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Gambling Exposure in Virtual Reality and Modification of Urge to Gamble

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Abstract

The urge to gamble is a psychological, physiological, and emotional state involved in the maintenance of pathological gambling. The ability of repeated exposure to a virtual gambling environment to modify the urge to gamble and perceived self-efficacy (PSE) is investigated. Ten video lottery players move throughout a virtual bar with five video lottery terminals five times. The urge to gamble and PSE do not significantly vary during exposure to the gambling environment. However, the desire to gamble significantly increases when passing from the practice environment to the gambling environment. These findings suggest that virtual reality is viable for use in exposure, but that a sole 20-minute session does not set the extinction process into motion. Future studies should be conducted on virtual exposure over the course of several sessions, with the addition of a cognitive restructuring intervention.

Introduction

Pathological gambling is classified as an Impulse Control Disorder, which is mainly characterized by persistent and recurrent maladaptive gambling behavior that disrupts personal, family, or professional pursuits.[1] Within the general adult population, lifetime prevalence is situated between 0.4 and 3.4 percent.[1] Cognitive-behavioral interventions for the treatment of pathological gamblers may involve a cue-exposure component.[2] This treatment component consists of exposing a gambler to gambling-related stimuli that evokes an urge to gamble, which refers to a psychological, physiological, and emotional state giving rise to a need or a desire to gamble.[3,4] Exposure continues until this desire decreases and fades away, which corresponds to the desensitization or extinction process.[5]

Exposure is generally conducted by means of two methods: *in vivo* or through imagination. An alternative to these methods is that of virtual reality, which enables an interaction between the individual and an environment rich in stimuli, visualized through a virtual reality headset. The individual thus finds oneself actively involved within the computer-generated environment rather than being passively subjected to a series of stimuli.[6] The individual's movements within this environment reinforce their sense of presence, contributing to the realism of the experience and the intensity of their reactions.[7] Virtual reality also solves certain problems of *in vivo* or imaginal exposure. This technology, which is controlled by the therapist, makes it possible to preserve patient confidentiality and to place patients in contact with situations or stimuli that would otherwise be unsafe or difficult to access.[8]

Exposure is an integral aspect of several cognitive-behavioral treatments. Indeed, Olatunji et al.[9] report that cognitive-behavioral therapies involving an exposure component are more effective in treating anxiety disorders. Exposure is also used in the treatment of substance dependence, as classical and operant conditioning may be operating when faced with attractive stimuli (alcohol and drugs).[10] It is through repeated exposure to conditioned stimuli, in the absence of substance abuse, that the extinction of conditioned responses occurs. The treatment environment must, however, contain several conditioned cues, as conditioned extinction related to one conditioned stimulus in particular is not generalizable to other substance-related stimuli.[11] Lee et al.[10] also emphasize the importance of creating a treatment environment similar to the context in which classical conditioning occurred, without which, exposure could prove to be ineffective.

Similar conditionings are also operating in pathological gambling. First, intermittent monetary gains act as positive reinforcement for gambling.[12,13] Over time, stimuli that were initially neutral, for example, the sounds emitted from a video lottery terminal (VLT) become conditioned stimuli that are able to evoke the desire to gamble. As a conditioned response,

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the urge to gamble is involved in the maintenance of pathological gambling and gambling behavior relapse following treatment.[4,14] The urge to gamble may arise from precipitating factors that are internal (e.g., negative emotions) or external, such as cues associated with gambling.[3]

In a study by Kushner et al.,[15] 18 pathological gamblers were accompanied to a real casino. A first group of nine participants moved 10 minutes around the gambling floor of the casino followed by an urge to gamble assessment period. The second group of nine participants also moved around the gambling floor the same length of time, but their urge to gamble was assessed before and after listening to an individualized audio-recording citing the negative consequences of gambling a given participant provided before. The urge to gamble significantly decreased among gamblers receiving a negative mood induction manipulation, while the urge to gamble did not significantly decrease among those who did not receive this negative feedback. The results of this study are debatable given that the presentation of stimuli associated with gambling may be very variable in a casino environment (e.g., noises associated with play, seeing a gambler winning a significant amount of money), therefore different for the two groups. Moreover, as the assessment of the urge to gamble was done outside the casino, it is difficult to know if the decrease in the urge to gamble is related to not being in the presence of gambling stimuli anymore or the audio message itself.

