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Is Luck on My Side? Optimism, Pessimism, and Ambiguity Aversion

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Abstract

The influences of optimism and pessimism on ambiguity aversion were investigated in two tasks that manipulated the presence or absence of a potentially competitive experimenter. A total of 112 participants chose which option, ambiguous or known-risk, they preferred in the two slightly differing Ellsberg urns tasks. Optimism was measured using the Extended Life Orientation Test (ELOT). Highly optimistic people showed significantly less ambiguity aversion than less optimistic people when information was given that the number of balls was randomly determined. This pattern was present but less pronounced in the condition when the composition of the ambiguous urn could be interpreted as being influenced (rigged) by the experimenter. Pessimism was uninfluential. Perceptions of the situation, especially the degree of trust in the experimenter, were significantly influenced by the participants' optimism. People who do not have highly optimistic personalities tend to shy away from choosing ambiguous options. When ambiguity is clear, and trust issues are removed, people's optimistic outlook influences their degree of ambiguity aversion and thus their decisions.

KEYWORDS: ambiguity aversion; decision making; Ellsberg paradox; optimism; personality; trust.

Ambiguity aversion has been investigated by psychologists since Ellsberg (1961) noted that decision makers tend to prefer taking gambles with known-risk probabilities over equivalent gambles with ambiguous probabilities (for reviews, see Camerer & Weber, 1992; Keren & Gerritsen, 1999). In Ellsberg's simplest illustration of it, two urns are filled with red and black balls, Urn A containing 50 red and 50 black balls, randomly mixed, and Urn B containing an unknown ratio of 100 red and black balls, randomly mixed. A decision maker chooses a colour (red or black) and an urn (A or B) from which to make a blind drawing and wins a prize if a ball of the chosen colour is drawn. A large majority of decision makers strictly prefer the known-risk Urn A to the

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ambiguous Urn B, irrespective of the preferred colour. Ambiguity aversion has also been found in many applied contexts, such as insurance decisions (Einhorn & Hogarth, 1985, 1986), environmental risk (Viscusi, Magat, & Huber, 1991), and medical decisions (Ritov & Baron, 1990; Bier & Connell, 1994).

Ambiguity aversion has been examined from both cognitive and motivational perspectives (for a discussion, see Rode, Cosmides, Hell, & Tooby, 1999). Researchers taking the cognitive perspective have produced evidence that ambiguity influences perceptions of likelihood or risk. Einhorn and Hogarth (1985) argued that when people are given a probability that they believe is ambiguous, they use it as an anchor and then adjust it upwards or downwards, and one important factor in this adjustment is whether they are pessimistic or optimistic about the outcome. However, "the motivational approach assumes that people avoid ambiguity in order to satisfy secondary motivational factors that arise from the relative lack of information about the ambiguous option" (Kühberger & Perner, 2003, p. 182). The motivational explanations imply that decision makers prefer to obtain more information or choose the option about which they are best informed, all other things being equal (Baron & Frisch, 1994).

While the majority of people are ambiguity averse when faced with unknown probabilities, some individuals are less ambiguity averse than the rest. Individual differences have been incorporated into theoretical models of ambiguity aversion (Einhorn & Hogarth, 1985; Kahn & Sarin, 1988), because consistent individual differences in ambiguity aversion have been demonstrated. Personality correlates of ambiguity aversion that have been investigated include optimism (Bier & Connell, 1994), attitudes towards risk (Lauriola & Levin, 2001) and fear of negative evaluation (Trautmann & Vieider, 2007).

Since optimism and pessimism are defined as positive and negative outcome expectancies, it would seem logical that people with a predisposition to expecting things to turn out well might perceive an ambiguous situation differently from someone who tends to expect the worst to happen. Some empirical research on optimism and ambiguity aversion has been carried out by Bier and Connell (1994), who investigated the sources of ambiguity aversion by studying optimism (measured with the Life Orientation Test, LOT; Scheier & Carver, 1985), anxiety, mood, need for cognitive structure and locus of control. The LOT is a unidimensional measure of the construct of optimism–pessimism, and Bier and Connell split the scores to form three groups that they called optimists, moderates, and pessimists. Their hypothesis originated from Curley, Eraker, and Yates's (1984) observation that ambiguity avoiders tend to believe that their actual chances of success are worse in the ambiguous situation, which suggests a link with optimism/pessimism. Bier and Connell found ambiguity seeking for moderate and optimistic participants with scenarios that were positively framed in terms of gains, but no effect with ones that were negatively framed as losses. This finding goes against the majority of earlier results reporting the reverse (e.g., Einhorn & Hogarth, 1986; Kahn & Sarin 1988). The most likely explanation, they proposed, is the nature of the scenarios that they used, which had many attributes to consider and may have made the information about ambiguity less salient.

