

Gambling Data and Modalities of Interaction for Responsible Online Gambling: A Qualitative Study

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Abstract

Online gambling, as opposed to land-based gambling and other mediums of problematic and addictive behaviours such as alcohol and tobacco, offers unprecedented opportunities for monitoring and understanding users' behaviour in real-time, along with the ability to adapt persuasive messages and interactions that would fit the gamblers usage and personal context. This opens a new avenue for research on the monitoring and interactive utilisation of gambling behavioural data. To this end, in this paper we explore the range of data and modalities of interaction which can facilitate richer interactive persuasive interventions and offer additional support to limit setting, with the ultimate aim of aiding gamblers, who gamble at low to moderate levels, to stay in control of their gambling experience. The exploration is based on our previous research on online addiction and interviews with experts ($n_e = 13$) from different relevant multidisciplinary backgrounds and different points of view. We also interviewed gamblers ($n_g = 6$) about their perception of the utilisation of their data for aiding more conscious gambling. Directed at multiple stakeholders including the gambling software providers, compliance and responsible gambling personnel as well as policymakers, this paper aims to provide a basis and a reference point for empowering future responsible gambling socio-technical tools through the capture and utilisation of relevant online gambling behavioural data.

Keywords: Online gambling, problem gambling, behavioural data, limit setting, persuasive interventions.

Introduction

Online gambling is on a continuous upward growth trajectory (Gambling Commission, 2016) and gambling disorder is now recognized as an addictive disorder by the DSM-51 (American Psychiatric Association, 2013). Online gambling is easy to access and is enhanced by creative technology that makes the medium increasingly appealing and fascinating to users. The ubiquitous accessibility, through desktop and mobile devices, makes the scale and complexity of the problem even higher compared to traditional gambling machines such as fixed-odds betting terminals (FOBTs). This is exacerbated by the social computing features that can add further problematic capabilities, such as accompanying forums that allow gamblers to communicate to share tips, betting stories and so on. Such techniques, along with peer pressure, may extend exposure, stimulate relapse and prevent efforts to maintain gambling at an acceptable level. This integration of social computing into gambling reflects the increasing socialisation of gambling. Television adverts promoting the gambling industry, for example, often highlight the social aspects of activities, such as playing online bingo with friends, rather than the potential monetary gain. Furthermore, the usage of persuasive techniques (e.g., badges and leader boards) in online gambling may create an even more engaging medium and increase the risk of gambling being used as a method for avoiding real life difficulties. It is therefore important to ensure that gambling remains controlled and responsible from the start. Given the limited usage and experience with data-driven technology-assisted tools for responsible gambling, perspectives of both experts and gamblers are needed to first determine the acceptability of such technology. This will help the managed induction and introduction of the solutions relying on it. For example, some gamblers can see it as an enabler for more self-awareness and responsible gambling while others see it as an enabler for optimising gambling.

The features that make online and mobile gambling more impressive and attractive, simultaneously have significant potential to combat the problem of gambling (Zhao, Marchica, Derevensky, & Ivoska, 2018). The accessibility and persuasive techniques utilised in online gambling could equally be used as behavioural change mechanisms to prevent potential problematic behaviour. For example, gambling behavioural data can be used to show players patterns of loss of control and loss chasing as experienced by themselves or other players or peers in the case of using peer support groups and group therapy. Our research indicated that online gambling money tends to be seen as less real. Hence, gamblers can be shown visualisations of the actual value of the money used for gambling, e.g. a progress bar showing how the spent money compares to 10% of the monthly income and how much of certain goods and services this could buy. Consequently, the online medium

¹ The *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)* is a taxonomic and diagnostic tool published by the *American Psychiatric Association (APA)* that defines and classifies mental disorders in order to improve diagnosis, therapy and research.

provides a unique opportunity to empower classical behaviour change as it offers real-time responses, interactivity, traceability of usage data, intelligence, personalization and the ability to be context-aware. Building on the established research on influence (Davidson et al., 1999), help seeking and behaviour change (Moos & Moos, 2004), and online addiction labels (Ali, Jiang, Phalp, Muir, & McAlaney, 2015), we advocate persuasive approaches for assisting responsible online gambling behaviour instead of relying solely on compulsive ones (e.g., self-limitation and self-exclusion (Chagas & Gomes, 2017)).

Self-regulation theory (Baumeister, Schmeichel, & Vohs, 2007) introduces the concept of self-regulation systems, which are information systems for conscious personal management that involve the process of guiding one's own thoughts, behaviours, and emotions to achieve a goal. These systems can be advocated to prevent problematic online behaviour given the nature of the medium which allows various workarounds when classic and coercive approaches are enacted, e.g. using a different device or account. Self-regulation systems are focused on the users who have an active role in changing their own behaviour, as supported by psychological theories such as goal-setting (Fenner, Straker, Davis, & Hagger, 2013), self-monitoring (Miller & Thayer, 1988) and implementation intentions (Hagger & Luszczynska, 2014). A basic assumption and premise would be that people understand the benefits of maintaining control of their behaviour. Furthermore, such self-regulation systems for regulating online behaviour can derive benefit from the online medium itself, in order to monitor the behaviour (e.g., user's interaction with an online platform) and introduce addiction mitigation technologies, e.g., interactive warning labels and persuasive techniques such as timers and avatars (Ali et al., 2015). For example, Webb and colleagues (Webb, Sniehotta, & Michie, 2010) state that goal-setting theory provides clear implications for promoting change in addictive behaviours. Goal setting, along with feedback and advice is a core component of interventions to reduce problem drinking and facilitate smoking cessation (e.g., Scott-Sheldon, Carey, Elliott, Garey, & Carey, 2014; Whitlock et al., 2004). Also, recent studies show that limit setting approaches using pop-up message reduces in the majority of cases (apart from those with a financially focused self-concept) gambling expenditures (Tabri, Hollingshead, & Wohl, 2019). Therefore, in our study we will explore what types of limits could be utilised in a self-regulation system to control the online gambling experience.

