

Good luck, bad luck, and ambiguity aversion

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Abstract

We report a series of experiments investigating the influence of feeling lucky or unlucky on people's choice of known-risk or ambiguous options using the traditional Ellsberg Urns decision-making task. We induced a state of feeling lucky or unlucky in subjects by using a rigged wheel-of-fortune game, which just missed either the bankrupt or the jackpot outcome. In the first experiment a large reversal of the usual ambiguity aversion effect was shown, indicating that feeling lucky made subjects significantly more ambiguity *seeking* than usual. However, this effect failed to replicate in five refined and larger follow-up experiments. Thus we conclude that there is no evidence that feeling lucky reliably influences ambiguity aversion. Men were less ambiguity averse than women when there were potential gains to be had, but there were no gender differences when the task was negatively framed in terms of losses.

Keywords: ambiguity aversion, decision making, Ellsberg paradox, luck.

1 Introduction

When taking decisions, people tend to be ambiguity averse and avoid unknown probabilities. This has consistently been shown to occur in individual decision making and also occurs more widely, for example in dyadic decision making (Pulford & Colman, 2007) and intertemporal choice (Weber & Tan, 2012). Research into ambiguity aversion has spanned more than 50 years since Ellsberg's discussion of it in 1961. People's aversion to ambiguity has proved to be robust, although individual differences such as optimism have been shown to relate to the degree to which people are ambiguity averse (Pulford, 2009). Explanations for ambiguity aversion range from the dislike of missing information (Frisch & Baron, 1988), especially if an opponent is perceived to have that information, and fear of negative evaluation by other people if the ambiguous urn turns out to have been a bad choice (Trautmann, Vieider, & Wakker, 2008).

In discussing why optimistic people are less ambiguity averse, Pulford (2009) speculated that optimistic people may feel that luck is on their side, and this is why they do not avoid the ambiguous option. In this article we test this speculation to see if feeling lucky is connected to reduced

ambiguity aversion. We decided to investigate whether experiencing a lucky or unlucky event can influence subsequent decisions.

Research has established that the degree to which a negative or positive outcome was narrowly missed is the decisive factor in determining whether events are perceived as lucky or unlucky, and that the effect of narrowly missing a negative/positive outcome is influential enough to alter self-perceived luckiness and subsequent gambling behavior (Wohl & Enzle, 2003). Narrowly missing an alternative outcome triggers feelings of being lucky or unlucky because people make counterfactual comparisons, and these comparisons are necessary for such feelings to arise (Teigen, 2005). It may be that people who feel lucky change their perceptions of the odds of winning in the ambiguous urn and therefore are more attracted to it than usual (therefore becoming less ambiguity averse). We hypothesize that people who experience a lucky event should increase their self-perceived luckiness and therefore become less ambiguity averse in a subsequent Ellsberg Urns task. Those subjects who experience a near big win that makes them feel unlucky should show more ambiguity aversion.

2 Experiment 1

To investigate our hypothesis that feelings of luck influence ambiguity aversion we used a rigged slot machine style wheel-of-fortune game to give people a near big loss or near big win experience, to make them feel lucky (to have avoided it) or unlucky (to have missed it), and then observed their choice of known-risk or ambiguous option in a traditional Ellsberg Urns Task (Ellsberg, 1961). We chose to use both positively and negatively framed urns

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tasks as Einhorn and Hogarth (1986) showed that there are significant differences in responses to ambiguity when there are gains and losses. In their study 47% of subjects preferred the known-risk urn in the positively framed scenario, but this reduced to 30% in the negative, loss, scenario. In both situations a large number of subjects were indifferent (an option not usually offered and we are not offering in our study) and only 19% and 14% respectively wanted the ambiguous urn.

2.1 Method

2.1.1 Subjects

A convenience sample of 74 undergraduate students volunteered for course credit and raffle tickets for a £30 prize. There were 20 men and 54 women (mean age 20.32 years, $SD = 3.41$).

2.1.2 Design

Subjects were randomly assigned to one of three conditions; Lucky ($n = 26$), Unlucky ($n = 27$), and Control ($n = 21$). They completed both a positively framed Ellsberg Urns task and a negatively framed one, within subjects, counterbalanced. In the positively framed condition subjects were told that they would win five more raffle tickets if they picked out a red bead, but if they picked out a blue bead then they would win nothing. In the negatively framed condition they were told that if they drew a red bead then they would keep all of their tickets, but if they drew a blue bead then they would lose five of their tickets. The dependent variable was their choice of known or ambiguous urn on each task.

