review

Internet Gambling: A Critical Review of Behavioural Tracking Research

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Abstract

This paper reviews and analyzes studies that are focused on Internet gambling with the use of behavioural tracking and big data to identify gambling behaviour. The behaviour of gamblers has been extensively studied and much has been published on the subject. The vast majority of research has relied on self-reported gambling behaviour or case study research. With the advent of the Internet, however, it has become possible for researchers to remotely study the real behaviour of gamblers. The goal has been to empirically describe playing behaviour in several conditions and contexts. Existing research, conducted since the 2000s, focuses on several forms of gambling such as sports betting, casino, poker, and lottery, but there is still only a concise body of research on gambling behaviour with the use of Internet gambling tracking data. Most studies are based on the same databases, meaning that a few companies and websites were the basis for most of the research produced so far. It is important to explore new sources of information, methodologies, and approaches to enrich discussion and contribute to a better understanding of this field. The empirical analysis of gambling behaviour with the use of tracking data was found to greatly contribute to the understanding of player behaviour, despite existing limitations and problems. Considering that Internet gambling behavioural tracking is still a fairly recent phenomenon, much can still be done to further develop this field of research.

Keywords: consumption, consumer behaviour, online gambling, Internet gambling, behavioural tracking, tracking data, big data

Résumé

Cet article examine et analyse les études axées sur le jeu en ligne qui recourent au suivi comportemental et aux mégadonnées pour cerner le comportement lié au jeu. Or, on a souvent étudié le comportement des joueurs et on a beaucoup publié sur le sujet,

mais jusqu'à présent, la majeure partie de la recherche repose sur le comportement autodéclaré ou la recherche fondée sur les études de cas. Avec l'avènement d'Internet, il est dorénavant possible pour les chercheurs d'étudier à distance le comportement réel des joueurs. L'objectif a donc consisté à décrire de manière empirique le comportement lié au jeu dans plusieurs conditions et contextes. La recherche existante, menée depuis les années 2000, se concentre sur plusieurs formes de jeux de hasard tels que les paris sportifs, le casino, le poker et la loterie. Mais à ce jour, il n'existe qu'un corpus de recherches très concis sur le comportement lié au jeu qui utilise des données de suivi sur le jeu par Internet. La plupart des études sont fondées sur les mêmes bases de données, car seulement quelques entreprises et sites Web ont servi de base à la plupart des recherches produites jusqu'à maintenant. Il est donc important d'explorer de nouvelles sources d'information, méthodologies et approches pour pouvoir enrichir les discussions et améliorer la compréhension de ce domaine. L'analyse empirique du comportement lié au jeu à l'aide de données de suivi a ainsi largement contribué à la compréhension du comportement du joueur en dépit des limites et problèmes existants. Si l'on tient compte du fait que le suivi comportemental du jeu sur Internet est un phénomène encore assez récent, il reste beaucoup à faire pour exploiter davantage ce domaine de recherche.

Introduction

Until 2006, Internet gambling studies on gambling behaviour were mainly based on self-reported methods and data (Griffiths, Parke, Wood, & Parke, 2006). More recently, a new trend in gambling research has appeared that is based on the data records of gambling players to observe and understand their gambling behaviour. Considering gambling history in its entirety, Internet gambling is a more recent phenomenon. As a result, research on Internet gambling, particularly on gambling behaviour with the use of tracking data, is still in its infancy (Shaffer, Peller, LaPlante, Nelson, & LaBrie, 2010). Despite being a recent trend, empirical studies and new analytical methodologies are emerging with increasing intensity. The current proliferation of Internet gambling and other platforms, such as mobile devices, smartphones, tablets, and Internet protocol television, among other devices, has also raised the awareness of public policy makers and other gambling-related stakeholders, who have further expressed concern regarding the difficulty in controlling and/or surveying Internet gambling (European Commission, 2011). Internet gambling is classified as an online game in which payment is required, monetary prizes may be awarded, and the outcome of the game is predominately determined by chance (Gainsbury, Hing, Delfabbro, & King, 2014). Gambling activities offered over the Internet usually demand a player account. Gainsbury (2011) considers this to be a result of escalating technological sophistication and the incorporation of these developments into gambling.

In this article, we review the published literature on Internet gambling that tries to explain gambling behaviour and describe how this behaviour is characterized.

Another objective of this paper is to understand whether the observation of real gambling behaviour provides relevant outputs for the creation of gambling products and effective responses for player protection. We foremost highlight some of the gaps found in the research literature on Internet gambling behavioural tracking and we contribute to the current debate by providing future research directions that might overcome such gaps. To do so, we focused on reviewing research published in peer-reviewed papers in which real Internet gambling player data were used to analyze players' behaviour. Other researchers have previously focused on reviewing Internet gambling, namely, Shaffer et al. (2010). In their review, they question the validity of the data in self-reported studies and add that such studies do not provide any empirical evidence about Internet gambling. Furthermore, they assert that research findings on real Internet gambling behaviour show inconsistencies with self-reported patterns of Internet gambling, particularly the estimation of gambling behaviour. Although they highlight these limitations in self-reported research and state that behavioural tracking research can overcome them, they also identify shortfalls in real-world gambling behaviour research. Notably, although their paper addresses behavioural tracking in gambling, they mention that their literature search did not return any behavioural tracking data or any tracking data in Internet gambling studies. The reason for this probably lies in the fact that they limited their search to only two databases (PubMed and PsycINFO) and two terms: ''Internet [AND] gambling.'' This proved to be a poor methodological choice, as the final outcome presented limitations that resulted in the failure to identify some Internet gambling studies, as demonstrated by Griffiths (2010). Shaffer et al.'s (2010) review had a different objective from that of the present study, as it was not limited to a specific approach in Internet gambling research. In contrast, the main objective of this study was to exclusively identify and review Internet gambling research with the use of behaviour tracking. The purpose was to cover the studies that have, so far, been conducted on this issue and with the use of this method. Considering that Internet gambling behavioural tracking research is a fairly recent phenomenon and that Shaffer et al.'s (2010) review was limited to 2008, we also covered studies conducted after that year up to January 2017. Studies on Internet gambling with the use of behavioural tracking methods have contributed to the identification of gambling behaviour, but most of the initial studies consisted of descriptive analyses of gambling behaviour that lacked the support of theoretical models or frameworks and added limited contributions to theory. In this paper, we analyze player behaviour published in these studies and try to identify which of the shortcomings can be overcome in future research.

Method

A systematic search was carried out to identify the research produced and the literature published with the use of tracking data tools to identify real gambling behaviour. Considering the technology that enables such analysis, the search was limited to the period from January 2000 to January 2017. In this search, only academic journals that used players' real gambling data to analyze their behaviour were considered. The following search terms were used: "actual," "behavioral tracking," "tracking data," "big data," "real world," "player card," and "loyalty card,"

always in association with the term "gambling." The terms were searched in the keywords, titles, abstracts, and text of the published literature on Internet gambling behaviour with tracking data. In the search, the same terms were used in four languages, English, French, Spanish, and Portuguese, to minimize any English publication bias. For the search, the following databases were used: Scopus, PsycINFO, Science Direct, PsycARTICLES, PubMED, Wiley Online Library Dissertations and Theses Academic Search Complete, Google Scholar, ProQuest, and EBSCO. In addition, the reference list of the studies that resulted from the search and other reviews already available in the literature was also analyzed to identify other possibly relevant studies. The objective was to be as comprehensive as possible in identifying all studies conducted on real-world gambling behaviour.

