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Information about objective probability of a lottery and the illusion of control

Abstract: *This paper investigates the effect of explicitly informing participants about the objective probability of winning a lottery on the illusion of control. In a procedure based on Experiment 3 from Langer's 1975 seminal paper, participants were faced with lotteries based on familiar vs. unfamiliar stimuli and either explicitly informed about the objective probability of winning or not (the probability could be derived from other data). Results indicated that stating the objective probability of winning the lottery reduced, but not eliminated the illusion of control. Moreover, Langer's effect of stimulus familiarity was not replicated. Experiment 2, which included a lottery based on the full set of Polish alphabet letters, confirmed the same effects. Results indicate that illusion of control may be explained by the control heuristic (Thompson et al., 1998) – in absence of explicitly stated probability, participants estimate their chances of winning based on perceived control, even though calculating the objective probability is possible.*

Keywords: *decision making, gambling, illusion of control, objective probability, random chance games*

INTRODUCTION

The illusion of control was defined by Ellen Langer (1975) as *an expectancy of a personal success probability inappropriately higher than the objective probability would warrant* (p.313). Langer stated that illusion of control occurs because we mistakenly assume that random chance events are skill-based. Therefore we try to use this illusory skill to maximize our odds of success, even though in reality we don't change them.

The illusion of control is a subject of research in many contexts. As stated by Stefan and David in their meta-analysis (2013), the illusion of control is constantly present as an effect of several situational and psychological factors, and tends to generate moderate to large effect sizes. The illusion of control is the subject of research in areas such as economic psychology, for example as a factor influencing the continuation of playing in the face of sustained losses (Cowley, Briley & Farrel, 2015) and neuropsychology, where its impact on the BOLD response during reward anticipation was studied (Lorenz et al., 2015). It is also considered to impact problem gambling (Moore & Ohtsuka, 1999; Ladouceur & Sévigny, 2005). During gambling, many cognitive biases occur, such as the perceived ability to influence random chance games. This leads to the desire to continue gambling despite heavy losses. Ladouceur & Sévigny (op.cit.) noted that it would be possible to reduce problem gambling by preventing the illusion of control. For example, one could try explaining the mechanisms of random chance games so that gamblers know they have no actual control over them. Other research shows that illusion of control influences the development of gambling disorder (Stark, 2014) and is useful in predicting problem gambling (Ginakis & Ohtsuka, 2005). Recent empirical studies suggest that illusion of control is higher in disordered gamblers than in the general population (Wolfson and Briggs 2002; Myrseth et al. 2010; Orgaz et al. 2013).

Research from the area of psychopathology indicates the presence of illusion of control in obsessive-compulsive disorder. Reuven-Magril et al. (2008) found that OCD symptoms were related to an increased self-reported sense of control. Similar results were obtained by Vassiliou (2014); OCD symptoms and the illusion of control were significantly positively correlated. On the other hand, Gillan et al. (2014) found that OCD patients made more accurate control judgements and thus felt weaker illusion of control compared to the control group. People suffering from OCD have a high need for control, and fear events they cannot control. Therefore they try to exert illusory control by means of compulsive behavior in order to reduce uncertainty.

A lot of research investigates individual factors influencing the illusion of control, such as mood (Alloy

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& Abramson, 1979) or need for control (Burger, 1986). Relatively little research, however, concerned the underlying mechanisms of illusion of control. These mechanisms need to be investigated to understand the nature of illusory control. One of the situational factors which facilitated illusory control in Langer's (1975) research was stimulus familiarity. In her Experiment 3, participants took part in a raffle lottery, where each participant received a single lottery ticket out of 26, knowing that there would be one winning ticket. In a 2x2 factorial plan, the tickets were either chosen by participants or given to them at random (choice vs. no choice), and contained either letters of the alphabet or 'esoteric symbols' (familiar vs. unfamiliar stimuli). Regardless of the condition, it was easy to calculate that chances of winning are 1 in 26. Two days before the raffle draw, an experimenter called the participants and offered exchanging their raffle ticket for a different one with a higher chance of winning (1 in 21). Langer assumed that illusory control would prevent participants from accepting this objectively favorable exchange, which was indeed what happened – participants were less likely to exchange tickets they chose themselves, but also less likely to exchange tickets which had 'familiar stimuli'.

