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Using Virtual Reality to Provide a Naturalistic Setting for the Treatment of Pathological Gambling

Stéphane Bouchard, Claudie Loranger,
Isabelle Giroux, Christian Jacques and
Geneviève Robillard

Additional information is available at the end of the chapter

1. Introduction

Recent studies reveal psychotherapy is effective in reducing gambling behaviours [1, 2]. However, an important issue in treating pathological gambling is that, despite understanding the negative consequences of continued gambling, problem gamblers at times experience an overwhelming craving to gamble [3]. Furthermore, the therapeutic work carried out when patients are emotionally distant from the gambling situation, such as in a therapist's office, is hard to transfer to real-life tempting situations.

Previous researches have studied the efficacy of imaginal [4, 5]; and *in vivo* exposure to gambling-related cues in order to reduce gamblers' cravings [6-9] either in cue exposure therapy or as part of a broader Cognitive-Behaviour Therapy (CBT) package where skills are developed or strengthened while confronted to the addictive stimuli [10, 11]. In imaginal exposure, patients are asked to imagine different stimuli, while *in vivo* exposure requires the physical presentation of the stimuli. Results from these studies indicate that these two forms of exposure therapy can help reduce cravings among pathological gamblers [4, 9] and generate broader therapeutic impact such as significant improvements on other gambling variables and psychopathological symptoms [4, 8].

Since the 90s, a new kind of exposure tool has appeared in clinical psychology: Virtual Reality (VR) or *in virtuo* exposure [12, 13, 14]. VR can be defined as "an application that makes it possible for the user to navigate and to interact in real time with an environment in three dimensions generated by a computer" [15]. *In virtuo* exposure is usually conducted using a Head Mounted Display (HMD or helmet) which is a pair of goggles allowing the presentation

of images in stereoscopy, combined with audio stimuli and a motion tracker that follows the user's head movements [13,14]. Both for cue exposure and broader CBT package, VR presents the same advantages as imaginal exposure since it offers great control over different stimuli and the rhythm of exposure in a context that assures patients' confidentiality and eliminates many ethical problems unlike *in vivo* exposure. However, VR also presents some advantages over imaginal exposure because it reduces problems related to lack of memory, difficulties inducing emotions solely with thoughts or patients' refusal to fully access their memories [13,14]. Finally, VR allows therapists to control the impact of stimuli related to patients' other addictions on the course of therapy. For example, alcohol, cigarettes or drugs could also be found in a virtual environment to provide specific cues for a patient. VR also offers the possibility to conduct exposure and relapse prevention in various locations (for example, a bar or casino) that could provoke different reactions in the same person. The fact that VR is interactive and very similar to real-life situations could also positively influence gamblers' perceptions about therapy and encourage them to seek treatment. But they key argument in favor of using VR is its potential to replicate an environment where addictive behavior is usually taking place, thereby allowing to witness pathological gamblers' emotions and dysfunctional behaviors, and accessing their mental state as it is operating in gambling situations. Replicating gambling situations with a naturalistic setting in the safety of the therapist's office should be quite an advantage to treatment efficacy.

A significant number of outcome studies have been conducted where CBT is combined with VR to treat anxiety disorders [16]. Indeed, VR exposure has shown its efficacy in the treatment of acrophobia, claustrophobia, arachnophobia, fear of driving, fear of flying, social anxiety disorder (fear of speaking in public) and posttraumatic stress disorder [17]. Less work has been done with addictions, but researchers have shown that VR can be used with pathological gamblers, either for experimental research, to induce cravings or in single-case trials.

In 2008, a study using VR by Young and colleagues [3] revealed that for pathological gamblers, the desire to gamble was influenced by wins, losses and the different amounts won which was not the case for non-gamblers. This research is interesting because it shows VR can induce a desire to gamble, but it didn't use VR as a treatment tool. The first study using VR in a CBT program for pathological gambling was realized in Spain [18]. Unfortunately, results from this research were never officially published.

