Greediness, Generosity and Magical Thinking[*]

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Abstract

Experimental evidence of a new form of *magical thinking* is presented. In various situations of uncertainty, participants acted as if they believe that generous or less-greedy behavior on their part may increase the likelihood of their desired outcome, even though its objective probability is known and is independent of their actions. This behavior may be explained by an underlying belief, originated in the intuitive system, that good behavior is magically rewarded and bad behavior is punished by some higher power. The phenomenon may affect a variety of economic decisions, such as charity donations, bargaining strategies and insurance purchase.

Keywords: a belief in a just world; generosity; greediness; karma; magical thinking

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1. Introduction

Magical thinking is a belief that one's actions can affect the outcome of some chance event, when in fact its likelihood is independent of those actions. There is considerable evidence in the Psychology literature for the presence of such beliefs. For example, individuals use more physical force when rolling a die if the desired outcome is one of the higher numbers (Henslin, 1967). Participants tend to place a higher value on lottery tickets when they, rather than the experimenter, pick them out of a box (Langer, 1975 explained this phenomenon as the "illusion of control"). It was found that participants in a medical test selected actions that lead to a favorable diagnosis (such as a strong heart), even though those actions obviously could not affect their state of health (Quattrone and Tversky, 1984). Many superstitious beliefs, such as wearing a lucky charm on the day of an important exam, also reflect this kind of illusion.

This paper investigates the magical thinking phenomenon in economic decisions. More specifically, the experimental findings reported here suggest a novel form of magical thinking whereby participants appear to believe that choosing more generous actions and less-greedy risky actions (in terms of their consequences) may increase the likelihood of a desirable outcome, which is in fact independent of their actions. Actions driven by superstitious beliefs usually do not bear a significant material cost. In contrast, participants in the experiments reported here appear to believe that "sacrificing" a non-negligible amount of money will magically increase the likelihood of the desirable outcome. This aspect of the phenomenon may make it particularly relevant for economic contexts.

This pattern of behavior may be related to the notion of *belief in a just world* introduced by Lerner (1965). He suggested that people need to believe that the world is just and hence form beliefs in accordance with this idea (for a review of the literature, see Furnham, 2003). The findings can also be explained by a belief in *Karma* (the law of moral causation in Hinduism and Buddhism). According to both ideas, good behavior will be rewarded and bad behavior will be punished, either by the universe or possibly by a just god. "Two-system" explanations of behavior (e.g., Chaiken and Trope, 1999; Evans, 2007; Kahneman, 2003; and Sloman, 1996) suggest that a person may rationally understand that his actions cannot affect the probability of an outcome, whether desired or undesired, while at the same time having a strong gut feeling that they indeed can. This gut feeling may be

based on a set of associations that are stored by the intuitive system and a person may not even be fully aware that these "magical" thoughts are influencing his intuition and instincts.[3]

The paper presents the results from four different experiments. Overall, the findings suggest that the presence of uncertainty may trigger more generous and less-greedy behavior. This phenomenon can be observed in many real-life situations. For example, when an individual is about to undergo risky surgery, he is more likely to give money to a beggar on the street. This form of magical thinking is particularly relevant in uncertain situations where risky behavior can be seen as reflecting greediness. For example, an individual who considers canceling his insurance for a valuable object (in an attempt to save very small cost) may fear being magically punished for choosing this risky and "greedy" action. Thus, it is suggested that in such situations people will buy insurance more frequently than implied by their estimated risk aversion in contexts where risky choices are not associated with greediness.

This phenomenon may also affect the outcome of strategic interactions. Consider, for example, a bargaining situation in which two players negotiate the allocation of a pie. Suppose that regardless of the players' behavior during the negotiating process and the agreement they reach, there is a small probability that eventually the pie will be taken away by a third party. Magical thinking suggests that a player who uses his bargaining power to claim a large portion of the pie in situations without exogenous uncertainty would make more generous offers in the uncertain situation (believing that tough behavior may magically increase the probability of the undesirable outcome in which the pie is taken away).

Behavioral patterns in the spirit of those found in this paper have been reported in a number of previous studies. Shafir and Tversky (1992) and Croson (1999) found increased cooperation in a prisoner dilemma game when a player does not know what the others are going to do, as compared to the case in which he knows that the others will either defect or cooperate (in both situations the others do not observe his choice). One possible way to interpret these results is that under uncertainty[4] a player believes that his action may magically affect those of the other players and that his cooperative behavior will be rewarded by the same behavior on their part. In experiments reported by Risen and Gilovich (2008), participants believed that actions that tempt fate (such as commenting on a basketball player's streak of success) increase the likelihood of negative outcomes.

