a between subjects design, using real choices with substantial incentives. Second, we aim at testing predictions derived from two competing accounts for the observed temporal effect on risk attitudes: The Construal Level Theory explanation (Sagristano et al., 2002) and the affect-based reasoning explanation (Abdellaoui et al., 2011).

To test the effect on real choices in a between-, rather than a within-, subjects design is important for at least three reasons. First, because within-subjects designs render the research hypothesis transparent (e.g., Tversky & Kahneman, 1983). That is, in a within-subjects design, subjects are aware of the purposes of the experiment and may behave accordingly, thus posing a threat to the internal validity of the experiment. Second, some have argued that life is more similar to a between-subjects design (Slovic, Fischhoff, & Lichtenstein, 1979; Tversky, Kahneman, & Slovic, 1982). Therefore, between-subjects designs increase the external generalizability of the experimental findings. Third, it has been claimed that "Within-subject designs with multiple trials encourage the adoption of simplifying strategies in which answers are computed mechanically,

without delving into the specifics of each problem. Factorial designs are particularly undesirable, because they provide an unmistakable cue that every factor that is manipulated must be relevant to the judgment (Kahneman & Frederick, 2002). The methodological implication of this analysis is that intuitive judgments and preferences are best studied in between-subject designs" (p.473; Kahneman, 2003). Since we believe that the temporal effect is the result of an intuitive judgment, the best test for it is through a between-subjects design.

Likewise, to generalize the effect to real choices with substantial incentives is an important test of external validly. Some have argued that substantial incentives lead to more thorough processing, and (ii) more thorough processing makes economic (rational) anomalies disappear, because more cognitive effort leads to better decisions, mostly by reducing the within-subjects error variance ("effort-model of decision making") (Smith & Walker, 1993; Tversky & Kahneman, 1986). For this reason, we believe that showing that the effect can be replicated using real choices with substantial incentives (i.e., 400 euro) is an important test of the strength of the effect.

In experiments 1 and 2 we test the generalizability of the effect to real choices with substantial incentives in a between subjects design. In experiment 2 we also test the hypothesis that the effect increases as the time delay increases, but up to a certain point. We hypothesize that, mentally representing a choice that is resolved in a very distant time might be a too abstract task for subjects to perform, leading to an absence of the effect. As a consequence, we expect a reduction of the effect for time delays of a certain magnitude, such as six months.

In experiments 3 and 4 we aim to understand the psychological underpinnings of the temporal effect using the same stimuli used in experiments 1 and 2. Two are the explanations put forward for the effect. The CLT explanation predicts that temporal distance reduces the influence of probability, and independently, increases the influence of the payoffs in determining preferences among the gambles (Sagristano et al., 2002). As a result, people will choose less the p-bet and more the $-bet, hence show a decrease in their risk aversion. The affect-based explanation, instead, predicts that the effect of temporal distance is not through the effect of time on payoffs but through the effect of time on probabilities (Abdellaoui et al., 2011). That is, the temporal

delay only reduces the attractiveness of the p-bet (since this is the bet with the high probability) but does not increase the attractiveness of the $-bet (since this is the bet with the high payoff) . As a result, people will choose less the p-bet, hence show a decrease in their risk aversion. Abdellaoui et al. (2011) indeed found that temporal distance had no impact on utilities but had a considerable impact on the probability weighting function. The authors argue that this change in probability weighting function might be caused by a decrease in the strength of anticipated affective reactions to the gambles caused by temporal delay. This affect-based explanation, however, has never been directly empirically tested. In experiment 3 we examine the hypothesis that temporal distance changes individuals' affective reactions to the two lotteries. If the CLT explanation is true, we should expect that temporal distance *both* decreases positive feelings towards the p-bet, *and* increases positive feelings towards the $-bet. If the affective reasoning explanation is true, instead, we should observe *only* a decrease in positive feelings towards the p-bet, and *not* an increase in positive feelings towards the $-bet, as temporal delay increases. Likewise, we hypothesize that temporal distance changes individuals' attitude towards the relevant features of the two lotteries (i.e., the probability of the p-bet and the payoff of the $-bet). If the CLT explanation is true, we should observe *both* a decrease in the positive evaluation of the probability of the p-bet *and* an increase in the positive evaluation of the payoff of the $-bet, as time delay increases. In other words, we should observe that the high probability of winning the p-bet is judged not so positive in the long run as it is in the short run, and that the high prize of the $-bet is judged more positive in the long run than it is in the short run. If the affective reasoning explanation is true, instead, we should observe *only* a decrease in the positive attitude towards the probability of the p-bet and *not* an increase in positive attitude towards the payoffs of the $-bet.

Finally in experiment 4 we further test the explanations for the temporal effect by manipulating the salience of the payoff and the salience of the probability. CLT predicts that information regarding payoffs should be more prominent in construing distant-future than near-future gambles. As a result, temporal distance from future gambles would increase the weight of payoff information *relative* to the weight of probability information in determining preferences among the gambles (Sagristano et al., 2002). We hypothesize that, if

time has an effect on risk aversion through the payoff, as suggested by CLT, then increasing payoff salience should increase the temporal effect. Whereas, if time has an effect on risk aversion through probabilities (time reduces perception of probabilities), as suggested by both CLT and the affect-based explanation, then increasing the probability salience should contrast this effect and reduce the temporal effect.

