

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 behaviour such as alcohol and tobacco consumption, offers unprecedented opportunities for monitoring and understanding users' behaviour in real-time. It also provides the ability to adapt persuasive messages and interactions that would fit the gamblers usage and personal context. These features open a new avenue for research on the monitoring and interactive utilization of gambling behavioural data. 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 utilization 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 utilization of relevant online gambling behavioural data.

Keywords: online gambling, problem gambling, behavioural data, limit setting, persuasive interventions

Résumé

Le jeu en ligne, contrairement aux formes de jeu hors ligne et à d'autres types de comportements problématiques et de dépendance comme la consommation d'alcool et de tabac, offre des possibilités sans précédent de surveillance et de compréhension du comportement des utilisateurs en temps réel, ainsi que la capacité d'adapter des messages persuasifs et des interactions adaptées à l'utilisation des joueurs et au contexte personnel. Cela ouvre une nouvelle voie pour la recherche sur la surveillance et l'utilisation interactive des données comportementales relatives au jeu. Dans cet article, nous explorons à cette fin la gamme de données et les modalités d'interaction qui peuvent faciliter des interventions persuasives interactives plus riches et permettre un soutien accru pour l'établissement de limites, dans le but ultime d'aider les joueurs de niveaux faibles à modérés à demeurer en contrôle de leur expérience de jeu. L'exploration est basée sur nos recherches antérieures sur la dépendance en ligne et sur des entretiens avec des experts ($n_e = 13$) issus de différents contextes multidisciplinaires pertinents et ayant différents points de vue. Nous avons également interrogé des joueurs ($n_g = 6$) à propos de leur perception de l'utilisation de leurs données pour contribuer à un jeu plus conscient. Ce document vise à fournir une base et un point de référence pour l'autonomisation de futurs outils socio-techniques du jeu responsable grâce à la saisie et l'utilisation de données pertinentes sur les comportements de jeu en ligne, et il est destiné à de multiples parties prenantes, notamment des fournisseurs de logiciels de jeu, du personnel de conformité et de jeu responsable ainsi que des décideurs.

Introduction

Online gambling is on a continuous upward growth trajectory (Gambling Commission, 2016), and the DSM-5 now recognizes gambling disorder as an addictive disorder (American Psychiatric Association, 2013). Online gambling is easy to gain access to, 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 situation is exacerbated by the social computing features that can add further problematic capabilities. Examples include accompanying forums that allow gamblers to communicate to share tips and betting stories. 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 *socialization* of gambling. Television advertising promoting the gambling industry, for example, often highlights the social

aspects of activities rather than the potential monetary gain. (An instance might be playing online bingo with friends.) Furthermore, the usage of persuasive techniques in online gambling (e.g., badges and leader boards) may in turn create an even more engaging medium, and therefore 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 determine first the acceptability of such technology. Such a contribution would help the managed induction and introduction of the solutions relying on it. For example, certain gamblers can see it as an enabler for more self-awareness and responsible gambling, while others see it as an enabler for optimizing gambling.

The features that make online and mobile gambling more simultaneously impressive and attractive also provide significant potential to combat the problem of gambling (Zhao, Marchica, Derevensky, & Ivoska, 2018). The accessibility and persuasive techniques utilized 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 reveal players' patterns of both loss of control and loss chasing as experienced by themselves or other players, or by peers in the case of using peer support groups and group therapy. Our research indicates that in online gambling money tends to be perceived as less real. Hence, gamblers can be shown visualizations of the actual value of the money used for gambling. An example would be a progress bar displaying how the spent money compares to 10% of the monthly income and how much of certain goods and services this money could buy. Consequently, the online medium provides a unique opportunity to empower classic 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 self-designated 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 those users who have an active role in changing their own behaviour, as supported by such psychological theories 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, 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 suggest that limit-setting approaches using pop-up message reduces in the majority of cases (apart from those cases 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 utilized in a self-regulation system to control the online gambling experience.

The data can be used within an individual or personalised setting (e.g., individual limit setting and plans); within a social setting (e.g., group therapy and online peer support groups), and 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 individual performance, people feel a sense of belonging when they receive assistance from others, either directly through dialogue support (Oinas-Kukkonen & Harjumaa, 2009) or indirectly through showing others success stories, e.g., data-driven graphs displaying a decline in problematic patterns of other gamblers over time which can act as a social proof and give hope to the afflicted persons.

