Psychopathology of Online Poker Players: Review of Literature

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Background and aims: Online Texas Hold'em poker has become a spectacular form of entertainment in our society, and the number of people who use this form of gambling is increasing. It seems that online poker activity challenges existing theoretical concepts about problem gambling behaviors. The purpose of this literature review is to provide a current overview about the population of online poker players. *Methods:* To be selected, articles had to focus on psychopathology in a sample of online poker players, be written in English or French, and be published before November 2015. A total of 17 relevant studies were identified. *Results:* In this population, the proportion of problematic gamblers was higher than in other forms of gambling. Several factors predicting excessive gambling were identified such as stress, internal attribution, dissociation, boredom, negative emotions, irrational beliefs, anxiety, and impulsivity. The population of online poker players is largely heterogeneous, with experimental players forming a specific group. Finally, the validity of the tools used to measure excessive or problematic gambling and irrational beliefs are not suitable for assessing online poker activity. *Discussion and conclusions:* Future studies need to confirm previous findings in the literature of online poker games. Given that skills are important in poker playing, skill development in the frames of excessive use of online poker should be explored more in depth, particularly regarding poker experience and loss chasing. Future research should focus on skills, self-regulation, and psychopathology of online poker players.

Keywords: literature review, online poker, gambling, pathological gambling, problematic use, tilt

INTRODUCTION

Poker is a card game that was created in the United States in the 1820s (Depaulis, 2008). The game became popular in the 1970s with the setting up of the World Series of Poker. Professional and lucky players made it famous. Poker is played in different ways, the most common being Texas Hold'em. It has become a spectacular craze in our society and there is a strong tendency to gamble (Rossé & Codina, 2009). A French survey revealed that one patient in five from the active file of the Excessive Gambling Reference Centre (Centre de Recherche sur le Jeux Excessif, CRJE) of Nantes Hospital was a poker player, including 75% of online players (Venisse & Grall-Bronnec, 2012).

Recently, the French Game Observatory (Observatoire Du Jeu, ODJ) indicated that 22% of the poker player population has a problematic use, including 14% with an excessive use (Eroukmanoff, Costes, & Tovar, 2014). A comparative study between French and Quebec (Canada) populations suggested that the level of excessive poker players was 14% in Quebec versus 18% in France (Kairouz, Nadeau, Tovar, & Pousset, 2014). Shead, Hodgins, and Scharf (2008) found a positive association between the playing online and the score on Problem Gambling Severity Index (PGSI) (Ferris & Wynne, 2001), and poker players had higher scores of problematic use of alcohol (AUDIT). According to the authors' best knowledge, only a few international epidemiological data are available to estimate the prevalence of excessive gaming in the poker player population.

The expressions "problematic gambling," "pathological gambling," and "risky gambling" are common and often used interchangeably. "Pathological gambling" means that a pathological gambling diagnosis has been established, based on the criterion of the DSM-5 (American Psychiatric Association, 2013). The concept of "risky gamblers" refers to players with a subclinical disorder. Pathological and problematic gambling are cross-checked, and we will use one or the other depending on the chosen framework (American or Canadian). A tool like the South Oaks Gambling Screen (SOGS, Lesieur & Blume, 1987) is used to diagnose pathological gambling, whereas the PGSI (Ferris & Wynne, 2001) diagnoses problematic gambling. "Risky gamblers" are identified by obtaining a score between 1 and 4 on the SOGS (some problems with gambling) or between 3 and 7 on the PGSI (moderate level of problems leading to some negative consequences).

Poker and skills

Poker is an "active game," whose outcome can be influenced by skills. It differs from "passive games" in which the outcome depends entirely on chance (slot machines, lottery) (Bonnaire, Lejoyeux, & Dardennes, 2004). One of the main reasons for the interest in poker is this major address component (Dufour, Petit, & Brunelle, 2012; Shead et al., 2008; Turner & Fritz, 2001; Wood, Griffiths, & Parke, 2007). Time spent on initiation and learning the codes and practices of the game can be long, requiring significant personal investment

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compared with other types of gambling (Eroukmanoff et al., 2014). Address expertise and experience explain why some players have made poker their main professional activity. Professional players are those for whom their main source of income is online poker. In most studies, gamblers identified themselves as "professionals" of online poker.

In poker, address and mastery of the game determine the gains over the long term. Chance predominates at the level of a hand, but the skills of the player determine whether they will win or lose at the level of 100,000 hands (DeDonno & Detterman, 2008). Several types of skills are encompassed in the term of address. A qualitative study indicated that for a poker player, to play their best and to win over the long term, they would need technical skills (mastering the rules of the game and strategies), psychological and emotional skills (self-regulation and specific analysis of opponents) and financial skills (ability to assess the financial risk correctly) (Bouju, Grall-Bronnec, Quistrebert-Davanne, Hardouin, & Venisse, 2013).

Several studies have shown that the problematic use of poker is positively linked to cognitive distortions, external motives to play, and difficulties in identifying feelings (Bouju, Hardouin, et al., 2013; Joukhador, Blaszczynski, & Maccallum, 2004; Mitrovic & Brown, 2009). Recreational players compared with problematic players bet lower daily amounts of money and have fewer anxious disorders (Bouju, Hardouin, et al., 2013). Poker is different from other gambling games in that it has specific game characteristics and the player presents psychopathological and behavioral specificity. However, these studies do not consider whether problematic gambling behaviors are exclusively associated with online poker or if these gamblers participate in any other type of gambling.

Online poker

Internet changes poker gaming behavior. It enables a larger number of hands to be played and gives access to technical tools (additional software) that can support the skills needed and improve mastery of the game. More than other online players (MMORPG, Online games, etc.), poker players consider that Internet improves game conditions (Eroukmanoff et al., 2014). The main advantages reported are playing at home, privacy in the playing environment, freedom to smoke, and the opportunity to gain experience quickly compared with traditional media (Eroukmanoff et al., 2014). However, this new environment deprives the player of face-to-face information. Behind the screen, communication with other players is limited to verbal communication, reducing the emotional control consequences on the game outcome. In online, the game environment and the poker players' behavior change.