2.1.3 Materials and procedure

The experimenter had three computer files to run the wheel-of-fortune software, consent forms, instructor and subject record sheets, raffle tickets, and four paper cups arranged in pairs—two labeled “A” and two labeled “B”, each containing 50 red and blue beads. All subjects were given five raffle tickets as an initial stake. They were told that the tickets they had at the end of the experiment would be entered into a £30 lottery draw. Therefore, the more tickets the higher the probability of winning the prize money.

Testing was one-to-one. Subjects played the wheel-of-fortune game first. They were told that the panel that the wheel stopped on would indicate the number of tickets they would win. However, if they landed on “Bankrupt” they would lose the five tickets just given to them. In the Lucky condition the subject just missed landing on the bankrupt panel. The repeating sequence of panels was: 70 tokens, 15 tokens, 5 tokens, Bankrupt, 10 tokens, 15

tokens, 5 tokens. The wheel slowed exponentially over 10 seconds and nearly stopped on the Bankrupt panel but crept on so that the 10 tokens outcome was highlighted. In the Unlucky condition the sequence was identical but with the Bankrupt and 70 tokens panels transposed and the wheel landed on 10 tokens but just missed landing on the jackpot “70 tokens” panel. The Control group did not play the wheel-of-fortune game. All subjects then completed one positively framed and one negatively framed Ellsberg Urns tasks (counterbalanced). They were told:

In each urn there is a mixture of 50 red and blue beads. Urn “A” contains a known-risk ratio of 25 blue and 25 red beads. Urn “B” contains an unknown ratio of red and blue beads, from 50 blue beads and 0 red beads to 50 red beads and 0 blue beads. The ratio of blue and red beads has been decided by writing the numbers 0, 1, 2 . . . 50 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 red beads to be put into Urn B, every possible mixture of blue and red beads is equally likely. What you have to do is pick out a red bead from either urn “A” or urn “B”. Which urn do you want to pick a bead from?

They were not allowed to pick from their chosen urns until both choices had been made.

2.2 Results and discussion

In the positively framed urns task, the Control group chose the ambiguous urn 42.9% of the time, see Table 1 row E1, and this did not differ from the 33.3% of subjects in the Unlucky condition who chose the ambiguous urn. The subjects in the Lucky condition, however, showed a strong degree of ambiguity *seeking*, as 76.9% of them chose the ambiguous urn, which was significantly higher than the Control and Unlucky conditions, $\chi^2(2, N = 74) = 10.921$, $p = .004$.

A similar but slightly less pronounced pattern occurred in the negatively framed urns, where 57.7% of subjects chose the ambiguous urn after experiencing the Lucky event, which was much higher than the 33.3% in the Control condition and 18.5% in the Unlucky condition, $\chi^2(2, N = 74) = 8.897$, $p = .012$.

Both the Lucky and Unlucky groups experienced a positive win of ten tokens on the first game, but their subsequent decisions were different. Subjects who experience a near big loss and thus felt lucky were not ambiguity averse, and were in fact ambiguity seeking in the both the positively and negatively framed tasks. The subjects who

Table 1: Percentage of subjects choosing the ambiguous option in the Lucky, Control and Unlucky conditions in six experiments (E1 to E6).

Expt.	Condition			χ^2	<i>N</i>	<i>p</i>
	Lucky	Control	Unlucky			
Positive framing						
E1	76.9	42.9	33.3	10.921	74	.004
E2	37.1	–	28.2	0.672	74	.412
E3	43.5	38.5	31.8	0.652	71	.722
E4	29.0	30.8	28.9	0.038	108	.981
E5	48.0	28.0	40.0	2.136	75	.344
E6	42.1	41.7	–	0.004	246	.950
Negative framing						
E1	57.7	33.3	18.5	8.897	74	.012
E3	21.7	26.9	40.9	2.123	71	.346
E4	32.3	46.2	36.8	1.507	108	.471
E5	44.0	44.0	36.0	0.440	75	.803

Note: Positive framing was in terms of winning more tickets, negative framing was in terms of losing already won tickets.

experienced a near big win (unlucky condition) or experienced nothing at all (control condition) exhibited the usually observed phenomenon of ambiguity aversion. Why experiencing a lucky event appears to reverse ambiguity aversion is unclear. It could alter the perceived probability of the number of winning balls in the ambiguous urn, or it could alter beliefs about the ability to positively influence the outcome.