[3] Shafir and Tversky (1992) use the term "quasi-magical thinking" when referring to behavior that is consistent with magical thinking but is not based on explicit magical beliefs or on the awareness of such beliefs.

[4] Throughout the paper, the term "uncertainty" is used whether probabilities are known or not (i.e. whether objective or subjective). When probabilities are known, it will be stated explicitly.

Tykocinski (2008) explored the effect of being uninsured on the perceived probability of negative events that could have been covered by the insurance. Participants in her study estimated a higher likelihood of such events when it was mentioned that they were uninsured, perhaps because they felt that being uninsured is tempting fate.

In the last two papers described above, probabilities were unknown and participants were asked to estimate the likelihoods of different events. In the studies reported in this paper, all situations are endowed with objective probabilities and it is argued that participants' choices reflect a perception of likelihood different from the objective probability.

The paper continues as follows. The first experiment examines the generosity in a dictator game when allocating a pie of *uncertain* size as compared to a pie of *certain* size. Then, three experiments test in various risky environments whether participants' avoid making choices that could be considered greedy. The interpretation of the findings as evidence for magical thinking is discusses throughout the presentation of the results. The paper concludes with a general discussion.

2. Study 1: Generosity in Splitting an Uncertain Pie

The aim of this study was to demonstrate that in some uncertain situations participants act as if they believe that more generous behavior increases the likelihood that the uncertainty will be resolved in their favor.

Each participant was asked to divide a pie of certain or uncertain size between himself and another participant. In two of the treatments, the size of the pie was a certain amount: either £6.50 or £10.50, and the proportion of the pie given to the other participant was similar in both cases. In other words, the exact size of the pie in this range did not change the decision of how much to allocate to the other player. In two other treatments, the size of the pie was uncertain: £10.50 with probability p and £6.50 with probability (1-p). In one of these treatment p was high (i.e. the pie was more likely to be £10.50) and the framing induced £10.50 as a reference point. In this treatment the wording suggested that the size of the pie would be £6.50 only if one is unlucky. In the second uncertain treatment p was relatively small and the framing induced £6.50 as a reference point. In addition, it was implied that the pie would be £10.5 only if one is lucky. These two treatments were designed to examine two types of beliefs, the first is that greedy behavior might be magically

punished and the second is that generous behavior may be magically rewarded. This distinction is further discussed below.

The experimental design

The experiment was conducted in the ELSE lab at University College London. A total of 154 participants participated in seven sessions of the experiment. Almost all the participants were UCL students (mostly undergraduates) in various fields. Participants received £5 for showing up and an additional amount depending on their choices in the experiment. Points were accumulated during the experiment and at its conclusion the participants received a payoff of £1 for each 40 points they had earned. Participants were informed of the "exchange rate" at the beginning of the experiment. No further instructions were provided.

Four treatments were randomly implemented. The first two parts of the experiment were identical in all treatments while the third part differed between them. In the first part, participants were asked to answer two hypothetical questions for an unrelated study and received £0.50 regardless of their choice. In the second part, participants were asked to answer four general knowledge questions and earned £0.50 for each correct answer. They were not told how many questions they had answered correctly.

In the third part, participants were informed that they had been matched with an anonymous participant who had correctly answered the same number of questions as they had in the second part of the experiment. The participant played the role of allocator in a dictator game with a pie of certain or uncertain size. He was asked to choose one allocation of the pie (expressed in percentages) from a list of seven possibilities (ranging from 0% to 60% of the pie to be allocated to the other participant).

The instructions of the four treatments appear in the appendix. The differences between them are described below. In Treatments 1 and 2, the pie was £10.50 and £6.50, respectively. In Treatment 3, the pie was £10.50 with probability 14/19 and £6.50 with probability 5/19, whereas in Treatment 4, the pie was £6.50 with probability 14/19 and £10.50 with probability 5/19. In the two "uncertain" treatments, i.e. 3 and 4, the lottery was described explicitly. Participants were told that it would take place at the end of the experiment when they will receive their payoff and that they would be asked to draw one ball from an urn containing 5 white balls and 14 yellow balls. In Treatment 3, they were told that the pie would be £10.50 unless they are unlucky and draw a white ball in which case it will be £6.50. In Treatment 4, they were told that the pie would be £6.50, unless they are lucky and draw a white ball in which case it will be £10.50. The urn with the 19 balls was

placed on a table in front of the experimenter throughout the experiment in order to make it clear that he could not manipulate the probability of winning after observing the participant's choice of allocation.

During the entire experiment, the participants were sitting in separate cubicles and could not see or talk to one another. Payment was made to the participant at the end of the experiment according to his lab identity number and without others observing the payment.