Results

The analysis of the results generated by the search in the above-mentioned databases and the reference lists from other studies followed a two-step process. In the first step, after a thorough analysis of the titles, abstracts, and contents, we identified 120 studies, of which 83 were peer reviewed and 55 were analyzed because they matched the inclusion and exclusion criteria. The articles that we found focused on several types of gambling activities for analysis, such as sports betting, casino gambling, and poker gambling; several studies focused on multiple forms of gambling. Papers on excessive gambling and the prevention of risk gambling were also found. In the second step, we included or excluded studies by considering the following criteria. Inclusion conditions were twofold: (1) texts that were peer reviewed or refereed articles and (2) texts dealing with real-world Internet gambling behaviour with the use of tracking data. Exclusion conditions were (1) unpublished studies, (2) texts not relevant to the field of gambling studies, and (3) texts that were relevant for the study of gambling but did not use real Internet gambling data for the analysis of gambling behaviour.

Behavioural Tracking Gambling Behaviour

Research on Internet gambling is a fairly recent phenomenon. According to Stevens (2006), the first casino websites appeared in 1995. One year later, the first academic study on Internet gambling was published (Griffiths, 1996), a theoretical paper. Following that, it took over 10 years for the first empirical paper on Internet gambling with the use of tracking data to be published (LaBrie, LaPlante, Nelson, Schumann, & Shaffer, 2007). Most of the studies found on actual playing behaviour, especially the first studies, resulted from one database provided by Bwin Interactive Entertainment. Recently, more studies have been published with the use of other tracking database information, such as win2day; Íslensk Getspá; Betchoice/Unibet; GTECH and GTECH G2; Online Poker Database of the University of Hamburg [Germany]; and PokerStars. Behavioural tracking information can include account data (user ID, date of birth, gender, postal codes), game data (game ID, game type, amount of winnings, amount of money spent, number of bets/spins), financial data (amount of deposits, number of money withdrawals, number of accounts), responsible gaming limit data (time and spend limits, changes of limits), and miscellaneous data

(length of playing session, login information, number of cool-off periods (Griffiths, 2013). Note that from the early 2000s, researchers were already using tracking data to evaluate gambling behaviour, but these studies focused on loyalty card data of players who gambled in brick-and-mortar venues rather than over the Internet. Because the purpose of the present study was to focus on Internet gambling, studies with the use of tracking data that do not respect this criterion were not considered in this review. The use of behavioural tracking has been considered a good opportunity for researchers to examine the real behaviour of gamblers in contrast to that in offline gambling (Griffiths & Whitty, 2010). Researchers also advise gambling operators to use their large behavioural tracking data sets to help identify problem gamblers and not just for marketing purposes.

Because of its characteristics, Internet gambling has generated many concerns. Some of these concerns include accessibility to gambling; fast action play; inability to protect underage and problem gamblers; inability to restrict unprincipled marketing techniques, such as embedding and serial pop-ups; capacity to prevent gambling while players are intoxicated or at work (Griffiths, 1999; Griffiths & Parke, 2002); and unknown product safety level (Labrie et al., 2007). These concerns have translated into research and the implementation of measures intended to protect consumers, focusing particularly on preventing underage gambling and gambling-related addiction (Adami, Benini, Boschetti, & Canini, 2013). Despite these efforts it remains questionable whether players can benefit from interventions that are based on this type of measures (Griffiths & Parke, 2010; Auer & Griffiths, 2013). LaBrie and Shaffer (2011), however, suggest that Internet gambling offers good conditions for the study of real gambling behaviour, as it allows the identification of patterns and consequently the development of interventions to develop strategies that promote balanced gambling behaviours.

The first research that we found on real-world Internet gambling behaviour was published in 2007 by LaBrie et al. It was a longitudinal study of sports gambling behaviour that analyzed fixed-odds and live-action bets. LaBrie et al. (2007) intended to identify Internet gambling behaviour and its impacts. The researchers focused on the outcome of sporting contests and live-action bets for 40,499 Internet sports gambling service subscribers who enrolled during February 2005 and followed them for 8 months. Gambling behaviour was determined by analyzing three variables transformed to measure gambling involvement: daily totals of the number of bets made, money spent, and money won.

In more recent years, increased interest has been shown in online gambling in general and Internet gambling in particular. Despite the growing interest, there is a limited body of research and publications about Internet gambling that use real-world playing data to identify gambling behaviour, although some researchers consider this new approach to gambling research to be of great relevance. According to Shaffer et al. (2010), the scientific shift from self-report to actual behaviour represents a methodological paradigm change for the field of gambling studies. Shaffer et al. (2010) claim that an accurate epidemiology of Internet gambling behaviour requires the examination of Internet gambling behavioural tracking, as in any other pattern of human behaviour.

Furthermore, they mention that this type of technology-enabled research is a shift to behavioural conceptual frameworks and research methods.

Most of the studies found on real-world playing behaviour result from the Bwin Interactive Entertainment, A.G., and Harvard Medical School Division on Addictions (DOA) research collaboration. This cooperation resulted from the concern about Internet-related addiction and was established to take advantage of new technologies to alleviate or prevent addiction (Shaffer et al., 2010). The original bwin database used for these studies was divided into multiple data sets, which were then used in several other studies. These data sets are now available as part of the Transparency Project and, since the first DOA studies, have been used by other non-DOA researchers who have produced several papers (Adami et al., 2013, Brosowski, Meyer, & Hayer, 2012). DOA researchers tried to describe gambling behaviour and some studies focused on the more extreme gamblers. A few focused on one particular gambling activity to analyze behaviour, while others covered several games, namely, the studies that analyzed players' self-limitation or account closing. Data sets of Internet sports gambling behaviour were used by LaBrie et al. (2007) to determine Internet sports gambling behaviour; by Braverman and Shaffer (2010) to examine betting patterns displayed during the first month of Internet gambling of live-action sports, especially of bettors who later closed their accounts because of gambling-related problems, in order to identify features associated with gambling that might influence the emergence of addiction; by Broda et al. (2008) to examine the effects on gambling behaviour of imposed limits on the amount of money that users can deposit into their online gambling accounts; by LaPlante, Schumann, LaBrie, Nelson, and Shaffer (2008) to analyze gambling participation and activity among a population of newly subscribed Internet bettors; by Xuan and Shaffer (2009) to examine behavioural patterns of real-world Internet gamblers who experienced gambling-related problems and voluntarily closed their accounts; and by LaBrie and Shaffer (2011) to discriminate sports bettors with self-reported gambling-related problems from sports bettors without such difficulties. LaBrie and Shaffer (2011) aimed to contrast the behaviour of players who closed their accounts because of gambling-related problems with the behaviour of other account closers who were either not satisfied with the service or no longer interested in betting.

