Percentage and currency framing of house-edge gambling warning labels

Philip W. S. Newall[1*]

Lukasz Walasek[2]

Elliot A. Ludvig[2]

1 Experimental Gambling Research Laboratory, School of Health, Medical and Applied Sciences, CQUniversity, 120 Spencer St, Melbourne, VIC 3000, Australia

2 Department of Psychology, University of Warwick, Coventry, CV4 7AL, United Kingdom

* Correspondence: Philip Newall, PhD; +63 039 616 0526; p.newall@cqu.edu.au

Running head: House-edge gambling warning labels

Abstract: All commercial gambling games are constructed so that the gamblers will on average lose money over time. This fact is often communicated to gamblers on virtual gambling games as the "return-to-player." A return-to-player of 90% means that for every £100 bet, on average £90 is paid back out in prizes. In previous work, gamblers were better informed, and perceived a lower chance of winning, when this information was equivalently reframed as a "house-edge" of 10%, whereby the game keeps 10% of all money bet on average. This paper explores whether there are further risk communication advantages to using currency framing for the house-edge format, by directly stating the amount kept as: "This game keeps £10 for every £100 bet on average." Online gamblers (N = 1,007) reported their perceived chances of winning for hypothetical games with house-edges of either 0.5%, 7.5%, or 15%, presented as either percentages or currency units. Gamblers' perceived chances of winning were only minimally affected by this framing of house-edge information.

Keywords: framing effect, behavioral science, risk communication, betting

All commercial gambling games are constructed so that gamblers will on average lose money over time. Some games, however, take a greater proportion of money wagered than others, effectively meaning that these games are sold at a higher "price" for the enjoyment derived from wagering a given amount of money (Harrigan & Dixon, 2009; Woolley, Livingstone, Harrigan, & Rintoul, 2013). Some fraction of real-world gambling behavior might be influenced by the fact that gamblers are poorly informed about the price of gambling (Eggert, 2004). An issue facing gambling warning labels for communicating the price of different gambling products is that the price of gambling is inherently statistical, and that proper understanding therefore requires a degree of risk literacy (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012). Therefore, an important question is not only what information to show to gamblers, but how best to display that information (Gigerenzer & Edwards, 2003). This question is important for policy makers, because moves toward more informative labelling of gambling product risk would be considered the most freedom-preserving way of intervening on the public health costs of gambling (Gambling Commission, 2019; Nuffield Council on Bioethics, 2007).

Currently, gambling warning labels for virtual gambling games in jurisdictions such as the UK and the Australian state of Victoria present the "price" of electronic gambling machines to gamblers with what is known as the "return-to-player" percentage. For example, "This game has an average percentage payout of 90%," means that for every £100 bet on this game £90 is paid out on average in prizes (Collins, Green, d'Ardenne, Wardle, & Williams, 2014). This is a statistical average payout that occurs over the lifetime of the machine, and does not refer to every play or even to each session of play. This information also means, indirectly, that the remaining £10 from the £100 bet is kept as profit for the game operator. A number of previous studies have shown that many gamblers fail to correctly understand what the return-to-player means, for example by thinking that the return-to-player percentage

refers to the percentage of winning gamblers, or the percentage of individual winning plays (Beresford & Blaszczynski, 2019; Collins, Green, d'Ardenne, Wardle, & Williams, 2014; Harrigan, Brown, & Barton, 2017).

This limitation of the return-to-player as a risk communication tool suggests that alternative approaches for communicating the price are needed. Newall, Walasek, and Ludvig (2020) investigated the effects of "reframing" the return-to-player as an equivalent statement which puts the emphasis on how much money the game operator keeps on average: e.g., "This game keeps 10% of all money bet on average." This statement, which is known as the "house-edge" percentage, is formally equivalent to a return-to-player of 90% (Parke, Parke, & Blaszczynski, 2016). The house-edge statement was, however, understood correctly by more regular gamblers, and led to a lower perceived chance of winning, than the equivalent return-to-player statement (Newall, Walasek, & Ludvig, 2020). These two factors combined suggest that the house-edge would make gamblers better informed and more aware of the price of gambling products. This is an example of a "framing effect", where the way risk is communicated can impact judgment and decision making (Levin, Johnson, Russo, & Deldin, 1985; Tversky & Kahneman, 1981). Given that equivalent information is not always processed equally, it is therefore important to explore potential further improvements in the communication of the price of gambling.