The data can be used for within an individual and personalised setting, e.g. individual limit setting and plans, within social setting, e.g. group therapy and online peer support groups, and also in a blended modality. Self-regulation systems can be facilitated by persuasive technology techniques exploiting principles of social influence such as authority, social proof, likeability and commitment (Cialdini, 2006). In addition to helping to regulate the individual performance, people feel a sense of belonging when they receive assistance from others, directly through dialogue support (Oinas-Kukkonen & Harjumaa, 2009) or indirectly through showing others success

stories, e.g. data-driven graphs showing a decline in problematic patterns of other gamblers over time which can act as a social proof and give hope.

Furthermore, interventions could be designed based on the Theory of Planned Behaviour (Ajzen, 1991), which holds that attitude, subjective norm (perception of how others feel about the behaviour) and perceived control over a behaviour influence the intention to perform that behaviour, which eventually affects whether the individual performs the behaviour. Feedback on regularity of gambling and amount of bets in relation to others could help individuals regulate their behaviour, in line with the theory of social norms and social comparisons (Festinger, 1954). Comparably, enhanced awareness of how behaviour differs across contexts (e.g., increasing people's awareness of how their gambling differs based on time and place) could increase perceptual control of gambling. These types of context-aware and social influence interventions are one of the main research questions that will be explored in the present study.

As a primary step towards the generation of self-regulation platforms which collect and use online gambling behavioural data, it is necessary to carry out an in-depth exploration of the range of data and modalities of interaction that can facilitate richer interactive persuasive interventions and variations of limit setting, with the ultimate goal of making gambling a more conscious and informed experience for those who are able to maintain control over their gambling. In line with the principles of usability testing, an assessment of the target group's views regarding the content and format of an intervention, which is best achieved by conducting qualitative research, is needed during intervention development (Yardley, Morrison, Andreou, Joseph, & Little, 2010). We will also need to explore gamblers perception of such automated and semi-automated data collection and utilisation. This paper builds on our previous work on online gambling and addressed the above point by exploring views from experts in responsible gambling and gamblers through interviews and qualitative analysis. We aim to provide a basis and reference points for future platforms to empower responsible gambling through the capture and utilisation of gambling behavioural data.

Gambling Data Flow for Enabling Responsible Gambling

In addition to marketing, personalisation and trend analysis, gambling data can be used for responsible and informed gambling. This type of data includes visited pages, navigation paths, played games, tournaments of interest, live betting event status, login status, login frequency, location, computing device used, limits set so far and tendency to comply with them. Furthermore, this data can be obtained for both past and real-time events. More complex data can additionally be obtained using the gambler's personal devices. For example, data indicating emotional status can be obtained through affective computing and multimodal interaction techniques (Kostoulas, Chanel, Muszynski, Lombardo, & Pun, 2017).

Having access to this data in a way that is practical and timely for processing

would necessitate real-time streaming and formatting of such data, so it could be used as input to algorithms meant for responsible, informed and conscious gambling. The algorithms could then visualise the data in various ways (e.g., charts and infographics), and send recommendations to the gamblers or relevant others to take action. This would take place under specific contractual constraints and settings and with gamblers' informed consent.

In practical terms, this means the data would be subject to retrieval by automated and programming means (such as Application Programming Interfaces (APIs)) and would also need to be put in place for use of the data by third-party applications or other beneficiaries, e.g., family members, counsellors and therapists, when authorised by the gambler. This data sharing stream for the well-being of gamblers and their families is shown in Figure 1. In a typical data flow scenario, the gamblers have the ability to access their personal data located in the gambling operators and also any other third-party data provider, such as a bank and a healthcare provider. Thus, they could use it in their personal device for enabling responsible online gambling through a self-regulation mobile application. Additionally, this application could combine this data with additional multimodal data from the gamblers' environment and the device usage. Potentially, all this data could also, with the gamblers' consent, be shared with other recipients, such as the gambler's family and friends, researchers and/or any other responsible gambling services, for the gamblers' benefit.

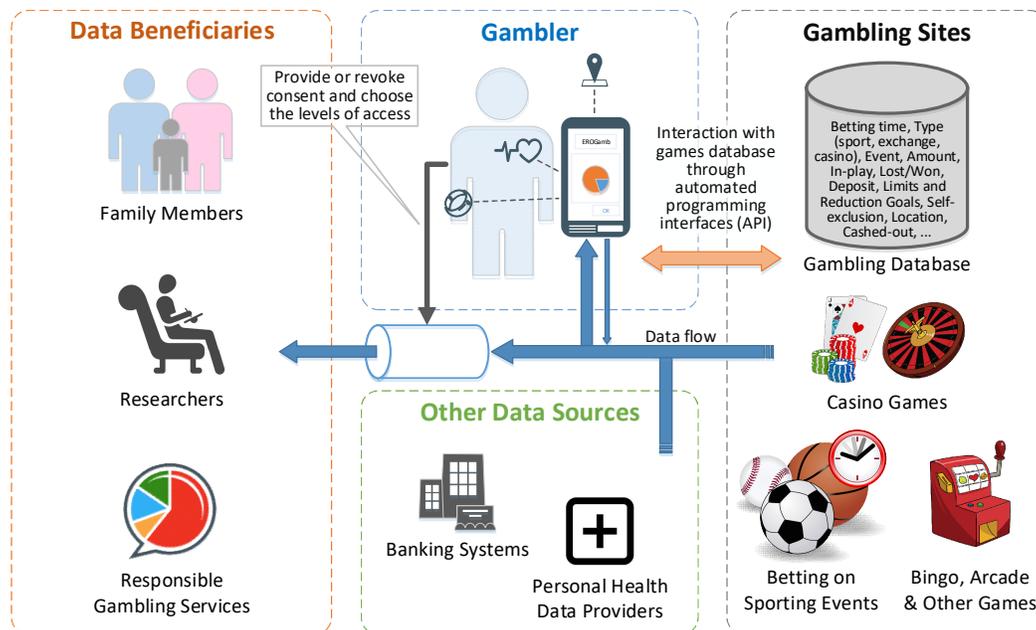


Figure 1. The data flow of gamblers to third-parties.