A study by Nelson et al. (2008) analyzed the gambling behaviour of players who used the site's self-limit feature. In that study, the data analyzed was composed of a majority of subscribers who engaged primarily in sports betting, although some also played other games such as casino or poker. In a later study by Braverman, LaBrie, and Shaffer (2011), a similar characterization of the types of games played could be observed. Most players engaged in betting or sports betting, with only 3% of players not engaged in these types of gambling activities, which, according to Braverman et al. (2011), was probably due to bwin's main focus being on sports gambling. The researchers applied taxometric techniques to determine whether a taxon of Internet sports gamblers could be identified, but results failed to provide support for the view that the most involved Internet sports gamblers included a distinct category of gamblers. As mentioned, most players who comprised the bwin databases were

engaged in sports betting, and thus it would be expected that most studies would focus on such players. Aside from that area of study, DOA researchers also studied the single-game gambling behaviour of other players included in the bwin database. LaBrie, Kaplan, LaPlante, Nelson, and Shaffer (2008) conducted a prospective longitudinal study of real Internet casino gambling behaviour and LaPlante, Kleschinsky, LaBrie, Nelson, and Shaffer (2009) performed an epidemiological study on Internet poker gambling behaviour.

Because of the partnership established between Harvard's DOA and bwin, and since the Transparency Project is still fairly recent, it would be expected that most studies produced to date on real-world gambling would be under such collaboration. Other researchers have also used the bwin databases to analyze actual gambling behaviour. Despite the nature of the databases, namely, being composed mainly of players who engage mostly in sports betting, different approaches have been taken to behavioural tracking gambling research. One research concern that seems to be common to several studies relates to the identification of markers and playing characteristics that may lead to greater involvement with gambling and the possibility of developing excessive or compulsive gambling. This increased gambling involvement has also been studied by other researchers, and one of the research contributions is the development of measures and features that help players limit or prevent such risks.

Behavioural tracking research has also been developed in Australia by Gainsbury, Sadeque, Mizerski, and Blaszczynski (2012), who analyzed the player account data of 11,394 customers of a large Australian wagering operator over a 10-year period. This is the longest period that we found of all of the studies reviewed. Gainsbury et al. (2012) intended to investigate the characteristics and betting patterns of players. They found that more frequent bettors tended to make smaller bets, but bet greater total amounts. They also found that this group of gamblers lost smaller proportions than less frequent bettors did. Less frequent bettors bet larger single bets and lost a greater proportion of their total amounts bet (Gainsbury et al., 2012). Gainsbury et al. (2012) suggest that such findings indicate that players exhibit differential patterns of betting. They argue that this allows for player segmentation, which can be used for player education and responsible gambling strategies for players who present different levels of gambling involvement and intensity.

Gambling Involvement and Gambling Intensity

Player behaviour is considered to be moderate when players can control their gambling activity and can decrease or stop gambling when they engage in heavier gambling. Players with higher involvement in gambling might not be addicted, but may be on the way to developing such an addiction. These different levels are now identified by researchers and can provide relevant clues for identifying players who may need support and additional gambling control measures.

Dragicevic, Tsogas, and Kudic (2011) assessed the first month of play following registration by using four behavioural markers of casino gambling: trajectory,

frequency, intensity, and variability. Their results did not provide concrete evidence of loss chasing among the website's players and so they could only infer that more intensive and frequent gamblers spend most of their time gambling on slot-type games, in contrast to moderate gamblers, who, although playing across all gaming types, have a preference for table games. Different games have distinctive characteristics and affect players in diverse ways; hence, studies that focus on specific types of games might produce different results. Poker is such an example. To LaPlante et al. (2009), poker gambling poses a concern for public health by allegedly potentiating addictive behaviours. This game has specific characteristics, as it is considered a game in which player skill can influence outcomes and might create in players the illusion of control over the outcome (Fiedler, 2011). In addition, professionals can influence the behaviour patterns of gamblers. Fiedler (2011) analyzed the data from the Online Poker Database of the University of Hamburg to determine player behaviour. In this study, he found that a small group of heavily involved poker players was responsible for most of the playing volume. In another study with the same database, Fiedler (2013) explored gambling habits over a 6-month period to analyze the playing habits of three subgroups of players: regulars, newcomers, and dropouts. The description of these subgroups depicts regulars as players with high expenditures and long playing periods, newcomers as players with no (or very low) expenditures, and dropouts as players who stopped playing despite having played before. In Fiedler's (2013) research, the analysis of gambling activity included number of sessions, session length, total time spent playing, average number of tables played simultaneously, playing intensity in amount raked per hour, and playing volume in amount raked per hour over the total observation period. The aforementioned variables were referred to as gambling behaviour and are part of the players' ''gambling habits,'' which also include playing duration (days played from the first to the last observation) and the relationship between playing duration and the variables of the playing behaviour. Fiedler (2013) found that regular players tend to increase their playing volume over time, whereas for most newcomers, their playing volume tends to decrease over time (for a small but relevant group of newcomers in terms of prevention of pathological gambling, playing volume increased sharply). The third group of players, dubbed by Fiedler (2013) as the dropouts, also have a tendency to decrease their playing volume over time. When analyzing the correlation between variables, Fiedler (2013) found that when the total playing time of a player increases, the average number of tables played simultaneously also increases. Playing frequency in sessions per day was found to be negatively correlated to the variables of the playing behaviour of newcomers and dropouts, working as a moderator of gambling involvement for these groups, which does not apply to regular players. Fiedler (2013) concluded that, although it seems counterintuitive, the more often that someone gambles, the lower the person's gambling involvement. One possible explanation given by this researcher is that losing money quickly prevents most people from playing more.

LaPlante et al. (2009) followed 3,445 Internet gamblers in a 2-year period to study their poker gambling behaviour in what the investigators consider to be the first prospective epidemiological study of real Internet poker gambling behaviour.

They concluded that most Internet poker players moderated their behaviour on the basis of their wins and losses, but the most involved players did not show such moderation. Fiedler's (2011) results were consonant with those of LaPlante et al. (2009). Nevertheless, Fiedler (2011) considers that LaPlante et al.'s (2009) results should be interpreted carefully because he points out that the data sets are not representative, as bwin is mainly a sports betting operator and offers poker only on the side. Furthermore, Fiedler (2011) considers LaPlante et al.'s (2009) study not to have addressed the role of skill in poker, which can lead to professional gamblers influencing the variables of gambling behaviour.

In a study with a more generalized approach to the assessment of online gambling and player behavior, with the use of real data, Ma, Kim and Kim (2014) found that individuals' online gambling increases with any increase in cumulative net gains or cumulative net losses. They also found that recent losses reduce online gambling, whereas recent gains increases it. Another of their findings, which can be consider particularly relevant for the study of gambling involvement, namely in repeated behaviour situations, shows that regular use and extended use moderated the relationship between current and subsequent gambling, which they considered to be a series of risk-taking attempts with the potential of eventually becoming routine behaviors (Ma, Kim & Kim, 2014).

