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Experimental evidence on measures to protect consumers of online gambling services.

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Abstract
Online gambling has grown rapidly in recent decades due to increased accessibility and availability. This article reports the results of a behavioral experiment conducted in a laboratory (N=522) and an online experiment administered in seven European countries (N=5997). The experiments examined the effectiveness of a range of mainstream and also innovative protective interventions for online gambling. The rationale of the interventions was to disrupt both individuals' mental processes and the affordances embedded in the human-machine system designed to maximize the time spent gambling and industry profits. Behavioral measures including stake size, speed of play and decision to stop playing or make further gambles were recorded. The results show that interventions addressing both individuals' mental processes and the human-machine interaction are effective in reducing the stake size and in slowing down the pace of gambling. All other interventions directed at the level of the individual have no effect on behavior. The results show that traditional 'nudges' are not sufficient and structural features such as the affordances embedded by design into the online gambling machines must be addressed in order to effectively protect consumers of online gambling.

Keywords
online gambling — behavioral economics — experimental economics — protective intervention

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Introduction

In the last decade, online gambling has increased into a substantial global industry (Banks 2017). The introduction of the Internet has changed some of the structural and situational characteristics of gambling activities. Such changes could make gambling more addictive and/or more problematic than pre-online forms, having a negative psychosocial impact on individuals and on society (Griffiths, 2003) Although hard data is not available, it is estimated that the number of consumers playing online is between 5% and 30% of the national populations (Gainsbury, 2010; Petry, 2006; Wardle et al., 2011; Wood and Williams, 2009). According to market estimates in Europe there are about 6.8 million consumers of online gambling services (EC, 2018). In the last decade, online gambling has grown from a minor window show on the Internet into a substantial global industry. According to worldwide market estimates, in 2012 online gambling reached 9.5% (i.e. about 27bn) of the total worldwide gaming revenues 283bn also in 2012) (H2 Gambling Capital, 2014).

The volume of online gambling in the EU accounts for 45% of global revenues. It is a fast growing industry as revenues have been doubled in 2015 compared to 2008 (going from 6.16bn to 13bn). The largest gambling markets in Europe are Italy, United Kingdom, Spain, France, Germany, and Sweden. Estimates show that in Germany, for example, there are around 140 thousand problematic gamblers and over 27 million per year of additional expenditures in the German health sector as a consequence of online gambling (Effertz et al., 2018). Since it is unrealistic to expect the gambling industry to prioritize harm prevention over revenue maximization, policy makers and regulators need to implement measures to minimize harm of online gambling (Yani-de-Soriano Yousafzai, 2012).

Availability of gambling is positively correlated with higher incidence rates of pathological gambling (Abbott Volberg, 1996; Grun McKeigue, 2000). Studies showed that the prevalence of pathological gambling is higher among internet gamblers than 'in person' gamblers (de Freitas Griffiths, 2008; Derevensky Gupta, 2007; Griffiths, 2009; Griffiths Parke, 2010; Ladd Petry, 2002; Olason et al., 2011; Wood Williams, 2009). Gambling machines are programmed to produce ad-

diction by design, labeled as the human-machine interaction (Fogg, 2003; Schull, 2012). The designers of technological interfaces mold the human-machine interaction and use scripts that favor certain actions over others (Latour, 1999). Electronic gambling, because of its continuous and repeated interaction and its greater speed compared to the mechanical 'machine' of the past, functions as a 'psychostimulant'.

Cognitive biases in the processing of reward-related cues in the environment include the capacity of substance-related cues to selectively recruit attentional resources, for example gambling-related cues. These cues trigger affect, arousal and motivational implicit memory associations and activate the behavioral schemata associated with the rewarding outcome. This gives the individual a behavioral motivation to seek out the expected pleasure from the rewarding substance or activity (Wiers et al., 2013; Stacy Wiers, 2010). In gambling addiction, gambling-related cues, and contexts related to gambling appear to take on increased incentive salience, becoming 'motivational magnets' driving behavior (Thomsen, Fjorback, Moller, Lou, 2014; Robinson et al., 2015).

Interventions to overcome these cognitive biases are tested in the current experiment, and are grounded in the insights developed by Strack et al. (2006) and other authors on the strategy to activate slow and deliberative thinking (Petty Cacioppo, 1986; Streff Geller, 1988). For example, one possible method to induce more reflective thinking in online gambling is the use of warning messages. Ginley et al. (2017) systematically reviewed the literature on gambling-related warning messages to provide players feedback on potentially risky playing. They conclude that message display, placement, content, framing, and context are all important factors influencing the impact of protective messages. This is also in line with Reijula et al (2018), who show that *soft interventions* such as 'nudge' and 'boost' (Bond, 2009), influence behavior by changing cognitive and affective aspects of the situation, people's motivation, and/or their competence to make rational decisions. Nudges build on the heuristics-and-biases research from the psychology of decision making (Kahneman Tversky, 2000). Boost aims at building new decision competences or extending existing ones (Hertwig Grüne-Yanoff, 2017; Heukelom Sent, 2017; Mousavi Keirandish, 2017). In similar vein the current study tests various protective messages with the aim of improving the understanding of online gambling processes and providing expert advice for policy-makers. (Baddeley, 2017).