According to the French Regulation Authority of Online Gaming (Autorité de Régulation de Jeu en Ligne, ARJEL), online gamers are mostly men (88%) and poker players (61%). The French Observatory of Gambling (ODJ) indicates that 62% of online poker players consider that their gambling activities have an impact on their lifestyle, leading them to neglect daily tasks in favor of playing the game (22%). Nineteen percent of online poker players report that their gambling habit has already been the subject of criticism from relatives (Eroukmanoff et al., 2014).

There are special features among gamblers as a function of the most frequently used games (Bonnaire, Bungener, & Varescon, 2009; Lund, 2011). For example, there is a trend for problematic gambling on Internet compared to at the poker table. Virtual gamblers have 3–4 times more risk to be compulsive gamblers than those who play around a table (Dufour et al., 2012; Kairouz, Paradis, & Nadeau, 2012; Wood et al., 2007). A pilot study on online problematic gambling among students showed that 19% of online gamers were problematic. A negative mood after the game and a general negative mood predicted problematic online gambling (Matthews, Farnsworth, & Griffiths, 2009; McCormack, Shorter, & Griffiths, 2013). These results are contradictory to most studies on gambling. Among poker players, there is a wide variability in the way problematic gambling may develop. For example, problematic gamblers are losing or winning players, irrational or rational in their game perception, and their playing styles can be uncontrolled or controlled. It seems that online poker challenges existing theoretical concepts about problem gambling behaviors, especially concerning money spent and lost, rationality, and control abilities (Bjerg, 2010).

The purpose of this literature review is to provide a state-of-the-art on the knowledge available today about the online poker player population. What is known about the psychopathology of online poker players? What is the prevalence of problematic online poker? What are the predictors of problematic online poker? Finally, which research aspect of online poker remains unexplored?

MATERIALS AND METHODS

Several methods were employed to ensure that the search for pertinent studies was all-encompassing.

Articles included were published in English, in a peer-review journal (excluding books, theses, and dissertations) after 2000 (before this date, few households had access to computers and Internet). Conference proceedings were excluded. Databases were searched on November 26, 2015. The selection process is illustrated in Figure 1.

Step 1: Database search. First, a search was undertaken on Pubmed and Psychinfo via EBSCO and on Science-Direct, using "online poker gambling" as key words. All articles including "poker" in the title or key words were selected.

Step 2: Reading abstracts and references. Articles focusing on a sample of online poker players were then selected. Articles focusing on poker Web sites, advertising, the legal framework, an analysis of poker games, or gaming operator data were excluded.

Step 3: Reading articles. After reading the above articles, we selected those that met the following criteria: qualitative and quantitative methodology, population including at least one sample of online poker players, considering psychopathological variables (excessive gambling, personality, anxiety, depression) or tilt.

Articles focusing exclusively on professional players or with variables centered exclusively on decision-making or
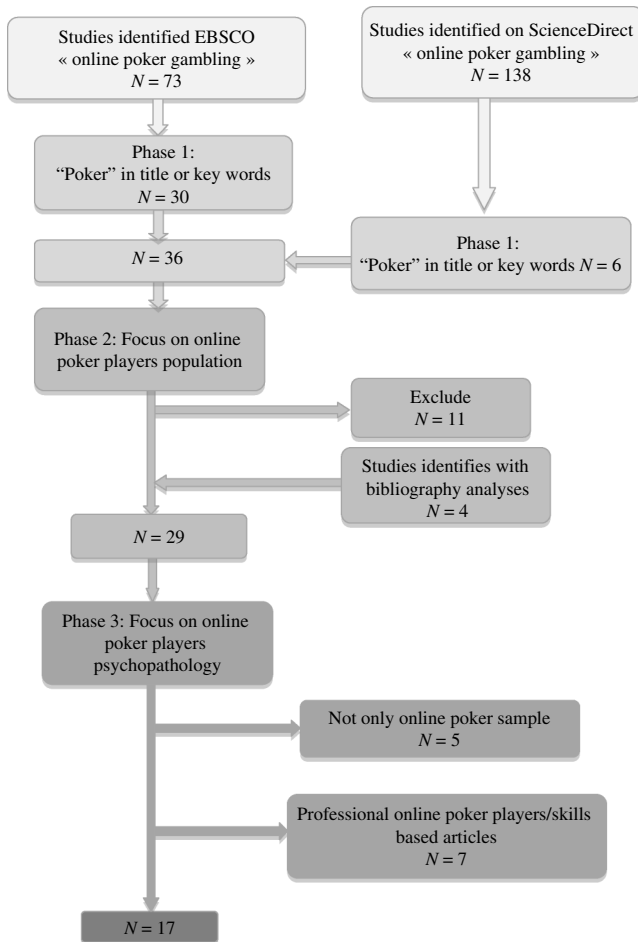
Figure 1. Selection of articles

skills were excluded. In fact, decision-making and professional poker players' behavior are complex issues. These topics differ from the issue of the psychopathology of the overall population of players and deserve a specific study. Selected articles were analyzed and the results are presented in Table 1.

RESULTS

Seventeen articles matching the criteria set out above were identified. These articles were published between 2007 and 2015 and mostly between 2012 and 2014. Four research teams wrote 13 of these articles (Wood and Griffiths [2 articles], Barrault and Varescon [3 articles], Hopley and Nicki [3 articles], and Palomäki and Laakasuo [5 articles]). Most of the samples were composed of young men (between 74% and 100%). For all studies except that of Gainsbury, Suhonen, and Saastamoinen (2014) (in which 60% were older than 35), the participants' average age ranged between 21 and 30 years (Table 1). Generally, the scales used in these studies are very heterogeneous and may not be validated (see Table 1). Four main tools were used: the PGSI (4 articles), the SOGS (3 articles), DSM-IV-TR criteria (3 articles), and the Behavioral Addiction Scale (based on

Griffiths, 2005, 1 article). These four tools do not have the same sensitivity and make results difficult to compare (Venisse & Grall-Bronnec, 2012). Furthermore, most of the samples were not the representative of the poker player population, as they included professional players or a limited number of online poker players.