It is worthwhile summarizing the purpose of the four different treatments. Treatments 1 and 2 were constructed to confirm that in the chosen range of dollar amounts, the percentages of the pie allocated by dictators do not differ significantly. (It is possible that within a wider range, the concrete size of the pie does affect the percentages allocated). These two "certain" treatments provide control for the dictators' fairness consideration in this range of pies, which allows studying how allocations are affected by uncertainty regarding the size of a pie, within the same range.

The choice of the probabilities and the framing in Treatment 3 were aimed at making £10.50 the psychological reference point and £6.50 to be perceived as a loss. On the contrary, the design of Treatment 4 was aimed at making £6.50 the reference point and £10.50 to be perceived as a gain. Thus, these two uncertain treatments may trigger different types of magical thinking. In Treatments 3, the loss manipulation may induce a fear of being punished for greediness. In treatment 4, the gain manipulation may induce the belief that generous behavior will be magically rewarded.

In many real-life situations it is hard to infer which of these two types of magical thinking is in play since the individual's unrevealed reference point (perhaps his expectation) determine whether it is a loss or a gain frame. A positive outcome could be perceived as a loss if the individual expected a much better outcome. Causal real-life observations hint that magical thinking could be activated by both the fear from a bad outcome (e.g. when waiting for the results of a medical test for a terrible disease) and the hope for a good outcome (e.g. winning a large amount of money in a lottery). In our context, where only money is at stake, it is plausible to expect that the loss frame would trigger more magical thinking than the gain frame, in accordance with the asymmetry implied by the notion of *loss aversion* and the findings that anxiety amplifies other types of magical thinking and superstitious beliefs.[5]

[5] Simonds et al. (2009), for example, find such an effect in a non-clinical sample. Berle and Starcevic (2005) provide a review of the topic.

Results and discussion

Table 1 presents the distribution of choices for each treatment in Part 3.[6] The distributions of choices in Treatments 1 and 2 are not significantly different according to a Mann-Whitney test (p=0.71). This is consistent with previous findings in the literature, which concluded that within similar ranges of pie size the distribution of allocations (expressed in percentages) does not depend on the size of the pie (see Forsythe et al., 1994). When we combine the observations from Treatments 1 and 2, the distribution of the proportions kept by the participants in these certain treatments is significantly higher than the distribution in Treatment 3 (p=0.047).[7] The largest difference is in the percentages of participants who chose to keep the whole pie (about 31% in the certain treatments vs. 17% in Treatment 3). These results can be interpreted as evidence of magical thinking, whereby participants may have been concerned that being greedy in a situation where luck plays a role might be "punished". Figure 1 presents a comparison between the allocations in the certain treatments and in Treatment 3.

Table 1

Proportion kept	Treatment 1 (£10.50)	Treatment 2 (£6.50)	Treatments 1 and 2	Treatment 3 (possible loss)	Treatment 4 (possible gain)
100%	27.3%	34.4%	30.8%	17.1%	35.4%
90%	6.1%	9.4%	7.7%	7.3%	2.1%
80%	12.1%	9.4%	10.8%	9.8%	8.3%
70%	24.2%	12.5%	18.5%	19.5%	14.6%
60%	9.1%	12.5%	10.8%	17.1%	12.5%
50%	21.2%	21.9%	21.5%	26.8%	27.1%
40%	0%	0%	0%	2.4%	0%
	n=33	**n=32**	**n=65**	**n=41**	**n=48**