The current study was designed in response to a request by the European Commission to test, using behavioral experiments going beyond classical behavioral economics and related policy nudges, the effectiveness of measures aimed at protecting consumers of online gambling services (Codagone *et al.*, 2014). The study comprised two experiments designed (one in the laboratory and one online) as randomized controlled trial. The protective measures tested included existing interventions used by some of the online gambling operators (hereafter 'existing measures') and innovative measures that could be introduced in the future. Interventions at the level of the individual were combined with those that address the interaction between the machine and gambler to counter some of the affordances [1] embedded in the design of the online gambling games. It was hypothesized that the protective measures would decrease the average bet per spins, slow down betting, and encourage players not to keep playing when the choice of stopping or continuing is presented to them.

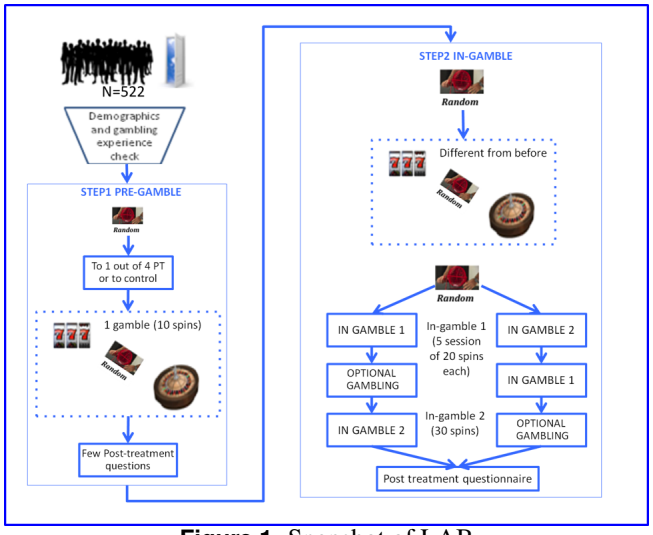

Figure 1. Snapshot of LAB

Materials and Methods

The current study consists of two experiments with 5997 respondents in total - as follows (see also Figure 1 and 2):

1. a behavioral laboratory experiment in the UK with a convenience sample of 522 respondents; and
2. a behavioral online experiment with representative samples of the online populations of Estonia, France, Germany, Italy, Spain, Sweden and the United Kingdom.

The two experiments were designed as randomized controlled trials with intervention and control groups. All participants were randomly allocated to the intervention or the control group. The first experiment maximizes internal validity, because it is based on performance related payment, while the second experiment maximizes external validity because it recruits a representative sample of the online population. A website and two types of online gambling machines were designed and programmed for the two experiments – a slot machine and a roulette wheel. Using the Expilab experimental platform, a fictitious gambling website was built closely

[1] The psychologist James J. Gibson (1975) developed the concept of affordance and defined it as what the environment provides, either for good or for ill. Humans have the general tendency to alter and modify their direct environment so as to change its affordances to better suit them, to make life easier and more convenient. Gibson argues that it is a mistake to treat the social world apart from the material world or the tools apart from the natural environment, the tendency to change the environment is natural to humans.

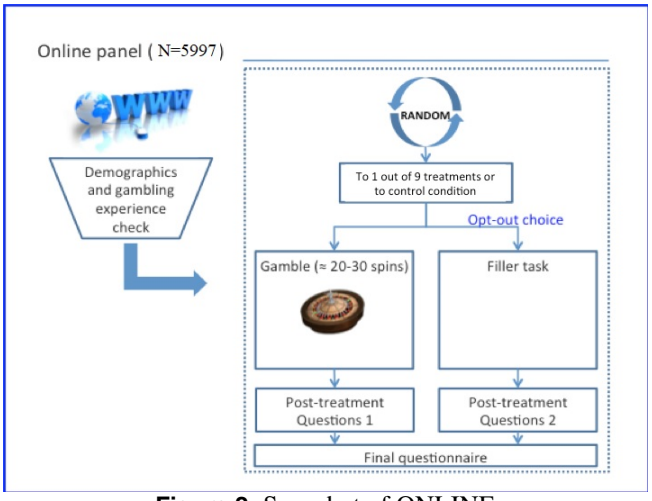

Figure 2. Snapshot of ONLINE

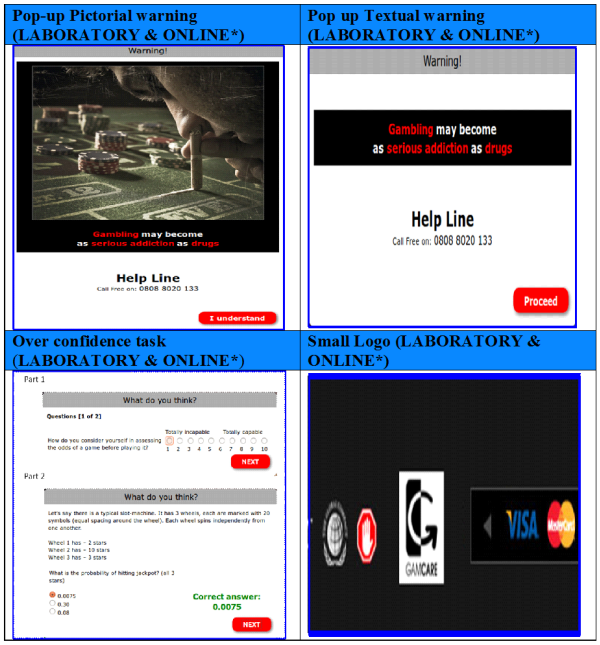

Figure 3. Screenshots of selected interventions
*For the online experiment the four interventions above were presented in the local language (i.e. translation of the wording, logo of the national organisation, help number).

replicating typical online gambling sites and the conditions offered by online gambling operators. It is common practice for operators to offer a free trial to play (we refer to this stage as 'pre-gamble'), after which the individual can proceed to the real gambling activity and register, if they decide to do so (we refer to this stage as 'in-gamble'). We mirror realistically this practice in the games designed for the experiments and in the design and the procedure of the studies, distinguishing the protective measures (interventions) to which participants are exposed into 'pre-gamble' and 'in-gamble'.