Psychopathology of online poker players

The first study in this area was conducted by Wood et al. (2007), using nonvalidated tools. Their findings indicated that the main predictors of problematic use were changing the gender of their avatar (male having a female avatar) ($\beta = -0.27$, $p < 0.001$), negative mood states after playing (guilty) ($\beta = 0.12$, $p < 0.002$), and playing to escape from problems ($\beta = 0.17$, $p < 0.001$). A second study performed with the same data set was published by Griffiths, Parke, Wood, and Rigbye (2009) and investigated the predictors of financial success in online poker. The financial gains were positively linked to discipline avoidance of spending over their monthly gambling budget ($\beta = -0.23$, $p < 0.0001$), playing at a higher stake level ($\beta = 0.191$, $p < 0.0001$), not overestimating the skills involved in poker ($\beta = -0.115$, $p < 0.0001$) and perceiving themselves as more skilful ($\beta = 0.111$, $p < 0.05$). Success was related to specific skills. Griffiths et al. (2009) found no relationship between the time spent and the score of pathological gambling factors when measured with the DSM-IV diagnostic for pathological gambling. The conclusions of these two studies indicated that the student population was particularly at risk of developing problematic gambling behavior. The authors suggested that online poker is different from other gambling activities. It induces a new form of problematic gambling in which players can benefit financially. These conclusions need to be nuanced as the authors did not consider the specific case of professional poker players.

Hopley and Nicki (2010) and Hopley, Dempsey, and Nicki (2012) replicated and extended the findings of these two previous studies (Griffiths et al., 2009; Wood et al., 2007) using questionnaires validated psychometrically. In their studies, problematic gambling (measured with the PGSI) was predicted by time played ($\beta = 0.62$, $p < 0.001$), internal locus of control ($\beta = 0.44$, $p = 0.005$), dissociation ($\beta = 0.33$, $p < 0.001$), impulsivity ($\beta = 0.21$, $p < 0.01$), boredom proneness ($\beta = 0.14$, $p < 0.05$), and the negative emotion of stress ($\beta = 0.15$, $p < 0.05$). These two models explained 42% (Hopley & Nicki, 2010) and 67% (Hopley et al., 2012) of the PGSI score variance.

In these two studies, most of the participants were experienced players. In the 2010 article, 19% of players made a living by playing poker, whereas in the 2012 research, the average weekly playing time was 16 h among a small sample of 62 participants. The results indicated that the main predictors were dissociated, and the internal locus of control inducing increased irrational beliefs. The link between internal locus of control and irrational beliefs should be clarified by considering poker skills and the sample's high level of expertise. Hopley et al. (2012) and Hopley and Nicki (2010) found a positive correlation between the time spent playing and the pathological gaming score when measured with the PGSI. The authors

Table 1. Articles selected

Authors	Title		Aims	Population	Method
Barrault et al. (2014)	Special features of poker	France	Investigate the representations of regular poker players of the game's special features, and their probable links with tilt and problem gambling	23 participants (0 females) Mean age = 29.5 years (SD = 4.6) Semidirective interview, face-to-face or by phone 5.2 poker session/week and a duration of 3.5 h/session.	• Qualitative method with Alceste®
Barrault and Varescon (2013a)	Cognitive distortions, anxiety, and depression among regular and pathological gambling online poker players	France	Examine the relationship between cognitive distortions and psychological distress (anxiety and depression) among online poker players of different levels of gambling intensity [nonpathological gamblers (NPG), problem gamblers (PbG), and pathological gamblers (PG)]	245 participants (2.8% females) Mean age 29.14 (SD = 7.9) Internet survey Nonproblem gamblers = 59.5%Some gambling problems gamblers = 22.4% Probable pathological gamblers = 17.9%	• South Oaks Gambling Screen (SOGS) • Hospital Anxiety and Depression Scale Gambling-Related Cognition Scale
Barrault and Varescon (2013b)	Impulsive sensation seeking and gambling practice among a sample of online poker players	France	To examine the links between impulsive sensation seeking and gambling practice among online poker players	180 participants (0 females) Mean age = 28.9 (SD = 7.7) Internet survey Nonproblem gamblers = 62.2% Some gambling problems gamblers = 20.5% Probable pathological gamblers = 17%	• Sociodemographic questionnaire • SOGS • The Impulsive Sensation Seeking Scale The Poker questionnaire: 16 items designed for research
Biolcati et al. (2014)	All-in and bad beat: Professional poker players and pathological gambling	Italy	(1) Compare motivations to play of recreational and professional Texas Hold'em poker players (2) Investigate the psychological characteristics of online poker players in relation to narcissism, impulsivity, self-esteem, and problem gambling (3) Compare professional and recreational poker players on these psychological variables	256 participants (2.7% females) Mean age = 27.10 (SD = 6.29) Internet survey Professional players = 50.8% Recreational players = 49.2% 1.6% of probable pathological gamblers (endorsing 5 or more DSM-IV-TR symptoms)	• DSM-IV-TR for Pathological Gambling • Narcissistic Personality Inventory • Barratt Impulsivity Scale (BIS) Self-esteem Rosenberg
Gainsbury et al. (2014)	Chasing losses in online poker and casino games: Characteristics and game play of Internet gamblers at risk of disordered gambling	Australia	Examine loss chasing behavior in a sample of Internet gamblers and the link of chasing losses was with sociodemographic variables, irrational beliefs and game play behaviors	10,838 participants (54.8% females) from 96 different countries Internet survey 7342 Internet casino players (45.2% male) 75.5% aged over 35 years 5461 poker players (74.5% male), 60.9% aged over 35 years	• Sociodemographic and gambling variables • Chasing behavior: one question asked "If you lose when gambling online are you more likely or less likely to keep playing to try and win some money back?" • Internet casino/poker use (frequency, duration) • Bias in betting behavior: participants asked to choose the response which best reflected their betting behavior. Three responses reflecting commonly held biases/irrational belief were provided (the Hot Hand, the Gambler's Fallacy, and no bias)

(Continued)

Table 1. (Continued)