Method

Design

Qualitative semi-structured interviews were used to explore the following research questions:

RQ1 *What are the main types of limits gamblers could set to stay in control of their online gambling experience?*

RQ2 *What are the main types of online interactive interventions, corrective measures, visualization techniques and infographics that could be applied in order to help gamblers to play responsibly?*

RQ3 *What are the main types of data that could measure those limits and inform the gamblers about their activity and level of problem gambling?*

These research questions were explored with experts from different relevant multidisciplinary backgrounds such as computer/data science or psychology, with various areas of expertise such as persuasive technology or addiction (see Table 1 and Table 2). Experts included academics from UK with established track record manifested through peer-reviewed publications and projects within the domain of online gambling and its core area such as decision making and cyber-psychology, a CEO of an addiction rehabilitation charity, a head and a manager of a gambling rehabilitation centre, and three directors of responsible gambling from three gambling companies in Europe. The head and the directors had a longstanding experience with responsible gambling which enabled them to take a leadership role in their companies.

Gamblers with problematic gambling experience were then interviewed about their perception of the utilisation of their data for aiding more conscious gambling and their views about the experts' responses to the research questions (RQ1 – 3).

Experts were interviewed in order to identify potential behaviour change techniques that could be applied to online gambling using the online gambling behaviour data, and gamblers were interviewed to determine their perception of the collection of their data and the application of such techniques.

Participants

In our study, the interviews were conducted in two different groups of participants. Participants in the *first group* were experts in multiple subject areas in relation to addiction, persuasive technology and the gambling industry. This was used to explore RQ1 to RQ3. Demographic information for these participants is presented in Table 1 and details of each participant are showed in Table 2. Participants in the *second group* were gamblers ($n_g = 6$, 1 female) that were recruited via (1) an open call on social media which was shared by organisations and charities working on gambling

awareness and responsible gambling, and (2) snowball sampling through the gamblers. The interviewed gamblers (4 online gamblers, 1 in-person only gambler, 1 gamer/gambler) were identified as individuals with gambling disorder in recovery and were interviewed to express their perception about the findings of the first group. Individuals with gambling disorder in recovery were specifically chosen as they could reflect back on their own gambling experiences and provide more insightful comments than those who are currently experiencing problems with gambling or those who are just casual or social gamblers. In total, the two groups had a population of 19 participants (12 males, 7 females).

Table 1
Demographic information of experts.

Variable	Value	n _e = 13	%
Sex	Male	7	54%
	Female	6	46%
Years of experience	< 5	1	8%
	5 – 10	8	62%
	> 10	4	31%
Academic experience	Yes	8	62%
	No	5	38%
Background	Computer & Data Science	6	46%
	Psychology	8	62%
	Regulatory Compliance	3	23%
	Management	5	38%
Study-related expertise	Addiction	8	62%
	Persuasive Technology	5	38%
	Gambling	4	31%

Table 2
Details of the participating experts.

Participant	Sex	Years of experience	Academia vs Ind. & Recov.	Background				Study-related expertise		
				Computer & Data Science	Psychology	Regulatory Compliance	Management	Addiction	Persuasive Technology	Gambling
P _e 1	M	5 – 10	A	✓				✓	✓	
P _e 2	M	> 10	A	✓	✓				✓	
P _e 3	F	< 5	A	✓					✓	
P _e 4	F	5 – 10	A		✓			✓		
P _e 5	M	5 – 10	R		✓	✓	✓	✓		✓
P _e 6	M	5 – 10	R	✓	✓		✓	✓		

P _e 7	M	5 – 10	A	✓			✓
P _e 8	F	5 – 10	I		✓	✓	✓
P _e 9	F	> 10	R	✓		✓	✓
P _e 10	F	5 – 10	I	✓	✓	✓	✓
P _e 11	F	5 – 10	A, I	✓			✓
P _e 12	M	> 10	A	✓		✓	✓
P _e 13	M	> 10	A	✓		✓	✓

Data Collection

Approval for this project was granted by Bournemouth University Research Ethics Committee in UK, and all participants provided written informed consent prior to interview.

The semi-structured interviews with experts lasted 40-70 minutes and were remotely conducted using teleconferencing services during August - September 2017 by one of the authors (GD) who has 12 years of experience in both computing and health care through working in this area in various European projects.

The semi-structured interviews with the gamblers lasted 1-2 hours and were conducted either face-to-face (2 of 6) or by teleconferencing (4 of 6), by another author, a health psychologist with experience in qualitative interviewing and web-based interventions (EAC).

All interviews were audio recorded and transcribed verbatim. The interviews with experts began with questions about their profile (i.e. education, expertise and experience in gambling). During the interviews, the research questions mentioned above were elaborated and exemplified with a wide range of data and techniques typically used in the literature in software-assisted behaviour awareness and change. This was based on the project team and interviewer's experience in the general areas of Digital Addiction, Persuasive Technology and Behaviour Change and was meant to aid interviewees with a basis for a more specialized discussion tailored to the domain of online gambling. Examples from previous research (Ali et al., 2015; Alrobai, Dogan, Phalp, & Ali, 2018; Alrobai, McAlaney, Phalp, & Ali, 2016b) as well as an explanatory video showing the architecture were given to familiarize the interviewees with the overall architecture and processes of the solution proposed, e.g. how data can be collected and used by users and their surrogate software for limit settings and regulated usage. In the interview induction phase all participants were shown that the authentication is done through the usual log in to the operator site and that they are given full control over the transfer of the data to any additional tools or personnel and the right to revoke any permission they have given at any time. The illustration was done through showing a rich picture explaining the architecture and the data flow as well as a video we specifically developed to explain the whole process and its guiding policies and constraints. The conversation was also focused on individual

interviewees' expertise in order to maximize the quality of input. The interviews with gamblers (the second group) covered (a) their experience of gambling and (b) their views regarding the acceptability of the limits, intervention techniques and data suggested by the experts, which are presented here.