Procedure of the experiments

Laboratory Experiment

The laboratory experiment was conducted between September-October 2013 in a Behavioural Research Laboratory to test both 'pre-gamble' and 'in-gamble' measures. A convenience sample of 522 subjects (which yielded 81.4% participants with previous gambling experience and 18.6% with no previous gambling experience) was recruited from the Behavioural Research Laboratory panel. The laboratory experiment fulfilled incentive compatibility conditions (Smith, 1976) as subjects were given real monetary performance related incentives. They could gain more than the usual fee paid in a laboratory experiment but they could also bet the basic fee and lose it at a certain point in the course of the experiment.

The experiment included both a classical between-subject main factor design and a 'between-subject' with repeated measures full factorial design. A main characteristic of the experiment is that there is a standard fixed participation fee of 10 GBP (which was reduced to 5 in case of opt out because length of the experiment is also significantly reduced), and a performance related payment, in the form of a virtual wallet that could be exchanged for real money.

Pre-gamble task: After entering the experiment, signing the participation sheet, and answering preliminary questions (socio-demographic items, on gambling experience, frequency, and preferred online gamble channel) subjects started the pre-gamble task where they were randomly allocated to 1 out of 4 interventions (pop-up pictorial warning, pop-up textual warning, over-confidence task, and logo, see Figure 3) or the control condition. Subjects played either European roulette or a slot machine. The pictorial warning condition was an evocative picture followed by the messages *'gambling may become as serious addiction as drugs'* followed by a helpline number, while textual warning condition contained the same but without a picture. The over-confidence task condition contained a self-assessment of subjects' competence in calculating the odds of winning in a game and then an exercise to calculate the odds. After answering participants were given feedback on whether they were correct or not. The logo condition contained a logo of a national gambling information provider placed on the front page of a fictitious gambling operator.

Those subjects allocated to control condition went immediately to the front page without being shown any of the four interventions above. The first gambling session comprised 10 spins. After completing the pre-gamble step, participants were asked questions on emotions, intentions, and the use of logos.

In-gamble task: After being exposed to the interventions, subjects could choose to opt out of further gambling (in which case they were directed to a filler task, and when they finished it, they were paid only the basic incentive of 5 GBP). Those who did not choose to opt out proceeded to the in-gamble Step 2 that consisted of two sub-steps with 130 spins in total along with additional free-to-play time (optional). Whether they

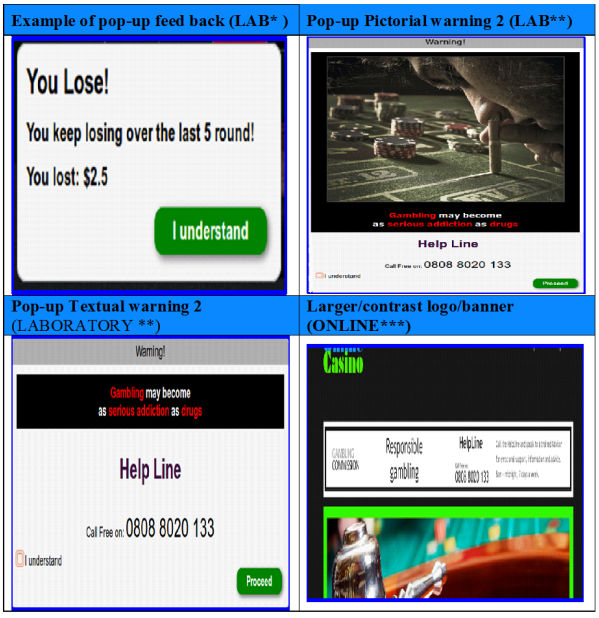

Figure 4. Screenshots of selected interventions

* This is one example of the feedback alerts shown. In practice through a combination of monetary limits and of the form of the pop-up alerts participants were exposed to the following combinations:

- Fixed monetary limits with push pop up (standard: reporting statistics on their gambling)
- Fixed monetary limits with pull pop up
- Fixed monetary limits with push pop up ('you lose');
- Self-defined monetary limits with push pop up (standard);
- Self-defined monetary limits with pull pop up;
- Self-defined monetary limits with push pop up ('you lose')

** This differs from the previous version shown during the pre-gamble phase in that they participant had to tick I understand and click on the button 'proceed' in order to continue playing.

*** For the online experiment adapted to countries (translation, logo, helpline number).

started with one or the other of the two sub-steps was allocated at random. Subjects who had played the slot machine in the pre-gamble played roulette in in-gamble, and vice versa. If they started with step 1 they then proceeded to step 2 or vice versa, see Figure 4.