Authors	Title		Aims	Population	Method
Griffiths et al. (2009)	Online poker gambling in university Students: Further findings from an online survey	UK	Investigate the predicting factors of online poker success and problem gambling	422 participants (14.2% females) students of the UK University Mean age = 21 (SD = 3.4) Internet survey Nonproblem gamblers = 52% Some gambling problems gamblers = 30% Probable pathological gamblers = 18%	• DSM-IV diagnostic criteria for pathological gambling • Four open-ended questions (frequency of play, average wins and losses, and experience relating to a variety of gambling activities) Open ended questions on poker playing motivations, strategies, concerns, mood states before and after playing, and perceptions of the activity
Hopley et al. (2012)	Texas Hold'em online poker: A further examination	Canada	Extend the findings of Hopley and Nicki (2010) Examine the skill component involved in poker	62 participants (4.8% females) Mean age = 30 (SD = 10.44) Mean hours played/week = 16 (SD = 10.8) Internet survey Nonproblem gamblers = 12.9% Low-risk gamblers = 31.4% Moderate-risk gamblers = 44.2% Problematic gamblers = 11.5%	• Demographic questions • Depression Anxiety Stress Scales (DASS) • Internal Control Index (ICI) • Problem Gambling Severity Index (PGSI)
Hopley and Nicki (2010)	Predictive Factors of Excessive Online Poker Playing	Canada	(1) Determine whether impulsivity, boredom proneness, negative emotions, and dissociation are predictive of problem gambling. (2) To replicate and extend the findings of Wood et al. (2007) by using psychometrically valid questionnaires.	179 participants (3.9% females). Mean age = 30 (SD = 10.25). Mean hours played per week = 20 Internet survey "Professional" poker players = 19% Non-problem gamblers = 25.1% Low-risk gamblers = 27.9% Moderate-risk gamblers = 38% Problematic gamblers = 8.9%	• Boredom Proneness Scale–Short Form (BPS-SF) • Dissociation Questionnaire (DQ) • Barratt Impulsivity Scale–Short Form (BIS-SF) • DASS • PGSI
Hopley et al. (2014)	Making a living online: Problem gambling and workaholism in high earning online Texas holdem poker players	Canada	Demonstrate the similarity between problem gambling among a high earning subgroup of Texas Hold'em Poker players and workaholism	31 participants (0 females) Mean age = 28.77 (SD = 8.81). Internet survey Mean hours played/week = 30.5 (SD = 15.9) Nonproblem gamblers = 9.7% Low-risk gamblers = 22.6% Moderate-risk gamblers = 35.5% Problematic gamblers = 32.3%	• DASS • ICI • Revised NEO Personality Inventory (NEO-PI-R) • Workaholism Battery (Work-BAT) • PGSI

(Continued)

Table 1. (Continued)

Authors	Title		Aims	Population	Method
Laakasuo et al. (2015).	Poker players with experience and skill are not "ill" – Exposing a discrepancy in measures of problem gambling	Finland	Differentiate the concepts of poker experience and problematic gambling behavior Study 1. Evaluate the associations among problem gambling, poker experience, and well-being (general satisfaction with life and emotion regulation abilities) Study 2. Assessing whether experience in poker is associated with lower levels of prosocial behavior and with cold incentives for competition or individualistic goals Study 3. Assessing the associations between poker experience and social well-being	Study 1: 478 participants (7.5% females) Mean age = 29.9 years (SD = 9.35) Internet survey Study 2: 417 participants (7.4% females) Mean age = 27.9 years (SD = 7.45) Internet survey Study 3: 354 participants (6.5% female) Mean age 28.4 (SD = 7.7) Internet survey Proportion of excessive or problematic players not available	Study 1: • Sensitivity to Losses (SL) • Poker Experience Scale (PES) • Hope Scale • Satisfaction in Life Scale • Reading the Mind in the Eyes Task • PGSI Scale scored by averaging the items • Self-rumination and Self-reflection Scales Study 2: • PES • Social Value Orientation Scale • Modified SOGS (scored on 7 points Likert Scale) Study 3: • PES • Srole's Anomia Scale • Marginalization of Society Alienation Scale (Six items version) • Social Well-Being Scale • Emotional Intelligence Scale Self-Control Scale
Laakasuo, Palomäki, and Salmela (2014b)	Experienced poker players are emotionally stable	Finland	Assess the associations between poker players' level of poker experience and HEXACO-PI-R personality traits	Same as Study 1 of Laakasuo et al. (2015)	• HEXACO-PI-R • PES Engagement in live versus online play
Mihaylova et al. (2013)	Online poker gambling among university students: Risky endeavor or harmless pastime?	Quebec	Describe online poker gambling patterns and associated problems	366 participants (33% female) students of Montreal universities Derived from the University Student Gambling Habit Survey 2008 293 offline gamblers (40.3% females) Mean age = 22.0 (SD = 2.5) Nonproblem gamblers = 78.9% Low-risk gamblers = 14.7% Moderate-risk gamblers = 5.3% Problematic gamblers = 1.1% 73 online gamblers (8.2% females) Mean age = 22.0 (SD = 2.4) Nonproblem gamblers = 47.1% Low-risk gamblers = 22.1% Moderate-risk gamblers = 13.2% Problematic gamblers = 17.6%	• PGSI • Type of gambling activity, number of gambling formats, frequency of play, and spending • Frequency of alcohol use in the past 12 months and the alcohol use disorders Frequency of use of cannabis, cocaine, other stimulants, and hallucinogens

(Continued)

Table 1. (Continued)