4. Experiment 1

In the first experiment we asked students to choose between two lotteries. Lottery A had a high probability of winning a smaller but significant prize (*p*-bet) and Lottery B had a very low probability of winning a very large prize ($-bet). The scope of the experiment was to test the robustness of the temporal distance effect generalizing it to a real choice with substantial incentive in a between-subjects design.

4.1. Method

Eighty-four undergraduate students (56% males; mean age 22.2) spontaneously registered to participate in a study on decision-making in a situation that offered real economic incentives. The experiment took place in the Cognitive Experimental Economic Laboratory (CEEL) at Trento University. Students were welcomed into the laboratory in groups of 20 or less.

Participants were randomly assigned to either the near future (n = 42) or distant future conditions (n = 42). In the near condition, participants were told that they would play the game at the conclusion of their experimental session. In the distant condition, participants were informed that they would play the game one month later. Participants were instructed that they would be receiving real money according to the outcome of the lottery. In both cases, participants were asked to choose between two lotteries: one with a 60% probability of winning €14 (p-bet) and the other with a 2% probability of winning €400 ($-bet)[1]. The two lotteries had a similar expected value (EV = €8.00 and €8.40). The slight difference in EV between the lotteries was due to the need to express the values in integer numbers.

[1] Parameters of the lotteries were chosen after a series of pilot experiments where students were presented with sets of four pairs of lotteries varying in probability and outcome and were randomly assigned to the near future or the distant future condition. The two lotteries used in Experiment 1 are very similar to the pair of lotteries for which we obtained the strongest effect of temporal distance on choice.

The two lotteries were presented on a computer monitor, as shown in Figure 1, with the probability represented both numerically and graphically, and the prize represented only numerically. The order of presentation (left/right) was randomized. Participants in the near condition were paid according to the outcome of the chosen lottery and then debriefed, while participants in the distant condition were asked to come back in one month to play and receive the outcome.

4.2. Results and Discussion

Table 1 shows the preferences for the lotteries in the two temporal conditions. A chi-square comparison of participants' choices revealed a significant effect of the temporal condition, $\chi^2(1, N = 84) = 4.421$, $p = .035$. In the near condition, the majority preferred the high-probability, low-prize lottery, in accordance with standard risk aversion literature (Bernoulli, 1954; Goldstein & Einhorn, 1987; Tversky & Kahneman, 1981) but in the distant condition this percentage decreased in a significant way. Results successfully replicate the temporal effect finding that people are indeed less risk averse for delayed risks (Abdellaoui et al., 2011; Lovallo & Kahneman, 2000; Noussair & Wu, 2006; Öncüler et al., 2009; Sagristano et al., 2002). The temporal distance effect, therefore, was revealed to be a robust phenomenon that generalizes to a real choice with substantial incentive.

5. Experiment 2

Experiment 2 aimed to replicate and extend the findings of Experiment 1. Participants were asked to choose among the same two bets used in experiment 1, but they were told that they would play the game either now, two weeks later, three months later or six months later. We hypothesized that participants would show a stronger temporal effect as the time delay increases. We also hypothesize that the effect should reach a threshold, and that it should decrease or disappear for very long delays (6 months).

5.1. Method

Two hundred undergraduate students took part in Experiment 2 (55% males; mean age 21.8). The experiment took place at the Cognitive Experimental Laboratory of the University of Trento. The procedure was the same as in Experiment 1. Participants were randomly assigned to either the near future condition (n = 50), or

one of the three distant future conditions: the two weeks (n= 50), three months (n = 50) or six months (n = 50) conditions. In the near condition, participants were told that they would play the game at the conclusion of their experimental session. In the distant condition, participants were informed that they would play the game two weeks later, three months later or six months later, according to the condition they were assigned to. Participants were instructed that they would be receiving real money according to the outcome of the lottery. In both cases, participants were asked to choose between the same lotteries used in Experiment 1, one with a high probability of winning (60%) a small prize (€14) (p-bet) and the other with a low probability of winning (2%) a large prize (€400) ($-bet). The order of presentation (left/right) was randomized.

5.2. Results and Discussion

The frequencies of choices for each of the two lotteries in the four different temporal conditions are summarized in Table 2. Replicating our previous findings, the increase in temporal distance had an incremental effect on the shift of preferences in favor of the low-probability, large-prize lottery. At a distance of two weeks, the displacement of preferences was not yet significant, $\chi^2(1, N = 100) = 0.457$, $p = .499$, but at a distance of three months, the deviation of preferences became significant, $\chi^2(1, N = 100) = 5.319$, $p = .021$. The deviation of preferences was even more significant at a six month distance, $\chi^2(1, N = 100) = 10.667$, $p = .001$. With increasing temporal distance, individuals moved their preferences in favor of the $-bet lottery. Kendall's Tau-b association score indicates a positive significant relationship between the choice and the condition, r = .257; p = .0001. The temporal distance effect is so strong that it took only six months to reach a reversal of preferences, that is, the majority of individuals preferred the p-bet in the near future, but the majority of individuals preferred the $-bet in the distant future. Furthermore, contrary to our expectations, the effect did not reach a threshold.