Data Analysis

Data analysis was carried out using content analysis and thematic analysis. Content analysis was especially appropriate for the interviews with experts as it is the best technique for identifying and categorising data points (i.e. RQ3: gambling operators' data, multimodal sensors' data) (Woodrum, 1984).

Data from the expert interviews in the first group was analysed using content analysis, in order to identify particular techniques around each research question (RQ1 – 3) (Joffe & Yardley, 2004). As the topic is relatively new, the method allowed us to analyse the data with a minimal degree of assumptions and be open to new types of gambling related data, rationale and modalities of collection. It also allowed us to unify the relatively diverse terminology used by the participants. The content analysis was mainly performed for data categorisation and with ultimate aim to elicit the types of online gambling behaviour data and other non-gambling related data. Moreover, it was also important for a holistic understanding of the gamblers' status and behaviour. The findings were then sent to the experts to comment on and to debate over a 4-week period through a shared online document.

Data from the interviews with gamblers in the second group was analysed using thematic analysis (Joffe & Yardley, 2004). Thematic analysis was a preferred option for the analysis of interviews with gamblers as it allowed to combine deductive and inductive approaches to themes identification (Fereday & Muir-Cochrane, 2006). In particular, the deductive a priori template of codes was developed based on the interviews with the experts (i.e. RQ1: 'limit setting' code-theme). However, we have not ignored the data-driven themes that provided us with the richness of descriptions and explanations (i.e. RQ2: feelings regarding the comparative visualisation). For the purposes of this study, only content specifically relating to the research questions RQ1 – 3 was included. In the following section, the anonymised results of the interviews are presented based on the research questions RQ1 – 3. It is important to highlight that the data collection was driven by theoretical saturation. With the first group of participants (experts) this was achieved quickly as the main points were mentioned by the majority of the participants and also because experts typically provide factual and evidence-based statements. For the second group (gamblers), we interviewed a range of participants, leading us to conclude that persuasive techniques were broadly acceptable to gamblers, but we acknowledge that interviewing a wider sample could further refine our general findings and contextualise it more. Hence, the saturation here is up to the point where the collection of data and their utilisation for responsible gambling was generally accepted in principle.

Results

Findings about Limit Setting (RQ1)

Interviews with Experts. Experts in Psychology highlighted that the limits that should be set to aid gamblers in regulating their online gambling activity would need to follow the SMART approach to goal setting (Doran, 1981), as follows:

- *Specific* (simple, sensible, significant): target a specific area for improvement
- *Measurable* (meaningful, motivating): quantify or at least suggest an indicator of progress
- *Assignable* (agreed, attainable): specify who will do it
- *Realistic* (reasonable, results-based): state what results can realistically be achieved, given available resources
- *Time-related* (time-based, time limited, time/cost limited, timely, time-sensitive): specify when the results shall be achieved

Additionally, our experts mentioned that the individuals should set their own limits to increase their autonomy (as per Locke and Latham (2004)), but that each limit should cover the individuals' expectations of reaching it and its value to them (as per Atkinson (1964)). For instance, they should not set limits that are unachievable (e.g. quitting without any support in place) or too easy (e.g. never gambling more than £1 million in one bet), as they would be set to fail (if unachievable or too hard) or would not feel satisfaction at achieving this limit (if too easy). That is, limits offered by the platform should be realistic but challenging and could be based on betting history. Finally, our experts mentioned that individuals may find it difficult to set SMART goals (as per Yardley et al. (2012)), so they could also be set in collaboration with therapists or family members.

Table 3 summarises our findings from RQ1. These results were obtained by 12/13 interviewees (one of them preferred to not answer due to lack of expertise). We organized our findings in six groups. The first three groups present the subject of the limits that should be specified (money, time and access limits). The fourth group ("who should set the limits?") discusses the party who should set these limits, while the fifth group ("limit duration") discusses the time by which a limit should be achieved, and the sixth group ("special considerations") presents best practices on how limits should be set.

Table 3
Findings about limit setting.

ID	Findings about limit setting
Money limits	
<u>Experts' points:</u>	
G01	Limitations in the amount of money that a gambler can lose, if this limit is achieved, the gambler would have to stop playing for a period of time
G02	Limitations in the amount and frequency of deposits (i.e. in credit or debit cards usage)
G03	Limitations in the percentage of gambler's salary and income
G04	Limitations in the max value of each bet
G05	Limitations in the amount of money that a gambler wins, if this limit is achieved, the gambler will stop playing for a period of time
<u>Gamblers' views:</u>	
	- Would reduce damage, enabling the software to prevent gamblers from reaching a critical stage
Time limits	
<u>Experts' points:</u>	
G06	Limitations in the overall time spent gambling
G07	Limitations in the duration of games and their sessions (e.g. casino, arcade, bingo games, etc.)
<u>Gamblers' views:</u>	
	- Would enable staying in control
Access limits	
<u>Experts' points:</u>	
G08	Limitations in the number of bets per type of game (i.e. different for live events and static games) at a specific time period
G09	Limitations based on the gambler's location (e.g., being at home may increase the chance of betting for some gamblers, while for others it may reduce it as they may access family support)
G10	Limitations based on gambler's location and in specific time periods (e.g. 18:00-20:00 at home every day)
G11	Limitations in the time periods (per day, week or weekend) to access gambling sites
G12	Limitations in the platforms (i.e. website or mobile app) that gamblers could bet
<u>Gamblers' views:</u>	
	- Time between bets should be limited
	- Ban on access to gambling operators at certain hours would be helpful
Who should set the limits?	
<u>Experts' points:</u>	
G13	Limits can be proposed by the platform and should be data driven (e.g. betting history) based on heuristics and patterns
G14	Limits can be self-set by the gambler
G15	Limits can be set by the gambler's family members or friends (i.e. some gamblers can trust a family member or a friend to do that on their behalf)
<u>Gamblers' views:</u>	
	- Time limits need to be set by the platform
	- Platform could provide a guide to calculating disposable income
	- Not all gamblers involve family members
Limit duration	
<u>Experts' points:</u>	
G16	Limit duration depends on the type of limits (i.e., money, time and access limits) and the application time (i.e., in the beginning or after an application period)
G17	Short-term limits (e.g. hour, day or week)
G18	Long-term limits (e.g. month)
<u>Gamblers' views:</u>	