3 Experiment 2

A criticism of Experiment 1 is that subjects may have felt that they urn was rigged for or against them by the experimenter (Pulford, 2009). In Experiment 2 we changed the task so that the subjects had to choose which color ball they would try to draw from their chosen urn. There seemed to be no real difference between the unlucky and the control conditions in Experiment 1, so we omitted the control condition for this replication and used only the positive urns task, since that was where the largest effect occurred. We predicted that the subjects who felt lucky would be ambiguity seeking rather than averse and choose Urn B more than Urn A.

3.1 Method

3.1.1 Subjects

A convenience sample of 97 undergraduate students took part in a group lab class. In Experiments 2–4, subjects were excluded if they failed a memory check question “In the wheel-of-fortune game, what was in the section directly above where the wheel finally stopped”, because if they had not noticed it then they may not have felt lucky or unlucky. In this experiment 23 failed the manipulation check, leaving 74 in the analyses. Subjects’ decisions influenced how many raffle tickets they won for a £10 prize raffle. There were 10 men and 64 women (mean age 20.12 years, $SD = 4.79$).

3.1.2 Design

Subjects were randomly assigned to one of two conditions; Lucky ($n = 35$) or Unlucky ($n = 39$). The dependent variable was their choice of known or ambiguous urn on a positively framed Ellsberg urns task.

3.1.3 Materials and procedure

The materials and procedure were the same as Experiment 1, except that the subjects read the description of the task on screen and we changed the urns to contain the more usual 100 rather than 50 beads, although urn size typically does not matter (Pulford & Colman, 2008). Subjects then answered (a) which color will you choose, and (b) I will draw a ball from box A/B, before drawing their ball from their chosen urn without looking.

3.2 Results and discussion

The Lucky group did not show the ambiguity seeking we predicted: only 37.1% of them chose the ambiguous urn, which was not significantly higher than the 28.2% of the Unlucky group who chose that urn (see Table 1, row E2). Group testing led to many people being excluded for failing the memory manipulation check. Thus we felt that we may have failed to induce the lucky feeling that had occurred in Experiment 1 and this would explain why the ambiguity seeking had disappeared. To remedy this we used one-to-one testing for all further experiments to improve attention levels.

4 Experiment 3

As well as individual testing we decided in this replication to introduce a control condition where subjects would experience a wheel-of-fortune game and win 10 tickets but not see the panel above the one they landed on. So, in the control condition the wheel spun very fast and stopped

suddenly. We also used real cash incentives instead of raffle tickets.

4.1 Method

4.1.1 Subjects

A convenience sample of 71 university staff and students volunteered (79 took part but 8 failed the manipulation check). They received up to £3 depending on the results of the decisions that they made. There were 29 men and 42 women (mean age 24.38 years, $SD = 7.91$).

4.1.2 Design

Subjects were randomly assigned to either: Lucky ($n = 23$), Unlucky ($n = 22$), or Control ($n = 26$). The dependent variable was their choice of known or ambiguous urn on a positively and a negatively framed Urns task.

4.1.3 Materials and procedure

Subjects were given five ten-pence tokens to play the game, and then the procedure followed that of Experiment 2, with the inclusion of the new Control wheel-of-fortune game, and subjects read the instructions on a card, at their own pace.

4.2 Results and discussion

The E3 rows in Table 1 show that for both positively and negatively framed urns the Lucky group did not show the ambiguity seeking we predicted, as there was no significant effect of Condition. One-to-one testing reduced the number of people who failed the memory check, but the cash incentives and real control condition had no influence and the results stayed non-significant.

5 Experiment 4

In this experiment we replicated study 3 but added in verbal statements to emphasize the lucky or unlucky nature of the outcome on the first game, following the example set by Damisch, Stoberock, and Mussweiler (2010). In their experiments saying “I’ll keep my fingers crossed for you” activated good-luck related superstitions and raised performance in a motor-dexterity task.