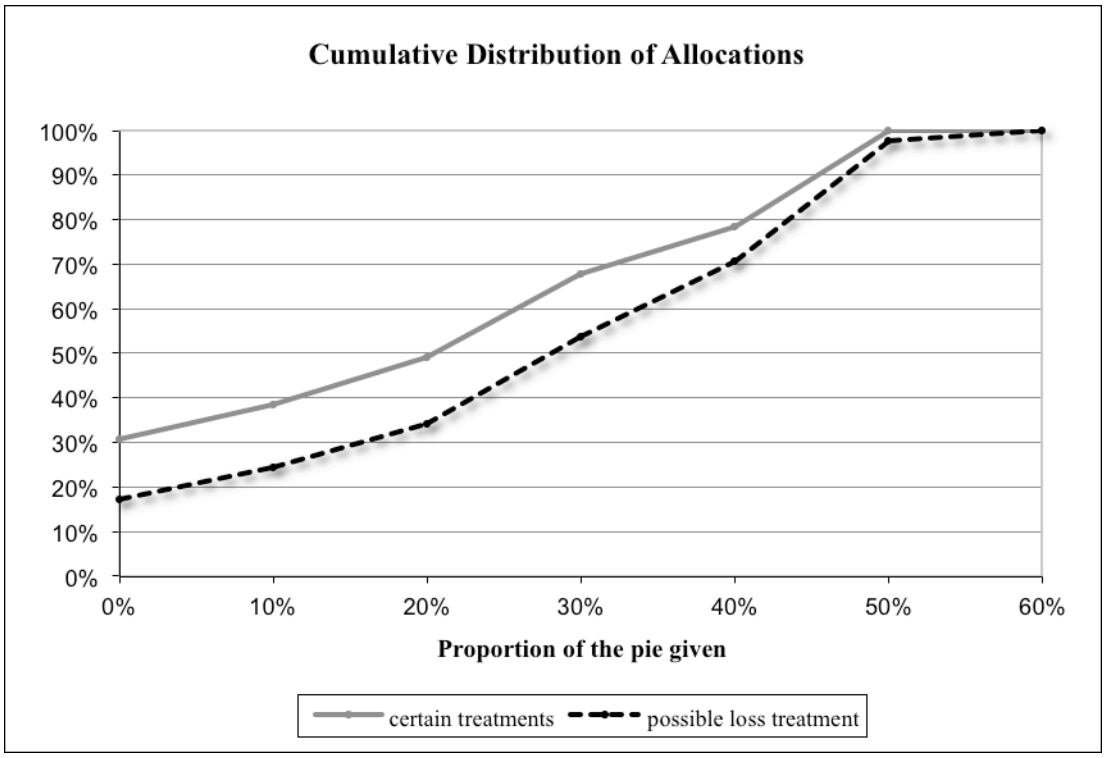
In contrast, the distribution of allocations in Treatment 4 is not significantly different from that in Treatment 1 (p=0.68), Treatment 2 (p=0.92) or the two certain treatments combined (p=0.78). Thus, it appears that in this experiment the fear of being magically punished (associated with Treatment 3) triggered generosity, whereas the hope of being magically rewarded for generous behavior was not reflected in participants' behavior. These

[6] Participants' allocations were found to be independent of the number of correct answers they gave in Part 2.

[7] Treatment 3 reflects more generosity also compared to each of the certain pie treatments separately (the difference from Treatment 1 and Treatment 2 is significant at the 10% level and at the 6% level, respectively).

results also confirm that the possible cognitive or procedural differences between the certain and uncertain treatments are not the reason for the greater generosity in Treatment 3 (which, as mentioned, was not observed in Treatment 4).

Figure 1



In conclusion, by controlling for fairness considerations in the context of this particular allocation game (and in this specific range of pies), it was possible to test the effect of uncertainty on participants' allocation decisions. Some evidence was found for increased generosity towards the other participant when the size of the pie was to be determined by a lottery after the choice of allocation had been made. This tendency is found only when the size of the pie can be reduced (with a low probability) relative to some reference point and not in the case where the size can increase (also with a low probability). This further supports the interpretation of increased generosity as an outcome of magical thinking, rather than some other effect of the uncertainty manipulation. Of course, this is not to say that people's intuitive expectation to be magically rewarded for generous behavior does not arise in other contexts.

3. Study 2: Avoiding Greedy Choices in a Risky Environment

The three experiments reported in this section provide further evidence that in uncertain situations a significant proportion of participants avoid actions that may reflect greediness. The design of the experiments makes it possible to determine this proportion in each context. The main differences from Study 1 are that in the current study there is no room for other-regarding preferences and that some actions are normatively right or wrong.

3.1 The Die Experiment

The experimental design

The experiment was conducted in the ELSE lab at University College London. A total of 49 participants participated in three sessions of the experiment. Almost all participants were UCL students (mostly undergraduates) in various fields. After answering two hypothetical questions for an unrelated study (similar to those in Part 1 of Study 1), each participant received a form and a small sticker. The form, which appears in the appendix, includes all instructions needed for the experiment. Participants were asked to select one of the following amounts of money: £16, £17, £18, £19, £21 or £23 and to write it on their sticker (and on the form as well). After all the participants had made their choices, each was in turn asked up to the experimenter's desk according to his lab identity number. The participant put his sticker on one of the six faces of a standard die and rolled it. (The participants were informed in advance that it is a standard die, though the numbers on the die had no meaning in this experiment.) If the die came to rest with the sticker facing up, the participant received *the amount written on the sticker*. Otherwise, he received only £5 for showing up.

Results and discussion

The distribution of choices appears in Table 2. Only 69% of the participants chose the highest possible amount (the 95% confidence interval extends from 55% to 81%). The rest chose one of the other amounts, with about half of them choosing the second highest amount. Although the situation is endowed with objective probability, one could argue that participants may not perceive all outcomes of the die's roll as equally likely. If the probabilities of the different faces of the die are not perceived as equal, one could try to explain the results using theories of behavior under ambiguity (see Camerer and Weber (1992) for a survey of the topic). Note, however, that even in these theories, the perceived

probability of winning the amount of money written on the sticker could not depend on the specific amount which was chosen by the participant (only on the selected face).