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 all influence the intention to perform that behaviour. This process eventually affects whether the individual does in fact execute that 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' perceptions of such automated and semi-automated data collection and utilization. This paper builds on our previous work on online gambling and addresses 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 utilization of gambling behavioural data.

Gambling Data Flow for Enabling Responsible Gambling

In addition to marketing, personalization 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, these 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).

Enjoying access to these 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 visualize the data in various ways (e.g., charts and infographics), and send recommendations to the gamblers or relevant others to take action. This process 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 or APIs) and would also need to be put in place for use of the data by third-party applications or other beneficiaries, such as family members, counsellors and, when authorized by the gambler, therapists. 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 enjoy the ability to retrieve 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 gambler's environment and the device usage. Potentially, all this data could also, with the gambler's consent, be shared with other recipients, such as the gambler's family and friends, researchers, or any other responsible gambling services, for the gambler's benefit.

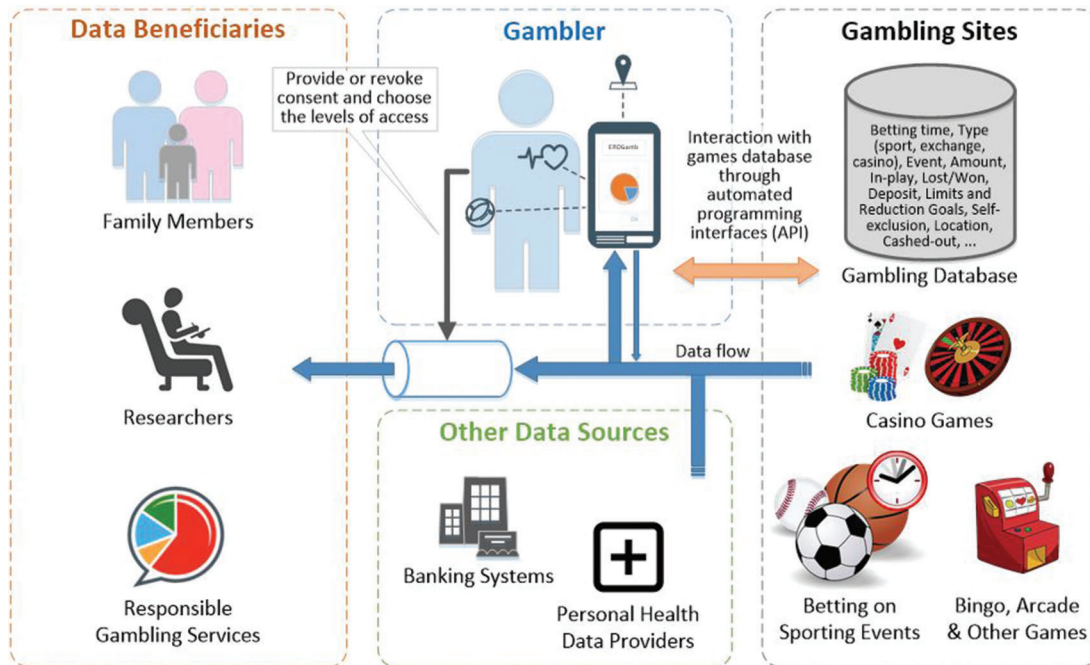


Figure 1. The data flow of gamblers to third-parties.

Method

Design

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

- RQ 1. What are the main types of limits gamblers could set to stay in control of their online gambling experience?
- RQ 2. What are the main types of online interactive interventions, corrective measures, visualization techniques and infographics that could be applied help gamblers to play responsibly?
- RQ 3. 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 developed with experts from different relevant multidisciplinary backgrounds, such as computer and data science, and psychology, and who possessed various areas of expertise pertinent to the research, such as persuasive technology or addiction (see Table 2). Experts included the four following persons or groups. First, academics from the UK with established track records established through peer-reviewed publications and projects within the domain of online gambling and its core areas, such as decision making and cyber-psychology. Second, the CEO of an addiction rehabilitation charity. Third, the head and a manager of a gambling rehabilitation centre. And, fourth, three directors of responsible gambling units from within three gambling companies in Europe. The head and the

directors had a longstanding experience with responsible gambling, one which enabled them to take a leadership role in their companies.