In the current chapter, two virtual environments and their clinical applications for pathological gambling and co-occurring problems will be detailed. First, data from a validation study and a pilot clinical trial with gamblers will be presented. Then, a presentation of a CBT manual for using VR will follow. The two virtual environments described in this chapter, a bar and a casino, were the first in North America designed for the treatment of pathological gambling to be empirically tested [19, 20]. Note that the choice of Video Lottery Terminals (VLT) in bars and slot machines in casinos was based on epidemiological data on gambler's playing habits [21].

Before using these two environments in treatment (see section 2.1.2 for a detailed description), a validation study was conducted in order to determine if they could induce a desire to gamble [19,20]. First, a training immersion in VR was performed to allow participants learning how

to navigate in VR and manipulate the equipment. All immersions were performed on a PC computer with an nVisor SX HMD, a pair of computer loudspeakers, an Intersense Cube2 motion tracker for measuring head rotations, a wireless mouse for translations / navigation in the virtual environments, and a box with push-buttons allowing the user to physically interface and play with the VLT and slot machines. Second, participants removed the HMD and had to physically play a game of Scrabble™ (a control condition where the game is not significantly based on chance) with the experimenter for a period of 7 minutes. Then, participants were randomly assigned to 7 minutes of playing on: a real VLT (gold standard control condition), playing VLT in a virtual bar (VR bar condition), and playing slot machines in a virtual casino (VR casino condition). Subjects' desire to gamble was assessed after each game with the Gambling Craving Scale (GACS) [22] and physiological reactions (skin conductance and heart rate) were measured throughout the experiment. It is noteworthy that participants recruited for this validation study (n=67) had prior experience with games of chance and VLTs but were not pathological gamblers. Participants presenting a potential gambling problem according to the South Oaks Gambling Screen (SOGS) [23] were excluded from the project and referred to proper resources. Accepted participants were divided in two categories according to self-reported frequency of gambling: frequent gamblers (played at least once a month with VLT or slot machines) or non-gamblers (played a maximum of twice a year). Results show that physiological arousal (according to the skin conductance), desire to gamble, and anticipation of positive mood while gambling were statistically higher in the frequent gamblers group than in the non-gamblers group for the real VLT and the two virtual environments. The Time by Condition interaction was significant [$F_{(3,186)}$=11.53, p <.001] and revealed that, compared to playing Scrabble™, the craving to gamble was increased as significantly in the two virtual conditions than with the real VLT for the gamblers group. In sum, the two virtual environments seemed to provoke among gamblers the same desire to gamble than a real machine, even if no real money was involved [19,20].

A pilot clinical trial was then conducted with 28 pathological gamblers participating in a 28-day residential CBT program with group and individual interventions [20]. A more affordable HMD was used and the treatment was adapted from an already validated CBT program developed by Ladouceur [24]. Only two sessions of the CBT program were modified to include VR (the first and last sessions described further in this chapter), allowing to compare the use of imaginal exposure (standard technique) with immersions in virtual reality in the bar. Participants were randomly assigned either to the virtual reality condition or the imaginal exposure condition. Results revealed that the first VR immersion allowed finding significantly more high risk situations and more dysfunctional thoughts than the standard imaginal exposure exercise [20]. In the second experimental therapy session, devoted to relapse prevention, immersion in the virtual bar was associated with stronger changes in urges to gamble compared with the imaginal exposure condition. Furthermore, a multiple regression predicting pre to post-treatment improvements revealed that the strength of changes in urges to gamble induced during the relapse prevention session significantly predicted patients' improvements [$F_{(1,19)}$=5.13, p <.025]. Finally, another interesting finding from this clinical trial is that no ethical issue or adverse events were reported following the use of VR [20] (e.g., inducing cravings that would be too intense).