Table 2

Amount selected	**% of the participants**
£23	69%
£21	14%
£19	6%
£18	8%
£17	0%
£16	2%

I suggest that the participants who did not choose the highest amount intuitively believed that the realization of the die's roll depends on the choice they make and feared being punished for greediness by some higher power. In other words, they had a gut feeling that the likelihood of winning would be lower if they selected £23, which was liable to be considered greedy. The specific design of the experiment may have triggered the illusion of dependence between a participant's action and the outcome of the die's roll by creating a physical connection between the two (i.e. by writing the selected amount on the sticker and placing it on the die).

In real life, small prizes are often objectively associated with a higher probability of winning than large prizes and it is more common to observe someone who has won a small prize than someone who has won a large prize. This may lead people to feel that going for smaller prizes generally brings luck. In other words, it is possible that we develop an intuitive association between "greedy" choices and a low likelihood of winning.

A participant's intuitive belief may have affected his choices despite his awareness of the rational argument for choosing £23. This is in line with two-system theories, according to which System 1 and System 2, which are responsible for intuitive and deliberate reasoning, may be active simultaneously and both can guide decisions. This is also consistent with the claim made by Loewenstein et al. (2001) that feelings play a prominent role in decision-making under risk and uncertainty.

As in many other contexts (in both real life and experiments) in which an individual's behavior is affected by superstitious beliefs, participants in the die experiment apparently allowed themselves to be influenced by magical beliefs in order to be "on the safe side". In contrast to the results of previous studies, the participants in this experiment were willing to sacrifice an amount of money (at least £2) for that purpose.

Further support for the interpretation of the findings

While the intuitive system is allegedly responsible for magical thinking, the second system encourages the use of reason and does not allow for such beliefs. This is particularly true in situations where the probabilities are objective and there is a clear rational choice, such as in the situation of the die experiment. Thus, participants may feel uncomfortable admitting that they actually hold magical beliefs and it would be unnatural to elicit their beliefs over the events in this context. Therefore, in order to shed light on the arguments that might lead to choosing less than £23, a different group was asked to explain the behavior of the 31% of participants who chose the smaller prizes in the die experiment. To this end, the die experiment and its results were briefly described to 35 students majoring in Social Work at Tel-Aviv University. They were asked to write down the most likely explanation in their opinion for not choosing the largest possible prize.

Among this group, 46% interpreted the choice of a prize smaller than £23 as an outcome of magical thinking. They conjectured that participants in the die experiment believed that their chances of winning would increase if they did not choose the largest prize. Most of their answers explicitly mentioned that the greediness associated with selecting the highest prize is the reason for the lower perceived probability of winning and a few suggested that some number other than 23 felt luckier. In fact, the magical thinking interpretation was the most popular by far. Other explanations suggested that the participants did not understand some aspect of the experiment, that they did not believe they would win and hence did not care which amount they chose, that they did not want to appear greedy in the experimenter's eyes or that they wanted to lower their expectations in order to minimize their potential disappointment if they did not win.

Note that misunderstanding of the experiment and an attempt not to appear greedy in the experimenter's eyes cannot explain the tendency found in Study 1 (since it was found in one particular treatment but not in the control treatments). Furthermore, there was no indication that the die experiment or any of the other experiments were not fully understood.

Overall, the findings suggest that many people have in mind magical thinking arguments. Moreover, these arguments arise in the particular context of the die experiment. Indeed, it is likely that many of those who were asked to explain the observed irrational behavior would themselves have chosen the largest possible prize if they had participated in the experiment; nonetheless, they offered magical thinking as the most likely explanation for the behavior of 31% of the participants in the die experiment.

3.2 The Dreidel Experiment

In the die experiment, it is clear that any bet of an amount lower than £23 is dominated by the bet of £23. Nonetheless, dominated bets were selected by about 1/3 of the participants. The following experiment demonstrates that a much higher proportion of the population chooses the "less greedy" bets when the fact that these bets are dominated is not as prominent.