Low perceived self-efficacy (PSE) in gamblers may also contribute to the maintenance of pathological gambling behaviors.[16] In regard to gambling, PSE can be defined as an individual's belief that he or she can or cannot resist the opportunity to gamble in a given context.[17] In a study conducted among 785 students, Martin et al.[18] reported that PSE significantly predicts both having gambled during the year preceding measurement and the frequency of gambling. The weaker a gambler's PSE, the more the gambling frequency increases. Moreover, pathological gamblers who wish to stop gambling and whose PSE increases over the course of treatment are more likely to use coping behaviors to prevent relapse.[19]

Symes and Nicki[16] tested the effect of repeated exposure to stimuli associated with gambling on the urge to gamble and PSE. Within the scope of *in vivo* cue-exposure, response prevention within establishments with VLTs, two probable pathological gamblers repeated a sequence of actions meaning to provoke the urge to gamble five times within the session. Upon completion of the sessions (17 and 22 sessions, respectively), PSE increased and the urge to gamble decreased from baseline to the end of exposure. Comparison of data obtained during each session also shows a decrease in urge to gamble over the course of certain sessions. However, the authors do not specify whether this decrease occurred within the first exposure session or only within the course of later sessions. The authors report that the urge to gamble seems to fade when gamblers are repeatedly exposed to an environment rich in gambling-related stimuli without obtaining monetary gains. In another study conducted by Tolchard et al.,[20] findings indicate that a single *in vivo* exposure session can result in a decrease in the urge to gamble and gambling behaviors in pathological gamblers. The cue-exposure, response prevention session took place according to a series of hierarchical stages, each being gradually more likely to provoke the participant's urge to gamble. During the session, 39 measures of desire to gamble were taken at 5-minute intervals. However, the single or multiple case-study experimental design (one and two participants) used in these two studies restricts generalization of their findings.

In regard to gambling and virtual reality, only one study was found.[21] These researchers tested the influence of wins on the desire to continue gambling on slot machines in a virtual casino. Although the urge to gamble was measured, it is impossible to determine whether it was attributable to the virtual gambling environment or rather being able to gamble. In 2009, Bouchard created a virtual reality exposure program with the aim of eventually being able to use it in the treatment of pathological gamblers. This program makes it possible to expose gamblers to a bar with five VLTs and several gambling-related cues. An experimental comparison between gamblers and nongamblers, and between the virtual environment and two control conditions (a real VLT and the game of Scrabble), shows that this virtual reality is able to evoke an urge to gamble equivalent to that measured when participants gamble on a VLT *in vivo*. Results also show that gamblers in the virtual reality group experienced a greater urge to gamble than gamblers in the game of skill condition (Scrabble) as well as a greater urge to gamble than the one experienced by nongamblers in every condition.[22] Given that this computer-generated environment has not yet been tested within a treatment perspective, this aspect will be explored in this study.

In short, virtual reality makes it possible to recreate the complexity of a gambling environment and its numerous associated stimuli, all the while controlling for these stimuli. The studies by Conklin and Tiffany,[11] Lee et al.,[10] and Symes and Nicki[16] highlight the relevance of an exposure context possessing diversified cues that are adapted to the population being exposed. Virtual reality enables such adjustments, thus the interest in investigating the ability of virtual reality to be used in cue-exposure techniques aiming to modify the urge to gamble. It is a method that combines the advantages of *in vivo* and imaginal exposure without most of the inconveniences of these two traditional methods. Despite the fact that the literature supports the use of virtual reality as a tool for exposure, some clinicians are hesitant to use it in the treatment of gamblers. This hesitation is based on the fear of seeing gamblers' urge to gamble increase and remain high during exposure to a virtual gambling environment. This fear could be amplified by the fact that it is recommended to limit the duration of immersions in virtual reality as eye strain and headache may occur during immersions lasting more than 20 minutes,[23,24] at least until empirical data document the safety of immersion in virtual reality with gamblers. This duration of immersion in virtual reality may be insufficient to set an extinction process into motion, but it was decided to limit the duration of the immersion due to ethical considerations. Such a time constraint does not apply to traditional exposure methods.

The first hypothesis of this study is that one session cue-exposure to a virtual gambling environment will modify participants' urge to gamble on VLTs. Second, it is hypothesized that PSE will also change within this same session of exposure.

Method

Participants

Study participants were recruited through a list of volunteers and an advertisement that appeared in a local newspaper.