Einhorn and Hogarth (1985) also speculated that optimism and pessimism may influence ambiguity aversion, and they proposed a model in which individual differences would affect the second of their factors – the differential weighting of imagined probabilities. Optimism and pessimism may alter the weights placed on the best and worst outcomes. Bier and Connell similarly proposed that "positive framing may have caused optimistic subjects to regard the true probability as closer to the favorable end of the ambiguous range" (p. 179), and they concluded by recommending that their findings should be tested in the more traditional ball-and-urn setting where

ambiguity is more salient. This article aims to do just that.

Recent publications in the optimism literature have criticised the validity of the LOT, which Bier and Connell (1994) used, and have argued that optimism–pessimism are not polar opposites on a unidimensional continuum (Chang, Maydeu-Olivares, & D'Zurilla, 1997). The prevailing view is now that optimism and pessimism are separate but related constructs. The Extended Life Orientation Test (ELOT, developed by Chang, et al.), is therefore used to measure both optimism and pessimism, viewing them as separate constructs.

The present investigation focuses on whether optimism and pessimism measured via the ELOT influence ambiguity aversion in a simple lottery like Ellsberg's urns. It was expected that participants would tend to be more ambiguity averse than ambiguity seeking, but that optimism and pessimism would be associated with the degree of ambiguity aversion. Bier and Connell (1994) found ambiguity seeking for the most optimistic participants in positively framed multi-attribute scenarios, leading to the first hypothesis in this experiment with the classic urns task, that participants with higher optimism scores will be more ambiguity seeking than participants with lower optimism. Whether lower pessimism also leads to more ambiguity seeking is also evaluated.

To throw more light on the reasons for ambiguity aversion, the role of perceived competition is also investigated, since research has shown that if people view a situation as competitive – for example, if an experimenter or an opponent has determined the number of blue balls in the ambiguous urn – then they tend to be more ambiguity averse (Kühberger & Perner, 2003). Kühberger and Perner place ambiguity aversion in a game-theoretic context, and propose that people's attitudes toward ambiguity in the Ellsberg urns task depends upon the perceived competitiveness of the situation, because "people treat the person responsible for composing the box as another player who has either a cooperative or a competitive interest in the outcome of the gamble" (p. 182). Recent research has shown that ambiguity aversion also occurs in dyadic decision making with another player (Pulford & Colman, 2007), as well as in the traditionally studied individual decision-making situation.

Kühberger and Perner's (2003) results suggest that some people may interpret the Ellsberg urns task as a competition against a knowledgeable opponent, and that this assumption can be reversed, and ambiguity aversion turned to ambiguity seeking, when people believe they are playing with a cooperative and knowledgeable friend. Their hypothesis followed on from the "hostile nature" hypothesis that people are ambiguity averse because they are suspicious that they are facing a biased/rigged ambiguous urn or box (Frisch & Baron, 1988; Yates & Zukowski, 1975). Frisch and Baron argued that ambiguity aversion arises from generalizing a heuristic to avoid placing bets when one lacks information that others might have; for example if we think that there is a hostile opponent who will bias the situation to our disadvantage. In order to empirically investigate whether participants are indeed suspicious, the participants in this study are asked about their perceptions of the situation, for example, whether the urn is rigged or the experimenter untrustworthy. Participants' perceptions may turn out to relate to their degree of optimism and this may help to explain why optimism influences ambiguity aversion.

In this experiment, a within-subjects design is employed to control for other individual differences influencing choices in the different conditions. Instructions to participants are manipulated in two conditions, to alter the perceived likelihood that the ambiguous urn has been 'rigged' by the experimenter. In Condition 1 the information given specifies that the number of blue balls in the ambiguous urn was randomly determined by selecting a number out of a hat and that every possible mixture of blue and red balls is equally likely. This instruction should cause the participants to view the

task in a non-competitive manner. Condition 2 is designed to remove the details of how the proportion of balls in the ambiguous urn was determined, thus leaving room for competitive interpretations of the situation. The second hypothesis is that the pattern of ambiguity aversion between conditions will be influenced by the optimism or pessimism of the participants. Optimism or pessimism may influence people's perceptions of how competitive the situation is and how likely it is that the experiment has been rigged for or against them.