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

Experts were interviewed 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 shown in Table 2. Participants in the second group were gamblers ($n_g = 6$, one female) that were recruited via (1) an open call on social media which was shared by organizations 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,

Table 1
Demographic information of experts

Variable	$n_e = 13$	%
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 and 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												
	P _e 1	P _e 2	P _e 3	P _e 4	P _e 5	P _e 6	P _e 7	P _e 8	P _e 9	P _e 10	P _e 11	P _e 12	P _e 13
Sex	M	M	F	F	M	M	M	F	F	F	F	F	M
Experience (years)	5-10	> 10	< 5	5-10	5-10	5-10	5-10	5-10	> 10	5-10	5-10	> 10	> 10
Academia vs Individual & Rehabilitation Centre	A	A	A	A	R	R	A	I	R	I	A,I	A	A
Background	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Computer & Data Science		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Psychology		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Regulatory Compliance					✓	✓		✓	✓	✓	✓	✓	✓
Management					✓	✓		✓	✓	✓	✓	✓	✓
Study-Related Expertise					✓	✓		✓	✓	✓	✓	✓	✓
Addiction	✓			✓	✓	✓			✓	✓		✓	✓
Persuasive Technology	✓	✓	✓				✓					✓	✓
Gambling					✓			✓			✓	✓	✓

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 unique 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 comprised a sample of 19 participants (12 males, 7 females).

Data Collection

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

The semi-structured interviews with experts lasted 40–70 minutes and were remotely conducted using teleconferencing services during August to September 2017 by one of the authors (GD). This author holds 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 that are typically used in literature concerning software-assisted behaviour awareness and change. This approach 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 manipulated by users and their surrogate software for limit setting and regulated usage. In the interview induction phase all participants were shown that the authentication is executed 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 have the right to revoke any permission they have given at any time. The illustration was done through displaying a rich picture explaining the architecture and the data flow, as well as through 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 to maximize the quality of input. The interviews with

gamblers (the second group) explored (1) their experience of gambling and (2) 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 remains the best technique in research for the identification and categorization of pertinent data points (i.e., RQ3: gambling operators' data, multimodal sensors' data) (Woodrum, 1984).

Data from the expert interviews in the first group were analysed using content analysis 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 relative few assumptions and to be open to new types of gambling related data, rationale, and modalities of collection. It also allowed us to unify the relatively diverse terms used by the participants. The content analysis was mainly performed for data categorization, and with the ultimate aim of eliciting 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 four-week period through a shared online document.

Data from the interviews with gamblers in the second group were analysed using thematic analysis (Joffe & Yardley, 2004). Thematic analysis was a preferred option for the analysis of these interviews as it allowed the combination of deductive and inductive approaches to identification of themes (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 visualization). For the purposes of this study, only content specifically relating to the research questions RQ1–3 was included. In the following section, the anonymized results of the interviews are presented based only on those questions. It is important to highlight that the data collection was driven by theoretical saturation. With the first group of participants (experts), this goal was achieved quickly, because the main points were mentioned by the majority of the participants, and also because it is typical for experts to 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 contextualize it more. Hence, the saturation here is up to the point where the collection of data and their utilization for responsible gambling was generally accepted in principle.

Results

Findings about Limit Setting (RQ1)

Interviews with Experts. Experts in psychology highlighted that 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). The limits were 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- or 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 consider the individuals' expectations of reaching it and its value to them (as per Atkinson, 1964). For instance, the individuals 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., 2013), so they could also be set in collaboration with therapists or family members.

Table summarises our findings from RQ1. These results were obtained through twelve of the thirteen interviewees. (One of the thirteen preferred instead to not answer because of 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 which party should be the one to set the limits, while the fifth group ("limit duration") explores the time by which a limit should be achieved, and the sixth group ("special considerations") presents best practices on how limits should in fact be set.

Interviews with Gamblers. In relation to the findings in Table 3, the interviews with gamblers indicated that they were positive about setting money, time and access limits. They believed time limits would enable gamblers to stay in control, as certain

Table 3
Findings about limit setting

Limit	Findings about limit	ID
Money limits		
Experts' points	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	G01
	Limitations in the amount and frequency of deposits (i.e., in credit or debit cards usage)	G02
	Limitations in the percentage of gambler's salary and income	G03
	Limitations in the max value of each bet	G04
	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	G05
Gamblers' views	Would reduce damage, enabling the software to prevent gamblers from reaching a critical stage	
Time limits		
Experts' points	Limitations in the overall time spent gambling	G06
	Limitations in the duration of games and their sessions (e.g., casino, arcade, bingo games, etc.)	G07
Gamblers' views	Would enable staying in control	
Access limits		
Experts' points	Limitations in the number of bets per type of game (i.e., different for live events and static games) at a specific time period	G08
	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 gain access to family support)	G09
	Limitations based on gambler's location and in specific time periods (e.g., 18:00-20:00 at home every day)	G10
	Limitations in the time periods (per day, week or weekend) to gain access to gambling sites	G11
	Limitations in the platforms (i.e., website or mobile app) that gamblers could bet	G12
Gamblers' views	Time between bets should be limited Ban on access to gambling operators at certain hours would be helpful	
Who should set limits?		
Experts' points	Limitations can be proposed by the platform and should be data-driven (e.g., betting history) based on heuristics and patterns	G13
	Limitations can be self-set by the gambler	G14