Langer's paper falls short of explaining the mechanisms behind the illusion of control, focusing on select factors which may cause it. Thompson, Armstrong & Thomas (1998) proposed a very interesting explanation of the illusion of control, called the control heuristic. They assume that there exists a heuristic based on the intentionality of the outcome (foreseeability, ability to produce the effect, valence of the outcome) and perceived connection (between the action and outcome). Illusion of control is caused by an incorrect conclusion that one has control over the situation, based on these antecedents. The idea of control heuristic leads to a critical question – can situational characteristics of (illusory) control be used to estimate not only the degree of control, but also the probability of success? Heuristics are often responsible for estimating the probabilities of different scenarios – this is true for the availability heuristic, representativeness heuristic, affect heuristic, anchoring bias, etc. Therefore one could argue that individuals may estimate their odds using their perceived control over a random chance game, while ignoring objective probability. This would indeed be similar to the mechanism of the representativeness heuristic as described by Tversky & Kahneman, (1974, p.3) – *probabilities are evaluated by the degree to which A is representative of B, i.e. by the degree of similarity between them*, whereas we are also *insensitive to the prior probability of outcomes* (p.4). Basically, individuals may consider a random chance game to be representative of a controllable situation, and estimate their chances as if it were controllable, while ignoring objective probability. Let us call this the *control heuristic and representativeness* hypothesis. Should this be the case, making objective probability the focal point of the decision problem should lead to reflective thinking (Langer 1993) i.e. force participants to use an algorithm instead of the heuristic, and therefore move the perceived chances of winning toward objective probability. On the other hand, participants in a decision task which contains high illusory control and no explicit information about probability, should also overestimate objective probability of winning, even though this probability is easy to calculate.

To investigate this theory, we used Langer's (1975) Experiment 3 and manipulated the presence of explicitly stated objective probabilities of winning. Research on gambling by Gaboury & Ladouceur (1989) indicated that while 90% of participants in a neutral setting stated that a game was completely random, 70% participants in-game considered its results to be strategy. Behsain, Taillefer & Ladouceur (2004) presented participants in a random chance game either with neutral (irrelevant) information, or with statements reminding them that the game is random and unpredictable. Participants who received these reminders were less likely to make cognitive errors, and were less motivated to continue playing the game. These results indicate that information which causes reflection may reduce illusory control, and allow more accurate estimates of chances.

Reflection was researched in the context of illusory control by Bouts & Van Avermaet (1992). They asked participants to bet on drawing a higher card than the experimenter. Cards contained either familiar or unfamiliar stimuli. Participants were either asked to first estimate their chances and then bet, or to first bet and then estimate their chances. If betting was preceded by an estimate of chances, participants bet more when the stimulus was familiar. Moreover, estimating chances prior to the bet reduced the bet size . Results indicate that the request for a probability estimate caused reflection on the actual chances and therefore led to a reduction of the bet, which may have coincided with a reduction of illusory control.

To sum up, we wanted to investigate whether providing explicit information about the objective chances of winning (as opposed to providing the same information only by stating the number of lottery tickets, which would require simple calculation) would reduce illusory control measured as one's own perceived chances of winning. Should this information not influence the results, it would mean that participants are more or less aware of the objective chances, but overestimate their own chances based on the illusory 'skill' or 'personal luck' components of the situation. This would be consistent with existing interpretations of illusory control (Langer, 1975; Wohl & Enzle, 2003, 2004). If, on the other hand, stating objective probability would eliminate or reduce the illusion of control, it would mean that participants are either unaware of, or ignore this probability, and instead estimate their chances based on the control heuristic or representativeness. In the latter case, we would expect participants to overestimate the objective probability of winning when explicit probability is not stated. We also investigated the locus of control (Rotter, 1966) in Experiment 1, and self-esteem and narcissism in Experiment 2, as potential correlates of illusion of control.