To be admissible to the study, the gamblers had to: (a) be 18 years of age or older, (b) gamble on VLTs at least once a month, and (c) wish to control or decrease their VLT gambling habits. Gamblers were excluded if they met one of the following criteria: (a) being treated for a gambling problem, (b) came to the experimental session under the effects of drugs or alcohol, (c) present a disorder increasing the risk of motion sickness, such as epilepsy or inner ear disorders,[24] and (d) must have to wear correcting glasses during immersion. Each participant received a compensation of $20.00 CAN to cover expenses incurred for participating in the study.

Of the people contacted (40), 14 were not eligible, three did not complete participation, and 13 were not interested. Four women and six men participated in the study ($N = 10$). The mean age of the participants was 63.4 years ($SD = 7.2$). Two participants were working full-time, three were working part-time, and five were retired. Five participants had completed high-school, two had completed college, and three had completed university-level studies. Their mean score on the Canadian Problem Gambling Index [CPGI] was 9.9 ($SD = 5.5$). According to the same measure, six participants met criteria for pathological gambling, three participants met criteria for at risk gambling, and one participant did not present a gambling problem. With regard to the participants' gambling habits, four reported gambling on VLTs several times per week, five gambled once a week, and one participant a few times per month. All of the participants gambled on VLTs most often in establishments with between 5 and 10 machines. The median amount spent by the participants on VLTs over the course of the last year was $8,700 CAN. Among the ten gamblers recruited, only one reported smoking cigarettes before and after a VLT gambling session and only one reported drinking alcohol while gambling.

Material

Screening questionnaire

This questionnaire documents the inclusion and exclusion criteria (eight questions) and evaluates pathological gambling (see the Canadian Problem Gambling Index [CPGI]). It also contains nine sociodemographic questions; three questions regarding the participant's most recent VLT gambling experience (date, particularity of this last experience, and amounts associated) and three questions pertained to the alcohol and tobacco habits while gambling. These are habits that may influence the urge to gamble on VLTs if jointly occurring with gambling practices.[25]

Postexposure questionnaire

This questionnaire summarily evaluates participants' gambling habits (see the Gambling inventory). The three questions from the screening questionnaire relating to the last VLT gambling experience are asked again, as a new gambling experience may have occurred between the telephone screening interview and experimentation. One question aims to determine if the participant has ever experienced motion sickness during immersion in virtual reality. The participants evaluate the realism of the virtual gambling environment on a scale ranging from 0 *(not at all realistic)* to 10 *(totally realistic)*. They also indicate whether the gambling environment is similar to the environment in which they most often gamble on a scale ranging from 0 *(not at all similar)* to 10 *(totally similar)*. A final question aims to determine if the participant is experiencing any distress with regard to his or her urge to gamble after exposure.

Gambling inventory

This inventory is comprised of 12 questions aiming to identify the categories of gambling activities played by participants (e.g., lotteries) as well as the frequency with which they play these games and the amounts of money spent on them over the past year.[26] For certain gambling activities, additional questions are asked to determine the subtypes of games played by the participant (e.g., daily lotteries). This inventory is inspired by that used in the CPGI.[27]

Canadian problem gambling index[27]

This questionnaire, developed in French and English, is comprised of 31 items among which nine (the Problem Gambling Severity Index [PGSI]) are used to determine the presence of gambling pathology. Only these nine items are administered within the scope of this study. Scores of 0 to 2 correspond to the absence of problem gambling, scores of 3 to 7 indicate a risk of developing a gambling problem, while scores of 8 to 27 indicate a probable gambling pathology. According to Ferris and Wynne,[27] the PGSI possesses good psychometric qualities, a notably good internal consistency (Cronbach $\alpha = 0.84$), and a good criterion validity when compared to the South Oaks Gambling Screen[28] and the DSM-IV criteria for pathological gambling.[29]

Urge to gamble on VLTs

Participants evaluate their urge to gamble on VLTs on a scale ranging from 0 (*no urge to gamble*) to 10 (*extreme urge to gamble*). This type of scale is often used to measure pathological gambling treatment outcome variables.[30–32]

Perceived self-efficacy

Participants evaluate their PSE on a scale from 0 *(not at all able to resist the temptation to gamble)* to 10 *(totally able to resist the temptation to gamble)*. This scale is inspired by that used by Ladouceur et al.[30]