Table 3 Continued.

Limit	Findings about limit	ID	
Gamblers' views	Limitations 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)	G15	
	Time limitations need to be set by the platform		
	Platform could provide a guide to calculating disposable income		
	Not all gamblers involve family members		
Limit duration			
Experts' points	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)	G16	
Gamblers' views	Short-term limitations (e.g., hour, day or week)	G17	
	Long-term limitations (e.g., month)	G18	
	It is good that gamblers could set long-term limitations Feedback would motivate them		
Special considerations			
Experts' points	Limitations should be realistic and achievable	G19	
	Limitations 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)	G20	
	Make it difficult for a gambler to change a limit during the application period	G21	
	Provide the option to change the limit setting and to encourage gambler to not change it	G22	
	Provide the option to select the appropriate limit(s) for themselves from a variety of available limits	G23	
	Use gamification to provide encouraging messages (i.e., congratulations, well done, etc.) to build gamblers' motivation	G24	
	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	G25	
	Ask gamblers if they prefer to use a different type of limit (through a guided approach)	G26	
	Gamblers' views	Once limits have been set, it should be difficult to change them for a period of time (such as money limits)	

of them reported gambling for over eight 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 understood as helpful in limiting damage. Participants believed that setting spending limits would reduce damage, as they understood that when they were losing they lost an important sense of logic.

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 argued it was important to restrict the time between bets, in order for them to locate the time to take a meaningful pause:

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 believed time limits should be set by the platform, as they thought they would be unable to do this themselves. The subjects also believed 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 in fact 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, all of which can be applied, based on the gambling behavioural data, 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 display 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 visualizations are more aesthetically pleasing to users than pure writing (O'Brien & Toms, 2008).

Comparative information. This category included comparisons of gamblers' activity with other multimodal data (e.g., emotions and locations) that could help them to understand their behaviour and change it. The category also incorporated 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—that is, feedback about regularity of gambling and amounts gambled relative to others—could help

Table 4
Findings about interactive persuasive interventions

Intervention	Findings about intervention	ID
Information for empowerment		
Experts' points	Visualization (graphs) of the amount of money spent per day	I01
	Visualization (graphs) of the time spent on gambling per day	I02
	Visualization (graphs) of betting history (win & losses)	I03
	Visualization (graphs) of the amount of time playing games	I04
	Visualization of gambler's trends about spending time/money and number of bets	I05
	Visualization of the times of day with higher betting activity	I06
	Visualization of the time waiting until an event happens	I07
	Visualization of the status of gambler's bank account (especially at the end of the month)	I08
Gambler's views	Would encourage reflection on gambling behaviour and help plant seeds of awareness	
Comparative information		
Experts' points	Comparative visualization between emotions/stress and betting activity (money and/or time)	I09
	Comparative visualization between locations and betting activity (money and/or time)	I10
	Comparative visualization between the gambler's time spent gambling and the average amount of time other people spend gambling ¹	I11
	Comparative visualization between the gambler's percentage of money spent gambling and the average percentage of other people with similar profiles	I12
	Comparative visualization of gambler's daily activities where the time spent gambling is compared with other activities	I13
Gambler's views	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		
Experts' points	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)	I14
	Infographics that focus on gambler's financial condition, such as an empty (or with little money) bank account or two stacks of coins showing losses vs. wins	I15
	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	I16

Table 4 Continued.