Given that Experiments 1 and 2 showed that the temporal effect on lottery choices was a robust phenomenon, the following experiments were designed to test several predictions derived from the explanations proposed for the observed behavior.

6. Experiment 3

The results of Experiments 1 and 2 showed that participants preferred a high probability of winning a small prize for the near future, but a low probability of winning a larger prize for the distant future. But what is the psychological mechanism underneath this temporal effect? In experiment 3 participants were asked to make hypothetical choices among the same two bets used in experiments 1 and 2 and they were told that they would play the game either now or three months later. However, before making their choice, participants were asked to self-report their affective reactions (i.e., feelings) towards the two lotteries and their positive or negative evaluation of the features of the two lotteries (i.e., how positive/negative is the probability/payoff of the p-bet/$-bet). We hypothesize that temporal distance produces a change in the affective reactions towards the lotteries. More specifically, if the CLT explanation is true we expected lower levels of positive affect towards the p-bet and higher levels of positive affect towards the $-bet, in the delayed choice. Whereas, if the affect-based reasoning explanation is true, we expected only lower levels of positive affect towards the p-bet. Likewise, we hypothesize that temporal distance changes individuals' attitude towards the relevant features of the two lotteries (i.e., the high probability of the p-bet and the high payoff of the $-bet). If the CLT explanation is true, we should observe *both* a decrease in the positive evaluation of the probability of the p-bet *and* an increase in the positive evaluation of the payoff of the $-bet, as time delay increases. If the affect-based reasoning explanation is true, instead, we should observe *only* a decrease in the positive evaluation of the probability of the p-bet and *not* an increase in positive evaluation of the payoff of the $-bet.

A part from testing the affect-based explanation, feelings toward the two lotteries were of interest to us because the perception of risk has been shown to be mediated by affective evaluations of the stimuli (Finucane, Alhakami, Slovic, & Johnson, 2000; Slovic, Finucane, Peters, & MacGregor, 2004, 2007). Finucane et al. (2000) found evidence of an affect heuristic with which individuals evaluate risk. According to this heuristic, the real or imagined stimuli evoke mental images that can be composed of both emotional and instrumental dimensions. All images that are in people's minds are characterized, to varying degrees, with affect, either consciously or unconsciously. When people have to make a judgment about the risks and benefits, they consult the affect associated with the images. If the affect associated with an image evoked by a stimulus is negative,

individuals indicate high risks and low benefits. Likewise, if the affect is positive, they indicate low risks and high benefits. Beside predicting risk perception, affect also severs as a motivator for behavior and decision making (Loewenstein & Lerner, 2003; Peters, Västfjäll, Gärling, & Slovic, 2006; Zajonc, 1980).

6.1. Method

One hundred and seven participants (53% males; mean age 24) spontaneously accepted an invitation to take part in a study on the decision-making process. No economic incentive was given. Participants were separated into groups of about 10 students. They were approached at the university's classrooms and library. The participants were given a paper and pencil questionnaire and asked to respond as sincerely as possible, and in silence, without discussing the task with others.

Participants were randomly assigned to either the near future (n = 54) or the distant future condition (n = 53). In the near condition, participants were instructed to imagine playing the game at the conclusion of their experimental session. In the distant condition, participants were instructed to imagine that they would play the game three months later. In both cases, participants were instructed to imagine that they were given the opportunity to choose between two lotteries: one with a high probability of winning (60%) a small prize (€14) (p-bet) and the other with a low probability of winning (2%) a large prize (€400) ($-bet). The lotteries were presented in the same graphical representation as in Experiment 1, but on paper and not on the computer. The order (left/right) was counterbalanced so that for half of the participants, Lottery A was the $-bet lottery, and for the other half, Lottery A was the p-bet lottery.

Before deciding which lottery they would prefer to play, participants were asked to answer a series of questions related to the two lotteries. First, participants were instructed to "consider the feelings raised by the two lotteries". They were then asked three questions measuring affective reaction. The first was, "What feelings does lottery A cause in you?" Answers could vary from -3 (very negative feelings) to +3 (very positive feelings). Next, they were asked, "To what extent would you feel happy at the idea of playing Lottery A?" Answers could vary from 1 (not at all happy) to 7 (extremely happy). Then they were asked, "To what extent would you feel tickled by the idea of playing lottery A?" Answers could vary from 1 (not at all tickled) to 7

(extremely tickled). The same questions followed for Lottery B. Then, participants were asked to report on the strength and valence of the mental image evoked by the lottery. Participants were instructed to "Consider the Lottery A and think of the first image that springs to mind when you think of the idea of playing this lottery. Any image that comes to mind is fine, we do not care to know the contents". Then they were asked, "How strong is this image?" and "What are your feelings towards this image?" Answers could vary from 1 (not at all strong) to 7 (extremely strong) and from -3 (very negative feelings) to +3 (very positive feelings). Then the same questions followed for Lottery B.

In the second part of the questionnaire participants were instructed to "consider all of the positive and negative aspects, not only the feelings, towards the two lotteries". They were asked, "Please, indicate the most significant negative (in bold) feature of Lottery A". The answer was open end. Then they were asked, "Using a 7-point scale, how negative is this feature?" Answers could vary from 1 (not at all negative) to 7 (extremely negative). Next, they were asked, "Please indicate the most significant positive (in bold) feature of Lottery A". The answer was open-ended. Then they were asked, "Using a 7-point scale, how positive is this feature?" Answers could vary from 1 (not at all positive) to 7 (extremely positive). Then the same questions were asked for Lottery B. At the conclusion of the questionnaire, participants were asked to state which lottery that they would choose, and were also requested to report their gender and their age.