The in-gamble task is the main experimental activity capturing the behavioral variable, while the pre-gamble task is the round of practice which mimics the free rounds offers to gamblers. The pre-gamble and in-gamble interventions are similar, but come at different moments of the experimental flow. Interventions included in the first step within-gamble interventions were monetary limits (fixed limits with automatic refill possibilities versus self-defined limits with automatic refill possibilities), feedback on winnings and losses via a *push pop up* (clock with length of play, cumulative winnings and losses versus "you lose" message similarly based on the subject's performance), feedback on winnings and losses via *pull pop up* (clock with length of play, cumulative winnings and losses) or control. The interventions in the second step were similar to pre-gamble interventions, but with additional modifications. First, a pictorial warning with the same text as in the pre-gamble with addition of a checkbox "I understand" appearing in the form of popup while subjects were playing. Second, a textual warning with the same text as in the pre-gamble also with addition of a checkbox "I understand" appearing in the form of pop up while subjects were playing. After having completed both step 1 and step 2 all subjects completed a common post-intervention questionnaire used to measure other self-reported measures.

Online Experiment

The online experiment was conducted between October and November 2013 to test 'pre-gamble' measures mostly similar to those tested in the laboratory experiment. In addition, the online experiment tested how subjects reacted to some additional measures regarding the registration process. A sample of 5997 subjects (circa 850 per country) was drawn representative of the general internet population of each country. No quota was imposed *ex ante* on previous gambling experience (*ex post* the sample split is: 91.4% had a least a previous gambling experience 8.6% had never gambled in their life). Given the less controlled settings of online experiments, participants were only given the basic incentive, because it was not possible to set up the performance related incentive system that was used in the laboratory experiment. Given the lack of performance related payment, for the online experiment the focus is on the behavioural actions of playing after exposure to the preventative measure interventions, and in particular their choice to opt out of further gambling or not.

The online experiment was designed as a randomized controlled trial based on the classical between-subject main factor design. Participants were randomized to one out of nine interventions (pop-up pictorial warning, pop-up textual warning, over-confidence task, logo of national gambling information provider, wide/contrast banner, helpline, terms and conditions, standard registration form, extended registration form, (see Figure 3 and Figure 5) or to the control condition. The online participants clicked on an invitation link and accessed the experimental platform, read the instruction, completed a set of general demographic questions and questions regarding their gambling experience, and then were randomly allocated to one of the nine interventions or to the control condition. Participants then went into the front page of a fictitious gambling website where they played for 20 spins within a 20 minutes total gambling time limit with their behavioral choices being automatically recorded. Note, however, that after being exposed to the intervention the participants were given the possibility of opt-out that, if chosen, is a key behavioral variable for the online experiment.

Interventions

Table 1 shows the interventions. These are a mix of existing and innovative protective measures. The existing measures

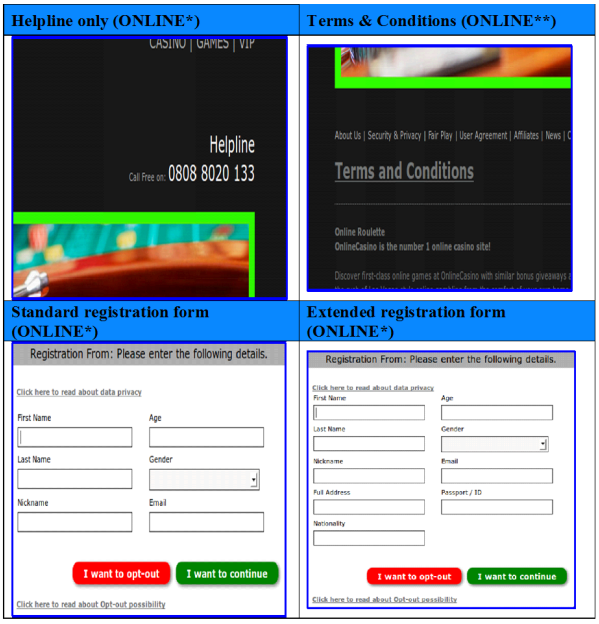

Figure 5. Screenshots of selected interventions
* Adapted to countries (translation, logo, helpline number).
** Could be clicked and information popped up (adapted to countries).

are typical of consumer protection approaches based on information provision, some of which are already in use by the operators as a form of self-regulation. These measures address individuals' cognition, attempting to raise awareness, counter rational bias and activate reflective thinking. Some other measures derived from behavioral studies target the individual gambler (i.e. the over-confidence task and the pictorial warning that try to leverage the affect heuristic following the authors' experience with testing the effectiveness of pictorial warning for tobacco products, see Anonymous et al., 2015). Finally, there is a group of innovative measures not currently in use and to the best of our knowledge not yet tested experimentally that tackle both individual biases and the human-machine interaction. For some of the pre-gamble interventions, well-documented cognitive biases and heuristics typical in online behavior may reduce the effectiveness of textual warnings, logos, terms and conditions, registration forms. This also applies to the laboratory experiment where the subjects played on a realistic reproduction of an online gambling website. For some of the other pre-gamble interventions, an informed conjecture based on the existing literature in behavioral studies suggests that they might be effective (pictorial warning, plus overconfidence tasks). In the case of step 1 of the in-gambles interventions in the laboratory experiment a full factorial design was adopted. This was designed to test the effects of the following six combinations resulting from the monetary limit (two values) and the alert (three values) interventions. Specifically:

1. fixed monetary limits with *push pop up* (standard);
2. fixed monetary limits with *pull pop up*;
3. fixed monetary limits with *push pop up* ('you lose');
4. self-defined monetary limits with *push pop up* (standard);
5. self-defined monetary limits with *pull pop up*, and
6. self-defined monetary limits with *push pop up* ('you lose').