Authors	Title		Aims	Population	Method
Palomäki et al. (2014)	Losing more by losing it: Poker experience, sensitivity to losses and tilting severity	Finland	Assess the link among experience, emotional sensitivity to losses, and severity of tilting (1) Poker experience is associated with being more likely to perceive having tilted less severely, as a result of accumulating poker experience; (2) Players with more poker experience have lower severity of tilting; (3) Players with more poker experience report lower emotional sensitivity to losses; and (4) Players with a higher emotional sensitivity to losses have higher severity of tilting	Same as Study 2 of Laakasuo et al. (2015)	• PES • Perceived effect of experience on tilting (PEET) • SL • Severity of tilting
Palomäki et al. (2013b)	"This is just so unfair!": A qualitative analysis of loss-induced emotions and tilting in online poker	Finland	Identified the aetiology and phenomenology of tilting	60 participants (5% females) from Finland Mean age = 27.1 (SD = 6) Internet survey with open questions	Thematic and narrative analyses (Internet open questions)
Palomäki et al. (2013a)	"Don't worry, it's just poker!" – Experience, self-rumination and self-reflection as determinants of decision-making in online poker	Finland	Assess the link between self-rumination, self-reflection, conceptualization of "luck," and poker playing experience. To determine if poker playing experience can predict decision-making strategies	354 participants (6.5% female) Internet survey Mean age = 28.4 (SD = 7.7)	• PES Cronbach's a = 0.88. • Poker decision scenarios (PD1 and PD2) • Belief in luck measure Self-Rumination and Self-Reflection Scales
Szabó and Kocsis (2012)	Susceptibility to addictive behavior in online and traditional poker playing environments	Hungary	Compare the susceptibility to behavioural addiction in online and traditional poker players	131 participants (12.2% females) Internet survey 96 online poker players (7.2% females) Mean age = 28.3 (SD = 8.2), Mean hours played/week = 18.5 (SD = 12.1) "Asymptomatic" gamblers = 30.2% "Symptomatic" gamblers = 67.7% "At risk" gamblers = 2.1% 35 table players (25.7% females) Mean age = 32.9 (SD = 10.8) Mean hours played/week = 17.9 (SD = 9.4) "Asymptomatic" gamblers = 5.7% "Symptomatic" gamblers = 94.3% "At risk" gamblers = 0%	• Demographic questions (gender, history of playing, and estimated weekly hours of playing Behavioral addictions scale (based on Griffiths, 2005): (salience, conflict, mood modification, tolerance, relapse)
Wood et al. (2007)	Acquisition, development, and maintenance of online poker playing in a student sample	UK	Explore Internet poker-playing behavior among the student population, including various motives for participation, monies won and lost, level of problem gambling, and predictor of problematic play	Same Griffiths et al. (2009)	Same Griffiths et al. (2009)

suggested that in the population of online poker players, playing time is a poor indicator of problematic gambling due to experienced and/or professional players. In poker, skills are part of the game, and impact the score obtained on the PGSI, particularly due to chasing included in the questionnaire. Chasing could be a different process when experienced by professional players (going back to work) or problematic gamblers. These studies are the first to raise the problem of the measurement of problematic gambling in professional or very experienced populations (Hopley & Nicki, 2010).

A third study published in 2014 focused on the link between workaholism and problematic gambling in a population of experienced online poker players (Hopley, Wagner, & Nicki, 2014). This last research complemented the previous work, evidencing that for experienced players, poker is either an additional income or a professional activity. Problematic online poker and workaholism share common predictors (stress, neuroticism, and internal locus of control) (Hopley & Nicki, 2010). Contrary to the authors' hypothesis, no significant link was found between problematic gambling and workaholism. Problematic gambling was predicted by an external locus of control ($r = -0.71$, $p < 0.05$) and by stress ($r = 0.78$, $p < 0.05$). Among the 31 highly experienced participants, 32% were categorised as problematic gamblers. This very high proportion confirms the inability of the PGSI to measure problematic gambling among experienced online players. However, workaholism is not an alternative to identify problematic gambling in online poker players. These results should be confirmed considering the small sample size.

Barrault and Varescon (2013a, 2013b) worked on the factors predicting online poker pathological gambling. The first study proposed a model explaining 36% of the SOGS score variance. Their results indicated that irrationals beliefs "perceived inability to stop gambling" ($\beta = 0.26$; $p < 0.001$) and "illusion of control" ($\beta = 0.23$, $p < 0.001$), depression ($\beta = 0.20$, $p < 0.001$), and anxiety ($\beta = 0.15$, $p = 0.01$) were good predictors of SOGS scores among poker players (Barrault & Varescon, 2013a). For these authors, the illusion of control plays an important role in the development of pathological gambling in a game of skill such as online poker. However, assessing gambling irrational belief in a game of skill raises the question of the validity of the measure of this scale in the poker player population.

Their second study focused on impulsivity and sensation seeking. Both have been identified as problematic gambling risk factors (Demaree, DeDonno, Burns, & Everhart, 2008; Petry, 2001). The authors assessed the specific connection between online poker and impulsivity (Barrault & Varescon, 2013b). Their results indicated that all online poker players had a higher level of sensation seeking, regardless of their intensity of gambling. Pathological gamblers were more impulsive than problematic and nonpathological gamblers. The model including frequency and duration of game session, impulsivity, and sensation seeking explained 12% of SOGS variance. Impulsivity was strongly predictive of the pathological use of online poker ($\beta = 0.32$, $p < 0.001$), but sensation seeking was not a significant predictor.

These studies were carried out with the SOGS, which is based on the DSM-III-R criteria and is increasingly used less

than the PGSI. Although the dichotomous quotation makes SOGS, a more appropriate tool for clinical practice, it is relatively not discriminative in the overall population (false positive) (Stinchfield, 2002). Indeed, the dichotomous quotation lacks statistical accuracy for research samples.

In this context, several comparative studies have been conducted to improve the understanding of influence that skills and experience have on poker player behavior and problematic gambling.

One study focused on the psychopathological differences between recreational online poker players (RPP) and professional online poker players (PPP) (Biolcati, Passini, & Griffiths, 2014). The comparison showed that PPPs spend more time for playing poker, wager more money, open more tables, and have longer gaming sessions than RPPs. PPPs had a higher self-esteem than RPPs. Biolcati et al. (2014) showed that narcissism ($\beta = 0.14$, $p < 0.05$), impulsivity ($\beta = 0.18$, $p < 0.01$) and the motives of "excitement" ($\beta = 0.17$, $p < 0.01$), and "escape from reality" ($\beta = 0.12$, $p < 0.05$) were positively associated with the DSM-IV-TR criteria of pathological gambling. Furthermore, self-esteem ($\beta = -0.19$; $p < 0.001$) was negatively associated with problem gambling criteria. In this study, the proportion of pathological players was the lowest (1.6%) due to the large number of professional players (50% of the sample). This is not representative of the online poker player population. Furthermore, 46% of the PPPs and 42.9% of the RPPs declared that they felt chasing (no significant difference). However, gambling to recover lost bets, in a game including skills such as poker, does not have the same meaning as in a game of chance. For professional players, it is normal to return to play even if they have lost money. This could be considered not chasing but rather going back to work. The concept of chasing should be regarded more carefully as a problematic gambling criterion for online poker.