5.1 Method

5.1.1 Subjects

A group of 108 undergraduate students in a lab class took part (116 took part but 8 failed the manipulation check),

and they were tested individually. There were 21 men and 87 women (mean age 20.08 years, $SD = 4.62$).

5.1.2 Design

Subjects were randomly assigned to either: Lucky ($n = 31$), Unlucky ($n = 38$), or Control ($n = 39$). The dependent variable was their choice of known or ambiguous urn on a positively and a negatively framed Urns task.

5.1.3 Materials and procedure

Experiment 3 was replicated but with raffle tickets (tokens) for a £20 prize rather than individual cash payments. Depending on the condition, when the wheel stopped spinning the experimenter said either: “Oh, that was lucky you nearly lost all your tokens, here are the 10 tokens you won” to emphasize how lucky the event was, or “Oh, that was unlucky you nearly got 70 tokens, here are the 10 tokens you won” to emphasize how unlucky the event was, or “Here are the 10 tokens you won” said in a neutral manner. As a manipulation check we also asked them to rate several statements about how they felt, such as “attentive”, “alert”, “happy”, and “lucky” (*1 does not describe me at the present moment to 5 describes me very well at the present moment*), before they drew the ball from their chosen urn.

5.2 Results and discussion

Again, Table 1 (E4 rows) shows that for both positively and negatively framed urns the Lucky group did not show the ambiguity seeking we had found earlier, as there was no significant effect of condition. The manipulation check ratings, about how lucky they felt, showed that the Control group did not differ significantly from the Lucky and Unlucky groups but the Lucky group rated themselves as feeling significantly more lucky ($M = 3.55$) and fortunate ($M = 3.77$) than the Unlucky group did ($M = 2.97$ and $M = 3.13$), $p = .028$ and $p = .011$. There was no correlation between the ratings of feeling lucky and the choice of ambiguous urn, and this was unaffected by framing and condition. So, by the inclusion of verbal statements we successfully induced higher feelings of luckiness in the Lucky group compared to the Unlucky group, but this did not translate into more ambiguity seeking.

6 Experiment 5

We decided to do an exact replication of study 1 in all respects to see if we could reproduce its findings.

6.1 Method

6.1.1 Subjects

A convenience sample of 75 university staff and students volunteered and could win raffle tickets for a £30 prize. There were 33 men and 42 women (mean age 29.43 years, $SD = 11.18$).

6.1.2 Design.

Subjects were randomly assigned to either: Lucky ($n = 25$), Unlucky ($n = 25$), or Control ($n = 25$). The dependent variable was their choice of known or ambiguous urn on a positively and a negatively framed Urns task.

6.1.3 Materials and procedure.

Identical to Experiment 1.

6.2 Results and discussion

The E5 rows in Table 1 show that for both positively and negatively framed urns the Lucky group did not show the ambiguity seeking we predicted, as there was no significant effect of Condition in Experiment 5. Thus, in the exact replication of the first study, we failed to find the ambiguity seeking that we had initially found in the Lucky group. Moreover, combining positive and negative framing and comparing Lucky and Unlucky conditions (without Control), the interaction between experiment (E1 vs. E5) and condition (Lucky vs. Unlucky) was significant ($p = .020$).

7 Experiment 6

Previous research by Xu, Zwick and Schwarz (2012) showed that subjects' risk taking behavior was influenced by whether they were feeling lucky or not. Similarly Damisch, et al. (2010) found that activating a superstition and making people feel lucky could raise their performance on skill tasks such as golf, memory, and puzzles. Both of these studies evoked feelings of luck by methods other than the just-missed technique that we used. Xu et al. asked people to recall incidents where they had experienced good or bad luck, or they actually experienced a winning or losing streak in a gambling task. Damisch et al. activated good luck superstitions by verbally wishing subjects good luck, with sayings such as "break a leg" or "I'll keep my fingers crossed". Thus we decided to find out if using a different technique to evoke lucky feelings would prove more effective at showing the differences found only in Experiment 1.