Method

Participants

A sample of 112 British undergraduate students (75 women and 37 men) volunteered as part of a course requirement, (mean age 19.33 years, *SD* = 1.96, range 18 to 37 years).

Materials

Participants completed the Extended Life Orientation Test (ELOT; Chang, Maydeu-Olivares and D'Zurilla, 1997), a 20–item scale containing six optimism items and nine pessimism items. The optimism and pessimism scales show adequate internal consistency (Cronbach's alphas of .77 and .89) and 6-week retest reliability statistics (.73 and .84). Chang et al. report that the mean optimism score for college students was 21.73 (*SD* = 3.69), and 22.51 (*SD* = 6.57) for pessimism, and no significant gender differences were found.

Design and procedure

The dependent variable was the urn chosen. The experiment used a classic forced-choice Ellsberg urns task, where one urn is ambiguous as to the proportion of balls inside it and the other is not. In Condition 1, the participants were given the following information:

> Consider the following problem carefully, then write down your choice. Imagine that there are two urns, labelled ***A* and *B***, containing blue and red marbles, and you have to draw a marble from one of the urns without looking. If you get a **blue** marble, you will be entered into a lottery draw with a cash prize.
>
> Urn *A* contains 50 blue marbles and 50 red marbles. Urn *B* contains 100 marbles in an unknown colour ratio, from 100 blue marbles and 0 red marbles to 0 blue marbles and 100 red marbles. The mixture of blue and red marbles in Urn *B* has been decided by writing the numbers 0, 1, 2, ..., 100 on separate slips of paper, shuffling the slips thoroughly, and then drawing one of them at random. The number chosen was used to determine the number of blue marbles to be put into Urn *B*, but you do not know the number. Every possible mixture of blue and red marbles in Urn *B* is equally likely.
>
> You have to decide whether you prefer to draw a marble at random from Urn *A* or Urn *B*. What you hope is to draw a blue marble and be entered for the lottery draw.
>
> I prefer to draw a marble from Urn A / Urn B.

Participants then rated the following two statements "The experimenter may have rigged urn B so the odds are against me getting a blue marble" and "I trust the experimenter", using a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

In Condition 2, participants were given the same instructions, but the information differed insofar as the following information was removed: "The mixture of blue and red marbles in Urn *B* has been decided by writing the numbers 0, 1, 2, ..., 100 on separate slips of paper….. Every possible mixture of blue and red marbles in Urn *B* is

equally likely".

Testing took place online. The options Urn A/Urn B were counterbalanced, as was the order of completing the two conditions. The two conditions were separated by a filler task that took 15 minutes. Participants completed the ELOT approximately two months prior to the main study. Upon completion of the questionnaires, the participants were thanked and debriefed.

Results

Choice

In Condition 1, when information was given, 82 of the 112 participants chose the known-risk urn (73%), and only 30 chose the ambiguous urn (27%), clearly showing that ambiguity aversion is present, χ^2 (1, N = 112) = 24.143, $p < .001$. Slightly higher and significant ambiguity aversion was found in Condition 2 when the random-selection information was removed; 88 participants chose the known-risk urn (79%), and 24 chose the ambiguous urn (21%), χ^2 (1, N = 112) = 36.571, $p < .001$.

The known-risk urn was consistently chosen in both conditions by 64% of participants, while 13% chose the ambiguous urn in both, and 23% changed their choice of urn between conditions. Condition order did not significantly influence choice.

Optimism and Pessimism

In this sample, the reliability of the ELOT was $\alpha = .73$ for optimism, and $\alpha = .87$ for pessimism. Mean optimism was 20.85 (SD = 3.40), and pessimism was 23.29 (SD = 6.30), similar to that found by Chang et al. (1997). Optimism and pessimism correlated negatively, $r(110) = -.58$, $p < .001$. Participants were divided into three groups according to their optimism and pessimism scores, using ± 0.75 of a standard deviation as cut off points.