Intervention	Findings about intervention	ID
Gambler's views	Concern: might worsen emotional state Concern: might trivialize the problem	
Notifications and messages		
Experts' points	Popup notifications and messages (supportive and not overly critical) about gambling activity and harm and aligned with the beliefs and limits of the gambler	I17
	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.	I18
	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.)	I19
	Weekly and/or monthly reports about spending money, time, betting history and the achieved limits of gambler	I20
	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	I21
	Notifications and messages to trusted authorized contacts or members of their family when the gambler is in a critical condition	I22
Gambler's views	Helpful: pop up or text enables change of focus Concern: pop ups perceived 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	Notifications and messages through smart device applications	I23
	Notifications and messages through SMS (e.g., Rodda, Dowling, Knaebe, & Lubman, 2018)	I24
	Emails especially for non time-critical messages/reports	I25
	Phone call from specialist in the area on how to manage such cases	I26
	Notifications and messages through the web browser (e.g., a browser extension or a plug-in within the gambling website)	I27

Table 4 Continued.

Intervention	Findings about intervention	ID
Gambler's views	Good to have personal touch Telephone call more helpful for switching attention Alerts when not following a particular pattern	
Educational materials		
Experts' points	Educational materials about proportions and probabilities of games	I28
	Stress reduction materials using appropriate messages, supported with video, that will encourage them to do some anti-stress exercises	I29
	Education about gambling negative consequences (i.e., cognitive distortions)	I30
	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)	I31
	Inform gamblers about their risk to become addictive in comparison with the standard group of peoples based on their demographic data	I32
	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)	I33
Gambler's 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	Intelligent selection of appropriate infographics based on their impact on the gambler's betting activity (i.e., if there is any positive change)	I34
	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)	I35
	Selection of appropriate infographics based on results relative to other gamblers with the same profile and demographic data, i.e., collaborative filtering	I36
	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)	I37
	The provided visualizations should be ordered by priority based on the gambler's limits	I38

¹This 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.

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). 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 included infographics that could make gamblers better understand their gambling behaviours. Such graphics, we argued, might clarify the nature of the information being provided, particularly to individuals of lower educational levels.

Notifications and messages. This category concerned different types of notifications and messages (in certain cases framing the situations as part of a game) according to gamblers' limits, to inform gamblers about their achievements, encourage them to not play more, and instruct their families. Persuasive system design enhances adherence to web-based interventions (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012).

Communication mediums. This category summarized 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, this category, we reasoned, was 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 to move from precontemplation (no intention to change behaviour) to contemplation (intention to change behaviour within the next 6 months).

Special considerations. This category concerned thoughts about the appropriate selection of infographics and visualizations, as well as the timing of the provided notifications and messages.

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 certain gamblers argued they would help raise awareness, others believed that

a focus on the gambler as an individual would be more helpful, as others might in fact 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 perceived 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, certain participants believed they would find pop ups annoying, and would instead be likely to click on them and then 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 maintained 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 thought 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 had a net loss) were not understood as helpful. Certain participants believed they would worsen low mood and contended they would trivialize the problem.

Findings about Interactive Persuasive Interventions (RQ3)

Interviews with Experts. In this section, we report the data needed to support 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 were organized into the following groups.

Gambling operators' data. This category contained data that were generated or recorded by the gambling operators' platforms. Data concerning betting history, including real time data, could, we argued, enhance gamblers self-awareness regarding the pervasiveness of their behaviour. Problem gamblers tend to place higher confidence in their bets and believed they command greater control over their bets than non-problem gamblers (Goodie, 2005). Data showing gamblers how much they have been betting and winning or losing over a particular period may break their illusion of

Table 5
Findings about the relevant gambling behavioural data

Data source	Findings about the relevant gambling behavioural data	ID
Gambling operators' data		
Experts' points	Betting history (i.e., time of betting, type of events, amount of money, won/lost, etc.) across gambling operators	D01
	Spent time in gambling operators' services	D02
	Real-time data about login status, navigation tracking in gambling operators' website or just online status	D03
	Social factors from gambling operators' online forums, e.g., posts and topics	D04
	Knowledge if gambling operators provide any social recognition (i.e., social features)	D05
	Platform (website or mobile app) used for gambling	D06
	Record the time frame of bets in relation to the events, i.e., the betting time in relation to the betting event time	D07
Gambler's views	Helpful to have data across gambling operators Data from individual operators is currently available anyway (although not in visual format)	
Multimodal sensors' data		
Experts' points	Locations of gambler (geolocations or quantified in places (e.g., home, office, bus, etc. or even walking, driving and cycling))	D08
	Data from sensors in mobile devices: accelerometer, gyroscope, heart rate, galvanic skin response, etc. This data could be useful for emotion and stress detection	D09
	Captured video and sound from mobile devices. This type of data could be useful to detect gamblers' emotion, stress and experience	D10
	Tracking applications usage in mobile devices (useful to compare gambling with other activities)	D11
Gambler's views	Helpful: could predict when someone is likely to gamble Concern: too intrusive	
Web presence data		
Experts' points	Browsing history and searching on the Web	D12
	Social media data: Tweets, likes, friends, etc.	D13
	Track mouse movements during the browsing as indicators of interest and potential actions	D14
Gambler's views	Data unrelated to gambling was not considered as relevant or helpful by gamblers	

Table 5 Continued.