- It is good that gamblers could set long-term limits
- Feedback would motivate them

Special considerations

Experts' points:

- G19 Limits should be realistic and achievable
- G20 Limits should be initially set and adjusted based on the gambler's behaviour (e.g., if limits are not achievable, they could be automatically adjusted by changing the initial limits or setting sub-limits)
- G21 Make it difficult for a gambler to change a limit during the application period
- G22 Provide the option to change the limit setting and to encourage gambler to not change it
- G23 Provide the option to select the appropriate limit(s) for themselves from a variety of available limits
- G24 Use gamification to provide encouraging messages (i.e. congratulations, well done, etc.) to build gamblers' motivation
- G25 The initial limit should be reasonable and in the short term, if the gambler achieves this limit, the limit should be bigger and in longer term
- G26 Ask gamblers if they prefer to use a different type of limit (through a guided approach)

Gamblers' views:

- Once limits have been set, it should be difficult to change them for a period of time (such as money limits)
-

Interviews with Gamblers. In relation to the findings in Table 3, the interviews with gamblers show that they were positive about setting time, money and access limits. They felt time limits would enable gamblers to stay in control, as some reported gambling for over 8 hours, and not wanting to stop until they had won:

“That experience [playing with a particular operator] ... was very helpful because it forced me to take a break for a significant period. I think 24 hours ... The longer I am gambling, the less likely I am to make rational choices around my gambling and the more likely I am to gamble problematically and place stupid bet stakes, lose control basically.” [Pg3, online gambler]

Similarly, money limits were seen as helpful in limiting damage. Participants felt that setting spending limits would reduce damage, as they felt that when they were losing their logic went out of the window.

“It's so dangerous to be allowed to gamble to the extent that I was allowed to. I had a £20,000 spin one night.” [Pg2, online gambler]

Regarding access limits, participants also felt it was important to limit the time between bets, in order for them to have the time to take a breath:

“You must equally take into consideration the time [between bets in online roulette] and stop it being 20 seconds and make it at least a minute if not 90 seconds.” [Pg2, online gambler]

The interviewed gamblers felt time limits should be set by the platform, as they felt they would be unable to do this themselves. They also felt that the platform should provide a guide to setting money limits, e.g., calculating disposable income

based on occupation and income bracket. However, nominating a family member was not considered to be helpful for everyone, as many gamblers hide or deny information from their families, so this feature would need to be voluntary.

Findings about Interactive Persuasive Interventions (RQ2)

Interviews with Experts. In this section, we summarize the results about the online interventions, corrective measures, visualization techniques and infographics that can be applied, based on the gambling behavioural data, in order to help the gambler to play responsibly. The results answering research question RQ2 are presented in Table 4 and detailed below:

- *Information for empowerment:* this category includes information we need to show to the gamblers to empower them through graphs or any other forms of visualizations. Aesthetics is one of the key factors in enhancing engagement with web-based interventions, and visualisations are more aesthetically pleasing than pure writing (O'Brien & Toms, 2008).
- *Comparative information:* this category includes comparisons of gamblers' activity with other multimodal data (e.g. emotions and locations) that could help them to understand their behaviour and change it. Also, it includes comparisons of their gambling activity with gambling activities of others (Auer & Griffiths, 2015). Social norm theory suggests that gamblers are likely to underestimate how much they gamble relative to others, based on research around alcohol use in students (Perkins, 2002). Normative feedback (about regularity of gambling and amounts gambled relative to others) could help individuals to regulate their behaviour. This approach has been effective in reducing alcohol consumption among university students, across a variety of studies e.g. (Neighbors et al., 2016), and a personalized normative feedback intervention led to reductions in gambling problems in university students (Neighbors et al., 2015).
- *Infographics about user's level of gambling:* this category includes infographics that could make gamblers better understand their gambling behaviours. Such graphics might clarify the nature of the information being provided, particularly to individuals of lower educational levels.
- *Notifications and messages:* this category concerns different types of notifications and messages (in some cases framing the situations as part of a game) according to gamblers' limits, to inform gamblers about their achievements, to encourage them to not play more and also to inform their families. Persuasive system design enhances adherence to web-based interventions (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012).
- *Communication mediums:* this category summarizes how such notifications and messages could be communicated to the gamblers through different

mediums. Using a range of mediums, preferably tailored to the user's interest, is likely to enhance adherence to the intervention.

- *Educational materials*: this category includes educational materials that could be provided to gamblers as knowledge at appropriate times during betting. Such examples of knowledge are related to gambling consequences, how to reduce stress, games' probabilities and the risks of addiction. Education is an essential part of interventions to reduce addictive behaviour, as knowledge is an essential first step in bringing about behaviour change. In the stages of change model (Prochaska, DiClemente, & Norcross, 1993), knowledge is required in order to move from precontemplation (no intention to change behaviour) to contemplation (intention to change behaviour within the next 6 months).
- *Special considerations*: this category concerns thoughts about the appropriate selection of infographics and visualizations, as well as the timing of the provided notifications and messages.

Table 4
Findings about interactive persuasive interventions.

ID	Findings about interactive persuasive interventions
Information for empowerment	
<u>Experts' points:</u>	
I01	Visualization (graphs) of the amount of money spent per day
I02	Visualization (graphs) of the time spent on gambling per day
I03	Visualization (graphs) of betting history (win & losses)
I04	Visualization (graphs) of the amount of time playing games
I05	Visualization of gambler's trends about spending time/money and number of bets
I06	Visualization of the times of day with higher betting activity
I07	Visualization of the time waiting until an event happens
I08	Visualization of the status of gambler's bank account (especially at the end of the month)
<u>Gamblers' views:</u>	
- Would encourage reflection on gambling behaviour and help plant seeds of awareness	
Comparative information	
<u>Experts' points:</u>	
I09	Comparative visualization between emotions/stress and betting activity (money and/or time)
I10	Comparative visualization between locations and betting activity (money and/or time)
I11	Comparative visualization between the gambler's time spent gambling and the average amount of time other people spend gambling ²
I12	Comparative visualization between the gambler's percentage of money spent gambling and the average percentage of other people with similar profiles
I13	Comparative visualization of gambler's daily activities where the time spent gambling is compared with other activities
<u>Gamblers' views:</u>	
- Helpful: would encourage reflection on gambling behaviour	
- Concern: gamblers might find it difficult to relate to information about others	
Infographics about user's level in problem gambling	

² This comparison should be done within peer group settings where people are comparable and an induction has taken place on how these numbers shall be interpreted. The facilitation by an expert therapist is required.