Previous research suggests that percentages are an imperfect risk communication tool (Chen & Rao, 2007; Gigerenzer & Hoffrage, 1995). For example, reframing the percentage management fees charged by mutual funds as corresponding currency equivalents can help nudge investors toward the rational strategy of choosing a low-fee fund (Choi, Laibson, & Madrian, 2010; Hastings & Tejeda-Ashton, 2008). Participants in those studies with a hypothetical portfolio of $10,000 put more weight on a management fee of $100/year than a fee of 1% a year, even though the information conveyed by the two formats is identical. In

the present context, we predict that, “This game keeps £10 for every £100 bet on average,” helps gamblers to be more wary of the price of a gambling game than equivalently saying, “This game keeps 10% of all money bet on average.”

The benefits of currency over equivalent percentage framing, however, are not always uniform. In general, people are more risk-seeking for small amounts of money, which is known as the “peanuts” effect (Weber & Chapman, 2005). For example, for a small investor whose mutual fund management fees correspond to $10-$15 a year, the currency framing actually makes them less likely than percentage framing to choose a low-fee fund (Newall & Love, 2015).

Such a combination of effects of converting percentages into currency amounts could be useful in the current context, because this would make gamblers more wary of high house-edge games, while increasing the relative attractiveness of low house-edge games. This would effectively increase gamblers’ sensitivity to the price of different gambling products.

Therefore, the present research explored the impact of percentage and currency framing for house-edge warning labels on gamblers’ perceived chances of winning across a wide range of values (0.5% to 15%). This range of values was chosen because 0.5% is about the lowest house-edge possible to allow an operator to recoup the cost of providing a game, while 15% is the top end for the house-edge found previously in Canada (Harrigan & Dixon, 2009) and Australia (Woolley et al., 2013).

Our preregistered hypothesis was that there would be an interaction between label framing and house-edge value. Specifically, we expected the dependent variable (a gambler’s perceived chance of winning), to vary more under currency than percentage framing. That is, we expected participants to be more sensitive to variations in a gambling product’s “price”

with currency framing. Data, materials, analysis code, and the preregistration document can be accessed from https://osf.io/9ckph/.

Method

Participants

A total of 1,007 participants were recruited on Prolific Academic and were paid £0.50 each. Participants took an average of 3.6 minutes to complete the study, so this translated to an average payment of £8.33/hour. Prolific Academic is a crowdsourcing platform similar to Amazon Mechanical Turk, where researchers post experiments for a pool of registered potential participants to complete (Palan & Schitter, 2018). Prolific Academic has the benefit compared to Mechanical Turk of various pre-screening filters that can be set by the experimenter to ensure that only a relevant subset of the participant pool can take part. In this case, participants were pre-screened to be aged 18 or older, UK residents, and to have played at least one online luck-based casino gambling game (i.e., one or more of Baccarat, Craps, Pachinko, Roulette, Slots, Video poker, and Virtual sports betting). Participants were 54.3% female (0.1% other), and had a mean age of 35.9 years (SD = 10.1). Occupation was reported as: student (5.6%), in work (80.8%), unemployed (7.8%), retired (15.9%), other (4.2%). Education was reported as: secondary school (14.2%), college (35.2%), undergraduate (36.1%), and postgraduate (14.5%). Ethical approval was obtained from the University of Warwick human ethics committee prior to the study commencing.

Design and Materials

Participants were randomly assigned to either receive percentage or currency framing (between-participants). Participants then completed three trials in random order, corresponding to a house-edge of 0.5%, 7.5%, and 15%. On each trial participants were

presented with some short introductory text about online gambling and then a warning label. Figure 1 shows an example from the percentage condition. The exact wordings used were:

This game keeps 0.5%/7.5%/15% of all money bet on average

This game keeps 50p/£7.50/£15 for every £100 bet on average

On each trial participants gave their perceived chance of winning using a 7-point Likert scale, which can also be seen in Figure 1.