These interventions address both individuals' cognition and the human-machine interaction as they involve actions that interrupt the flow of gambling.

Response variables

Behavioral Measurements

Average bet per spin: the average amount each subject bet in each spin in either the slot machine or the roulette wheel during pre-gamble stage.

Average time per spin: the average time required for making a bet and a spin by each subject in either slot machine or roulette during pre-gamble stage.

Average bet per spin: the average amount each subject bet in the in-gamble stage. Keep gambling: the subject's decision to keep gambling when the option to stop is available (laboratory experiment in-gamble stage).

Change in average bet per spin, post warning: the difference between the average bet post and pre-exposure to the pop up (laboratory experiment in-gamble stage).

Change in average time per spin, post warning: the difference between the average time required for making a bet and a spin by each subject for the post and pre-exposure to the pop up (stage 2 of laboratory experiment in-gamble stage).

Results

Descriptive information

Of the participants in the laboratory experiment 56.4% were male, 93.7% between 18-35 years old, and 68% completed some tertiary education (31.2% secondary education, and 0.8% primary education). Of the participants in the online experiment 49.6% were male, 38% between 18-35 years (33.5% between 35-60 years, and 28.6% between 51-60 years), and 9.6% finished only primary education (46.8% secondary education, and 43.6% tertiary education). In the online experiment sample, regular consumers of online gambling services (playing every day and/or 2-3 days a week) play online more than occasional gamblers (playing about once a month and/or 6-11 times a year or less). Respondents reporting that they play every day or at least 2-3 times a week, in 22.9% of cases also reported that they play only offline, whereas in 77.1% of the cases they reported that either they play only online or that they play both online and off line. Ordinary Least Squares regression was used to analyse the data. The causal effect of the protective measure (stimulus) on those exposed to it (Angrist Pischke, 2008). For the in-gamble measures,

Table 1. Summary of interventions

Intervention (stage/experiment)[1,2]	Comment	Addressing	Rationale
Pop-up Pictorial warning Pre-gamble (LAB & ONLINE)	New	Individuals' emotions	Activation of 'reflective thinking' by inducing unpleasant/worrying emotions using an unsettling picture. It attempts to leverage the 'affect heuristic'
Pop-up Textual warning Pre-gamble (LAB & ONLINE)	New	Individuals' cognition	Activation of 'reflective' thinking with standard information
Overconfidence task Pre-gamble (LAB & ONLINE)	New	Individuals' cognition	Aimed at de-biasing overconfidence and related self-delusional biases, as well as 'near-miss' and 'chasing losses'.
Logos Pre-gamble (LAB & ONLINE)	In use by operators	Individuals' cognition	Awareness raising
Wide banner Pre-gamble (ONLINE)	New	Individuals' cognition	Awareness raising, increased attention
Terms & conditions Pre-gamble (ONLINE)	In use by operators	Individuals' cognition	More information, counter 'rational ignorance'
Helpline Pre-gamble (ONLINE)	In use by operators	Individuals' cognition	Awareness raising, more information, counter 'rational ignorance', instil doubts
Simple registration form Pre-gamble (ONLINE)	In use by operators	Individuals' cognition	Awareness raising, more information, counter 'rational ignorance', instil doubts
Extended registration form Pre-gamble (ONLINE)	In use by operators	Individuals' cognition	Awareness raising, more information, counter 'rational ignorance', instil doubts
Pop-up Pictorial warning with "I understand" checkbox In-Gamble (LAB)	New	Individuals' cognition	Pay more attention, reinforcement of simpler variation
Pop-up Textual warning with "I understand" checkbox In-Gamble (LAB)	New	Individuals' cognition	Pay more attention, reinforcement of simpler variation
Combination of monetary limits & pop-up alerts In-Gamble (LAB)	New	Individuals & human-machine interaction	Leveraging 'loss aversion' and/or mental accounting to activate reflecting thinking, but also stop human-machine flow (frontal lobe wash out, mental disengagement, mental diversion)

1. LAB=laboratory experiment
2. ONLINE=online experiment

we also controlled for the exposure to the pre-gamble stimuli. On account of the randomization, the assignment to pre gamble and in gamble stimuli is orthogonal, however, it may be interesting (also from a policy perspective) to see if some spill-over effect is taking places across tasks. Not one subject opted out of the laboratory experiment, which guarantees the absence of selection bias in the estimation. In the case of opt out for the online experiment, the estimates are based on probit regression.

Laboratory experiment – pre-gamble interventions

Behavioural measurements

The results from the regression analyses showed that there were no effects for any of the treatments ($p<0.05$). Subjects exposed to the textual warning ($p<0.05$) and overconfidence task ($p<0.05$) interventions showed a faster bet per spin than those in the control group. For the other relations, we found no significant effect ($p<0.05$). The interventions aiming at activating a more accurate and reflective thinking do not reduce the amount bet and or slow down betting. The same applies also for the pictorial warning aimed at leveraging affect to activate reflective thinking.