The experimental design

The participants in this experiment consisted of 30 undergraduate students in Philosophy and Architecture at Tel Aviv University. The experiment was carried out in a small classroom. Participants were asked to participate in a short experiment after class hours. They received a form, which can be found in the appendix, explaining the experiment and were asked to mark their choice on the form. Participants were asked to select one of the following amounts of money: NIS 40, NIS 50, NIS 60 and NIS 70 (equal to approximately $10, $12.50, $15 and $17.50, respectively, at the time). Once all the participants had made their choices, each had the opportunity to spin a dreidel (a four-sided spinning top played with during the Jewish holiday of Hanukkah). The numbers 40, 50, 60 and 70 were written on stickers and placed on the sides of the dreidel prior to the experiment. A participant was paid the amount he had selected only if that specific number was facing up when the dreidel stopped spinning; otherwise, he did not receive any payment. In other words, the participant was to choose one of four bets, each with a 0.25 probability of winning the chosen amount. Thus, the three bets with an amount of less than NIS 70 are dominated bets.

Results and discussion

Only 30% of the participants chose the highest amount of NIS 70 (the 95% confidence interval extends from 17% to 48%). Almost all the rest (60%) chose 50 or 60 NIS (roughly

in the same proportion) and 10% selected the lowest amount of NIS 40. Despite the small sample, the results indicate a clear tendency to avoid choosing the highest amount, even though the objective probability of each number is known to be 0.25.

These findings can be interpreted as evidence that a high proportion of the participants believe that a greedy action (selecting NIS 70) decreases the likelihood of winning a prize in this uncertain situation. Apparently, it is somewhat easier for the participants in this experiment to believe that the different amounts are not equally likely, perhaps because the amounts are written on different sides of the dreidel (in contrast to the die experiment where the choice of the amount is separate from the choice of where to place the sticker).

In theory, the participants may have suspected that this specific dreidel is not a fair device. I doubt it was the case. In any event, the following experiment repeats the dreidel experiment with a different lottery device that ought to be perceived as fair.

3.3 The Urn Experiment

This section presents a variation of the dreidel experiment in which the lottery device is replaced by a draw of a ball out of an urn.

The experimental design

The participants in this experiment consisted of 39 music students at Tel Aviv University, most of them undergraduates. The experiment was carried out in four different classes taught by the same teacher. The students were asked to participate in a short experiment at the beginning of the lesson. Prior to the experiment, an urn was introduced containing five balls with the numbers 30, 40, 50, 60 and 70. (The participants could see that each of the five numbers was written on one of the balls.) Each participant then received a form, a copy of which can be found in the appendix, and was asked to mark his choices on it. After answering four hypothetical questions (which were unrelated to the study), each participant was asked to select one of the following amounts of money: NIS 30, NIS 40, NIS 50, NIS 60 and NIS 70 (equal to approximately $7.50, $10, $12.50, $15 and $17.50, respectively, at the time). As explained on the form, once all the participants had made their choices, each participant had the opportunity to draw a ball out of the urn. A participant was paid the amount he had selected only if the specific number that he had chosen was written on the

drawn ball; otherwise, he did not receive any payment. After each draw, the drawn ball was returned to the urn.

Results and discussion

The results resemble those of the dreidel experiment. Only 44% chose NIS 70 (the 95% confidence interval extends from 29% to 59%) whereas the majority of the participants chose dominated bets: 15% chose NIS 60, 23% chose NIS 50, 15% chose NIS 40 and 3% chose NIS 30. The similarity of the qualitative results, using a lottery device that ought to be perceived as fair and within a different group of participants, strengthens the magical thinking interpretation, whereby some participants believe that choosing the highest possible amount might decrease their probability of winning the lottery.

One may argue that part of the results is driven by the fact that the experimenter observes the participant's choice in this experiment. Thus, a participant may avoid the greedy action for the purpose of leaving a good impression on the experimenter. That is, the participant is not necessarily worried of being punished for a greedy choice by some higher power, but rather tries not to appear greedy in the experimenter's eyes.[8] However, it is also plausible that the desire to impress the experimenter in such a context works in the opposite direction and motivates some participants to reject their magical thoughts and to choose rationally. After all, not choosing the highest amount may be considered an unwise choice. Thus, the extent of the magical thinking phenomenon in real life contexts may be even larger than in the context of the experiment.

Comments

1. The behavior observed in Study 2 was taken as evidence that participants avoid greedy actions in an attempt to magically increase the likelihood of winning a prize. One may also interpret this behavior as reflecting extreme pessimistic beliefs that are not action-dependent. Namely, the participants might believe that they are less likely to win a bet involving an objective probability p to win a prize of NIS 70 than a bet involving the same probability to

[8] Another version of the urn experiment manipulated the visibility of greediness by adding to each amount of money that the participant may win, an equal amount of money to be donated to charity. In this version, the experimenter who observes that a participant choose the highest amount cannot know whether the participant is greedy (tries to earn the highest possible amount of money for himself) or just wishes to donate the highest possible amount of money to charity. Thus, if the main reason that participants in the original urn experiment avoided choosing NIS 70 was that they didn't want the experimenter to find them greedy, the choice of the highest amount should have been more frequent in this version. However, the participants' chosen amounts in this version were slightly lower and not significantly different from those in the original urn experiment.