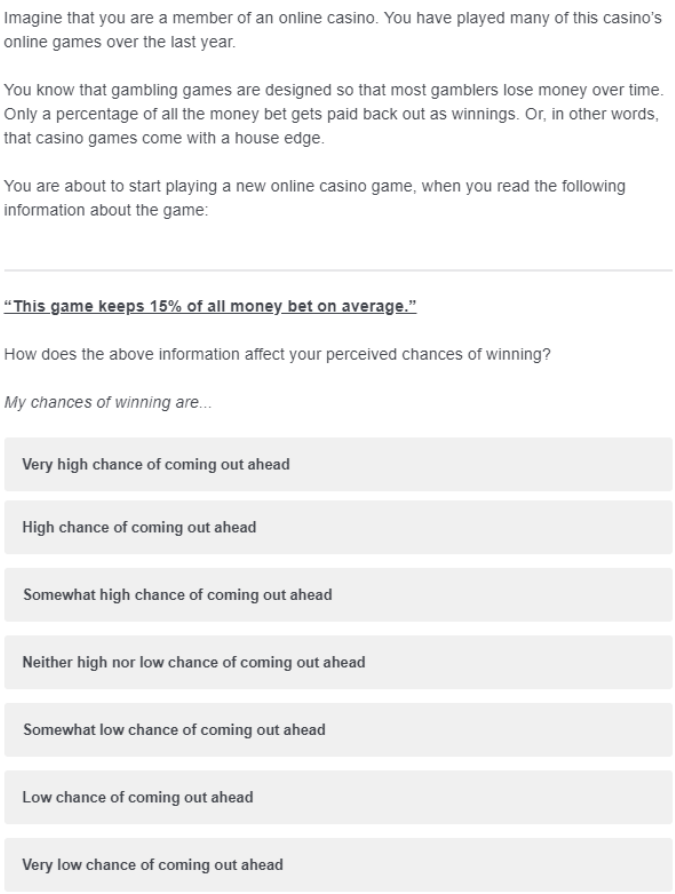

Figure 1: Example of the main stimulus screen (percentage condition).

Procedure

After these three trials, participants completed an attention-check trial corresponding to an implausibly high house edge of 95%, using the same framing that they had received

over the previous trials. As the first exclusion criterion, any participant who gave a higher perceived chance of winning on this trial than on any previous trial was be excluded, for reasons of potential inattentiveness. The second exclusion criterion was to remove any participants who gave a higher perceived chance of winning for a higher house-edge game. For example, if participants rated a higher chance of winning with a house-edge of 15% than with a house-edge of 7.5%, then they were excluded from the analysis, for an apparent failure to understand the statistical nature of the house-edge in gambling (which may well be due to participant inattentiveness, in this experimental setup).

After the attention-check trial, participants completed the two individual difference scales described below and provided demographic information.

Measures

The dependent variable was the gambler's perceived chances of winning, as measured by a 7-point Likert scale (see Figure 1). Participants also completed the Problem Gambling Severity Index (Ferris & Wynne, 2001), which directly measures behavioral dependence and gambling harm, and the Consumption Screen for Problem Gambling (Rockloff, 2012), a brief three-item screen which measures gambling consumption. The latter screen has been shown to also be an efficient method of detecting problem gamblers, as those who gamble the most frequently are also the most likely to have gambling problems.

Results

Participants had a mean problem gambling severity index of 3.1 (SD = 4.3), and a mean gambling consumption screen score of 3.3 (SD = 2.7). The results of the two exclusion criteria were as follows. The first exclusion criterion (95% house-edge catch trial) saw a loss of 6.9% of participants in the currency condition and 3.4% in the percentage condition. The

second exclusion criterion (mistaken perceived chances of winning) saw a loss of 16.2% of participants in the currency condition and 14.1% in the percentage condition. Across both exclusion criteria, 17.6% of participants were lost in the currency condition and 14.5% in the percentage condition. This difference was not significantly different, as measured by logistic regression (z = -1.33, p = .184). Because this meant that attrition was not significantly different between the two conditions, analysis could proceed on the remainder of the sample (N = 845) as preregistered.