Virtual reality immersion apparatus

A virtual reality headset projecting three-dimensional images is used to generate the virtual environment. This Vusix iWear (VR920) headset has a 1024×768 resolution and is connected to a computer (Windows XP Pro, 4 GO of RAM, NVIDIA GeForce 8800 GT video card). Speakers are connected to the computer. The images from the virtual reality software developed by Bouchard[33] are projected onto a computer screen as well as in the virtual reality headset worn by the participant. Movements within the virtual environment are carried out using an Intersense Cube 3 motion tracker (for head rotations) and wireless mouse (for moving forward and backward). The start-up point when initiating the immersion in the virtual environment is on the sidewalk of a street facing the bar (on the upper left corner in Fig. 1). This was defined as the practice environment where the

FIG. 1. Image in aerial view of the virtual bar. Color images available online at www.liebertpub.com/cyber

participant can practice how to navigate in the virtual environment. The participant sees some passersby, a car, and various shops. Further away on the street, there is a bar and an outdoor bank machine; these two elements represent the entrance to the gambling environment. The bar has five VLTs and other gambling-associated stimuli, such as people who are gambling on VLTs, a billiard table, and alcohol beverages (see Fig. 1). The participant is also exposed to auditory stimuli (e.g., the sounds of VLTs and ambient music).

Procedure

Participants responded to the screening questionnaire by telephone, and then a meeting at the Université Laval was arranged. Upon arrival, participants were met by a researcher who explained the main contents of the consent form. Participants and the researcher then signed the consent form. Next, an initial measure of the urge to gamble and PSE was taken (1B). To verify the ability of the virtual gambling

environment to modify the urge to gamble, it is preferable that the gamblers' urge to gamble be relatively high before beginning the exposure. To ensure so, participants were primed before beginning the practice period by asking them to name five things that they would do if they won at gambling that day (inspired by Kushner et al.[15]). Following priming, a second measure of the participants' urge to gamble on VLTs and PSE was taken (2B). Participants then put on the headset and the immersion in virtual reality began, starting with a practice environment. The practice task, lasting around 5 minutes, enabled participants to familiarize themselves with moving around within the virtual environment. Three measures of urge to gamble on VLTs and PSE (3P to 5P) were taken during this practice task. To begin exposure, the participants' urge to gamble had to be stable or on the rise between 3P and 5P. If not, a second priming was conducted and additional measures were taken of the participants' desire to gamble on VLTs. For analyses, only the last three measures taken during the practice task were used. Additional measures were taken for three participants due to a decrease in their urge to gamble between 3 practice task (P) and 5P.

Participants were then exposed to the gambling environment. They had to move around the environment according the experimenter's instructions, which were inspired by those used in the study by Symes and Nicki.[16] Participants were asked to: (a) face the bank machine (15 seconds); (b) face the bar counter (25 seconds); (c) look at the VLTs and gamblers (35 seconds); and (d) select a free VLT and sit down to play without playing (45 seconds). This sequence of actions was repeated five times (6 exposure sequence [ES] to 10ES). The exposure session ended when, following the final sequence, participants removed the virtual reality headset. Immersion within the virtual reality, including the practice task and the cue-exposure session lasts around 20 minutes. After exposure, participants responded to the postexposure questionnaire and three other measures (11 past exposure [PE] to 13PE) were taken. To decrease the participants' urge to gamble before leaving the laboratory, they were asked to name five negative consequences of their gambling habits. Participants were offered a list of resources and the possibility of meeting a clinician specialized in pathological gambling. The procedure was pretested among five people studying or working at the Laval University. This study was approved by the Université Laval research ethics committee.

Results

Figure 2 presents the mean urge to gamble on VLTs and mean PSE, as well as associated standard deviations for each measurement time. The mean urge to gamble on VLTs varies between 4.6 ($SD = 4.17$) and 5.9 ($SD = 3.51$) during exposure, while mean PSE varies between 4.5 ($SD = 3.92$) and 5.2 ($SD = 3.91$).