EXPERIMENT 1

The experiment was based on Langer's (1975) Experiment 3 on stimulus familiarity. We manipulated stimulus familiarity and explicitly presented objective probability in a 2x2 between-subjects design. We then measured the participants' *perceived chances of winning* ('how much do you believe that you will win the lottery') and their *stated objective probability of winning* ('what is the objective chance that someone will win the lottery'). In line with the *control heuristic and representativeness* hypothesis, we expected that explicitly presenting the objective probability of winning would reduce the participants' perceived chances of winning compared to the condition where objective probability was not presented. Moreover, we expected that participants' statements regarding the objective probability of winning would be much higher than the actual probability of 4% (1 in 25), even though this probability was easy to calculate from the number of tickets (25) and the number of winning tickets (1). We also expected to obtain Langer's effect of stimulus familiarity on illusory control, which based on the *control heuristic and representativeness* hypothesis should be weaker or absent in the condition where objective probability was presented. As an additional measure, we investigated the potential relation between Locus of Control (LoC) and the perceived chances of winning. Locus of Control is defined as "generalized expectancies for internal versus external control of reinforcement". LoC is a broader concept than the illusion of control (which is only situational), and is an attribution of control, i.e. a conclusion about the cause of control. We assumed that participants with internal locus of control may exhibit a stronger illusion of control, as demonstrated e.g. by Benassi, Sweeney & Drevno (1979) and Friedland, Keinan & Regev (1992).

Participants

One-hundred and twenty students (98 women and 22 men, aged 18-28 (M = 21.67, SD = 1.75) at the Jagiellonian University in Krakow were recruited on university grounds by means of direct contact outside classes. Participants were volunteers, informed that they may take part in a short experiment regarding lotteries in which they may win a small amount of money. No exclusion criteria were set, participants were randomly assigned to treatments. Informed consent was obtained from all participants.

Materials and procedure

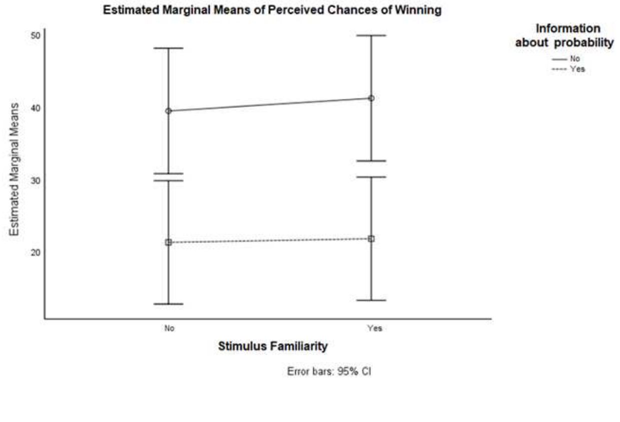
The experiment used a raffle lottery with a fixed probability of winning (4%). Participants were presented with twenty-five cards (face up), containing either letters of the alphabet (familiar stimuli) or runes (unfamiliar stimuli). A computerized procedure in PsychoPy (Peirce, 2007) was used to provide instructions and raffle the winning card. Participants were informed on-screen that they should choose one of the 25 cards and that the computer would then randomly select one winning card from the same set. If the participant's card matched the selected card, they would win 5 PLN (exchange equivalent of \$1.31, Big Mac Index perceived value of \$4.80). After the participants selected their cards, they were asked on-screen to estimate 'how much do you believe that you will win the lottery' using a slider from 0% to 100%, and then the computer randomly selected the winning card. Subsequently, on a separate sheet of paper, participants were asked to fill out Rotter's I-E locus of control scale (Rotter, 1966; Polish adaptation by H. Olearnik in: Drwal, 1995) and to state what the objective probability of winning the lottery was ('what is the objective chance that someone will win the lottery').

In the two treatments where objective probability was stated, there was an additional sentence presented on-screen along with the instructions, in bold red text on black background, stating that 'the objective probability of winning this lottery is 4%'. The total duration of the experiments in all conditions varied between 10-15 minutes, depending mostly on the time required to fill out the I-E scale. Participants were subsequently debriefed.

RESULTS

The explicitly stated information about probability reduced participants' perceived chances of winning (M = 40.05%, SE = 3.40 vs M = 21.62%, SE = 2.53; $F_{(1,116)}$ = 18.57, p < .001, η^2 = .138). No significant effect of stimulus familiarity was found (M = 30.45%, SE = 3.06 vs M = 31.22, SE = 3.39; F = .032, p = .858, η^2 < .001) nor was the interaction effect Information * Familiarity significant ($F_{(1,116)}$ = .004, p = .95, η^2 < .001). Results are presented in Figure 1.