Data were analysed using a mixed-effects model, to account for the shared variance across participants' three perceived chances of winning. Perceived chances of winning were regressed on the independent variables of framing (two levels, between-participants) and magnitude (three levels, within-participants), and their interaction. In addition, a random intercept for participants was included. This was performed with the afex package in R (Singmann, Bolker, Westfall, & Aust, 2015).

Figure 2 shows a plot of the results. There was a significant effect of magnitude F(2, 1686) = 1557.12, p < .001, meaning that participants correctly perceived a lower chance of winning with higher values of the house-edge. There was no significant effect of condition F(1, 843) = 3.01, p = .08. However, an inspection of the marginal means shows there was a trend for every level of the house edge for participants to give a higher perceived chance of winning in the currency than percentage condition. Additionally, our hypothesis of an interaction between condition and magnitude was not supported F(2, 1686) = 0.35, p = .71. Participants' perceived chances of winning were equally responsive to variations in the "price" of gambling, across both conditions. As this interaction effect was non-significant, no further analyses were performed, following the preregistered analysis plan.

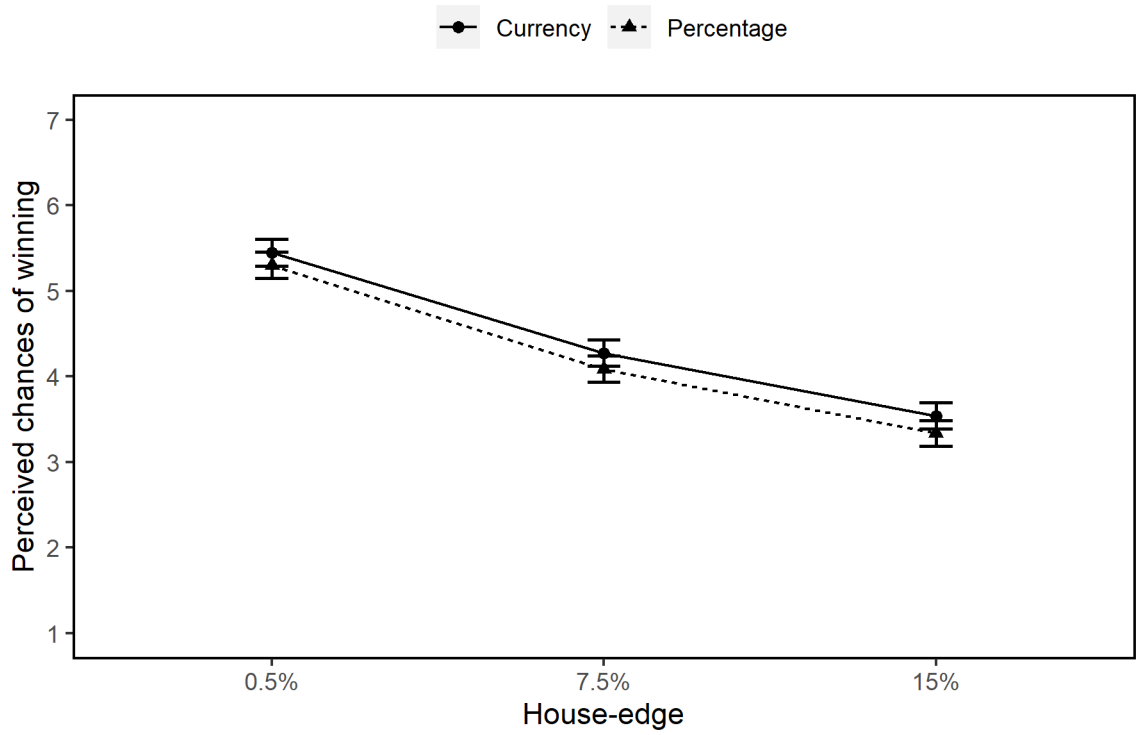

Figure 2: Experimental results. Perceived chances of winning: 7 = Very high chance of coming out ahead, 4 = Neither high nor low chance of coming out ahead, 1 = Very low chance of coming out ahead. Error bars represent 95% confidence intervals.