6.2. Results and Discussion

All item scores given on a scale from -3 to +3 were recoded into a 1 to 7 scale to simplify statistical comparisons and analyses. Since the scores from the five items constituting the affect scale displayed strong correlations with one another and with the total scale (coefficient alpha reliability estimate was $\alpha = .84$ for the p-bet and $\alpha = .81$ for the $-bet), they were collapsed into an overall mean rating of affect for the p-bet (M = 4.43, DS = 1.42) and a mean rating of affect for the $-bet ($M$ = 4.70, DS = 1.15). Ratings of the negative and positive features of the two lotteries were analyzed individually. However, before doing this, we checked that most of the respondents had written the same features as being the most important ones. As expected, there were 73% of the participants that indicated that the "small prize" was the most relevant negative feature of the

p-bet, while 88% of participants indicated that the "high probability of winning" was the most relevant positive feature of the p-bet. In addition, 89% of the participants indicated that the "low probability of winning" was the most relevant negative feature of the $-bet while 77% indicated that the "large prize" was the most relevant positive feature of the $-bet. Hence, we proceeded to compare the individuals' perceptions between the near and distant conditions for affect and for the negative and positive features of each lottery.

A series of one-way ANOVAs was used to test for differences between the two temporal conditions (near vs. distant). Mean ratings are shown in Figure 2. Time distance significantly changed affective reaction towards the p-bet, F (1, 105) = 5.770, p = .018, but it did not change affective reaction towards the $-bet, F (1, 105) = 0.381, *n.s.*, As predicted by the affect-based reasoning explanation, the temporal distance significantly decreased positive feelings toward the p-bet, but, it did not significantly increase the positive feelings toward the $-bet. Indeed, we observed a tendency for positive feelings to decrease for both lotteries, but the decrease was only significant in the p-bet.

Our hypothesis regarding changes in affect due to temporal distance was supported. Feelings for the safer option, €14 (.60), were less positive in the distant future condition than they were in the near future condition, this could explain why individuals felt that this option was less attractive and showed a reduced risk-aversion as the time distance increased. However, at the same time, feelings for the risky option, €400 (.02), were not more positive in the distant future condition than they were in the near future condition, showing that individuals were not attracted more by the riskier option in the future than they were to the same option in the short-term. In summary, these results point to the conclusion that temporal distance reduces risk aversion by reducing the attractiveness for the more certain, safer option and not by increasing the attractiveness for the more rewarding but uncertain one. These results support the affect-based explanation (Abdellaoui et al., 2011).

Turning to the changes in the individuals' attitude towards the relevant features of the two lotteries (i.e., the probability and the payoff), the analyses showed that the positive evaluation of the p-bet, namely, the high probability (60%) of winning, decreased as temporal distance increased, F (1, 92) = 4.588, p = .035, as predicted both by CLT and the affect-based explanations. However, the positive evaluation of the $-bet, namely

the large prize (€400), also decreased over time, F (1, 86) = 4.831, p = .031, contrary to the CLT explanation . No other significant change in attitude was registered. More precisely, the negative feature of the $-bet, namely the low probability of winning (2%), did not change, F (1, 95) = 0.386, *n.s.*, and the negative feature of the p-bet, namely the low prize (€14), did not change either, F (1, 91) = 0.503, *n.s.* The pattern of results therefore supported the affect-based reasoning predictions[2].

Participants' hypothetical choices paralleled those found in the real choices for Experiments 1 and 2, even if the difference by condition did not reached significance. In the near condition, 53.7% (n = 29) of our sample preferred the low-probability, high-prize lottery, but in the distant condition this percentage decreased to 39.6% (n = 21), $\chi^2(1, N = 107) = 2.130$, p = .144. Given that the hypothetical choice was asked last, after several other questions regarding feelings and attitudes about the two lotteries, the focus on the temporal manipulation might have lost its effect, and we were not surprised to find that the result of the temporal distance manipulation was not strong as expected. Nevertheless, the next experiment was designed, in part, to test this prediction.

The results of Experiment 3 indicated that temporal distance did have an impact on participants' feelings and evaluations. Participants instructed to imagine that their choice will be played after three months showed different affective reactions and different positive/negative evaluations of the two lotteries as compared with those instructed to imagine that their choice will be played now. Temporal distance reduced the affective attractiveness for the safer p-bet option but did not change the affective attractiveness of the riskier $-bet option. This pattern is coherent with the observed behavioral change registered in Experiments 1 and 2 where it was shown that temporal distance increased the choices for the riskier options. However, contrary to the CLT intuitive explanation that time increases the attractiveness for the riskier options, our results seem to suggest that time decreases the attractiveness only of the safer option, as predicted by the affect-based reasoning explanation. The results for attitudes paralleled results for affect. Temporal distance decreased the positive

[2] The same analyses were replicated on a sub-sample of 71subjects resulting from the deletion of all participants who gave incomplete answers to one or more open-end question, or who did not answered as we expected to the open-end questions. The results were not different from those examining the whole sample.

evaluation of the positive feature of the safer p-bet. In fact, the high 60% probability of winning that attracted most of the students in the near future, seemed not so attractive in the distant future. Again, it seems that choice shifts observed in Experiment 1 and 2 can be explained by the declining of the reasons that originally pushed participants in the near future to choose the safer option, and not by a growing of attractiveness for the riskier option in the distant future.