Gainsbury et al. (2014) studied chasing in a population of online poker and casino gamblers. Chasing "losses" is one of the diagnostic criteria of problematic gambling and one of the rare observable behaviors of problematic gambling (Gainsbury, 2011). The international sample of this study was composed of 10,838 online gamblers, including 5,461 poker players, recruited in 2006. The poker player sample was mostly composed of men aged over 35 years (61%). In most studies, the age of this population ranged between 18 and 30 years. The results indicated that the risk of chasing decreased with age (1.5%), corroborating the conclusions of Griffiths et al. (2009). Irrational beliefs (hot hand and gambler fallacy) (17.6% and 39%), more money spent (1.7%), female gender (11.7%), being mainly a cash player (3.8%), and excitement and winning money motives (3.1% and 2.2%) increased the risk of chasing. The skill level (1.9%) and playing for relaxation (1.4%) decreased the risk of chasing. There was no significant link between the duration and the frequency of the game and chasing. Playing only poker decreased the risk of chasing (10.4%). The authors indicated that poker could be less addictive than other online gambling. Experienced poker players proved more disciplined and less sensitive to irrational beliefs and consequently to chasing. In this study, the frequency of chasing was measured using a question with three possible answers: "If you lose when gambling online, are you more

likely or less likely to keep playing to try and win some money back?" "less likely"; "more likely"; "I would be unaffected by what was lost on previous gambles." This evaluation raises the question of the gambler's awareness of their own chasing behavior. Moreover, no measure of chasing frequency and problematic gambling was made. This innovative and relevant study should be replicated to confirm the results.

Two studies focused on the influence of the gamblers' experience on gambling behavior (Laakasuo et al., 2014b; Palomäki, Laakasuo, & Salmela, 2013a). Poker skills have both a technical (game strategy-related) and an emotional (emotion regulation-related) aspect. In the first study (Palomäki et al., 2013a), participants were provided with poker decision-making scenarios. They had to choose between two options (fold or call). The results pointed out cognitive decision-making processes specific to inexperienced and experienced players. Experienced poker players were able to make better decisions as they used mathematical standards. Poker experience was linked to more self-reflection ("philosophical and detached" analysis of situations, decisions, and emotions) and inexperience to self-rumination (going over the negative experience, inability to "let it go") after a correct answer. Poker experience could be associated with emotion regulation and processes. The second study of Laakasuo et al. (2014b) showed that a predisposition for emotional stability was linked to higher levels of poker experience. Experienced poker players could have better strategies to cope with emotions. This result should be considered cautiously. First, emotional stability was assessed using the emotionality factor from the HEXACO, similar to the emotional aspect of the Big Five personality inventory (Ashton & Lee, 2007, 2009; Lee & Ashton, 2004). This emotionality factor is a personality trait and could not be considered as emotional regulation ability. Second, most of the correlations between the emotionality factor, the total score, and the items of the Poker Experience Scale (PES) were significant but not powerful (< 0.25).

In these studies, the authors did not measure problematic gambling, and the PES used to measure poker experience was not validated. The authors suggested that this scale could measure poker experience accurately. However, more needs to be known about its convergent validity, factorial structure, and psychometric reliability. The publication of the validation studies would enable this tool to be more precise and clear about validity, accuracy, and internal/external consistency.

Another article examined the question raised by Hopley et al. (2012, 2014) and Hopley and Nicki (2010), concerning the validity of the scales used to assess problematic gambling among experienced poker players (Laakasuo, Palomäki, & Salmela, 2015). This article, divided into three studies, extended the results of the previous study by questioning the validity of the PGSI and SOGS in the population of experienced online poker players (Laakasuo et al., 2015). These studies were undertaken using three different samples, two of which had been used in other articles (see Table 1). The authors used amended versions of the PGSI and SOGS, the PES, and scales assessing satisfaction in life, well-being, emotion regulation, and social

adaptation (see Table 1). In the first study ($n = 478$), a negative correlation was found between the PGSI and the satisfaction in life ($r[478] = -0.15$, $p < 0.001$), empathizing abilities (emotional intelligence) ($r[478] = -0.22$, $p < 0.001$), and poker experience ($r[478] = -0.20$, $p < 0.001$). However, poker experience was not correlated with satisfaction in life ($r[478] = -0.02$, ns) or empathizing abilities ($r[478] = -0.03$, ns). In the second study ($n = 417$), the results showed a correlation between the SOGS and the PES ($r[417] = -0.29$, $p < 0.001$). In the third study ($n = 354$), there was no correlation between PES and social well-being ($r[354] = -0.01$, ns), anomia ($r[354] = -0.04$, ns), marginalization of society alienation ($r[354] = -0.01$, ns), self-control ($r[354] = 0.02$, ns), and emotional intelligence ($r[354] = -0.03$, ns).

Problematic gambling scales (SOGS or PGSI) were negatively related to well-being, emotion regulation, and social adaptation. Experienced players had higher scores on the PGSI or SOGS but did not suffer from trouble in social adaptation, emotion regulation, or well-being. The association between problematic gambling and poker experience seems complex. Laakasuo et al. (2015) hypothesized that this contradictory link could be due to the skills required to play poker. In poker, if the player wants to acquire experience and skills, he needs to practice and to spend time and money. With experience, players become able to play for a longer period of time. Consequently, players could meet several criteria for problematic gambling and increase the rate of problematic gamblers. The authors concluded that the SOGS and PGSI are not appropriate for measuring problematic gambling in the population of experienced poker players. To our knowledge, this study is the first to explore the question of the validity of the measure of problematic gambling among experienced players. However, these results should be interpreted cautiously. The authors primarily used a modified version of the PGSI and SOGS and rated experiences on a Likert scale rather than on a dichotomous one. Modifying the measure used in a validated scale (e.g., changing a dichotomous to a Likert scale) greatly alters its psychometric properties. This does not mean that the measure is invalid but, even though the discriminant and convergent validity is maintained, it is difficult to interpret the scores obtained. Thus, they cannot be compared to previous data or the cut-off used. On the other hand, the authors drew general conclusions by combining the results of the three studies using three different protocols. These deserve to be confirmed. A study on a unique and representative sample to compare the psychopathological and adaptive characteristics of experienced and novice online poker players should be implemented. Finally, it is not known if experienced players represent a major or a minor proportion of the online poker player population.

Is there a difference between playing online or on a table?