Since the postulate of normal distribution was not met for all measurement times, nonparametric tests were used. The Friedman's test shows no significant difference between the urge to gamble on VLT measures taken during exposure (6ES to 10ES), $\chi^2_F(4, N = 10) = 7.78$, $p = 0.10$. Moreover, for these same exposure sequences, no significant difference is observed between PSE measures, $\chi^2_F(4, N = 10) = 1.27$, $p = 0.87$. Given that drinking alcohol and tobacco smoking while gambling may influence the urge to gamble on VLTs, a Friedman's test was also conducted by withdrawing the two

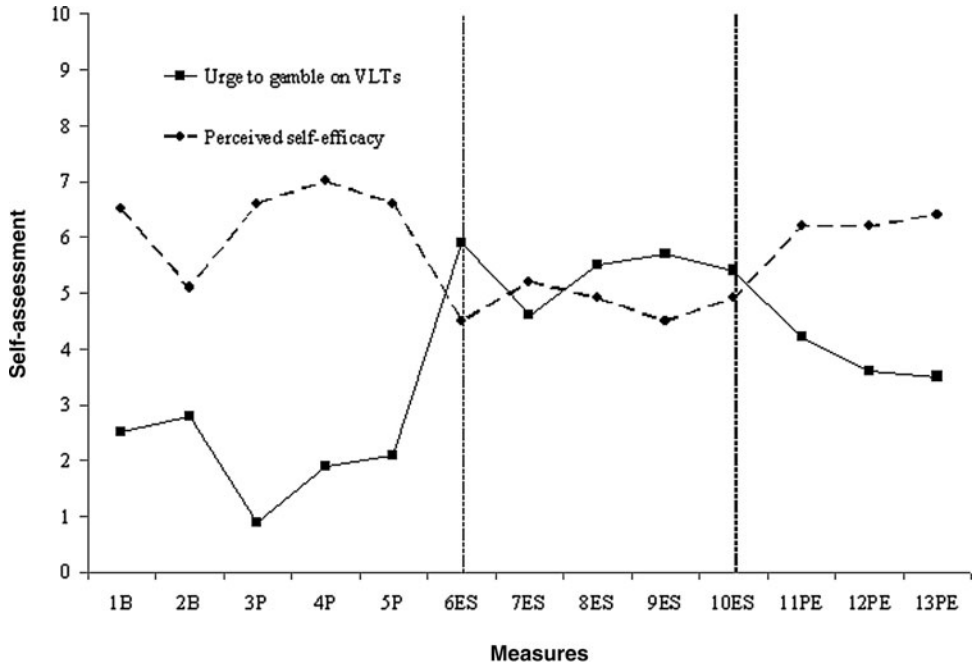

FIG. 2. Mean urge to gamble on video lottery terminals (VLTs) and perceived self-efficacy (PSE) according to measurement time. The different letters associated with measures 1 to 13 correspond to precise moments in the virtual reality immersion session: B, baseline; P, practice task; ES, exposure sequence; PE, postexposure. For self-reported urge to gamble on VLTs, 0 = no urge to gamble and 10 = extreme urge to gamble. For self-reported PSE, 0 = not at all able to resist the temptation to gamble and 10 = totally able to resist the temptation to gamble. The two vertical lines mark the boundaries of the exposure to the gambling environment session.

participants who reported engaging in these behaviors while gambling. Differences for measures remained nonsignificant, respectively, $\chi^2_F(4, N=8)=7.65$, $p=0.11$ and $\chi^2_F(4, N=8)=1.33$, $p=0.86$.

Secondary analyses were conducted to evaluate the impact of the virtual gambling environment on the urge to gamble on VLTs, while taking into account measures taken before and after exposure ($N=10$). Three Wilcoxon tests were carried out using a Holm–Bonferroni correction for the alpha threshold. A significant increase in the desire to gamble on VLTs is observed between the mean of the measures taken within the practice environment ($M=1.63$) and the mean of the measures taken within the gambling environment ($M=5.42$), $Z=-2.67$, $p=0.01$. No significant difference was observed between the mean urge to gamble on VLTs measures taken within the practice environment ($M=1.63$) and the last measure taken after exposure (3.5), $Z=-2.02$, $p=0.04$. Moreover, there were no significant differences between the mean urge to gamble on VLTs measures taken within the gambling environment ($M=5.42$) and the last measure taken after exposure (3.5), $Z=-1.78$, $p=0.08$.

On average, participants attributed a score of 8.2 out of 10 ($SD=2$) to the virtual environment for its realism and a score of 7.1 out of 10 ($SD=3$) for its similarity to their usual gambling environment. Following immersion in virtual reality, one participant asserted feeling some distress in regard to her desire to gamble on VLTs and no participant reported motion sickness during the immersion.

Discussion

The principal hypothesis of this study was that one session cue-exposure to a virtual gambling environment would modify the urge to gamble on VLTs. It was also expected that PSE would be modified. The absence of a significant difference between measures of urge to gamble and PSE during the cue-exposure to a gambling environment session leads to the rejection of these two hypotheses.