Discussing the Best Construct to Measure Gambling Activity: A Debate on Theoretical Loss

When analyzing gambling activity, one of the most important aspects is to identify how players engage in such activities. Internet gambling is no exception. Regarding real gambling data, the issue of identifying the best method to assess individual levels of gambling engagement has raised a debate among several researchers in the field. The debate has mainly focused on two key concepts to determine a player's commitment to gambling: gambling involvement and gambling intensity.

To Auer and Griffiths (2015b), gambling intensity and gambling involvement are essentially the same concept descriptors of gambling activity, although they mention in a response to Braverman, Tom, and Shaffer (2013) that gambling involvement is a vague concept. To these researchers (Auer & Griffiths, 2013; Auer, Schneeberger, & Griffiths, 2012), the most consistent measure for gambling intensity, or the amount risked by a player, is what they dubbed "theoretical loss," which reflects a player's risk propensity. Notably, although they consider the constructs of gambling intensity and gambling involvement to be equivalent when assessing gambling activity, they also mention that theoretical loss measures only monetary gambling intensity (Auer & Griffiths, 2014a, 2015b). Tom and Shaffer (2016) state that Auer and Griffiths' (2014a, 2015b) definition of gambling intensity has shown inconsistencies across different studies. For Tom and Shaffer (2016), the evaluation of gambling involvement and intensity has been motivated by the specific variables and data they have collected or calculated. For these researchers, each of these constructs emerged because of the availability of the analogous gambling measures. In addition,

Braverman, Tom, and Shaffer (2013) consider that calculating theoretical loss might not be that straightforward. They suggest that in games of skill and in games in which there is an interaction between the player, the house, and third parties or other agents (e.g., poker, prediction markets, and some sports betting frameworks), the calculation of theoretical loss may be different. Another issue when calculating theoretical loss is that it is assumed that a player will make optimal decisions at every opportunity to maximize expected value, although is not clear whether all players will always play optimally, especially recreational or infrequent gamblers (Tom & Shaffer, 2016). Tom and Shaffer (2016) argue that, on average, these players will have higher total amounts lost than their corresponding theoretical losses would imply. Tom and Shaffer (2016) also commented that theoretical loss is not a new concept, as it derives from the formula relating return on investment to expected value, and that it is a biased and flawed proxy that may not measure what it aims to (amount lost or expected amount lost). Despite these claims, Auer and Griffiths (2015b, 2015c) maintain that when considering pure monetary measures of gambling intensity, theoretical loss is a more robust and accurate measure than other financial proxy measures, such as bet size, regarding the financial risk that players are willing to take while gambling.

Auer and Griffiths (2013) argue that previous studies that have used different approaches to determine gambling intensity (i.e., bet size and number of games played; Broda et al., 2008; Dragicevic et al., 2011; LaBrie et al., 2008; LaPlante et al., 2008, 2009; Nelson et al., 2008) did not take into account the element of chance and house advantages across different game types and that other variables could also have been considered (time spent gambling and/or the amount of money won or lost while gambling). In a more recent study, Auer and Griffiths (2015b) also argue that none of the bwin behavioural tracking studies has directly examined gambling duration, which they consider important for determining gambling involvement, especially among some specific types of gamblers such as poker players. Auer and Griffiths (2015b) also criticize the analysis of gambling activity that uses only one variable (bet/stake or total amount wagered) for gamblers who engage in different game types, as it can be misleading when comparing the degree of risky gambling behaviour. Despite the controversy over the issue of theoretical loss, Braverman Tom, and Shaffer (2013) agree that it is an interesting concept that can be useful to determine gambling intensity as long as it can be correctly calculated. In some cases, such as poker and other games or skills, such a calculation can be difficult to perform (Braverman, Tom, & Shaffer, 2013). For this reason, these researchers state that it is too early to dismiss other previous measures of gambling intensity and to replace them with a single construct. Braverman, Tom, and Shaffer (2013) advise researchers to continue using multiple indicators of online gambling behaviour and to determine empirically which indicators are most useful.

When reviewing these studies, and in order to contribute to the debate raised by these researchers about the best way to assess involvement and intensity, we believe that different circumstances (games, players, type of data [cross-sectional or longitudinal], demographic, and geographic characteristics, etc.) must influence the methods and

tools chosen, which should dictate the most appropriate ways to evaluate gambling involvement for each specific study.

Another important aspect is to understand whether players are really aware of their gambling activity. An approach that has recently been used to assess such player perceptions combines two methods of collecting gambling data. This approach results from comparing self-reported with real Internet gambling data. By combining the information collected from these two methods, researchers are able to understand how players picture their own gambling behaviour. This becomes even more relevant when considering the advantages, but especially the limitations, of each of these methods. By combining the two methods, researchers can also be more aware of real gambling behaviour and the motivations that can explain such behaviours. Only two studies have been conducted so far that evaluate the discrepancies between real gambling behaviour and players' estimations of their gambling activity. The first was done by Braverman, Tom, and Shaffer (2014). They compared individual-level gambling activity of self-reported data and real gambling data. The authors used real gambling data from bwin and compared it with players' responses to a questionnaire. The objective was to assess whether players' self-perception of their gambling activity corresponded to the data from actual betting results. The researchers found that, on average, between 34% and 40% of the participants underestimated their losses or overestimated their gains. They also found that the size of the discrepancy was associated with the self-reported presence of a gambling-related problem. The second study was carried out by Auer and Griffiths (2016b), who used real online gambling data from Norsk Tipping, the Norwegian operator. They explored the relationship between objective (actual money spent gambling) and subjective (self-reported) information in relation to the individual players' attributes across different demographic (such as gender and age) and behavioural characteristics. Auer and Griffiths (2016b) also aimed to assess whether players who engaged in high event frequency games (e.g., casino-type games) would be less accurate in estimating their losses compared with those players who engaged in low event frequency games (e.g., lottery games). They found that 9% of the players underestimated their losses or overestimated their wins, and 17% of the players overestimated their losses or underestimated their wins. The skewed perception of players also meant that, on average, players underestimated their losses by 15%. The estimation bias increased with the intensity of play. In addition, the types of games played were found to be predictive of the magnitude of the estimation bias. Lottery players were found to be the most accurate in their estimates, whereas scratch-card players and sports bettors were the worst. Scratch-card players showed the highest percentage of favourable bias and sports bettors the highest percentage of unfavourable bias in their gambling expenditure estimations. Auer and Griffiths (2016b) mention that their findings suggest players with higher losses also tend to have more difficulty estimating their gambling expenditure accurately. These studies present interesting results that help in understanding gambling self-perception. One limitation, though, is that they assessed only gambling expenditure. It would be interesting to see further research undertaken that uses other variables to evaluate

gamblers' bias of the gambling perception of their gambling activities, such as time spent playing, the number of games played, and the number of bets placed.