Discussion

Overall, there was no reliable effect of percentage or currency framing of house-edge warning labels, with respect to gamblers' responsiveness to variations in the price of gambling. Although house-edge labels appear better than the return-to-player labels that are currently in use (Newall et al., 2020), reframing the house-edge as a currency amount instead of a percentage appears limited in terms of additional improvement. There was a weak trend toward gamblers perceiving a higher chance of winning with currency than percentage framing, although this potential effect requires replication. However, if found, any such effect would not say that either percentage or currency house-edge labels are more effective than

the other at communicating the price of gambling, only that they should not be used interchangeably.

This study only used an online questionnaire about a hypothetical gamble, but bigger differences may be found in a more ecologically valid task. In addition, participants here only gave subjective perceived chances of winning. Future studies should investigate whether, for example, wishful thinking may contribute to some gamblers thinking they can "beat the odds" and have a higher overall chance of winning than is communicated through the warning label. Actual gambling behavior may also be more responsive to changes in warning label framing than the subjective perceived chances of winning measured here. Research should also continue to explore other potential avenues for risk communication improvement in gambling warning labels (Ginley, Whelan, Pfund, Peter, & Meyers, 2017; McGivern, Hussain, Lipka, & Stupple, 2019; Walker, Stange, Dixon, Koehler, & Fugelsang, 2019). For example, many electronic machine gamblers appear confused about the return-to-player, misunderstanding that this single-play statistic does not correspond to their expected return after gambling an initial stake repeatedly (Harrigan et al., 2017). The currency format of house-edge warning labels may be most effective when combined with a running total of a gambler's total amount bet, as a potential correction for this misunderstanding surrounding repeated gambling. It might also be that presenting house-edge information graphically is more effective than using text (Garcia-Retamero & Cokely, 2017).

Gambling is increasingly seen as a public health issue (van Schalkwyk, Cassidy, McKee, & Petticrew, 2019; Wardle, Reith, Langham, & Rogers, 2019). The design of more effective warning labels is just one avenue that research should explore to attempt to lessen gambling's public health impact (Nuffield Council on Bioethics, 2007).

Informed consent: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

References

Beresford, K., & Blaszczynski, A. (2019). Return-to-player percentage in gaming machines: Impact of informative materials on player understanding. *Journal of Gambling Studies,* doi:10.1007/s10899-019-09854-z

Chen, H., & Rao, A. R. (2007). When two plus two is not equal to four: Errors in processing multiple percentage changes. *Journal of Consumer Research, 34*(3), 327-340.

Choi, J. J., Laibson, D., & Madrian, B. C. (2010). Why does the law of one price fail? an experiment on index mutual funds. *The Review of Financial Studies, 23*(4), 1405-1432.

Cokely, E. T., Galesic, M., Schulz, E., Ghazal, S., & Garcia-Retamero, R. (2012). Measuring risk literacy: The berlin numeracy test. *Judgment and Decision Making, 7*(1), 25-47.

Collins, D., Green, S., d'Ardenne, J., Wardle, H., & Williams, S. (2014). *Understanding of return to player messages: Findings from user testing*. London: NatCen Social Research.

Eggert, K. (2004). Truth in gaming: Toward consumer protection in the gambling industry. *Maryland Law Review, 63*(2), 217.

Ferris, J., & Wynne, H. J. (2001). *The canadian problem gambling index: Final report*. Ottawa, ON: Canadian Centre on Substance Abuse.

Gambling Commission. (2019). National strategy to reduce gambling harms. Retrieved from http://www.reducinggamblingharms.org/asset-library/national-strategy-to-reduce-gambling-harms.pdf

Garcia-Retamero, R., & Cokely, E. T. (2017). Designing visual aids that promote risk literacy: A systematic review of health research and evidence-based design heuristics. *Human Factors, 59*(4), 582-627.