A puzzling finding was that temporal distance especially affected the positive features of the two lotteries and not the negative features. We have no explanations for this result, especially for the outcome that temporal distance decreased the attractiveness of the large €400 prize. This result was confusing to us and in contradiction to the observed behaviors of participants in Experiments 1 and 2 that tended to choose more the $-bet lottery more often rather than less often. One explanation is that the decrease in attractiveness of the 60% probability was more relevant in determining the choice than the decrease in attractiveness of the €400 prize.

There were several limitations of Study 3 that pushed us toward conducting Study 4. First, judgments and perceptions are susceptible to lack of validity and context effects that are scarcely predictable in advance. Second, in Experiment 3, participants' choices to the hypothetical decision did not parallel the behaviors observed in Experiments 1 and 2 in a significant way. In other words, we found no significant effect of temporal distance on the hypothetical choice. Experiment 4 was designed to verify that the lack of choice shift in the hypothetical gamble was only due to the interference produced by the questions on perceptions that preceded choice and to further test the predictions of the CLT and the affect-based reasoning explanations.

7. Experiment 4

Experiment 4 was designed to replicate the temporal effect using the hypothetical choice used in Experiment 3and to further test the predictions of the CLT and affect-based explanations of the temporal effect. In experiment 4 participants were asked to make the same hypothetical choice among the two bets knowing that they would play the game either now or three months later. However, to increase the salience of the prize and the probability, we manipulated also the presentation mode of the information. In both the near-future and the distant-future conditions, participants received the same information, but the information could be presented

either in a default mode, in a prize-salient mode, or in a probability-salient mode (see Figure 4). We expected that, if time had an effect on risk aversion through increasing the relevance of the payoff *relative* to the probability, as suggested by CLT, the individuals given the prize-salient mode would exhibit a larger temporal distance effect than would the individuals given the default mode, since the two effects would sum up. Whereas, if time had an effect on risk aversion through probabilities, as suggested by both CLT and the affect-based explanation, then individuals given the probability-salient mode would show a smaller temporal distance effect than would individuals given the default mode.

7.1. Method

Six hundred and twenty-nine participants (39% males; mean age 24) agreed to take part in a study on decision-making behaviors in the absence of economic incentives. Participants were individually approached at the university's classrooms and libraries. They were given a paper and pencil questionnaire and asked to respond as sincerely as possible, and in silence, without discussing the task with others.

The experiment used a 2 x 3 (temporal distance x presentation mode) between-subjects design. The temporal distance variable had two levels: near future or distant future. The presentation mode variable had three levels: default mode vs. prize-salient mode vs. probability-salient mode. Participants were randomly assigned to one of the six conditions. In the near condition, participants were instructed to imagine playing the game at the conclusion of their experimental session. In the distant condition, participants were asked to imagine that they would play the game six months later. In all cases, participants were instructed to imagine that they were given the opportunity to choose between two lotteries, one with a high probability of winning (60%) a small prize (€14) (p-bet) and the other with a low probability of winning (2%) a large prize (€400) ($-bet).

In the default condition, the lotteries were presented in a descriptive way with the probability and the amount of the prize simply written in words and numbers. In the prize-salient condition, the same lotteries were presented as they were in the default condition but with the addition of the picture of the money corresponding to the prize. In the probability-salient condition, the same lotteries were presented as in the default condition but with the addition of a pie chart corresponding to the probability associated to each prize (see Figure 4). The

order (left/right) was counterbalanced so that for half of the participants, Lottery A was the $-bet lottery and for the other half, Lottery A was the p-bet lottery. The only dependent variable was the choice of the lottery. At the conclusion of the questionnaire participants were asked to report their gender and their age.

7.2. Results and Discussion

The frequency of choices of the two lotteries in the six conditions is presented in Table 3. A 2 (time) x 3 (presentation mode) x 2 (choice) log linear analysis showed that the best-unsaturated fitting model was time*choice, L^2 (8) = 9.533, p = .299. In the near future condition, more individuals choose the €14 (.60) lottery than they did in the distant future condition, independently of the presentation mode. Temporal distance had the predicted effect of moving individual preferences toward the more risky €400 (.02) lottery and away from the safer €14 (.60) lottery. Temporal distance significantly interacted with choices either in the default condition, $\chi^2(1, N = 220) = 10.22$, $p = .001$, in the prize-salient condition, $\chi^2(1, N = 205) = 6.59$, $p = .010$, and in the probability-salient condition, $\chi^2(1, N = 204) = 4.99$, $p = .025$.