Moreover, informing participants about the objective probability of winning reduced their statements of this objective probability (M = 21.54%, SE = 3.04 vs M = 9.53%, SE = 1.84; $F_{(1,114)}$ = 11.482, p = .001, η^2 = .092). However, in both cases these statements regarding objective probability were still significantly higher than the objective 4% ($t_{(57)}$ = 5.754, p < .001 in the groups without explicit information, and $t_{(59)}$ = 3.008, p = .004 in the groups with explicit information). There was no effect of stimulus familiarity on objective probability statements (M = 13.43%, SE = 2.30 vs M = 17.44%, SE = 2.87; $F_{(1,114)}$ = 1.273, p = .262, η^2 = .011) nor was the interaction



term Information * Familiarity significant ($F_{(1,114)}$ = .023, p = .881, η² < .001).

Participants estimated their own chances of winning as higher than the objective probability both in the groups without explicit information about probability (M = 40.05%, SD = 26.37 vs M = 21.54%, SD = 23.22; $t_{(57)}$ = 5.39; p < .001) and in the groups with explicitly stated probability(M = 21.62%, SD = 19.6 vs M = 9.5%, SD = 14.25; $t_{(59)}$ = 5.55, p < .001).

Gender did not influence the perceived chances of winning (M = 34.9, SD = 30.9 vs. M = 30.0, SD = 23.5 for men and women, respectively; $t_{(25.136)}$ = .690, p = .497). Moreover, there were no significant differences of gender proportions across groups (χ^2(1, N = 120) = .519, p = .471 for Information about probability; χ^2(1, N = 120) = .058, p = .810 for Stimulus familiarity.

Locus of Control weakly positively correlated with the participants' estimated chances of winning (Kendall's tau-b correlation; τ = .15; p = .025). LoC did not correlate with participants' statements of objective probability of winning (τ = .118, p = .099), nor did the participants in the two groups (with- and without direct information about chances) differ in their LoC ($t_{(117)}$ = .225, p = .822).

DISCUSSION

Results of Experiment 1 strongly indicate that information about objective probability of winning a lottery reduces the illusion of control measured as one's perceived chances at winning. This is in tune with the assumptions by Bouts & Van Avermaet (1992) that focusing one's attention on the random aspects of a situation causes them to be more reflective and therefore avoid illusory control. This result alone would also support the *control heuristic and representativeness* hypothesis – even though objective chances are easy to calculate, we would rather estimate our chances based on perceived elements representative of a controllable situation. Moreover, while the results regarding the objective probability of winning may seem trivial (stating a probability makes it easy to answer the question about this probability), they also indicate two important things: (1) that participants do not use the explicitly stated number of cards and number of winning cards as information about objective probability (even though chances of 1 in 25 and of 4% are the same information), which further supports the *control heuristic and representativeness* hypothesis and the fact that we ignore base probabilities, and (2) that even when this objective probability is stated, participants still overestimate it, which may indicate that either the situational elements of control influence the statements of objective probability even if it is stated, or that participants do not understand (or cannot reproduce) percentage probabilities (see Gigerenzer, 2003). Therefore perhaps these percentages should be swapped for frequencies or a graphical representation.

An interesting result is the lack of effect of stimulus familiarity on the perceived chances, which is inconsistent with Langer's results and existing replications. One explanation may be that the present study used 25 cards and the Polish alphabet contains 32 letters, while Langer used all of the 26 letters of the English alphabet. One can note that in Langer's research the 'familiar stimulus' condition contained the complete set of letters, while esoteric symbols could be considered an incomplete set (unless someone assumes that there exist no more than 26 abstract esoteric symbols), while the present study offered two incomplete sets. One could further postulate that if the computer was to generate a letter and all letters would be present on the cards, there is no chance that none of the cards will win – which is not necessarily true for esoteric symbols. Participants may assume that there is a risk of being cheated by the experimenter – a thing noted by Al-Najjar & Weinstein (2009) as a possible explanation for the Ellsberg paradox. This effect could also explain the results by Bouts & Van Avermaet (1992), who also used a complete set (52 standard playing cards) vs. a 'weird' set of cards with Egyptian motifs, which could very well be an incomplete set. The hypothesis that a complete set is needed to induce the stimulus familiarity effect on illusion of control will be investigated in Experiment 2 below.