These findings do not support those obtained by Symes and Nicki[16] and by Tolchard et al.[20] In both of these case studies of *in vivo* exposure to a gambling environment, a decrease in the desire to gamble on VLTs was observed among the participants. However, in these two studies, the procedure took place over a period of several weeks during which participants had to keep a journal detailing their gambling behavior, the amounts spent, and their desire to gamble. Participants were thus invested in a more elaborate intervention compared with the present study. Moreover, in the study by Symes and Nicki, the decrease in the desire to gamble within a session was obtained by calculating the mean urge to gamble scores on all of the 17 and 22 sessions, contrary to this study where only one exposure session was conducted. As such, it is possible that a fluctuation in the urge to gamble on VLTs and PSE within a same session could not be observed within the first exposure session, but only following several sessions. With regard to the case study by Tolchard et al., the decrease in the urge to gamble is observed during a sole exposure session, but this session took place over a period of more than 3 hours. As such, the absence of fluctuations in the urge to gamble on VLTs among participants of this study could be due to the fact that a 20-minute exposure session is not long enough to set the extinction process into motion.

The absence of a significant effect with regard to the urge to gamble during exposure to a virtual gambling environment does not, however, diminish the relevance of the use of virtual reality in cue-exposure, response prevention. Findings from this study indicate that there is a significant increase in the desire to gamble on VLTs when moving from the practice environment to the gambling environment. Thus, finding oneself in a virtual environment with several gambling-related cues evokes the desire to gamble on VLTs, in accordance with the data obtained by Loranger et al.[22].The virtual environment thus seems viable for conducting exposure given that it reliably recreates a real gambling environment. On average, participants did, in fact, attribute a high realism rating to the virtual environment.

It is possible to suppose that additional interventions or a greater number of exposure sessions are necessary for the extinction process to occur. According to the findings of this study, exposure to a virtual gambling environment should take place within a therapeutic framework where gamblers have access to tools enabling them to cope with gambling situations. In fact, despite certain methodological limitations, the study conducted by Kushner et al.[15] shows that *in vivo* cue-exposure to a gambling environment during which participants receive a negative feedback decreases their desire to gamble, while cue-exposure alone is ineffective.

In this study, the urge to gamble on VLTs does not significantly decrease following exposure, which could maintain clinicians' fears about the use of virtual reality for cue-exposure, response prevention among gamblers. Although one participant reported experiencing distress following exposure because of her urge to gamble on VLTs after the session, further discussion revealed that the participant had already planned to gamble on VLTs before coming to the cue-exposure session and that her urge to gamble was comparable to that experienced on a daily basis. This participant was referred to a gambling treatment center given her desire to cease gambling. Such an event reinforces the idea that exposure to virtual reality should be used in combination with cognitive interventions or after some cognitive-behavioral treatment sessions. Norcross et al.[34] suggest, in fact, that exposure should be used in advanced stages of therapeutic change. Even if an individual would like to decrease their gambling, it could possibly be difficult for exposure to lead to durable therapeutic gains if the individual is not ready to make changes to their gambling behavior.

Certain limitations of the present study should be pointed out, such as the small sample size and a potential lack of sensitivity of the measures. The technical difficulties that occurred during session preparation (e.g., reversed programmed images) suggest that the material required to use virtual reality should be adjusted to simplify its use. Moreover, several participants criticized the weight of the headset (3.2 ounces) used for the immersion, which may have attenuated their sense of being in a virtual environment. Finally, despite the uniformization of the exposure steps and the control of cues within the virtual environment, an additional control would have been necessary with regard to the VLTs. Indeed, the VLT screens from the virtual environment provide random results, sometimes showing winning symbols and sometimes not, making each virtual VLT gambling session unique to each gambler. Also, if the results are random, perhaps the virtual VLT gambling session does not expose them to cues associated with « wins ».

Future studies could explore the possibility of combining cue-exposure, response prevention sessions with a cognitive intervention. According to a study by Ladouceur et al.,[30] a strictly cognitive intervention among pathological gamblers leads to a significant increase in PSE and perceived control over their gambling problem, as well as a significant decrease in their urge to gamble. Cognitive intervention over the course of several sessions mainly aims to correct gamblers' erroneous cognitions about chance and randomness. Virtual exposure could thus be complementary to cognitive restructuring because the erroneous cognitions associated with gambling are likely to manifest themselves more spontaneously when gamblers are exposed to a gambling environment similar to that in which they usually gamble.

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