Table 1

Choices of ambiguous and known-risk urns, for different levels of optimism when different information was given about how the ambiguous urn was determined

Optimism		1: Information given about random selection		2: No information given	
		Known-risk urn	Ambiguous urn	Known-risk urn	Ambiguous urn
Low	Count	22	3	21	4
	% within group	88.0%	12.0%	84.0%	16.0%
Medium	Count	43	16	49	10
	% within group	72.9%	27.1%	83.1%	16.9%
High	Count	17	11	18	10
	% within group	60.7%	39.3%	64.3%	35.7%
Total	Count	82	30	88	24
	% within group	73.2%	26.8%	78.6%	21.4%

Table 1 shows how the choice of ambiguous or known-risk urn in the two conditions was influenced by the optimism level of the participants. In Condition 1 the low-optimism participants were significantly more ambiguity averse than the high-optimism participants, χ^2 (1, N = 53) = 5.06, p = .025, as only 12% of the low-optimism group chose the ambiguous urn compared with 39% of the high-optimism group. A total of 27% of the medium-optimism group chose the ambiguous urn.

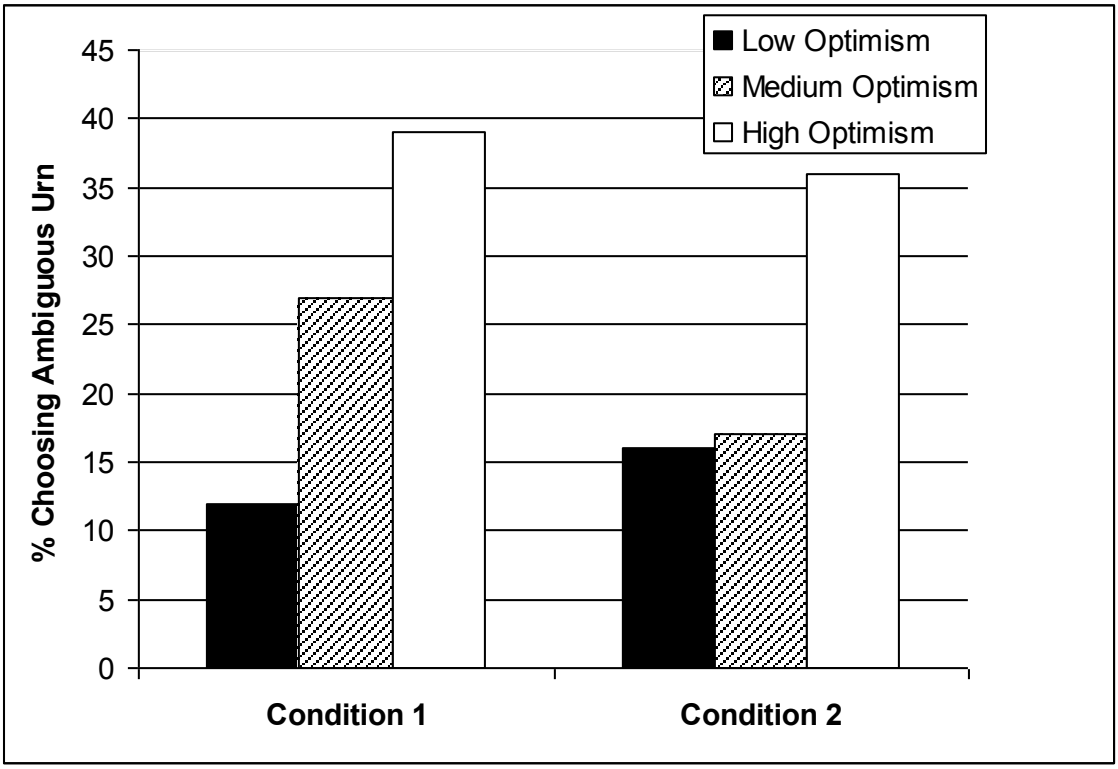

Figure 1. Percentage of participants choosing the ambiguous urn according to their degree of optimism.

When the information about random selection was absent, in Condition 2, there was a very small drop in the number of optimistic participants choosing the ambiguous urn, which fell from 39% to 36% for the most optimistic participants and a larger drop from 27% to 17% for the medium-optimism group (see Figure 1). The difference between the most and least optimistic participants in choosing the ambiguous urn in Condition 1 was nonsignificant in Condition 2 (although in the same direction and approaching significance), χ^2 (1, N = 53) = 2.641, p = .104, *ns*.