Laboratory experiment – In gamble interventions

Behavioral measurements

Four interventions had a significant effect on amount and time per bet ($p<0.05$) leading respondents exposed to them to bet less than those in the control condition. Fixed limits with push feedback ($p<0.01$); fixed limits with push feedback 'you lose' ($p<0.01$); self-defined limit with push feedback ($p<0.05$), and self-defined limit with push feedback 'you lose' ($p<0.05$) had a lower average bet per spin than the controls. Four interventions also lead respondents to bet more slowly than those in the control condition; fixed limits with push feedback ($p<0.05$); fixed limits with push feedback 'you lose' ($p<0.01$); self-defined limit with push feedback ($p<0.01$), and self-defined limit with push feedback 'you lose' ($p<0.01$) have a higher average time per spin than the controls. When the comparisons are based on averages from all non-optional sessions, there are a few variations but, in general, the findings are broadly similar. When respondents had played all the 5 non-optional sessions they were given the choice of proceeding to the next stage of the experiment (i.e. stop playing and answer the final questionnaire) or of playing an extra session of another 20 spins. Differences were not significant ($p<0.05$), except for the combination 'self-defined limits with pull feedback' ($p<0.05$). For the changes in bet and time post warning there were significant differences for change in time both for pictorial warning ($p<0.01$) as for textual warning ($p<0.01$), but no effects were found for change in bet ($p<0.05$). In summary, for the laboratory experiment, the results show no effects for any of the pre-gamble interventions. Participants in the fixed limits with push feedback, or with push feedback 'you lose', and self-defined limit with push feedback, or with push feedback 'you lose', bet less than participants in the control condition.

Online experiment

Behavioral measurements

Participants in the pictorial ($p<0.05$) and textual warning condition ($p<0.05$) on average opted out less frequently than the control condition. Contrary to expectation, the effect is positive and the coefficient is large for the standard registration form ($p<0.01$) and, particularly, for the extended registration form ($p<0.01$). The regressions predict that on average 24.63% of the control condition opt out. The percentage declines to 18.76% and 19.24% in the case of respectively the pictorial and textual warning. In the case of standard and extended registration form, the predicted percentage of opt outs increases to 71.68% and 87.94% respectively. In sum, participants in the pictorial and textual warning condition opted out less frequently than the control condition.

Discussion and Conclusion

In this article, we assessed the effectiveness of existing and innovative measures to protect consumers of online gambling. It was hypothesized that the protective measures would decrease the average bet per spins and number of respondents that continued playing. It was also expected that the average time per spin would increase

The main results showed that pre-gamble interventions, both the four tested in the laboratory experiment (pop-up pictorial warning, pop-up textual warning, overconfidence, small logo) and the nine tested in the online experiment (pop-up pictorial warning, pop-up textual warning, overconfidence, small logo, wide/contrast banner, only helpline, terms and conditions, standard registration form, extended registration form) have limited impacts on the behavioral measures. That this result is found in both the laboratory experiment and the online experiment points to a generalizable finding. The ineffectiveness of the existing measures (except the pop-up pictorial warnings and the overconfidence task) was anticipated to some extent as they are based on standard information provision. The problem is that they create overload and a generalized rational ignorance reaction, the more so in the context of an entertaining activity such as gambling.

Our expectations were higher regarding the effectiveness of the pictorial warnings designed following positive results obtained in a previous study (Bogliacino *et al.*, 2015), and for the overconfidence task, which was directly derived from the analysis of the gambling specific biases presented in the introduction (i.e. overconfidence and illusion of control). Yet, even these two new measures, like the others directed at debiasing individuals, are only partially effective. It appears that the embedded affordances designed into online gambling compounded with limited capacity of attention and cognitive bandwidth scarcity create a condition of absorptive flow for the players. Last but not least, the most noteworthy finding is that the monetary limits and the various alerts informing players about wins and losses and forcing them to tick the box 'I understand' in order to proceed are by far the most effective consumer measures among those tested, especially in terms

of the most reliable behavioral measures, namely the amount bet and the time per bet.

Fixed monetary limits leverage the power of the default option and the inertial effect this may have on betting decisions (Johnson Goldstein, 2003). This is also important in view of the fact that in the online context there is a demonstrated 'status quo' bias and people stick to default settings. Self-defined limits leverage mental accounting: individuals construct dedicated 'budgets' for specific activities keeping spending under control (Thaler, 1985). All variants of alerts (push, pull, or push with 'you lose') are a practical realization of the solutions the relevant literature suggests as ways to activate slow but accurate reasoning (Strack et al., 2006; Streff Geller, 1988; Petty Cacioppo, 1986). Neither of the two works alone, since they are associated to pop-up alerts that force the gamblers to stop playing for at least a few seconds, which is possibly enough for the reactivation of cool cognition. Furthermore, with monetary limits when the wallet was empty players must stop and decide to refill it.

It should be accepted that the illusion of control and some of the other biases described in this paper are part of the gambling experience (Cosgrave, 2010; Schull, 2012). For many players gambling acts as an affect management tool opening up a buffer insulation zone from the outside world. It is not only a matter of 'irrational cognitions' but also of affect based choices, that are actively promoted and kept alive by affordances in the technology of gambling machines. Such loss of control on time spent, and money bet, to some extent occurs with any individual engaging in gambling; not merely with problematic and pathological gamblers (Dickerson, 2003; Schrans et al., 2004; Volberg, 2004). In this respect, we stress that both traditional and online gambling provide 'affordances' that by definition invite the individuals to switch off their knowledge and awareness about the fact that you cannot beat the machine.