Experts' points:

- I14 Infographics that focus on gambler's emotional condition, such as an avatar (i.e. sad or happy face, etc.) or a virtual tree (i.e. showing four seasons)
- I15 Infographics that focus on gambler's financial condition, such as an empty (or with little money) bank account or two stacks of coins showing loses vs. wins
- I16 Infographics that focus on gambler's risk addiction, such as a person who is waiting in the queue of a flight and is at risk of not boarding the plane

Gamblers' views:

- Concern: might worsen emotional state
- Concern: might trivialize the problem

Notifications and messages

Experts' points:

- I17 Popup notifications and messages (supportive and not overly critical) about gambling activity and harm and aligned with the beliefs and limits of the gambler
- I18 Context-sensitive recommendation about the gamblers' need to reduce their gambling activity using alternative strategies for emotional regulation. Contextual factors include current game, location, winning status, etc. Alternative activities include going for a walk, visit a friend, etc.
- I19 Intelligent change of strategy about the way that the notifications (i.e. type of notifications, the time and the location where they will be appeared) are provided by tracking gamblers' behaviour when they see them (i.e. read notification, hide/close it, etc.)
- I20 Weekly and/or monthly reports about spending money, time, betting history and the achieved limits of gambler
- I21 Personalized messages and notifications (Armstrong, Donaldson, Langham, Rockloff, & Browne, 2018) during the gaming about the chances of current game, e.g. to help about stats and numbers and to clarify gamblers' fallacy
- I22 Notifications and messages to trusted authorized contacts or members of their family when the gambler is in a critical condition

Gamblers' views:

- Helpful: pop up or text enables change of focus
- Concern: pop ups seen as annoying
- Helpful: providing suggestions of alternative interests
- Concern: There to gamble, doesn't want time wasted
- Notifications to others: Could be helpful, but would need to be voluntary

Communication mediums

Experts' points:

- I23 Notifications and messages through smart device applications
- I24 Notifications and messages through SMS (e.g., Rodda, Dowling, Knaebe, & Lubman, 2018)
- I25 Emails especially for non time-critical messages/reports
- I26 Phone call from specialist in the area on how to manage such cases
- I27 Notifications and messages through the web browser (e.g. a browser extension or a plug-in within the gambling website)

Gamblers' views:

- Good to have personal touch
- Telephone call more helpful for switching attention
- Alerts when not following a particular pattern

Educational materials

Experts' points:

- I28 Educational materials about proportions and probabilities of games
- I29 Stress reduction materials using appropriate messages, supported with video, that will encourage them to do some anti-stress exercises
- I30 Education about gambling negative consequences (i.e. cognitive distortions)
- I31 Educational materials about the nature of gambler's addiction (i.e., understand their condition, how they feel is completely normal, they are not alone, they are not bad people, how addiction works in their brain, recovery is possible and it is only a health issue)
- I32 Inform gamblers about their risk to become addictive in comparison with the standard group

- of peoples based on their demographic data
- I33 Responsible gambling information in responsive style, i.e. encouraging more browsing and reading when a gambler starts to access similar materials (e.g. in the Web or in the gambling operators' websites)

Gamblers' views:

- Took time to realize they had a problem
- Education might have helped them realize this sooner
- Could also provide personal stories

Special considerations

Experts' points:

- I34 Intelligent selection of appropriate infographics based on their impact on the gambler's betting activity (i.e. if there is any positive change)
- I35 Provide notifications and messages at appropriate times (i.e. during in-play games or before bet again) using real-time data (e.g. login/online status and navigation tracking in gambling operators' websites)
- I36 Selection of appropriate infographics based on results relative to other gamblers with the same profile and demographic data, i.e. collaborative filtering
- I37 Intelligent selection of appropriate infographics based on their impact in the gambler's experience (i.e. detecting whether the user likes or dislikes the provided infographic)
- I38 The provided visualizations should be ordered by priority based on the gambler's limits
-

Interviews with Gamblers. Gamblers reported that visualizations about their gambling activity would be helpful, as they would enhance awareness of gambling behaviour, possibly leading to further reflection:

"Having a visual look of what I spent, it makes it real then, wow I didn't realise I spent £500 a day for the past 2 weeks on [gambling operator's] website." [Pg3, online gambler]

On the other hand, there were mixed feelings regarding comparative visualizations. While some gamblers felt they would help raise awareness, others felt that a focus on the gambler as an individual would be more helpful, as others might be experiencing different circumstances:

"I wouldn't really care what other people were gambling actually ... maybe they haven't got enough time, maybe they've got plenty of money" [Pg6, online gambler]

Similarly, notifications and messages were received with mixed views. On the one hand, they were seen as a way to enable change of focus, and therefore viewed positively:

"It [a message] would really have been helpful at the time because anything that gives you a reason to switch your whole attention from what you're doing. I could literally have been playing roulette and there could be a fire and I would have said, "Don't worry, I'm not using the fire, I'm watching this screen here." If you get a message whether it be oral or visual, it just distracts you." [Pg2, online gambler]

On the other hand, some participants felt they would find pop ups annoying, and would be likely to click on them and ignore them:

*“Similar to the pop-up messages that appear on fixed betting terminals ... they’re a *** nuisance. What I would do ... would be just switch them off ... I’m speaking from someone who ... when he’s gambling just wants to gamble, doesn’t want to be interfered with.”*
[Pg3, online gambler]

However, the interviewed gamblers felt it would be helpful to receive notifications from the platform if they appeared to be betting in an unusual manner. They particularly liked the idea of telephone calls, as they felt they would provide a personal touch. Providing emoticons as a method of giving feedback on betting activity (e.g., a smiley face if they had achieved their limits; a sad face if they had a net loss) were not seen as helpful. Some participants felt they would worsen low mood, and others felt they would trivialize the problem.