We also decided to see if people's background beliefs about luck influence their susceptibility to feelings of luck

influencing ambiguity aversion. It is possible that people who don't believe in luck wouldn't change their perceptions of odds in the ambiguous urn when superstitious finger crossing was done to raise lucky feelings, and maybe any effect only happens for people who do believe in luck. Thus we used the Darke and Freedman Beliefs Around Luck Scale (Maltby, et al., 2008) to measure subjects' beliefs in being lucky/unlucky, rejection of belief in luck, and general belief in luck. We looked for a relationship between lucky superstitious beliefs being evoked or not and the degree of ambiguity aversion, which would be heightened for people who believe in luck.

7.1 Method

7.1.1 Subjects

The subjects were 246 psychology undergraduates who took part voluntarily as part of a statistics module. There were 46 men and 200 women, age 18-47 years ($M = 19.35$ years, $SD = 2.57$), tested individually. They could win raffle tickets for a £15 prize.

7.1.2 Design

Subjects were randomly assigned to either; Lucky ($n = 126$), or Control ($n = 120$). The dependent variable was their choice of known or ambiguous urn on a positively framed Urns task.

7.1.3 Materials and procedure

After reading the consent form subjects read a description of an Ellsberg Urns task, and chose their color ball.

In front of you there are two jars, labeled A and B, containing blue and red balls, and you have to draw a ball from one of the jars without looking. Jar A contains 100 balls (50 red and 50 blue). Jar B contains 100 balls but in an unknown color ratio. The proportion of blue and red balls in Jar B has been randomly assigned by a computer. Every possible ratio of balls in Jar B is equally likely. You can choose the winning color. Then you draw a ball randomly from the jar you have picked. You will win a raffle ticket if you pick out your chosen color ball, and win nothing if you draw out the other color. Tell the experimenter which color ball you are trying to draw (red or blue).

If they were in the Lucky condition, the experimenter said to them (with enthusiasm, and crossing fingers at the same time so that the subject could see), "OK, now draw a ball from whichever jar you like, I'll keep my fingers

crossed for you.” If they were in the Control condition the experimenter said the following statement (without crossing fingers), “OK, now draw a ball from whichever jar you like.” The subject then drew a ball from one of the real jars in front of them (choosing between an ambiguous and a known option) to try and draw the ball of their chosen color. The experimenter recorded their decision and gave them a raffle ticket for a £15 lottery if they managed to draw a ball of the color that they had chosen. Subjects then completed the Darke and Freedman Beliefs Around Luck Scale (Maltby, et al., 2008)—a 22 item scale responded to on a 6 point Likert scale where 1 = “strongly disagree” and 6 = “strongly agree”.

7.2 Results and discussion

As in Experiments 2-5, there was general ambiguity aversion, with only 41.9% of the overall sample choosing the ambiguous urn. However, Table 1 shows that the Lucky group did not show significantly more ambiguity choices (42.1%) than the Control group (41.7%) as there was no significant effect of Condition in Experiment 6. There were no correlations between urn choice and the beliefs about luck scales, and this was unaffected by condition. A binary logistic regression was carried out to see if condition, age, gender, or the beliefs about luck influenced the choice of urn, and the only significant predictor was gender ($\text{Exp}(B) = 0.43, p = .02$). Of the 46 men in Experiment 6, 58.7% of them chose the ambiguous Urn B and were thus ambiguity seeking, whereas only 38.0% of the women chose urn B and thus the large majority of women were ambiguity averse.

To counter the argument that there were insufficient men in Experiment 6 we merged all the data across all six experiments for the positively framed urns task in a single binary logistic regression analysis. The gender difference persisted. Out of 159 men, 47.2% went for the ambiguous Urn B and out of 489 women 36.4% chose Urn B, $\chi^2(1, N = 648) = 5.85, p = .016$. Thus men appear to be rather less ambiguity averse than women when there were potential gains to be had. Including Condition into a regression analysis revealed that it had no effect on choice of urn; only gender did ($\text{Exp}(B) = .63, p = .013$). Since we also had data for the urn task where there were potential losses we merged the data from those four experiments and found that there were no significant condition or gender differences to be seen. On the negative outcome urns task 38.8% of 103 men chose the ambiguous Urn B which did not differ from the 36.0% of 225 women who chose it, $\chi^2(1, N = 328) = 0.24, p = .62$. Thus women seemed to be equally averse to ambiguity for both gains and losses, but men in our studies showed less ambiguity aversion when there were potential gains.