This study has three main limitations that point at possible directions for further experimental research on protective measures for consumers of online gambling services. First, in this experimental behavioral study the most important response variables were those that recorded subjects' actual behavior when playing the two gambling games: time and amount of money per bet. A future experiment could replicate the design of the in-gamble interventions recording behavioral choices and adding physiological measures to capture emotional and cognitive reactions, such as skin-conductance and eye-tracking. Second, a different experimental design is needed to disentangle the differences across possible protective measures. The focus of the current study was to compare different protective measures against a control condition, but there are important theoretical and methodological differences between the different protective measures that could be further examined testing for effectiveness a smaller number of interventions. Third, the study explored only the direct effect of protective measures, in one gambling session. It might be expected that after a while participants or players will become less susceptible to the protective measure compared to only one exposure.

Policy Implications

To conclude we present a number of policy implications. All the pre-gamble protective measures tested are ineffective from an experimental-behavioral perspective, but they could still be used as a non-invasive form of consumer information, which is not harmful and for sure cannot be considered as over-regulation. On the other hand, the use of an extended registration form, besides being ineffective in the same way as the other pre-gamble measures, may represent an instance of overregulation that could push consumers toward less scrupulous websites or operators not requiring such registrations (possibly non regulation compliant if not fully illegal). In addition, monetary limits and the alerts (in-gamble interventions) seem to be more effective in reducing the time per bet and the average bet per round. After accounting for the opportunity cost of time, it might be legitimately assumed that this will reduce the average money spent betting, and this could be an important policy objective. In general, the challenge consists in providing legal and safe opportunities treating gambling as a recreational activity while minimizing the risks that gambling-related problems emerge. Since such problems may gradually emerge from what starts just as a recreational activity, there is a need to keep gambling within a safe and controlled environment. While the technological design of gambling machines makes them using bio-medical language 'addictive', the focus on gamblers' irrationality and their pathological behavior has exactly the paradoxical result of removing the attention of the policy makers and of those designing interventions from these very technological features that generate addiction. As governments de-regulate or accept industry self-regulation, then discourses on pathology or interventions at the individual level to induce more responsible gambling end up obscuring the structural features, the uncontrolled spread of new forms of gambling that should be regulated (Reith, 2013).

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References

1. Abbott, M.W., Volberg, R.A. (1996). The New Zealand national survey of problem and pathological gambling. Journal of Gambling Studies,12(2):143–160.

2. Angrist, J.D., Pischke, J.S. (2008). *Mostly harmless econometrics: An empiricist's companion*. Princeton: Princeton University Press.

3. Baddeley, M. (2017). Experts in policy land–Insights from behavioural economics on improving experts' advice for policy-makers. *Behavioral Economics for Policy*, 1:27-31.

4. Banks, J. (2017). *Gambling, Crime and Society*. New York: Springer.

5. Bogliacino, F., Codagnone, C., Veltri, G.A., Chakravarti, A., Ortoleva, P., Gaskell, G., ... Rudisill, C. (2015). Pathos ethos: emotions and willingness to pay for tobacco products. *PLos One*, 10(10), e0139542.

6. Bond, Michael (2009). Risk school. Nature 46:1189-92.

7. Codagnone, C., Bogliacino, F., Ivchenko, A., Veltri, G., and Gaskell, G. (2014). Study on online gambling and adequate measures for the protection of consumers of gambling services. Final Report. Brussels: European Commission. (Available at http://ec.europa.eu/internal-market/gambling/docs/initiatives/140714-study-on-online-gambling-final-report–en.pdf)

8. Cosgrave, J.F. (2010). Embedded addiction: The social production of gambling knowledge. *Canadian Journal of Sociology/Cahiers canadiens de sociologie*, 35(1):113.

9. de Freitas, S., and Griffiths, M. (2008). The convergence of gaming practices with other media forms: what potential for learning? A review of the literature. *Learning, Media and Technology*, 33(1):11-20.

10. Derevensky, J., and Gupta, R. (2007). Internet Gambling Amongst Adolescents: A Growing Concern. *International Journal of Mental Health and Addiction*, 5(2):93-101.

11. Dickerson, M. (2003). Exploring the Limits of Responsible Gambling: Harm Minimization or Consumer Protection? *Gambling Research* (Journal of the National Association for Gambling Studies Australia), 15:29-44.

12. Effertz, T., Bischof, A., Rumpf, H.J., Meyer, C., and John, U. (2018). The effect of online gambling on gambling problems and resulting economic health costs in Germany. *European Journal of Health Economics*, 19:967-978.

13. Faul F., Erdfelder E., Lang A.G., Buchner A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods, 39:175-191.

14. Faul F., Erdfelder E., Buchner A., and Lang A.G.(2009) Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavioral Research Methods*, 41:1149-1160.

15. Fogg, B. (2003). *Persuasive computing: Technologies designed to change attitudes and behaviors*. San Francisco, Calif: Morgan Kaufmann.

16. Gainsbury, S. (2010). Response to the Productivity Commission inquiry into gambling: Online gaming and the Interactive Gambling Act. *Gambling Research*, 22(2):3–12.

17. Gibson, J.J. (1975). Affordances and behavior. Republished in Reed E. and Jones R.(eds)(2019), *Reasons for Realism: Selected essays of James J. Gibson*:410-11. Abingdon-on-Thames: Taylor Francis.

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

19. Griffiths, M. (2009). Gambling in Great Britain. In G. Meyer, T. Hayer and M. Griffiths (Eds.), *Problem gaming in Europe: Challenges, prevention, and interventions*:103-121). New York: Springer.

20. Griffiths, M.D. and Auer, M. (2015). Research funding in gambling studies: Some further observations. *International Gambling Studies*, 15:15-19.