Last, two inconsistent studies focused on the comparison of the psychopathological characteristics between online and offline poker players. The findings of Szabó and Kocsis (2012) suggested that traditional players were more problematic than online players. They stated that their results might be due to methodological bias. In fact, their sample of

traditional players was small (35 players) and unrepresentative of the whole poker player population (mean age 32.9 [SD = 10.8], with 26% women).

Mihaylova, Kairouz, and Nadeau (2013) found a significantly higher proportion of problem gamblers online than offline (17.6% and 1.1%, respectively). In addition, online poker players were more likely to have consumed illicit drugs during the past year, particularly cocaine. The population was composed exclusively of students. In the sample, 20% played poker online and 80% played table poker. Compared with the population of poker players, this sample included many women (40% of the table players). Substance use was measured using frequency scales instead of validated scales to assess substance use disorders (e.g., AUDIT, CUDIT, or Mini).

These studies had major limitations that prevent the generalization of the results. The psychopathological differences between online and offline populations remain to be explored.

A specific behavior of poker players: Tilt

Raised by Griffiths et al. (2009), poker tilt has been explored in three studies (Barrault, Untas, & Varescon, 2014; Palomäki, Laakasuo, & Salmela, 2013b, 2014). Two of these were qualitative (Barrault et al., 2014; Palomäki et al., 2013b).

Tilting is defined as "a strong negative emotional state elicited by elements of the poker game (e.g., "bad beats" or a prolonged "losing streak") that is characterised by losing control, and due to which the quality of decision-making in poker has decreased" (Palomäki et al., 2014, p. 10). One of the main articles on this topic concerns traditional poker and dates from 25 years ago (Browne, 1989).

In a qualitative study, including 56 participants using an Internet data collection, the authors asked participants to write their story about a situation concerning a significant loss of money while playing online poker (Palomäki et al., 2013b). They had to explain their emotions, thoughts, and behaviors. The authors explained the phenomenology and the etiology of tilt. After a significant loss, tilt occurs in three phases: (1) a dissociative phase (disbelief, "unreality," unwillingness to "accept" the events), (2) a phase of indignation and negative emotions (feelings of injustice and unfairness), (3) and the chasing phase. As an outcome, tilt produces disappointment in oneself for losing control, guilt, and anxiety and depression feelings. Finally, over the long term, it induces ruminations, sleep disturbances, and negative mood. However, a significant loss could lead to different pathways as a function of attribution of loss to a "bad beat" (unlucky) or a "bad play" (made a mistake). Inexperienced players reported a "bad beat" and experienced players a "bad play" attribution. Both could be followed by emotional or impassive reactions. Only emotional reactions comprising feelings of injustice and unfairness were linked to tilting. However, the authors limited their findings. Tilt is not only caused by a significant loss. Exhaustion or "needling" by other players could also lead to tilt on minor losses (Browne, 1989).

A quantitative correlation study aimed to identify the factors influencing the perceived severity of tilting. The authors created a four-item scale measuring the severity of tilting (Palomäki et al., 2014). They proposed a model linking poker experience (PE), perceived effect of experience on tilting (PEET), sensitivity to losses, and severity of tilting. Their results indicated that poker experience was associated with more intense, frequent tilt perceived as severe. However, experience at poker was also associated with perceiving experience as an attribute to tilt less severely. The interaction between PE and PEET indicated a protective effect of a high PEET score on tilt severity for the experienced players, who could have a better perception of the severity of their tilt. Then, sensitivity to losses (experience of negative emotions associated with losses, e.g., unfairness, anger, and frustration) was the main and strongest predictor of tilting severity. A moderate mediation effect suggested that PEET regulated sensitivity to losses among experienced poker players. Experience in the game and in tilting through emotion regulation plays a role in decision-making processes during poker playing, especially when players experience losses. Assessing pathological gambling could have improved and detailed the results by distinguishing "normal" and problematic players. The latter should experience more severe tilt and act in a different pattern concerning emotion regulation and decision-making than "normal" players. Finally, for most of the questionnaires, the validations have not yet been published (e.g., questionnaires of PEET, Sensitivity to Losses and severity of tilting), raising questions about the validity and accuracy of the measure.

Barrault et al. (2014) interviewed 23 experienced online poker players to investigate their representations. "Tilt" was the most mentioned item (29% of the corpus referred to it). This item included two classes, the first centered on emotional experience and the second on player behavior during tilt. All the players interviewed indicated having experienced tilt while the most reported strategy to cope with it was to stop playing. Players in this sample had different levels of experience (but at least 1 year of poker playing), and problematic gaming was not assessed. Did experienced and novice players have similar representations? How did experienced players learn to cope with tilt episodes? Were novice players able to identify tilt episodes and cope with them? These questions remain unanswered.

DISCUSSION

This literature review identified 17 articles on the psychopathology of online poker players and enabled us to establish a preliminary state of the art of the knowledge in this specific research area.

The main conclusions are that several factors predict problematic poker gambling, such as stress, internal attribution, dissociation, boredom tendency, negative emotions, irrational beliefs, anxiety, and impulsivity (Barrault & Varescon, 2013b; Biolcati et al., 2014; Hopley & Nicki, 2010; Hopley et al., 2012; Wood et al., 2007). Few of these studies were carried out with validated tools and were not replicated. Some studies presented inconsistent results, as in the case of the research on the locus of control (Hopley & Nicki, 2010; Hopley et al., 2014).

Young players are more at risk of chasing and problematic gambling (Gainsbury et al., 2014; Griffiths et al., 2009; Wood et al., 2007), and the amount of playing time does not appear to be a reliable indicator of a gambling disorder (Gainsbury et al., 2014; Hopley & Nicki, 2010; Hopley et al., 2012, 2014). The online poker player population is essentially male and young. Online poker gamblers seem to be younger and to spend more time playing than table players. There is not much information on the psychopathological differences between online and offline poker players, but it seems that the context has an influence on player behavior (Mihaylova et al., 2013; Szabó & Kocsis, 2012). Online poker players have specific characteristics that differ from other gambling practices.

This information is consistent with the fact that experienced players (older and playing more hours) are a specific group less at risk of developing pathological or problematic gambling. Several studies explored this hypothesis (Biolcati et al., 2014; Gainsbury et al., 2014; Griffiths et al., 2009; Laakasuo et al., 2014b, 2015; Palomäki et al., 2014). Despite these research works, the link between poker experience and gambling remains unclear.