Table 2
Choices of ambiguous and known-risk urns, for different levels of pessimism when different information was given about how the ambiguous urn was determined

		1: Information given about random selection		2: No information given	
Pessimism		Known-risk urn	Ambiguous urn	Known-risk urn	Ambiguous urn
Low	Count	22	10	24	8
	% within group	68.8%	31.3%	75.0%	25.0%
Medium	Count	37	13	41	9
	% within group	74.0%	26.0%	82.0%	18.0%
High	Count	23	7	23	7
	% within group	76.7%	23.3%	76.7%	23.3%
Total	Count	82	30	88	24
	% within group	73.2%	26.8%	78.6%	21.4%

Binomial tests showed that whereas there was a significant bias towards ambiguity aversion (choosing the known-risk urn) for low and medium optimism participants (p < .001 for both groups) in both conditions, there was no significant

ambiguity aversion for the most optimistic participants in either condition (p = .35 and p = .19, respectively). Thus, there is support for the hypothesis that participants with higher optimism scores are less ambiguity averse[1].

Analyses showed that the choice of urn was not related to pessimism (see Table 2) in either Condition 1 or 2. Significant ambiguity aversion occurred irrespective of the level of pessimism ($p < .05$).

Perceptions of the situation

The participants' perceptions of the situations were analysed using Kruskal-Wallis tests for nonparametric data with three independent groups. Table 3 shows that the three optimism groups did *not* differ in their perception that the ambiguous urn may be rigged, either in Condition 1, $H(2, N = 112) = 0.014$, $p = .99$, or in Condition 2, $H(2, N = 112) = 0.919$, $p = .63$. All three groups, however, tended to significantly perceive that urn B was more likely to be rigged against them in Condition 2 ($M = 3.33$) than in Condition 1 ($M = 2.84$; all $p < .05$).

All three optimism groups trusted the experimenter similarly in Condition 1 when the information about random selection was given, $H(2, N = 112) = 1.733$, $p = .42$, *ns*. In Condition 2, however, the low-optimism group were significantly less trusting of the experimenter than the most optimistic participants, $H(2, N = 112) = 7.893$, $p = .02$. This was due to the finding that while the low- and medium-optimism groups were significantly less trusting of the experimenter in Condition 2 than in Condition 1 (Wilcoxon $T = 2.52$, $p = .01$ and $T = 2.88$, $p = .004$, respectively), the highly optimistic group trusted the experimenter similarly in both conditions, $T = 1.41$, $p = .16$, *ns*. Pessimism was found to have no discernible pattern of influence on the ratings in either condition, except that highly pessimistic participants trusted the experimenter significantly less than the medium-pessimism participants in both conditions.

Examining Table 3 further reveals that in Condition 1 people who chose the ambiguous urn ($n = 30$) did not differ in their perceptions of the situation from those people who chose the known-risk urn ($n = 82$). Participants' perceptions in Condition 2, however, were different as those people who chose the known-risk urn ($n = 88$) tended to believe that Urn B was much more likely to be rigged than did those people who chose the ambiguous urn B ($n = 24$), $U = 721$, $p = .01$, and they were slightly less trusting of the experimenter, $U = 836$, $p = .09$.

Discussion

In Condition 1, it was explicit that the number of blue marbles in the ambiguous urn had been randomly chosen, and participants viewed the situation similarly, regardless of optimism, tending to believe that the urn was not rigged against them and that they trusted the experimenter. Their choices in Condition 1, however, were radically different, with the vast majority of low-optimism participants (88%) choosing the know-risk urn, and thus being very ambiguity averse, while the highly optimistic participants were relatively indifferent in their choice of urn, showing little if any ambiguity aversion. The first hypothesis was thus supported by the results. Clearly the ambiguous urn is far less threatening to optimistic participants than it is to the less optimistic ones. This result confirms Bier and Connell's (1994) finding that higher optimism is associated with less ambiguity aversion. Bier and Connell found this with medical scenarios, and this experiment shows that it also occurs in the traditional Ellsberg urns task where ambiguity is more obvious. Pessimism had no influence on either ambiguity aversion or perceptions of the situation. By measuring optimism and pessimism as separate constructs in this experiment it has become apparent that it is the

presence of optimism and not the absence of pessimism that reduces ambiguity aversion.

In Condition 1, the experimenter could not have rigged the urn and was not perceived to have done so. Why then were the people who lack optimism so extremely ambiguity averse? The 'hostile nature' or 'competitive other' theories do not seem capable of explaining these differences in Condition 1. These results do not contradict Einhorn and Hogarth's (1985) proposal that optimism and pessimism may alter perceived probabilities, but they do suggest that it is the least optimistic people who are the most likely to adjust perceived probabilities in the ambiguous urn to make them less likely to win and thus are most ambiguity averse.