At-Risk, High-Involvement, and Excessive Gambling

When players exceed what is designated as normal gambling activity, they may be considered at risk of developing gambling problems or may already be heavily involved or actively engaged in excessive gambling. The identification of such thresholds has been a challenge for researchers and a recurrent topic in gambling research, including behaviour tracking research.

The early detection of problem gambling has been a possible solution that researchers have explored. Some indicators that players might be having problems include (1) chasing losses, (2) total preoccupation with gambling, (3) increase in gambling behaviour over time, (4) playing with a variety of stakes, (5) playing a variety of games, (6) player "reload" of money within a gambling session, (7) frequent payment method changes, (8) verbal aggression within chat rooms, and (9) constant customer complaints (Griffiths, 2009). Adami et al. (2013) tried to identify at-risk gamblers in the early period of active betting, resorting to a segmentation strategy based on the analysis of behavioural player data from bwin. They identified two markers of gambling. The first focuses on a rapid drop in wager size over a wide range of fluctuation periods, which they ascribe to players exceeding their economic sustainability limits. The second takes into account the number of games a player is involved in simultaneously, with the objective of predicting possible consequences of an excessive amount of time dedicated to gambling (Adami et al., 2013). According to these researchers, the use of such markers allows identification of larger segments of high- and medium-risk gamblers when compared with previous research on tracking data betting behaviours. In a study by the DOA, Braverman and Shaffer (2010) selected a sample of 530 live-action sports bettors from a data set that included 48,114 players who opened an account with bwin. They studied the betting patterns displayed during the first month of Internet gambling. The objective of their study was to predict the development of gambling-related problems by grouping gamblers who presented similar gaming patterns (Braverman & Shaffer, 2010). They found that players who are characterized by high intensity and frequency of gambling, as well as by high variability of wager (bet) sizes during their first month of gambling, were at higher risk than others of reporting gambling-related problems on closing their accounts. To analyze the risk factors of problem gambling behaviour, Braverman and Shaffer (2010) used four variables (intensity, frequency, variability, and trajectory). Braverman et al. (2011) analyzed other indicators of betting behaviour, including total money lost, total number of bets, and total money wagered. According to Braverman et al. (2011), the results failed to provide support for the idea that the most involved Internet gamblers are a different group of players, and they found it too early to declare that excessive gambling behaviour is not qualitatively different from recreational sports gambling. In another approach, Gray, LaPlante and Shaffer (2012) used what they dubbed as non-monetary indices of intensity of betting activity, which includes variables such as total bets placed, the number of active betting days, and the duration of the gambling activity.

According to them, these variables can accurately differentiate the playing behaviour of players who have triggered responsible gambling responses from players who did not face such interventions. Brosowski et al. (2012) also explored several data sets provided by the DOA as part of the Transparency Project to investigate the associations between participation in different gambling segments and at-risk gambling. They chose transgression of day and net win/loss cut-offs as indicators of probable problematic involvement. They found that 60% of gamblers were involved in more than one form of gambling and that of these, 41% of the total stakes stem from casino games; they also found that the higher the number of games played consistently, the higher the risk of developing excessive gambling habits.

Studies on real-world gambling, so far, have aimed to increase the identification and understanding of early-stage problem gambling. Early identification can help in better comprehending gambling behaviour and in developing tools to help minimize the impacts of such practices. The following section describes how research was able to contribute to the development of player protection measures as part of responsible gaming policies. A key issue of these policies and measures is in understanding how useful they really are.

Social Responsibility and Player Protection Measures

Internet gambling allows players to play in different settings. In that sense, players may be gambling alone at home on their computer, or they might be playing in a myriad of different places, especially if using mobile devices. In addition, when playing online, there are no social constraints on the time or money spent on gambling. This has made social responsibility in gambling a central issue for the gaming industry (Auer & Griffiths, 2013). On the other hand, the Internet allows implementation of preventive measures such as players' own pre-commitment and self-limitation, which are arguably easier to implement than in offline or land-based gambling venues (Dragicevic et al., 2011). Additional measures include self-exclusion and deposit and loss limit setting, which are now part of the player protection process featured in responsible gaming codes of practice and online gaming operators' social responsibility measures (Auer & Griffiths, 2013; Dragicevic, Percy, Kudic, & Parke, 2015). Despite the availability of such measures, researchers question whether they are really effective in long-term gambling behaviour (Auer & Griffiths, 2013; Dragicevic et al., 2015). In addition, only a few studies have validated the effectiveness of such social responsibility tools. While some report a positive impact in player behavior, others have failed to find significant effects (Auer & Griffiths, 2014b). In order to understand whether such social responsibility practices have a positive impact, more research on the subject is needed (Auer & Griffiths, 2014b).

Self-Limitation, Account Closing, and Other Responsible Gaming Measures

   Self-limitation.   One of the social responsibility measures made available today by online gambling providers is the self-setting of time and money limits. Limits can be set on deposits, play limits, loss limits, and bets placed.

Auer and Griffiths (2013) argue that voluntary (rather than mandatory) limits are the most appropriate responsible gambling strategy to be implemented by gaming companies. They describe deposit limits as the maximum amount of money that a player can deposit into their play account at any given time. They also categorize play limits as the maximum amount of money that a player can play with at any given time. Loss limits refer to the maximum amount of money that a player is allowed to lose in one session and bet limits as the maximum amount of money that can be bet on a single game or on concurrent games (Auer & Griffiths, 2013). It is easy for a gambling operator to identify its top percentile players, being in total wagers, total amount spend, loss, etc. In such cases mandatory limits can be of use. Gray et al. (2015), among other objectives, tried to understand whether they could find any sub-group of subscribers who gambled in a relatively intense way. Their study used data from an Icelandic internet gambling operator (Íslensk Getspá). They found that those who wagered the most money and those who made the most bets evidenced very high values for several variables compared to their less intense counterparts. But what about the situations where players might be below those limits but still might consider limiting their gambling activity in order to prevent further engagement? This can be performed, by enabling players to place their own limits, usually below the ones set by the operator. Auer and Griffiths' (2013) study of self-limitation of gambling was performed by analyzing a random sample of 100,000 players who gambled on the win2day gambling website. The gambling website made all new players set time and cash-in limits. The researchers analyzed a 3-month period of a subset of 5,000 gamblers, namely, the 10% with the most intense gambling activity, particular money losses. They found that casino and lottery gamblers had the highest significant effect on monetary spending after setting limits and that poker players had the highest significant decrease in playing duration (Auer & Griffiths, 2013). They further explain that because playing poker is a more time-consuming activity than other forms of gambling, setting time limits for the duration of playing activity can have a positive impact on this particular type of player. They also found that the most intense players set limits appropriately and decreased their time and/or money playing the month after the limits were set. Other research conducted by Nelson et al. (2008) was centred on bettors who imposed limits on the amount they were allowed to deposit on a betting site. They analyzed betting transactions of more than 47,000 gamblers over 18 months. Self-limiting gamblers accounted for 567 players and were found to play a wider variety of games and place more bets than others, prior to imposing limits. After imposing their limits, self-limiters continued to wager the same amounts per bet but reduced their gambling activity. The researchers also found other indicators of gambling activity and gambling problems such as time spent gambling.