Given these results, we should conclude that our expectations on the effect of the presentation mode on time were not met. However, we can observe that individuals in the near future condition were 2.48 times more likely (odds ratio) to choose the safer p-bet than were those in the distant future condition when the two lotteries were presented in the default mode. This proportion (odds ratio) went down to 2.07 when the lotteries were presented in a prize-salient mode, and to 1.88 when the lotteries were presented in a probability-salient mode. In support of our predictions regarding probabilities, the temporal distance effect decreased when the probability was made more salient, even if it was not enough to emerge as significant. Contrary to predictions regarding payoffs, instead, the temporal distance effect decreased, and not increased, when the prize was made more salient.

Results of Experiment 4 showed that the temporal effect could be easily replicated using hypothetical scenarios. Indeed, and contrary to our expectations, the effect was very strong and resistant to influences due to the mode of presentation. Construal Level Theory predictions were only partially supported. Temporal distance changed the preferences, but we found no support to the fact that the change was driven by the prize becoming

more attractive in the distant future, whereas we did find partial support for the explanation that the change in preferences was driven by the probability becoming less attractive in the distant future as compared to the near future, as predicted by the affect-based reasoning explanation. In other words, increasing the salience of the probability information probably prevented the 60% probability to become less positive and the 2% probability to become less negative in the distant future as compared with the near future. This could explain the reduction of the temporal distance effect when probability information was made more salient. These results are coherent with those found in Experiment 3. Temporal distance does not make the prize more attractive, but makes the high probability less attractive in the distant future.

8. Summary and Concluding Discussion

It has been claimed that prospection, such as the ability to preview the future, is fundamental in orienting thinking, feeling and action in just about any setting (Gilbert & Wilson, 2007). It has also been shown that psychological time is often neglected in human decision making but seems to play an important role in the making of choices (Klapproth, 2008). Furthermore, it has been shown that people maximize their utility based on their perceived importance of probabilities and outcomes rather than by integrating the two parameters as though they were of equal weight. If the outcome is more important, people choose the option with the best outcome, whereas, if the probability is more important, they choose the option with the higher probability for the desirable outcome, or the option with the lower probability for the undesirable outcome (Shavit, Rosenboim, & Shani, 2013). It is therefore important to understand how temporal distance changes the relative importance that people assign to probabilities and outcomes.

The Construal Level Theory (Trope & Liberman, 2010) offers a compelling account of how temporal distance changes the weights attached to the probabilities and outcomes. As illustrated in the introduction, the Construal Level Theory states that the probability of winning is subordinate to the outcome. Moreover, the Construal Level Theory predicts that temporal distance influences the importance given to the probability and to the outcome: temporal distance both decreases the influence of probability and increases the influence of payoffs on gambling (Sagristano et al., 2002). On the other hand, another stream of research, mostly from the

behavioral economics literature, showed that temporal distance changes the probability weighting function, making it more elevated and sensitive at the end points (Abdellaoui et al., 2011). According to this finding, time does not act through changes in the weight people give to the payoffs, but it acts by changing the weight people give to the probabilities. An affect-based reasoning explanation has been suggested (Abdellaoui et al., 2011). Rottenstreich and Hsee (2001), indeed, showed that the less affect-rich a lottery is (such as winning $50 in cash instead of the opportunity to meet and kiss your favorite movie star) the lower the sensitivity is towards changes in probabilities near certainty and impossibility. Based on this finding, Abdellaoui et al. (2011) suggested that temporal distance might reduce the anticipatory affective reactions towards the gambles and this, in turn, might influence how people weight probabilities.

The results of our experiments, showed that temporal distance has indeed a strong effect even on real choices with substantial incentives in a between-subjects design, and specifically, temporal distance increases the preferences for the low probability, high payoff gamble. The effect increases with the time delay and reaches no threshold even at a delay of six months. More importantly, we collected evidence that would suggest that, the shift in preferences is not pulled by the increased importance given to the payoffs in the distant future, but is pushed by a decrease in the importance given to the probabilities in the distant future. That is, people seem to become less sensitive to the attractive high probability, in the distant future, but remain as sensitive (or slightly reduce the sensitivity) to payoffs in the distant future. Our findings can be described as an effect of "fading out" of the probability (or certainty) feature as time distance increases. The same exact probability is presumably perceived as less attractive in the distant future than it is in the near future. This "fading out" of the probability would act more strongly on the p-bet than it would on the $-bet, since the $-bet has already a very low probability (0.02) that cannot go further down. This explanation is coherent with the affect-based reasoning explanation (Abdellaoui et al., 2011) and other studies finding that experiencing any kind of distance reduces sensitivity to any other distance so that people become less responsive to a given span of distance when the stimulus is distal versus proximal (Maglio, Trope, & Liberman, 2012). Thus, increasing time distance would reduce sensitivity to probability, which has been said to be a kind of distance (Todorov, Goren, & Trope, 2007;

Wakslak, Trope, Liberman, & Alony, 2006). These findings could explain why people commit themselves so easily for the future when they have to decide on questions characterized by high risk. Our data would indicate that this happens not because they are allured by the rich prize, but more simply because they do not feel the advantage of choosing the safer alternative when the decision is resolved in the distant future. Future studies should investigate this effect to better understand why this happens and how humans' complexity of information use (probability, losses, gains) changes when the decision is resolved in the distant future rather than in the near future.