Locus of control weakly positively correlated with illusion of control, which is in tune with research by Hong & Chiu (1988) and Tobias-Webb et al. (2017), which show that external locus of control is related to higher illusory control. On the other hand, the control heuristic model (Thompson et al., 1998) would rather predict that internal locus of control be related with higher illusory control, since internal LoC makes one more sensitive to perceiving the relation between own actions and consequences.

EXPERIMENT 2

The aim of Experiment 2 was to replicate the findings of Experiment 1 regarding the influence of explicitly stated information about the objective probability of winning on the illusion of control. Moreover, we wanted to investigate whether the lack of differences between familiar and unfamiliar stimuli could be explained by stimulus set completeness. Therefore we modified Experiment 1 to include 32 cards with letters of the Polish alphabet (i.e. the complete set of letters) vs. 32 cards with runes. Since percentage probabilities used in Experiment 1 led to overestimation of the same percentage probabilities in the groups which received explicit information, we used frequencies and a graphical representation instead. We expected that these changes would lead to (1) a significant difference in the illusion of control between the complete (familiar) and incomplete (unfamiliar) set, and (2) a further reduction of illusion of control in the groups with explicit information about probability.

Moreover, since locus of control only weakly correlated with illusion of control, we instead investigated the relations between self-esteem, narcissism and illusory control. Research shows that competence leads to an actual increase in the probability of achieving one's goals, which could also lead to a higher expectancy of success in random chance tasks (Abele & Wojciszke, 2007; Abele

& Wojciszke, 2014; Peeters, 2001). People who perceive themselves as agentic (competent), feel a higher level of control, and thus have a higher self-esteem. We therefore expected high self-esteem to positively correlate with illusion of control. Lakey et al. (2008) showed that narcissists are more likely to gamble and make risky choices, partly due to their high self-esteem and self-confidence. We therefore also expected narcissism to positively correlate with illusion of control

We also measured participants' gambling behavior and motives. Although participants were students, one cannot rule out significant differences in gambling behavior and motivations leading to it, which could potentially lead either to different interpretations of games of chance and the related objective probabilities of winning, and/or to differences in illusion of control. Research shows that occasional gamblers do it mainly for personal enjoyment and have a rational understanding of the associated risk, while disordered gamblers do it to reduce tension and can get 'carried away' (Niewiadomska et al., 2014). Therefore we expected that the Social gambling motive would be negatively correlated with the expected chances of winning (as the person does not actually play to win), while the Coping motive would be positively correlated with these chances, as it is typical for gambling addicts.

METHOD

Participants

One hundred and twenty participants (94 women and 26 men) aged 18-26 (M = 20.15, SD = 1.338). Recruitment criteria and method were identical as in Experiment 1, to make results comparable.

Materials and methods

Experiment 2 employed the same method as Experiment 1 (card raffle with a computerized instruction and randomly generated winning card), with the following changes: (1) instead of 25 cards, 32 cards were presented to the participants on the table, and contained either all letters of the Polish alphabet, or 32 different runic symbols. Lottery winnings were still 5 PLN; (2) instead of an information that "the probability of winning this lottery is 4%", we informed participants that "statistically, one in thirty-two people will win this lottery" along with a pictogram representing 32 human silhouettes, one of which was colored red to indicate the winner. In the treatments with familiar stimuli, we explicitly stated that ***all** the letters of the Polish alphabet were present on the table*; (3) in tune with Al-Najjar & Weinstein (2009) we added a question asking participants whether they felt they could have been cheated in the experiment, and if so, why.

Instead of the I-E scale, we used the Single-Item Self-Esteem Scale (SISE) (Robins, Hendin, Trzesniewski, 2001; own translation) and the Narcissistic Personality Inventory-13 (NPI-13) (Gentile et al., 2013; Polish adaptation: Żemojtel-Piotrowska et al., 2018). We also asked about what types of gambling the participants had experience with, and measured gambling motives using the Gambling Motives Questionnaire (GMQ) (Stewart, Zack, 2008; Polish adaptation: Niewiadomska et al., 2014).