Broda et al. (2008) tried to evaluate the effects on gambling behaviour of imposed limits in account deposits of 47,000 bwin sports betting subscribers. Their period of analysis was greater than that of Nelson et al. (2008), as their research covered 2 years of gambling activity. Broda et al. (2008) found that only a small percentage of players (0.3%) exceeded deposit limits and concluded that Internet gamblers who exceed deposit limits are more willing to take high risks than are gamblers who do

not exceed those limits. When the initial data were collected, there was a maximum deposit limit of €1,000 per day or €5,000 per 30 days, and players could also set lower depositing limits in the same period. They found that most players (95%) never deposited more than €1,050 per 30 days, which is significantly lower than the maximum allowed. The analysis of the deposit limits was part of bwin's corporate social responsibility program. This limit-imposing strategy allows, according to Broda et al. (2008), a small loss of revenue while enabling the promotion effect for the company of being regarded as socially responsible. This argument is somewhat limited: In the case of this Internet gambling provider, deposit limits were company imposed, which means that in some cases, they might still be high and allow significant losses for some gamblers. Auer and Griffiths (2013) also draw consonant conclusions, as they found that self-limits have an effect on reducing gambling activity among the most intense players, both on time and money spent, although voluntary setting of time limits was considered less important than was voluntary setting of monetary limits. Such results regarding lottery games should be interpreted with care, as it is questionable as to whether setting limits (particularly time limits) would be beneficial because of the frequency of draws (e.g., once or twice a week). Another limitation of their study is the inability to determine whether changes in players' behaviour were due solely to voluntary limit setting or whether other variables also had an impact on such behaviour, as it is a significant change in usual behaviour that is most indicative of a problem gambler (Griffiths, 2009).

Account closing and Self-exclusion.   There are other measures that operators make available to protect players from engaging in excessive gambling, namely, the possibility of closing their own account or self-excluding from a particular gambling website. Xuan and Shaffer (2009) compared the behaviour of players who willingly closed their accounts to others who kept their accounts open during an 18-month study period. The researchers studied a cohort of 47,603 bwin subscribers. From this cohort, 226 gamblers who closed accounts because of gambling problems were selected and another 226 matched-case controls were selected from the group of gamblers who did not close their accounts. Xuan and Shaffer (2009) measured outcomes such as daily aggregates of stake, odds, and net loss. They also examined the number of bets to measure the trajectory of gambling frequency and found that account closers experienced increasing monetary loss and increased their stake per bet as the closure date approached, although their choice of wagers was more probabilistically conservative (i.e., short odds) compared with that of the controls. Their findings suggest an involvement-seeking yet risk-averse tendency among self-identified problem gamblers that challenges the notion that problem gamblers seek ''long odds'' during ''chasing.'' Another study that also focused on account closing had a complementary approach, as it tried to identify the reasons that players closed their accounts. LaBrie and Shaffer (2011) tried to identify patterns of sports gambling that distinguished bettors with self-reported gambling-related problems from bettors without such problems; they analyzed data from a 2-year period for 679 bettors who self-reported the reason for closing their accounts. They compared the behaviour of two types of account closers. The first group reported closing their

accounts because of dissatisfaction with the service or losing interest in playing. The second group members reported having closed their accounts because of gambling-related problems. The researchers found that half of the account closers had gambling-related problems and exhibited a distinct pattern of sports-betting behaviour. When compared with other players, these gamblers made more and larger bets, bet more frequently, and were more likely to exhibit intense betting soon after enrolment. Haefeli, Lischer, and Schwarz (2011) focused on the identification of early warning signs for problem gambling and found that, to some extent, self-exclusion can be predicted by using information about communication between the player and operator. More recently, other researchers (Dragicevic et al., 2015) also studied players' self-exclusion in order to comprehend drivers of self-exclusion and contribute to consumer protection. Dragicevic et al. (2015) proposed a three-tier model for assessing at-risk gambling behaviours by using data that covers exhibited, declared, and inferred behaviour, which, according to them, eliminates weak features of any specific individual approach. They examined a data set of 240,482 casino and poker players and found that self-exclusioners tend to either wager more overall or to place riskier bets. These players also play significantly fewer types of games than do non-self-exclusion players. Dragicevic et al. (2015) also found that self-excluding players typically concentrated on casino playing and had a tendency to spend less time on their most played game. These results are somewhat different from the conclusions of other studies, which found that multiple gambling involvement robustly predicted at-risk gambling (Brosowski et al., 2012). Dragicevic et al. (2015) also found that a quarter of players self-excluded within the same day of opening their accounts, which could imply that players self-excluded for commercial purposes, such as seeking more attractive bonuses, or because they were already problem gamblers who gamble at other venues or Internet sites. Self-excluders tend to be predominantly men and individuals in their twenties or thirties (Hayer & Meyer, 2011).

Behavioural feedback and self-appraisal. In addition to self-limitation and account-closing features, other responsible gaming measures such as behavioural feedback, including pop-up messages, and self-appraisal have also been made available to players, with the aim of alerting players to excessive gambling to limit or reduce gambling behaviour. This type of tool can help players, especially if it is used in a tailored, non-judgmental, and motivational way, to increase the likelihood that players will gamble more responsibly (Auer & Griffiths, 2014b).

Auer and Griffiths (2015c) evaluated the effectiveness of a responsible gambling tool (mentor) that provides personalized feedback to online gamblers at a European online gambling site. They investigated whether players' gambling behaviour (i.e., time and money spent gambling) changed after receiving personalized feedback. The authors indicate that the feedback system they analyzed was able to significantly reduce time and money spent gambling. They suggest that such responsible gambling tools may help gamblers play more responsibly, although they did not approach problem gambling in this study. Auer and Griffiths (2016a) also examined the impact of the use of three types of information (i.e., personalized feedback, normative