A couple of limitation of this study should be mentioned. A first limitation of the study is the fact that all four experiments use a single stimuli, that is a choice between (€400, 0.02;0) and (€14, 0.60;0) which might undermine the generalizability and external validity of the findings. However, the decision to use the same stimulus in all four experiments had the benefit of allowing us to add up the information collected across the four experiments into a comprehensive explanation of how the mental representation of that particular gamble changes with temporal delay. Future studies should investigate whether this "fading out" of the probability generalizes to other gambles, or is limited only to this specific gamble and to what type of gambles. For example, it might be the case that this specific property of time is particularly effective for highly emotional gambles and less for less emotional ones. It would also be interesting to verify whether this effect generalizes over and above gambles, to decisions involving probability that do not necessarily have a monetary outcome. Moreover, in experiment 3 the attitude questions were always posed after the affect questions and this might have altered the responses of the attitude questions, even if it not immediately clear to us why this distortion should act on probability and not on payoffs.

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Table 1

Cross tabulation of lottery choice and temporal condition for Experiment 1

Lottery	Time	
	Near	Distant
A: 60% chance to win €14	33	24
	(79%)	(57%)
B: 2% chance to win €400	9	18
	(21%)	(43%)

Note. Percentages are in parenthesis

Table 2

Crosstabulation of lottery choice and temporal condition for Experiment 2

Lottery	Time			
	Near	2 weeks	3 months	6 months
A: 60% chance to win €14	38	35	27	22
	(76%)	(70%)	(54%)	(44%)
B: 2% chance to win €400	12	15	23	28
	(24%)	(30%)	(46%)	(56%)

Note. Percentages are in parenthesis

Table 3

Crosstabulation of lottery choice, temporal condition and presentation mode for Experiment 4

	Presentation Mode					
	Default		Prize-salient		Probability-salient	
Lottery	Near	Distant	Near	Distant	Near	Distant
A: 60% chance to win €14	59	28	56	40	61	43
	(49%)	(28%)	(56%)	(38%)	(59%)	(43%)
B: 2% chance to win €400	61	72	44	65	43	57
	(51%)	(72%)	(44%)	(62%)	(41%)	(57%)

Note. Percentages are in parenthesis.