Findings about the Relevant Gambling Behavioural Data (RQ3)

Interviews with Experts. In this section, we report the data needed to support the limit setting and the different types of interventions with the aim of enabling more responsible online gambling. The results of the research question RQ3 are presented in Table 5. The resulting types of data mentioned are organised in the following groups:

- *Gambling operators’ data:* this category contains data that is generated or recorded by the gambling operators’ platforms. Data about betting history, including real time data, could enhance gamblers self-awareness regarding the pervasiveness of their behaviour. Problem gamblers tend to place higher confidence in their bets and believe they have greater control over their bets than non-problem gamblers (Goodie, 2005). Data showing gamblers how much they have been betting and winning/losing over a particular period may break their illusion of control, thus acting as a catalyst for behaviour change. Such information would be useful for individuals from when they start gambling.
- *Multimodal sensors’ data:* this category consists of data that is produced in the user-side and in gamblers’ personal digital devices (i.e., smartphones and sensors). This data could enable the platform to inform the gambler about their gambling behaviour in relation to location and time, in order to increase self-awareness of automatic behaviours (Banos et al., 2016). Information regarding how their behaviour varies across contexts (e.g., making people aware of their differential gambling activity based on time and place) could also increase perceived control over gambling.

- *Web presence data*: this category represents data describing the general online activities and behaviour of the gambler.
- *Third party data*: this category includes data outside the boundary of the gambling operators and can be collected with gamblers' consent from third party systems, such as financial and health-related institutional systems. Data could also be used to facilitate limit setting. Providing third party data such as bank statements could facilitate the platform in setting SMART goal type limit for the individual (Locke, Shaw, Saari, & Latham, 1981). For example, self-report data e.g., regarding the gamblers' financial situation, could enable the platform to set the gambler money limits.
- *Self-reported data*: this category contains data that can be reported by the gamblers themselves using appropriate forms spontaneously, after an event or in a specific time frequency. Data about the gambler's emotional state, and/or daily activities could enable the platform, over time, to determine when the gambler is likely to carry out problem gambling. In these situations, the platform could inform the gambler via instant messaging, and possibly suggest alternative activities, in order to enhance self-awareness and break the habit (Banos et al., 2016).
- *Self-administered measures*: this category consists of self-administered measurement and tasks that, when completed, can provide indicators and quantification of gambling addiction and psychological status of a gambler. Such questionnaires could further increase gamblers' awareness of their behaviour.

Table 5
Findings about the relevant gambling behavioural data.

ID	Findings about the relevant gambling behavioural data
Gambling operators' data	
<u>Experts' points:</u>	
D01	Betting history (i.e., time of betting, type of events, amount of money, won/lost, etc.) across gambling operators
D02	Spent time in gambling operators' services
D03	Real-time data about login status, navigation tracking in gambling operators' website or just online status
D04	Social factors from gambling operators' online forums, e.g. posts and topics
D05	Knowledge if gambling operators provide any social recognition (i.e. social features)
D06	Platform (website or mobile app) used for gambling
D07	Record the time frame of bets in relation to the events, i.e. the betting time in relation to the betting event time
<u>Gamblers' views:</u>	
	- Helpful to have data across gambling operators
	- Data from individual operators is currently available anyway (although not in visual format)
Multimodal sensors' data	
<u>Experts' points:</u>	
D08	Locations of gambler (geolocations or quantified in places (e.g. home, office, bus, etc. or

- even walking, driving and cycling))
- D09 Data from sensors in mobile devices: accelerometer, gyroscope, heart rate, galvanic skin response, etc. This data could be useful for emotion and stress detection
 - D10 Captured video and sound from mobile devices. This type of data could be useful to detect gamblers' emotion, stress and experience
 - D11 Tracking applications usage in mobile devices (useful to compare gambling with other activities)

Gamblers' views:

- Helpful: could predict when someone is likely to gamble
- Concern: too intrusive

Web presence data

Experts' points:

- D12 Browsing history and searching on the Web
- D13 Social media data: Tweets, likes, friends, etc.
- D14 Track mouse movements during the browsing as indicators of interest and potential actions

Gamblers' views:

- Data unrelated to gambling was not seen as relevant or helpful by gamblers

Third party data with gamblers' consent

Experts' points:

- D15 Financial data from third party system (e.g. banks, employers, tax, etc.)
- D16 Personal health records (PHR) (i.e. history of depression, addiction, etc.) from third party systems (e.g. PHR providers or apps)

Gamblers' views:

- Would need to be voluntary but could be helpful

Self-reported data

Experts' points:

- D17 Gamblers reporting their emotions at specific times (i.e. before a bet, after a bet, after a loss, after a day with high betting activity, etc.)
- D18 Personal profile information, such as demographic data, financial data (i.e. salary, deposits, available money until the end of month, etc.), health data (history of depression, alcohol consumption, etc.), cultural and religious background (e.g. gambling is forbidden in some religions and gamblers could hide and/or refuse to talk to therapists, etc.)
- D19 Gamblers reporting their overall gambling activity across the (online or not) gambling operators (e.g., how many accounts they have, how much time (or percentage) they spend in each account, which games they play in each account, etc.)
- D20 Gamblers reporting about what happens during the day (e.g. about work, an announcement at home, or any other distressing events, etc.). This can be done passively (gamblers choose to do that) or proactively (being asked after high betting activity)
- D21 Gamblers reporting their stress during betting
- D22 Gamblers reporting their personal preferences, what data they would like to report and at what times

Gamblers' views:

- Helpful to report data about emotions
- Could provide a commentary to look back on in future

Self-administered measures

Experts' points:

- D23 Questionnaire to classify the gambler to a specific level in gambling addiction (e.g. Problem Gambling Severity Index (PGSI) (Stinchfield, Govoni, & Frisch, 2007) and Protective Gambling Beliefs Scale (PGBS) (Armstrong, Rockloff, Browne, & Blaszczyński, 2019))
- D24 Iowa Gambling Task (IGT) (Bechara, Damasio, Damasio, & Anderson, 1994) is a psychological task thought to simulate real-life decision making during gambling
- D25 Toronto Alexithymia Scale (TAS) (Bagby, Taylor, & Ryan, 1986) is a self-report measure of alexithymia (difficulties identifying and describing their emotions). This is important to be known when the gamblers self-report their emotions
- D26 Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004) is a self-report measure of emotion regulation processes

D27 Questionnaire about relationship assessment (e.g. friends, marriage, family, etc.) to understand gambler social activities

Gamblers' views:

- Questionnaires beneficial for those new to gambling
 - Would need incentives to motivate gamblers to fill in questionnaires
-

Interviews with Gamblers. Gamblers felt it would be important to collect data across gambling operators, as many used a range of websites. Data from multimodal sensors (e.g., regarding location, emotion, stress) was seen as helpful by some gamblers, as they felt it might facilitate the platform in detecting potential issues:

“I can only see it [app sensing gambler’s location] as a positive especially if somebody’s got a problem.” [Pg1, online gambler]

On the other hand, some gamblers felt that the platform having access to this level of information about them would be too intrusive. The platform having access to third party data (such as bank statements), though, was seen as having the potential to be helpful, if provided with consent:

“I know people, through GA, who keep track of what they spend and what they’ve done and can prove they haven’t gambled and have spreadsheets and all sorts ... It works for them.” [Pg1, online gambler]

Self-report data about emotions was also seen as helpful. Participants mentioned being more likely to gamble when they were depressed/had a bad day. They felt this information would aid the platform in gaining knowledge of their behaviour. They also felt this information would be helpful to look back on in the future to maintain control:

“It’s nice to have a record of how bad it [binge] was because, sometimes, I’m reading through my journal and it can motivate me to stop or it can motivate me to stay stopped because I can just forget how bad these binges were.” [Pg4, gamer]

Finally, questionnaires to assess gambling activity were also seen as helpful, particularly for those new to gambling. However, participants were concerned filling in questionnaires would take quite a lot of time, which gamblers might feel would be better spent gambling. Incentives such as prize draws were suggested as a possible solution to this.

Discussion & Conclusions

This paper aimed to identify the limits, potentials interventions and type of data that could help online gamblers maintain control of their gambling via a self-regulation platform. For this reason, in our study, we interviewed two groups: experts and problem gamblers.

Our interviews with experts identified three types of limits (time, money and access) and identified areas to consider such as who should set these limits and their duration. We also identified 7 areas to consider when designing interventions (such as visualization of the gambling data) and 6 areas regarding the type of data collected (such as betting history and location).

Our interviews with gamblers showed mixed and sometimes contradictory views. For instance, while some of them found that obtaining multimodal data (e.g. information on geolocation, heart rate, and emotions) could be useful to predict when someone is likely to gamble, others found that this would be too intrusive. More research is needed to investigate what would work best for which individuals. We recommend in-depth interviews with service users before developing any interventions. However, gamblers did mention the importance of any intervention having a range of tools to manage responsible gambling, as they had used a range of strategies in recovering from their addiction.

Usability is not the only requirement for self-regulation applications which process the data and help gamblers stay in control. A wide range of other human factors seem to be prominent. For example, reactance (Miron & Brehm, 2006) could be one of the issues when gamblers feel that their freedom to take decisions is compromised. When the data is used in comparisons setting, i.e. amongst group of player, trivialisation and normalisation can happen, e.g. when one amount of expenditure compares well to others despite the different in affordability. There is also the risk of technology being seen as a remedy rather than an assistance and then may lead to players blaming the software for not curing them. Most of these risks has been studied by previous researches in the general context of digital addiction (Alrobai, McAlaney, Phalp, & Ali, 2016a).

Additionally, there are several arguments about the power and risks associated with self-regulation mediated by technology. We still do not have strong scientific evidence of their effectiveness and, in particular, the sustainability of change that they can bring (Leigh & Flatt, 2015). Delivering interventions within peer group settings could possibly be harmful due to group dynamics and structure factors. This may lead to reinforcing negative behaviour (Dishion, McCord, & Poulin, 1999) such as social loafing and compensation (Karau & Williams, 1993), along with conformity effects (Allen, 1965). Persuasive technologies may cause people to feel frustrated, anxious, pressured by peers, and guilty when they do not comply with the system or have to deceive (Hamari, Koivisto, & Pakkanen, 2014). Despite the potential opportunities of using online gambling behavioural data to help gamblers regulate their gambling, caution is required, as there is a possibility that the change may go in unforeseen directions.

According to Hing, Russell, and Hronis (2016), a responsible gambling concept involves responsible provision of gambling and responsible consumption. This in turn places responsibility for duty of care in hands of all players within the gambling

industry, operators and customers. It is clear that transparency on data sharing is heavily imposed on gambling operators; however, accountability for data sharing is not fully in place (Bachmann, Gillespie, & Priem, 2015). According to Bachmann et al. (2015) accountability is paramount to trust building between customers and organisations. The principles of data sharing and modalities for persuasive interactions proposed in this paper, such as requiring gambling operators to interact and share data within their various divisions and with the gamblers, are the first step to building transparent and accountable data sharing. This sort of transparency can firstly maximize compliance both the European Union General Data Protection Regulation (GDPR) and enable socially responsible practices across the gambling industry that will effectively lead to more trust.

To conclude, we hope this paper will stimulate discussions not only in the gambling industry but also in the software and well-being industries as well as policy makers to develop strategies towards more responsible gambling. Additionally, we aim that the results of this qualitative study to constitute a basis and reference points for future self-regulation information systems that should be developed following the principles of security and privacy by design (Vicini et al., 2016) and with ultimate goal to empower responsible gambling through the capture and utilisation of gambling behavioural data.

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