feedback, and/or a recommendation) from a behavioural tracking tool on players' behaviour. They used three measures to assess the impact of the information given to players (theoretical loss, amount of money wagered, and gross gaming revenue). Participants in their study sample (5,528) were drawn from the Norsk Tipping online platform (Instaspill) during April 2015. Auer and Griffiths (2016a) found that online gamblers who received personalized feedback spent significantly less money and time gambling in comparison to those who did not receive personalized feedback (i.e., the matched controls). They argue that the results support that personalized behavioural feedback can enable behavioural change in gambling but that normative feedback does not appear to change behaviour significantly more than personalized feedback. They also mention that the effect of the three types of messaging (i.e., personalized feedback, normative feedback, and a recommendation) appear to depend on players' gambling habits, as well as demographic and game-type factors. Lottery players and female scratch-card players were found to be more likely to read the message and act on messages than were casino players. However, despite the positive results, Auer and Griffiths (2016a) argue that because the gamblers who had used the behavioural tracking tool had volunteered to use it and had not been randomly assigned, the effect might not only be due to the feedback but also to other factors not controllable by them. In another study, Auer and Griffiths (2015a) investigated the effects of enhanced content of pop-up messages on player behaviour among online slot machine players of a gambling operator who used this feature as part of a responsible gambling program. Pop-up messages were triggered whenever a customer played 1,000 consecutive games on slot machines during a single online gambling session. When analyzing the 6-month-period data, these investigators found that enhanced pop-up messages doubled the number of gamblers who stopped playing when compared with gamblers who received a simple message, although they comment that pop-up messages influence only a small number of gamblers in ceasing gambling over long periods. In a previous study, Auer, Malischnig, and Griffiths (2014) were given access to a large anonymized data set by a gambling operator (i.e., win2day) in which weekly cash-in limits cannot exceed 800 € at any time during and after registration, but players can voluntarily lower their time and money limits at any time. Their data set included two representative random samples of 200,000 gamblers who were exposed to pop-up messages intended to give feedback to players regarding time and money spent gambling on slot machines. They found that the introduction of a mandatory pop-up message on slot machines had a positive effect on deterring gambling behaviour in a small number of gamblers, although sample characterization variables such as age, sex, income, ethnicity, and levels of pathology were not taken into account and the data analyzed was cross-sectional. Their results indicate that when players are exposed to a pop-up message after 1,000 consecutive gambles on an online slot machine game, which corresponds to playing time of between 50 and 66 minutes, nine times more gamblers ceased their gambling session than did gamblers who had not been exposed to such messages. The researchers concluded that pop-up messages can influence some gamblers to terminate their playing session; hence, pop-up messaging can help reduce excessive gambling within a session.

Future research in this field could, for instance, try to better determine which player attributes correlate with positive behavioural changes and whether there are interactions with other variables, such as types of games played or the intensity of gambling that can be used to optimize behavioural changes (Auer & Griffiths, 2014b). Other directions of research might include showing personalized behavioural feedback messages (including information about their recent wins and losses) to players on a regular basis and with varying content (e.g., emotional vs. warning vs. informative) to positively influence their gambling behaviour (Auer & Griffiths, 2016a). The results mentioned above show that some measures can increase the level of player protection. The study of the efficiency of such measures has benefited from the empirical analysis of real-world gambling behaviour. Among other advantages of using real gambling data to study behaviour and identify playing patterns is that it is also of possible benefit to players. The following section discusses the benefits and advantages that this methodology has brought to gambling research.

Advantages and Limitations of Behavioural Tracking Gambling Research

 Advantages of behavioural tracking gambling research. The field of gambling research has undoubtedly benefited from the possibility of studying actual playing behaviour by analyzing real gambling data. Griffiths (2009) considers that the analysis of real gambling data presents an opportunity for gaming operators and researchers to examine players' real-time gambling behaviour, which may be useful in the diagnosis of problem gambling. Griffiths and Whitty (2010) add that problem gambling can be identified without the need to assess the negative psychosocial consequences of problem gambling and even before being detected by empirical research, which can be used to trigger an online intervention (Griffiths, 2009).

This method has many advantages, one of the most immediate being the possibility to objectively monitor and examine individual gambling behaviour on a particular website (Auer et al., 2012; Griffiths & Auer, 2011) at relatively small expense (Adami et al., 2013). Other advantages include the possibility of recording players' individual gambling behaviour to later analyze it and allowing the analysis of big data in large sample sizes (Auer & Griffiths, 2014a; Griffiths & Auer, 2011). In addition, real gambling behaviour analysis provides researchers with the ability to track site visitors as they gamble and enables the analysis of the actual environment and conditions under which gamblers place wagers, which can be revisited after the event itself has finished (Auer & Griffiths, 2013, 2014a; Auer et al., 2012).

Other reasons highlighted are based on the difference between behaviour tracking research and other methods such as self-reporting. The latter does not allow researchers to assess longitudinal gambling behaviour, nor does it allow players to risk their own money, whereas both of these are possible with behaviour tracking gambling analysis, which enables unbiased behaviour analysis (Peller, LaPlante, & Shaffer, 2008). It simultaneously avoids other drawbacks of self-reporting in which subjects have to remember past experiences, such as memory errors, self-presentation

strategies, simple miscomprehension, and the phrasing of survey questions (Shaffer et al., 2010).

Real gambling data allow researchers to examine Internet gambling behaviour that is not influenced by the respondent's recollection of the events and is not affected by biases in sampling (Shaffer et al., 2010). It also offers researchers the possibility of being in different geographic locations from the participants and peers, which allows multicultural research and makes the research process easier to perform (Griffiths, 2010). Real-world online gambling research is also considered to be relevant in areas such as gaming addictions, as it can be useful in gathering rich and sensitive information (Griffiths, 2010). Online gambling data allow the collection of larger, more diverse, and extreme samples (e.g., addicts), which would be more difficult or even impossible to attain in an offline situation (Griffiths, 2010).

Arguments in favour of these methods are centred on the possibility of allowing researchers a greater understanding of the probable influential factors responsible for gambling-related problems. In addition, researchers argue that it can be not only relevant for the study of player behaviour, but also to provide helpful insights for public policy makers (Shaffer et al., 2010), although this is not new to gambling research or exclusive of gambling research in which behaviour tracking data is used.

Limitations of Internet gambling behavioural tracking research.   The analysis of real gambling data to determine Internet players' behaviour has proved to be a research method that has enriched the study of gambling, but like any other method, it also has its limitations. One example is the situation in which the analyzed period of a specific study might not be representative of typical behaviour (LaBrie et al., 2007). Another is that data are usually drawn from one website and players tend to, or might, play on various websites (Adami et al., 2013; Auer & Griffiths, 2013, 2014a; Auer, Schneeberger, & Griffiths, 2012; Dragicevic et al., 2011, 2015; Fiedler, 2011; Griffiths, 2012; Shaffer et al., 2010). To Griffiths (2012,), after players reach their money or time limit, they may initiate gambling activities on other online gambling websites. In addition, players might play in land-based or offline venues (Adami et al., 2013; Dragicevic et al., 2011, 2015; LaBrie et al., 2007; Xuan & Shaffer, 2009). This might induce a researcher to incorrectly characterize players, as their gambling activity on the analyzed gambling website data might be only a small fraction of their gambling activity and expenditure (Griffiths, 2012). Moreover, information regarding the number of websites in which a player might be a subscriber is usually unavailable. Because data are generally collected from only one gambling site, this does not allow researchers to identify and indicate general online gambling. Although less likely, players might also use different player accounts within the same website (Fiedler, 2011). The study of real Internet gambling data, specifically in longitudinal studies, allows real gambling behavioural tracking, but it is difficult to understand whether the player account might also be used by more than one person (Auer & Griffiths, 2013, 2014a; Fiedler, 2011; Griffiths, 2012; Shaffer et al., 2010). The registered person could also be placing bets for others, which can influence playing activity and hence determine individual playing

behaviour (Shaffer et al., 2010). This happens in situations in which other individuals choose not to, or cannot, register an account themselves. The latter is the case with minors (Fiedler, 2011). In addition, gamblers might engage only in unregistered online gambling activities (Dragicevic et al., 2015).