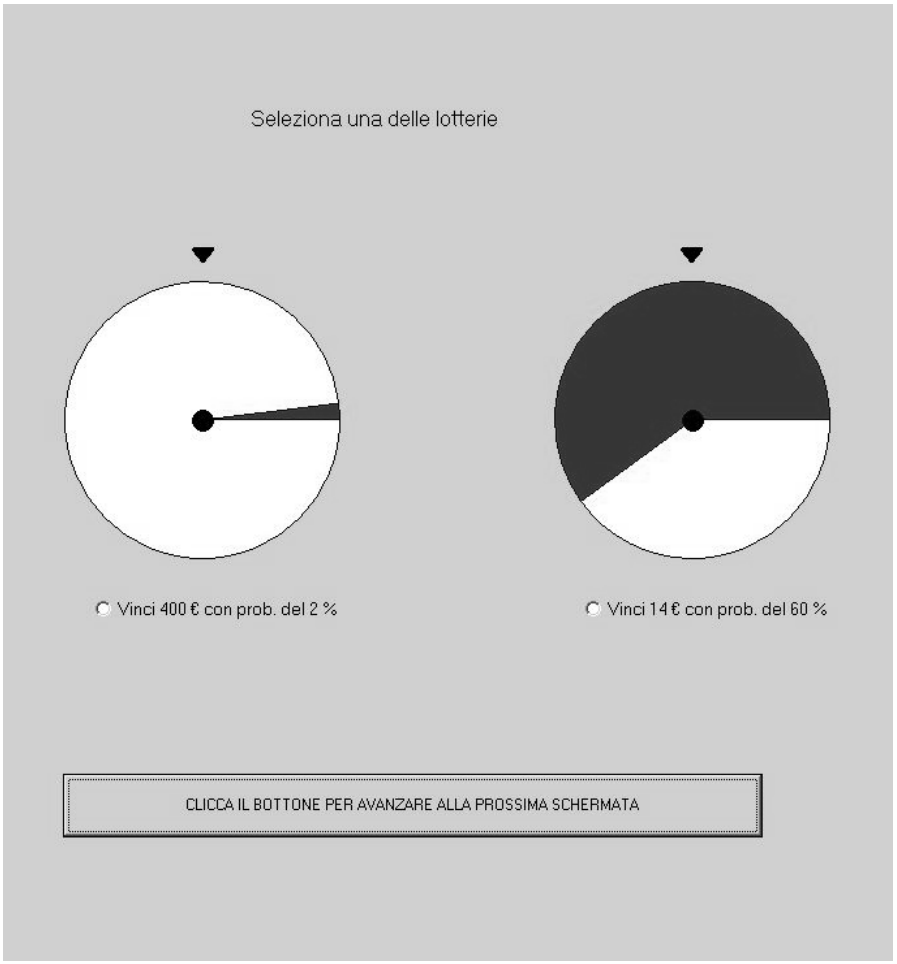


Figure 1. Screen display used to present the two lotteries

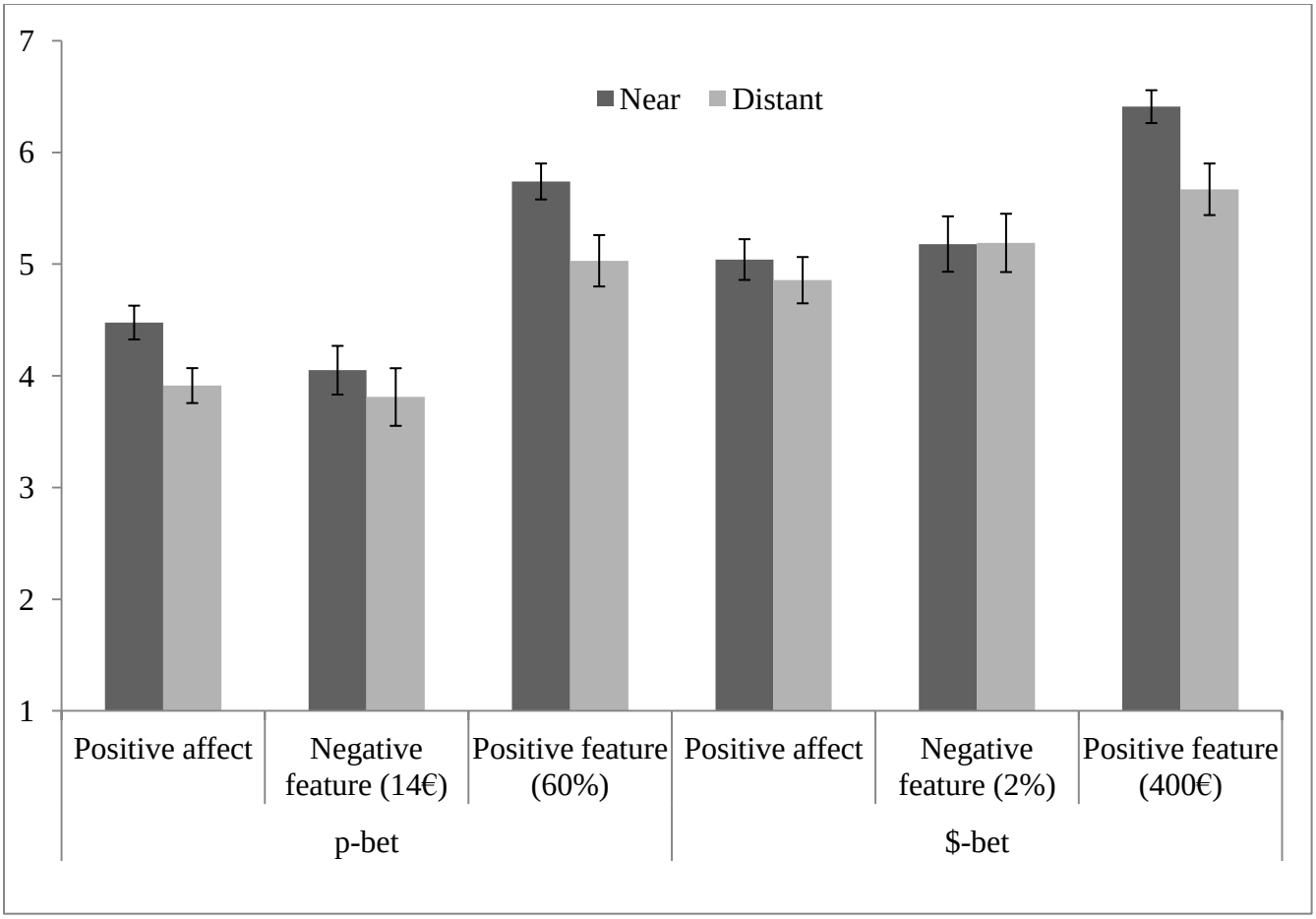


*Figure 2.*Mean ratings of positive affect for the p-bet and the $-bet and positive and negative evaluations of the positive and negative features of each bet in the near and distant future conditions. Positive affect for the p-bet decreased as time distance increased, while, positive affect towards the $-bet did not show any significant increase. The 60% probability of winning the p-bet was perceived as less positive in the distant future than in the near future, as well as the 400€ prize of the $-bet. No difference was found in the perception of the negative features of the two lotteries, the 14€ prize for the p-bet and the 2% probability for winning for the $-bet. Bars represent standard errors of the means.

a)

LOTTERIA A	LOTTERIA B
Vinci **400 €** con probabilità **2 %**	Vinci **14 €** con probabilità **60 %**

b)

LOTTERIA A	LOTTERIA B
 Vinci **400 €** con probabilità **2 %**	 Vinci **14 €** con probabilità **60 %**

c)

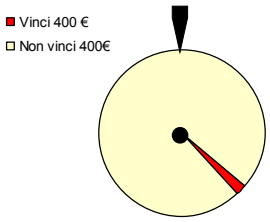
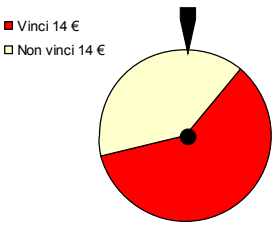
LOTTERIA A	LOTTERIA B
 Vinci **400 €** con probabilità **2 %**	 Vinci **14 €** con probabilità **60 %**

Figure 4. The presentation modes used in experiment 4: the default mode (a), the prize-salient mode (b) and the probability-salient mode (c).