21. Griffiths, M., and Parke, J. (2010). Adolescent gambling on the Internet: A review. *International Journal of Adolescent Medicine and Health*, 22(1):59-75.

22. Grun, L. and McKeigue, P. (2000). Prevalence of excessive gambling before and after introduction of a national lottery in the United Kingdom: another example of the single distribution theory. *Addiction*, 95(6):959-66.

23. Grüne-Yanoff, T., and Hertwig, R. (2016). Nudge versus boost: How coherent are policy and theory?. *Minds and Machines*, 26(1-2):149-183.

24. H2 Gambling Capital (2014). Retrieved from www.h2gc.com on April 4th, 2014.

25. Heukelom, F., and Sent, E. M. (2017). Behavioral economics: from advising organizations to nudging individuals. *Journal of Behavioral Economics for Policy*, 1(1):5-10.

26. Tversky, A., and Kahneman, D. (Eds.). (2000). *Choices, Values, and Frames*. Cambridge: Cambridge University Press.

27. Johnson, E.J. and Goldstein, D. (2003). Do Defaults Save Lives? *Science*, 302(5649):1338-1339.

28. Ladd, G.T., and Petry, N. (2002). Disordered gambling among university-based medical and dental patients: A focus on Internet gambling. *Psychology of Addictive Behaviors*, 16(1):76–79.

29. Latour, B. (1999). A Collective of Human and Non Humans. In B. Latour (Ed.), *Pandora's Hope: Essays on the Reality of Science Studies*: 174-215. Cambridge, MA: Harvard University Press.

30. Mousavi, S., and Kheirandish, R. (2017). Policy making with behavioral insight. *Journal of Behavioral Economics for Policy*, 1(1):41-46.

31. Olason, D., Kristjansdottir, E., Einarsdottir, H., Haraldsson, H., Bjarnason, G., and Derevensky, J. (2011). Internet Gambling and Problem Gambling Among 13 to 18 Year Old Adolescents in Iceland. *International Journal of Mental Health and Addiction* 9(3):257-263.

32. Petry, N. (2006). Internet gambling: An emerging concern in family practice medicine? *Family Practice*, 23(4):421–426.

33. Petty, R., and Cacioppo, J. (1986). *Communication and Persuasion: Central and Peripheral Routes to Attitude Change*. New York: Springer-Verlag.

34. Reijula, S., Kuorikoski, J., Ehrig, T., Katsikopoulos, K., and Sunder, S. (2018). Nudge, Boost, or Design? Limitations of behaviorally informed policy under social interaction. *Journal of Behavioral Economics for Policy*, 2(1):99-105.

35. Reith, G. (2013). Techno economic systems and excessive consumption: a political economy of 'pathological' gambling. *British Journal of Sociology*, 64(4):717-738.

36. Robinson, M. J. F., Fischer, A. M., Ahuja, A., Lesser, E. N., and Maniates, H. (2015). Roles of "wanting" and "liking" in motivating behavior: gambling, food, and drug addictions. In Simpson, E.H. and Balsam, P.D. (Eds.)(2016) *Behavioral Neuroscience of Motivation*: 105-136. Cham: Springer.

37. Schrans, T., Schellinck, T., and Grace, J. (2004). The Nova Scotia Video Lottery Self Exclusion Program Process Test. Halifax, Nova Scotia: Nova Scotia Gaming Corporation

38. Schull, N. (2012). *Addiction by Design*. Princeton: Princeton University Press.

39. Stacy, A. W., Wiers, R. W. (2010). Implicit cognition and addiction: a tool for explaining paradoxical behavior. *Annual Review of Clinical Psychology*, 6:551-575.

40. Strack, F., Werth,L., and Deutsch, R. (2006). Reflective and Impulsive Determinants of Consumer Behavior. *Journal of Consumer Psychology*, 16(3):205-216.

41. Streff, F., and Geller, E. (1988). An experimental test of risk compensation: Between-subject versus within-subject analyses. *Accident Analysis Prevention*, 20(4):277-287.

42. Thaler, R. (1985). Mental accounting and consumer choice. *Marketing Science*, 4:199–214.

43. Volberg, R. (2004). Fifteen years of problem gambling prevalence research: What do we know? Where do we go? *Journal of Gambling Issues*, 10:1-19.

44. Wardle, H., Moody, A., Griffiths, M., Orford, J., and Volberg, R. (2011). Defining the online gambler and patterns of behaviour integration: evidence from the British Gambling Prevalence Survey 2010. *International Gambling Studies*, 11(3):339-356.

45. Wiers, R.W., Gladwin, T.E., Hofmann, W., Salemink, E., and Ridderinkhof, K.R. (2013). Cognitive bias modification and cognitive control training in addiction and related psychopathology: Mechanisms, clinical perspectives, and ways forward. *Clinical Psychological Science*, 1(2):192-212.

46. Wiers, R.W., and Stacy, A.W. (2006). Implicit cognition and addiction. *Current Directions in Psychological Science*, 15(6):292-296.

47. Wood, R., and Williams, R. (2009). Internet Gambling: Prevalence, Patterns, Problems, and Policy Options. Guelph, Ontario: Ontario Problem Gambling Research Centre.

48. Yani-de-Soriano, M., Javed, U., and Yousafzai, S. (2012). Can an industry be socially responsible if its products harm consumers? The case of online gambling. *Journal of Business Ethics*, 110(4):481-497.