There are many gambling websites offering different types of games. When a researcher analyzes gambling data from a specific website, that specific website's subscribers might be more likely to engage in the form of gambling that the website is specialized in. Shaffer et al. (2010) consider that the subscriber population in their study, on the basis of bwin data, might be more likely to engage in sports betting because of the nature of the operator. Thus, the findings of their study might not be indicative of Internet gamblers' gambling behaviour. Representativeness is also challenged when player information is lacking. Researchers are dependent on subscriber's self-reported demographic information to characterize players, and the information provided might not always be correct (Shaffer et al., 2010). This raises the question as to whether, in such cases, players are representative of the customer base of a particular website, as well as other providers, or even of the entire online gambling community (Brosowski et al., 2012). Marketing campaigns and other factors might also influence gamblers' acquisition and player registry. This may impact on gamblers' characteristics and profiles, although longer longitudinal studies can overcome such limitations (Brosowski et al., 2012; LaBrie et al., 2007; LaBrie & Shaffer, 2011). Other limitations are related to the fact that there is usually no information about subscribers' income, which does not allow a comparison of their expenditure with their earnings (LaBrie et al., 2007; Xuan & Shaffer, 2009). Griffiths (2010) also raises the issue of the validity of reported players' characteristics, namely, demographic data, or concerning players' psychological characteristics, including addictiveness. This resides in the fact that players' demographic characteristics are still collected by using the subscriber's self-reported information (Shaffer et al., 2010). Griffiths (2011) also considers that these limitations do not allow examination of other behaviours and habits, such as alcohol and tobacco use, and are limited in determining problem gambling. The clinical characteristics and perceptions of players and the consequences of their gambling behaviour are also difficult to evaluate under such research methods. Perhaps the greatest limitation of this method is related to the fact that real gambling data does not explain why people gamble or why they engage in a particular online activity (Griffiths, 2012). Additional limitations are related to ethical issues in using behavioural tracking data without gamblers' awareness. This raises issues on informed consent and invasion of the gambler's privacy (Griffiths & Whitty, 2010).

Discussion

The body of published work on real-world Internet gambling behaviour is still limited. This is probably because researchers started to have access to such data only a few years ago. Despite this fact, there is a noticeable trend in the industry to make data available to researchers, as shown by recent studies. With some markets moving to more liberalized regulation models and the increasing availability of data, it may

be possible in the near future for more researchers to become interested in this field and dedicate their research efforts to studying gambling behaviour by using real gambling data. So far, studies have essentially been conducted with data from European and Australian players. It would be interesting to conduct studies in different locations, namely, North America, which is a big market for gambling. In addition, it is important to explore new sources of information, methodologies, and approaches to enrich discussion and contribute to a better understanding of this field. In the literature reviewed, it was possible to identify the advantages, the limitations, and some of the future research directions that may contribute to advancing the body of knowledge in this field. To Dragicevic et al. (2011), future research might include risk factors and the assessment of trends of player spending, deposits, losses, changes in player funding sources, and gambling behaviour related to time spent gambling. Another direction for future research is the integration of findings from studies of behavioural tracking with self-report data (Adami et al., 2013; Dragicevic et al., 2011; Shaffer et al., 2010, 2011). One such possibility is to combine these methods so they can be used to identify players' clinical characteristics or perceptions, or the social consequences associated with their betting behaviour. An efficient combination of self-report with analysis of real player behaviour may provide important insights into betting behaviour for key stakeholders, including policy makers, which can lead to the development of appropriate regulation that does not overly restrict recreational players, but offers appropriate safeguards (Gainsbury & Russell, 2015).

Future Research

Other further research paths also involve safer gaming parameters. Auer and Griffiths (2013) address the need to further study gambling behaviour of players when they are approaching their self-limitation or mandatory time and money limits. These future studies should try to understand whether the setting of limits brings only benefits for players or whether it can also be, in some cases, counterproductive and encourage greater gambling. Auer and Griffiths (2013) consider that more research is needed to assess the impact that spending limits might have on a player's behaviour over time, in order to provide evidence of changes made in gambling behaviour so that responsible gambling measures can be developed accordingly. Other measures for player protection that can be found today include players' self-exclusion. Future research on this subject intends to better identify types of self-excluders, as they might have different behaviours of self-exclusion and different motives to self-exclude. Some might engage in repeated patterns of self-exclusion, whereas others exclude themselves only after spending a considerable amount of time and money on gambling (Dragicevic et al., 2015).

As discussed in the present paper, one of the limitations of conducting research on gambling with behavioural tracking is that researchers do not know what compels players to behave in a certain way. Xu and Harvey (2014) conducted a study on sports betting to access players' beliefs on next outcomes after a series of winning or losing plays. They found that the behaviour of players changed their games according to whether they had been winning or losing. Sports gamblers expected

their luck to reverse in such situations. Although their study does not entirely explain why players behave in a certain way, it helps to draw some conclusions that may get researchers closer to understanding players' beliefs and behaviours. This type of research reinforces the need to better understand players' motivations and is a pillar of one of the future trends in player behaviour research. Working with data that are extracted from the Internet or other online gambling databases enables the study of the real behaviour of individuals and helps researchers to better understand how players behave. To explain the motivations and reasons for such behaviour, researchers should use complementary approaches and methods so that, when combined, a clearer and more in-depth picture of player behaviour can be drawn. This approach can help researchers, operators, and policy makers to better deal with gambling regulations, thresholds, and policies that can better serve players in a responsible way.

A different research direction may be based on the current trends in online social networks, which also include gaming activities and are becoming increasingly entangled with classic gambling activities. Gambling and gaming are converging as gaming operators begin offering gambling products and as gambling operators use social games as stand-alone products as well as marketing opportunities (Gainsbury et al., 2014). Today's social casino games (the central theme of which is simulation of a gambling activity; e.g., poker, slots, roulette, bingo, keno, betting), together with virtual worlds and augmented reality games, are blurring the boundaries between gaming and gambling. Also contributing to this situation are virtual currencies that are often used in games in which monetary payments are required to play but do not provide monetary prizes. Examples include console games and paid mobile apps with gambling themes (Gainsbury et al., 2014). Monetization is a current trend across many industries and sectors, from which gaming activities appear not to have escaped.

In conclusion, and regardless of the course chosen to conduct further research, it is clear that the analysis of tracking data has already greatly contributed to better identifying and understanding player behaviour, despite existing limitations and problems. It is important to sustain the trend found in the analysis of the latest studies published and reviewed here, and this should point to further research. Researchers must not solely analyze empirical data and describe behaviour, but should also take advantage of such information as a basis for the development of solid gambling theory in order to advance science in this field.

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