8 Concluding comments

8.1 Gender differences

The fact that women were more ambiguity averse than men in the positive/gain frame backs up earlier findings by Schubert et al. (2000) reporting the same effect. They found that women were more ambiguity averse in investment decisions that were positively framed in terms of gains, and the degree of aversion increased with the degree of ambiguity. They also found that with negatively framed (loss) decisions men were more ambiguity averse to strong ambiguity, but there were no gender differences for weak ambiguity, which could be consistent with our results if our ambiguity was perceived as weak by the subjects.

Using a different methodology, of willingness to pay for lotteries, Borghans, et al. (2009) found that female Dutch students (15-16 years old) tolerated lower levels of ambiguity more than males, but gender differences disappeared for higher levels of ambiguity. However, it has been argued by Trautmann, Vieder and Wakker (2011) that measurements of ambiguity aversion that use willingness to pay are confounded by loss aversion, casting doubt on whether Borghans et al.’s findings are due to ambiguity aversion or loss aversion. Other studies, such as Binmore, Stewart, and Voorhoeve (2012), that also used tasks other than the Ellsberg Urns task, have also found no gender differences in ambiguity aversion. More research on the requisite precursors for gender differences appears necessary.

The finding of gender differences in ambiguity aversion, with the large sample of 246 subjects in Experiment 6, raised the possibility that in Experiment 1 there were by chance more men in the Lucky condition, and this was the cause of the ambiguity seeking there. But inspecting the data showed that there were almost the same proportion of men to women in both conditions, so gender differences were not an explanation for the effect shown there. We cannot rule out experimenter effects as a cause of the ambiguity seeking in Experiment 1. Our belief though is that a Type I error occurred in the first experiment due to a larger proportion of naturally ambiguity seeking people ending up in the Lucky condition despite random allocation.

8.2 Replication failure

The failure to replicate the effect of feeling lucky, found in Experiment 1, is apparently real. Experiment 4 used a manipulation check and found differences between Lucky and Unlucky conditions. The interaction between condition and experiment, when Experiment 1 was replicated exactly, supports the conclusion that we had sufficient

power. As an additional test, we pooled the data from Experiments 2–6. We averaged the positive and negative conditions, using 1 to represent the ambiguous choice and 0 the non-ambiguous choice. And we averaged the Control and Unlucky conditions. The mean ambiguous choice was 39.4% for the Lucky condition and 37.0% for the other conditions combined. In a regression, in which we included dummy variables for Experiment, this difference was not significant ($p = .34$), and the 90% confidence interval for the difference was from -0.047 to 0.076 . (By contrast, the difference in Experiment 1 was 0.361 .)

We decided to write this article to avoid the file drawer problem (Renkewitz, Fuchs, & Fiedler, 2011), where non-significant results are never published—leading to increased false-positive rates in psychology (Simmons, Nelson, & Simonsohn, 2011). The first study in this paper, which found a strong significant effect, was reported at an EPS meeting in Manchester (Pulford, Gill, & Richard, 2010) and many hundreds of undergraduates (mostly psychologists) have taken part in our research and been debriefed about the general hypothesis. We feel it is important, therefore, that this work be published so that future researchers do not waste resources vainly attempting to replicate the effect of luck on ambiguity aversion.

It is our overall conclusion at the end of this series of studies that we have no reliable evidence that ambiguity aversion is affected by how lucky or unlucky people feel. Alternatively, there could be an effect that only occurs in very specific certain circumstances that we have not been able to pin down. Potentially aspects such as fear of negative evaluation, which have been shown to increase ambiguity aversion, may be situationally dependent. For example some experimenters may make subjects rather more fearful of being negatively evaluated, or the subjects may care more about what some experimenters think of them than others. The age or gender of the experimenter may also have some influence. In all of our experiments the experimenters were women, and in the Experiment 1 the sole experimenter was a slightly younger and quieter woman than in other experiments, potentially meaning that subjects could have been less fearful of negative evaluation by her. If further investigations are carried out, we suggest that future researchers should bear all of these factors in mind, as well as the need for large sample sizes, and should focus on increasing the strength of the feeling of luckiness and unluckiness via verbal statements and other manipulations.

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