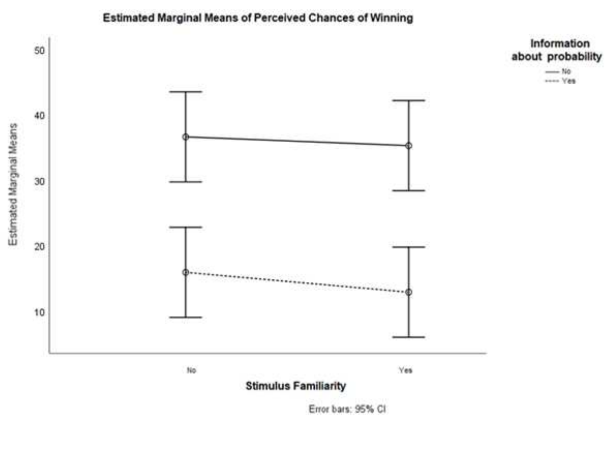
The procedure was identical as in Experiment 1. Participants were randomly assigned to one of the four conditions in a 2x2 plan (set completeness+familiarity x explicit information). They received instructions on-screen, chose their card, stated their perceived chances of winning, then after the winning card was drawn they answered the question about the objective chances and filled out the SISE, NPI-13 and GMQ questionnaires.

RESULTS

Explicitly stated information about objective probability significantly reduced participants' perceived chances of winning (M = 35.93%, SE = 2.96 vs M = 14.38%, SE = 1.78; $F_{(1,116)}$ = 38.425, p < .001, η^2 = 2.49). Like stimulus familiarity, set completeness+familiarity had no effect on perceived chances (M = 26.25%, SE = 2.91 vs M = 24.07%, SE = 2.71; $F_{(1,116)}$ = .394, p = .531, η^2 = .003) nor was the interaction term Set completeness x familiarity significant ($F_{(1,116)}$ = .060, p = .807, η^2 = .001). Results are presented in Figure 2.

Moreover, information about objective probability significantly reduced the participants' statements about what they consider the objective probability to be (M = 10.75%, SE = 1.79 vs M = 3.54%, SE = .33; $F_{(1,114)}$ = 19.375, p < .001, η^2 = .149). The objective probability estimated/stated by participants who received the explicit information was not different from the actual chances of 3.125% ($t_{(57)}$ = 1.263; p = .212). This may indicate that presenting chances as frequencies and pictograms was more effective than presenting them as percentages.

Participants both in the groups with- and without explicit information, overestimated their perceived chances of winning (not their estimates of objective probability) as compared to the mathematical objective probability (M = 36.5%, SD = 23.03, vs M=10.7%, SD = 13.53; $t_{(56)}$ = 8.17; p < .001 in the group without explicit information; M = 14%, SD = 13.77 vs M = 3.5%, SD = 2.52; $t_{(57)}$ = 5.99, p < .001 in the group with explicit information). This would indicate that despite explicit,



understandable information about objective chances, illusion of control persevered to some extent.

Again, gender did not influence the perceived chances of winning (M = 26.38, SD = 29.18 vs. M = 24.82, SD = 19.35 for men and women, $t_{(118)}$ = .258, p = .747). There were no significant differences of gender proportions across groups; χ^2(1, N = 120) < .001, p = 1.0 for Information about probability, χ^2(1, N = 120) = 1.768, p = .184 for Stimulus familiarity.

Perceived chances of winning weakly positively correlated with self-esteem (Kendall's tau-b correlation: τ = .145; p = .042). There was no significant correlation between perceived chances of winning and narcissism (τ = .08; p = .211) nor with gambling motives (GMQ Social τ = .061; p = .404; GMQ Coping τ = -.006; p = .939). We also found no significant correlations between statements of objective probability and narcissism (τ = .027, p = .682), self-esteem (τ = -.011, p = .888) nor GMQ Social (τ = -.021, p = .784) or Coping (τ = -.057, p = .488) scales.