In Condition 1, the high optimists were more than three times as likely to choose the ambiguous urn than people who were low in optimism, and they were twice as likely to in Condition 2. Fewer medium-optimism participants chose the ambiguous option in Condition 2 than Condition 1, and this indicates that the absence of the information about how the ambiguous urn was to be filled made some of these people more ambiguity averse and behave like the low-optimism group. Highly optimistic people tended to trust the experimenter in both conditions and thus were not much more ambiguity averse in Condition 2. When the random-selection information was missing (in Condition 2) the situation was construed as potentially more competitive, as Kühberger and Perner (2003) proposed, as evidenced by their changed ratings of how likely it was that the urn was rigged and how much they trusted the experimenter. These perceptions of the social situation do appear to influence how people perceive the odds in the ambiguous urn and thus also influence ambiguity aversion. Pessimism appears to be of lesser importance than optimism in these social judgements.

This experiment shows that optimism is associated with far less ambiguity aversion. Many of the optimists must have judged the probability of winning to be greater in the ambiguous urn than in the known-risk one. The more optimistic participants seem to be optimistic about the random nature of luck, perhaps having a belief in being lucky, or of having some personal control over the odds, although this is admittedly conjectural. Perhaps the judgement people make is not about how many winning balls there are in the urns but about how such situations usually turn out for them. By definition, people who are optimistic believe that things will turn out for the best, and events will go their way in the future, and thus they are indifferent between the two urns. People who are not optimistic, however, believe that things generally turn out badly for them and do not result in favourable outcomes; thus they may be more wary of any situation where odds may be stacked against them (by people or by chance), and thus they prefer known-risk 50:50 odds. Alternatively, optimism also correlates highly with self-esteem, and thus perhaps optimists can tolerate losing after drawing from an ambiguous urn, whereas someone with lower self-esteem and less optimism would feel more upset by a loss after choosing that urn. Anticipating these feelings may influence choices. Future research should investigate this possibility. Future researchers, using the two-colour Ellsberg Urns task, with a specified target colour to be drawn, should also consider the issue of trust in the experimenter not to rig the urn, as this needs controlling for if pure ambiguity aversion is to be measured.

In conclusion, highly optimistic people appear to feel that luck may be on their side, even when a potential competitor is involved, or perhaps feel optimistic that the experimenter is not a competitor and is trustworthy. People lacking high optimism, however, shy away from choosing ambiguous options, even when the situation is clearly not rigged against them by the experimenter.

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Footnotes

1. A similar pattern of results was found in two earlier unpublished experiments (Pulford, 2006). In the first (akin to Condition 1), in which 71 participants were given information about random selection of the number of blue balls in urn B, 42% of the optimists preferred the ambiguous urn, but only 29% of the medium- and 11% of the low-optimism participants chose it. In the second (akin to Condition 2), 201 participants did not receive information about how the number of balls was determined, and choice of ambiguous urn dropped to 25%, 19% ,and 17%, respectively. Prizes of £30 sterling were given to three raffle winners, with entry being dependent upon drawing a blue ball from their chosen urn. An anonymous referee of an earlier version of this manuscript recommended repeating the experiment using a within-subjects design, which this paper now reports.

Table 3

Ratings for trusting the experimenter, and believing the ambiguous urn was rigged in the two information conditions, for people with different levels of optimism, and different choices of urn

	Level of Optimism			All	Urn Chosen	
	Low	Medium	High	Participants	A: Known	B: Ambiguous
Trust the Experimenter?						
Condition1	2.96 (0.98)	3.22 (0.81)	3.29 (1.05)	3.18 (0.91)	3.15 (0.89)	3.27 (0.98)
Condition 2	2.48 (0.71)	2.85 (0.78)	3.14 (1.01)	2.84 (0.86)	2.77 (0.84)	3.08 (0.88)
Experimenter rigged the B urn?						
Condition1	2.72 (1.28)	2.69 (0.95)	2.68 (1.28)	2.70 (1.10)	2.72 (1.09)	2.63 (1.16)
Condition 2	3.44 (1.08)	3.37 (0.83)	3.14 (1.11)	3.33 (0.96)	3.45 (0.93)	2.88 (0.95)

Note: Figures are means with *SD*s in parentheses.