The special features of poker compared to other gambling are skills and their influence on the course of the game. It seems necessary to explore these influences and characteristics for several reasons. First, from a legislative perspective, if skills are predominant over chance, poker may be classified as a sport. This issue influences the understanding of problem gambling. For example, cognitive distortions strongly predict the problematic use of poker (Barrault & Varescon, 2013a; Gainsbury et al., 2014). Consequently, if there is a real control over the game, is it cognitive distortions? What is the nature of the link between skills and problematic gambling development? Several recent studies state that being a good player means having greater self-control and adaptive coping and emotion regulation, which may be a protective factor against problematic gambling (Biolcati et al., 2014; Gainsbury et al., 2014; Laakasuo et al., 2014b, 2015; Palomäki et al., 2014).

Nonetheless, the proportion of experienced players in the population of online poker players remains unknown. Is experience a protective factor? Or do the common characteristics among players (e.g., intelligence, coping abilities, emotion regulation, and impulsivity) enable them to become experienced players? One quantitative study focused on players with a low level of expertise compared with experienced players (Laakasuo et al., 2014b) and found differences in emotion regulation between the two groups. To date, no study has examined novice players and their psychopathological variables like impulsivity, anxiety, depression, or personality disorders (e.g., borderline).

The variable proportion of problematic players could be an outcome of the bias due to the choice of the tools to measure problematic/pathological online poker. Problematic or pathological uses of online poker were assessed with four different tools: DSM-IV-TR criteria (American Psychiatric Association, 2003), the Behavioral Addiction Scale (Griffiths, 2005), the SOGS (Lesieur & Blume, 1987), or the PGSI (Ferris & Wynne, 2001). None was specific to online poker. All scales indicated a higher level of problematic

gambling compared with other gambling activities. Is poker very addictive? Experienced players in the samples could explain the high rates of pathological or problematic gambling identified in the studies. Laakasuo et al. (2015) indicated that these tools induced false positives in the experienced player population.

Almost all tools focusing on problematic gambling integrate chasing, which is considered a behavioral indicator of problematic gambling (American Psychiatric Association, 2003; Gainsbury, 2011). However, is it pertinent to regard playing to compensate money losses as chasing when poker playing is a professional activity? Several studies questioned the validity of this criterion among poker players (Biolcati et al., 2014; Gainsbury et al., 2014; Hopley & Nicki, 2010; Hopley et al., 2012). Similarly, is it valid to assimilate thoughts such as "Relating my winnings to my skill and ability makes me continue gambling" (Gambling-Related Cognitions Scale of Raylu & Oei, 2004) to irrational beliefs? These various points demonstrate that existing tools are not fully adequate and difficult to adapt to the online poker playing population.

This research area also highlights a phenomenon particular to poker tilt. This is a dissociative state induced by frustration leading to a loss of self-control and money. To date, three articles have focused on this phenomenon, from a phenomenological to an etiological perspective. Tilt is an abrupt decline in poker skills leading to a loss of money, negative feelings, and chasing. Tilt and its intensity are influenced by poker player experience. It is a word commonly used by players in online discussion forums and in resources on poker (Laakasuo et al., 2014b; Palomäki et al., 2013b). To become an experienced and winning online poker player, the novice will experience tilt and learn how to manage it (Laakasuo et al., 2014b). Tilt shares some features with problematic gambling behavior, as players experience loss of control, negative feelings, and chasing (Browne, 1989). More research is needed to explore the links between problematic online poker, skills, self-control, and tilt. Finally, this process brings up the topic of the regulation of emotion in poker, which is a specific and interesting example.

This literature review has several limitations. Methodologically, the studies included were qualitative and quantitative, and the authors used various tools. As it is difficult to compare their results, they must be interpreted cautiously. Some tools and concepts were created by authors and have not yet been validated. Furthermore, the range of the study sample sizes must be acknowledged and considered a limitation when comparing the data and the results with each other.

Some articles present data from the same sample. This observation limits the generalization of the results. More studies are needed in the field of online poker gaming to validate the methodologies and the different concepts (such as tilt) to improve our knowledge.

Moreover, participants were mostly recruited online. These poker gamblers are part of a closed community and are characterized by a strong impulsiveness, which makes it difficult for them to participate in a research project, especially if this is considered a waste of time. We do not really have information about the players who were willing to

contribute to such studies. Are these gamblers representative of the whole population of online poker gamblers or does this type of recruitment induce a significant bias?

RECOMMENDED FUTURE DIRECTIONS

The studies included in this review point out several research perspectives. First, it is necessary to replicate these works in future research in order to consolidate the current data. The use of validated tools and the contribution of data using the same tool (e.g., the PGSIndex) should enable a comparison of poker player populations according to their countries and the associated legislation.

A specific tool for online poker players should be created and evaluated in order to enable an in-depth study of the characteristics of online poker players. The properties of psychometric tools, particularly regarding excessive gambling and irrational beliefs, should be adapted to poker in order to answer the questions raised by several studies. As poker requires skills, players should develop specific cognitive distortions.

Experienced and professional poker players appear to be a specific group of online poker players. Further research on their specificity would be helpful. Moreover, few studies have focused on the influence of experience in the game on player psychopathology (Laakasuo et al., 2015; Palomäki et al., 2013a). Further studies would help understand the influence of experience on emotion and cognition regulation (Laakasuo, Palomäki, & Salmela, 2014a). Furthermore, skills are important to play poker. Their place in the development of a problematic use of online poker is still little documented in the literature thus more research appears if necessary.

Finally, the phenomenon of tilt and, more generally, the processes of emotion regulation in online poker deserve to be explored. They could be the targets of prevention and provide a better understanding of the processes involved in online poker gambling.

CONCLUSION

To conclude, the first aim was to explain the problematic use of online poker from a psychopathological perspective. This is a relatively new research area and thus further detailed studies will be required. Future research should focus on a crossed perspective, mixing the skills, self-regulation, and psychopathology of online poker players.

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HC participated in drafting the manuscript. EC oversaw research, participated in data analysis and writing of the manuscript. All authors approved the final manuscript.

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