81.7 per cent of the participants declared partaking in some form of gambling. The most popular were scratch-it lotteries (87.8% of gamblers) and National Lottery (Lotto - 59.2%). Others included video game lootboxes (16.3%), sports bets (7.1%), poker (6.1%), online casinos (5.1%), real-life casinos and stock market trading (4.1% each) and cryptocurrency trading (2%). We ran analyses on participants who played the national lottery, scratch-it lotteries and used videogame lootboxes (other gambling types were not present in enough participants for analyses). It turned out that participants who played the national lottery did not significantly differ in their estimates of chances (t(64.352) = .079) nor their stated objective probability (t(62.598) = .320). For the other comparisons, we ran Mann-Whitney U tests (as groups were too small and uneven for t-tests) – scratch-it lottery players did not differ from non-players (Z = .833, p = .732 for perceived chances; Z = .342, p = .405 for stated objective probability). However, lootbox users estimated their chances as significantly lower than non-users (M = 15.63, SD = 15.08 vs. M = 28.89, SD = 23.03, Z = 2.277, p = .023). The difference in stated objective probabilities dependent on experience with lootboxes was not significant (Z = 1.947, p = .052). We ran analyses on participants who played the national lottery, scratch-it lotteries and used videogame lootboxes (other gambling types were not large enough for analyses). It turned out that participants who played the national lottery did not significantly differ in their estimates of chances (t(64.352) = .079) nor their stated objective probability ($t_{(62.598)}$ = .320). For the other comparisons, we ran Mann-Whitney U tests (as groups were too small and uneven for t-tests) – scratch-it lottery players did not differ from non-players (Z = .833, p = .732 for perceived chances; Z = .342, p = .405 for stated objective probability), however lootbox users estimated their chances as significantly lower than non-users (M = 15.63, SD = 15.08 vs. M = 28.89, SD = 23.03, Z = 2.277, p = .023). The difference for stated objective probabilities was not significant (Z = 1.947, p = .052).

15 per cent of the participants suspected being cheated in the lottery; most of the doubts focused on whether the computer truly generated the winning card randomly. Crucially, none of the participants considered a scenario in which the card chose by the computer would not be present on the table.

DISCUSSION

Results of both experiments indicate that informing participants about the objective chances of winning significantly reduces the illusion of control (measured as perceived chances of winning), but does not completely revert it toward objective probability. These results indicate that both the Control Heuristic and Representativeness hypothesis, and the standard interpretation of illusion of control, are partly true. When explicit information about the probabilities of winning is not presented as a focal point, elements of control in a situation may lead participants to overestimate the objective chances, and overestimate their chances even further. When such information is provided, participants are aware of objective chances but still overestimate their own chances of success, which is textbook illusion of control.

Experiment 2 also showed no effect of the completeness of the set on the perceived chances, and thus on the illusion of control itself. We did not manage to replicate Langer's (1975) findings about the effects of stimulus familiarity on illusion of control, nor did we achieve such an effect for complete and incomplete sets of stimuli. On the one hand, Langer's sample was rather low (N = 52 divided between four treatments) which greatly limits the robustness and generalizability of the results; on the other hand there were successful replications of this effect reported in published papers. Perhaps some sort of cultural specificity of Polish people (the attitude toward lotteries, luck or games of chance in general) may be the explanation; however research on this specificity relative to the illusion of control in games of chance is scarce. Moreover, unlike previous research, we used a computerized procedure and while cards were physical, the winning card was presented on-screen. This may have led to fewer doubts about being cheated as compared to a situation in which the winning card is drawn by a person, therefore knowing the symbols (letters) may no longer be considered 'additional protection against being cheated'.

The weak positive correlation between self-esteem and perceived chances of winning is in line with existing research on self-esteem, competence and locus of control.

The presented research shows that explicit information about the objective chances of winning a lottery is able to reduce the illusion of control, but this information must be a focal point of the task (merely presenting the total number of tickets and the number of winning tickets does not have such an effect – participants do not calculate it into objective chances). Such focal information strategy may be used to some extent in the prevention of disordered gambling and risky behavior. Results also indicate that any information about chances needs to be presented in the simplest, most obvious form possible to have an optimal effect on decision making and behavior, in line with Gigerenzer (2003).

Further research is needed to investigate this effect in other contexts of illusion of control, and to investigate the situational constraints which may prevent the stimulus familiarity effect from appearing, potentially providing an explanation as to its underlying mechanisms.

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