win a smaller amount, even in contexts where they don't choose between the bets. Note, however, that there is no previous evidence of pessimistic beliefs when the situation involves objective probabilities. In a sense, this pessimism bias works in the opposite direction to the well-documented *wishful thinking effect* or the *desirability bias*, which is the tendency to overestimate the likelihood of events with desirable consequences.[9]

2. The findings presented in Section 3 indicate that dominated lotteries are chosen with a high frequency. This result is related to a work done by Sharma and Vadovic (2011), in which monotonicity was tested in different contexts. They examined choices between two 50:50 chance lotteries that were explicitly presented side by side as vectors of two possible outcomes. In that presentation, the dominance of one lottery over the other is emphasized. The proportion of participants who chose the dominated lottery in Sharma and Vadovic (2011) was much lower than in the current study.

4. General Discussion

Participants in the experiments reported here acted as if they believe that less-greedy behavior increases the likelihood of being lucky in an intuitively related though independent chance event. Magical thinking is offered as an explanation for the overall behavior observed in the experiments.

Note that this tendency was found in simple circumstances that call for rational behavior since the objective probabilities of the various outcomes were known and there was no room for misperception of their likelihoods. Hence, it is plausible to speculate that the magnitude of such magical thinking is even greater in uncertain circumstances in which the probability of the independent event is not objective and is unknown.

Another factor that may affect the incidence of such magical thinking is related to the characteristics of the sampled population. The extent of the participants' religiosity could be relevant, as is their familiarity with rational choice in a risky environment. Thus, for example, one might conjecture that economics students would be less prone to this bias than, say, philosophy students.

Finally, it is likely that there are experiences that trigger such magical thinking (such as seeing bad behavior being magically punished). In some settings, magical beliefs might seem more justified. (A prominent example is the Newcomb paradox, first discussed in

[9] For a review of the large body of evidence on this effect, see Krizan and Windschitl (2009).

Nozick (1969), which almost forces such beliefs on participants by explicitly describing a "predictor" who is somehow capable of rewarding and punishing). In the experiments described above, there was no exogenous trigger for this kind of belief. Nevertheless, behavior consistent with magical thinking was common among the participants.

The findings in the above experiments suggest that people will tend to be more generous and decent when facing uncertainty. This tendency may be relevant in various economic contexts. The following example illustrates how it could be incorporated in a model of an economic interaction.

A seller owns an object that he would agree to sell for $10 or more. Tomorrow a buyer will be interested in buying the object for any price below his valuation of the object. The buyer's valuation depends on the state of the world tomorrow and will be either $200 or $500, each with probability of 0.5. The two can trade only through a middleman. The middleman has to offer a price to the seller today, without knowing the valuation of the buyer. Tomorrow, when uncertainty is resolved, the middleman will be informed of the buyer's actual valuation. Then, if the middleman has purchased the object from the seller, he will set a price for the buyer. The buyer will purchase the object only if the price is not higher than the object's value to him.

Thus, the middleman must make a decision that is similar to dividing a pie of uncertain size (as in Study 1) between himself and the seller. The findings in this paper suggest that even if the middleman is completely self-interested he might offer the seller a price higher than $10, falsely believing it will increase the likelihood that the uncertainty in the buyer's valuation will be resolved in his favor. Thus, in these circumstances, the middleman will offer the seller a higher price than he would have if the value of the object to the buyer were deterministic (between $200 and $500).

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Appendix

Study 1 - Part 3

Treatment 1 (Treatment 2)

At this moment, you were paired with another student who answered correctly the same number of questions as you did in Part 2. You will not learn the identity of this student either during or after the experiment, and this student will not learn your identity.
There is an amount of points X to be allocated between you and the other student. You were selected to be the allocator of the points. You need to choose the percentage of X that you take for yourself, and the percentage that you leave for the other student. At the end of the experiment, you will actually receive the percentage of X that you requested, and the other student will receive what's left.

The size of X is determined to be 420 points.
(The size of X is determined to be 260 points.).

What is your choice of allocation?

	% of X for me	% of X for the other
○	40%	60%
○	50%	50%
○	60%	40%
○	70%	30%
○	80%	20%
○	90%	10%
○	100%	0%

Treatment 3

At this moment, you were paired with another student who answered correctly the same number of questions as you did in Part 2. You will not learn the identity of this student either during or after the experiment, and this student will not learn your identity.
There is an amount of points X to be allocated between you and the other student. You were selected to be the allocator of the points. You need to choose the percentage of X that you take for yourself, and the percentage that you leave for the other student. At the end of the experiment, you will actually receive the percentage of X that you requested, and the other student will receive what's left.