Data source	Findings about the relevant gambling behavioural data	ID
Third party data with gamblers' consent		
Experts' points	Financial data from third party system (e.g., banks, employers, tax, etc.)	D15
	Personal health records (PHR) (i.e., history of depression, addiction, etc.) from third party systems (e.g., PHR providers or apps)	D16
Gambler's views	Would need to be voluntary but could be helpful	
Self-reported data		
Experts' points	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.)	D17
	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.)	D18
	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.)	D19
	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)	D20
	Gamblers reporting their stress during betting	D21
	Gamblers reporting their personal preferences, what data they would like to report and at what times	D22
Gambler's views	Helpful to report data about emotions Could provide a commentary to look back on in future	
Self-administered measures		
Experts' points	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, & Blaszczynski, 2019))	D23
	Iowa Gambling Task (IGT) (Bechara, Damasio, Damasio, & Anderson, 1994) is a psychological task thought to simulate real-life decision making during gambling	D24

Table 5 Continued.

Data source	Findings about the relevant gambling behavioural data	ID
	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	D25
	Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004) is a self-report measure of emotion regulation processes	D26
	Questionnaire about relationship assessment (e.g., friends, marriage, family, etc.) to understand gambler social activities	D27
Gambler's views	Questionnaires beneficial for those new to gambling	

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 consisted of data that were produced in the user-side and in gamblers' personal digital devices (i.e., smartphones and sensors). These data could enable the platform to inform the gambler about their gambling behaviour in relation to location and time, to increase self-awareness of automatic behaviours (Banos et al., 2016). Information regarding how their behaviour varies across contexts (e.g., creating awareness 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, that 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 limits for the individual (Locke, Shaw, Saari, & Latham, 1981). Self-reported information, such as the gamblers' financial situation, could enable the platform to set the gambler money limits.

Self-reported data. This category contained 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, daily activities, or both 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, to enhance self-awareness and break the habit (Banos et al., 2016).

Self-administered measures. This category consisted 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.

Interviews with Gamblers. Gamblers believed 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 perceived as helpful by certain gamblers, as they thought 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, certain gamblers contended 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) was, however, perceived 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 were also understood to be of use. Participants mentioned being more likely to gamble when they were depressed or had had what they perceived as a bad day. They concluded this information would aid the platform in gaining knowledge of their behaviour. They also argued that 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 perceived 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 problem.

Discussion

This paper aimed to identify the limits, potential interventions, and types 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 (money, time and access) and identified areas to consider such as who should set these limits and their duration. We also identified seven areas to consider when designing interventions

(such as visualization of the gambling data) and six areas regarding the type of data collected (such as betting history and location).

Our interviews with gamblers revealed mixed and sometimes contradictory views. For instance, whereas certain of the gamblers concluded that obtaining multimodal data (e.g., information on geolocation, heart rate, and emotions) could be useful to predict when someone is likely to gamble, other gamblers instead found that this process would prove too intrusive. More research is needed to investigate which approaches would work best for which specific individuals. We recommend in-depth interviews with service users before the development of 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 that 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 believe that their freedom to take decisions has been compromised. When the data is used in comparison setting (that is, among groups of players) trivialization and normalization can happen. An example of that process is when one amount of expenditure compares well to others despite the different in affordability. The risk also exists of technology being understood as a remedy rather than an assistance and this may lead to players blaming the software for not curing them. Most of these risks have been studied in previous research 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 possess 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 because of group dynamics and structure factors. This problem may in turn 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 the possibility exists 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 building trust between customers and organizations. 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, compose the first steps to building transparent and accountable data sharing. This sort of transparency can maximize compliance with the European Union General Data Protection Regulation (GDPR). It can also 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. It is also our aspiration that the results of this qualitative study will constitute both a meaningful basis and set of reference points for future self-regulation information systems, systems that should be developed following the principles of security and privacy by design (Vicini et al., 2016), and with the ultimate goal the empowerment of responsible gambling through the capture and utilization of gambling behavioural data.

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