Gigerenzer, G., & Hoffrage, U. (1995). How to improve bayesian reasoning without instruction: Frequency formats. *Psychological Review, 102*(4), 684-704.

Gigerenzer, G., & Edwards, A. (2003). Simple tools for understanding risks: From innumeracy to insight. *BMJ (Clinical Research Ed.), 327*(7417), 741-744. doi:10.1136/bmj.327.7417.741 [doi]

Ginley, M. K., Whelan, J. P., Pfund, R. A., Peter, S. C., & Meyers, A. W. (2017). Warning messages for electronic gambling machines: Evidence for regulatory policies. *Addiction Research & Theory, 25*(6), 495-504. doi:10.1080/16066359.2017.1321740

Harrigan, K. A., Brown, D., & Barton, K., R. (2017). *Classification of slot machines in ontario: Providing relevant information to players.* Guelph, Ontario, Canada: Gambling Research Exchange Ontario.

Harrigan, K. A., & Dixon, M. (2009). PAR sheets, probabilities, and slot machine play: Implications for problem and non-problem gambling. *Journal of Gambling Issues,* (23), 81-110.

Hastings, J. S., & Tejeda-Ashton, L. (2008). Financial literacy, information, and demand elasticity: Survey and experimental evidence from mexico (working paper no. w14538). Retrieved from National Bureau of Economic Research website: http://www.nber.org/papers/w14538;;

Levin, I. P., Johnson, R. D., Russo, C. P., & Deldin, P. J. (1985). Framing effects in judgment tasks with varying amounts of information. *Organizational Behavior and Human Decision Processes, 36*(3), 362-377.

McGivern, P., Hussain, Z., Lipka, S., & Stupple, E. (2019). The impact of pop-up warning messages of losses on expenditure in a simulated game of online roulette: A pilot study. *BMC Public Health, 19*(1), 822.

Newall, P. W. S., Walasek, L., & Ludvig, E. A. (2020). Equivalent gambling warning labels are perceived differently. *Addiction,* doi:10.1111/add.14954

Newall, P. W. S., & Love, B., C. (2015). Nudging investors big and small toward better decisions. *Decision, 2*(4), 319-326.

Nuffield Council on Bioethics. (2007). *Public health: Ethical issues*. UK: Cambridge Publishers.

Palan, S., & Schitter, C. (2018). Prolific. ac—A subject pool for online experiments. *Journal of Behavioral and Experimental Finance, 17*, 22-27.

Parke, J., Parke, A., & Blaszczynski, A. (2016). *Key issues in product-based harm minimisation: Examining theory, evidence and policy issues relevant in great britain*. London: Responsible Gambling Trust.

Rockloff, M. J. (2012). Validation of the consumption screen for problem gambling (CSPG). *Journal of Gambling Studies, 28*(2), 207-216.

Singmann, H., Bolker, B., Westfall, J., & Aust, F. (2015). Afex: Analysis of factorial experiments. *R Package Version 0.14-2,*

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science, 211*(4481), 453-458.

van Schalkwyk, M. C. I., Cassidy, R., McKee, M., & Petticrew, M. (2019). Gambling control: In support of a public health response to gambling. *Lancet (London, England), 393*(10182), 1680-1681. doi:10.1016/S0140-6736(19)30704-4

Walker, A. C., Stange, M., Dixon, M. J., Koehler, D. J., & Fugelsang, J. A. (2019). Graphical depiction of statistical information improves gambling-related judgments. *Journal of Gambling Studies,* doi:10.1007/s10899-019-09860-1

Wardle, H., Reith, G., Langham, E., & Rogers, R. D. (2019). Gambling and public health: We need policy action to prevent harm. *Bmj, 365* doi:10.1136/bmj.l1807

Weber, B. J., & Chapman, G. B. (2005). Playing for peanuts: Why is risk seeking more common for low-stakes gambles? *Organizational Behavior and Human Decision Processes, 97*(1), 31-46.

Woolley, R., Livingstone, C., Harrigan, K., & Rintoul, A. (2013). House edge: Hold percentage and the cost of EGM gambling. *International Gambling Studies, 13*(3), 388-402.