The size of X is not known yet and will be determined by the lottery described below. X will be 420 points, unless luck will not be on your side in the lottery, and then X will be 260 points. The lottery will take place at the end of the experiment, when you will be called to receive your total payoff from the experiment.

How does the lottery work?
In the experimenter's position there is an urn which contains 14 yellow balls and 5 white balls. After your decision of allocation has been made, you will get the opportunity to draw one ball from the urn.
- If you draw a yellow ball, X will be 420 points.
- If you are unlucky to draw a white ball, X will become 260 points.

You must decide now, without knowing the size of X, what is the percentage that you take for yourself and what is the percentage that you leave for the other student.

What is your choice of allocation?

	% of X for me	**% of X for the other**
○	40%	60%
○	50%	50%
○	60%	40%
○	70%	30%
○	80%	20%
○	90%	10%
○	100%	0%

Treatment 4

At this moment, you were paired with another student who answered correctly the same number of questions as you did in Part 2. You will not learn the identity of this student either during or after the experiment, and this student will not learn your identity.
There is an amount of points X to be allocated between you and the other student. You were selected to be the allocator of the points. You need to choose the percentage of X that you take for yourself, and the percentage that you leave for the other student. At the end of the experiment, you will actually receive the percentage of X that you requested, and the other student will receive what's left.

The size of X is not known yet and will be determined by the lottery described below. X will be 260 points, unless luck will be on your side in the lottery, and then X will be 420 points. The lottery will take place at the end of the experiment, when you will be called to receive your total payoff from the experiment.

How does the lottery work?
In the experimenter's position there is an urn which contains 14 yellow balls and 5 white balls. After your decision of allocation has been made, you will get the opportunity to draw one ball from the urn.
- If you draw a yellow ball, X will be 260 points.
- If you are lucky to draw a white ball, X will become 420 points.

You must decide now, without knowing the size of X, what is the percentage that you take for yourself and what is the percentage that you leave for the other student.

What is your choice of allocation?

	% of X for me	**% of X for the other**
○	40%	60%
○	50%	50%
○	60%	40%
○	70%	30%
○	80%	20%
○	90%	10%
○	100%	0%

Study 2

The die experiment

Gender: Female / Male Age:_____

Please read the instructions carefully and then answer the question.

You are asked to select one out of six amounts of money:
£23, £21, £19, £18, £17 and £16.
After your decision has been made, you will be asked to write the amount that you have selected on your small sticker.

After all participants have made their choices, you will be called (by your position number) to approach the experiment's position.

In the experimenter position, you will put your sticker on one of the faces of a standard die, and will roll this die once.
The outcome of the die roll will determine whether you are eligible to receive the specific amount that you have selected:

- You will receive the amount that you selected **only if the die roll goes your way. That is, the die shows this amount** (on the side facing upwards).
- If the die does not show the amount that you have selected and put on it, you only get £5 for your participation in the experiment.

Which amount do you choose?
Please mark your choice and write the selected amount on your sticker.

£23

£21

£19

£18

£17

£16

The dreidel experiment (translated from Hebrew)

Read the instructions carefully and then mark your choice.

In this task, you will be asked to select one out of four possible amounts of money.
After your decision has been made, the experimenter will approach you and spin a dreidel, each of whose four sides bears one of the amounts.
You will receive **the amount that you have selected** only if it is the outcome of the dreidel's spin (i.e. if it appears on the side facing upwards). In any other case, you will not receive any payment.
Following are the amounts from which you are asked to choose:
NIS 40, NIS 50, NIS 60 and NIS 70.

Which amount do you choose? (Circle your choice)

NIS 40

NIS 50

NIS 60

NIS 70

The urn experiment (translated from Hebrew)

[The following appeared after the four unrelated hypothetical questions]

You are being given the opportunity to participate in a lottery in which you can win some money.

Read the instructions carefully and then make your decision

At the end of this form, you will be asked to select one of five amounts of money: NIS 30, NIS 40, NIS 50, NIS 60 or NIS 70.

After your decision has been made, you will have the opportunity to draw one ball from the urn, which contains five balls marked 30, 40, 50, 60 and 70 (each number is written on exactly one ball).

- **If the amount you have selected is written on the drawn ball,** you will receive that amount**.**
- In any other case, you receive nothing.

The experimenter is the only person who will see your choice.

Which amount do you choose? (Please mark your choice)

NIS 30

NIS 40

NIS 50

NIS 60

NIS 70