2. Description of a treatment manual using VR

Following the pilot clinical trial described above [19,20], a randomized control trial was launched, this time using four sessions devoted to immersions in VR. Two additional sessions devoted to conducting cognitive restructuring were added. These sessions were not included in the pilot studies due to logistical constraints and were positively anticipated by the therapists. Their advantage is to allow conducting cognitive restructuring while patients are emotionally aroused and operate on an "emotional mode" instead of a "cold logical mode" that translates poorly to what happens in potential gambling situations. The treatment illustrated in this chapter refers to the virtual bar in the examples, but details about using the virtual casino in therapy are also mentioned. Detailing how to effectively treat pathological gambling is outside the scope of this book and, therefore, using our program requires professionals to become familiar with traditional CBT programs (e.g., such as the one developed by Ladouceur et al [24]) and this clinical population. The following sections will: (a) briefly introduce the equipment required and different features of the virtual environments; (b) suggest sessions when to use immersion in virtual reality; (c) describe in details the four therapy sessions where virtual reality can be exploited (identifying high risk situations, conducting cognitive restructuring and practicing relapse prevention techniques); and (d) address potential problems during immersion and related solutions.

2.1. Description of the equipment and of the virtual environments

2.1.1. Equipment

In the pilot [20] and current clinical trials, immersion in VR is conducted with an immersive version of the virtual bar with the help of a HMD (iWear VR920 from Vuzix), head-tracking system (Cube2 from Intersence), speakers, a wireless mouse, and a box with pushbuttons replicating the interface panel of a real VLT. Visual and audio stimuli from the virtual environment were controlled by the user's movements and external stimuli were essentially blocked when wearing the HMD. This immersive version allowed the user to feel completely present in the virtual environment and make him forget that he or she is actually in his therapist's office[1]. The pushbutton control box does not have to be used if therapists do not feel comfortable allowing their patients to actually play at a game of chance.

This immersive equipment provides a visual field of view of 32-degrees and a reliable 3 degrees-of-freedom head tracking, allowing the user to explore with the mouse a rather large area and interacting with virtual objects and virtual characters in the environments. Sound files are triggered and their loudness modulated by the proximity of various stimuli (e.g., music starts when entering the bar, sounds from the reels of the slot machines in the casino become louder as you approach the machines) or by the therapist (i.e., to have the barman talk with

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1 A less immersive version of the system is also available but it has not been tested with patients yet. In the non-immersive version, the virtual environments are simply presented on a computer screen, without the need of a HMD and motion tracking. However, there is no data documenting that a non-immersive VR system could be effective in the treatment.

the user), and the pushbutton box allows selecting how many lines to bet on, how much credits to bet, and to start / stop the VLT machines.

2.1.2. Virtual environments

The virtual bar (named *Chez Fortune / At Fortunes*) and the virtual casino (named *Les 3Dés / The 3Dices*) were created at the Cyberpsychology Lab of UQO with the intention of simulating a gambling situation without the use of real money (see Figure 1 and 2). Any resemblance with real locations and these fictive locations is fortuitous.

Figure 1. Screenshots of the virtual bar Chez Fortune / At Fortune

Figure 2. Screenshots of the virtual casino Les 3Dés / The 3Dices

A hierarchy has been constructed in the virtual bar to guide interventions, with users progressively approaching the machines where they can gamble (see steps 1 to 7 on Figure 3) and,

in the last two steps of the hierarchy, actually sitting and playing. Users are invited to walk to each step of the hierarchy and apply various CBT techniques described later in the chapter: (1) at the starting point outside of the bar, in front of the ATM machine; (2) at the entrance doors of the bar, with two people smoking outside; (3) at the bar, in front of the waitress; (4) further inside the bar, in front of the barman; (5) even further inside the bar and closer to the VLTs; (6) close to the washroom, very near of the VLTs; (7) right in front of two available VLTs (one VLT becomes available after the therapist activates an animation where a frustrated player leaves his seat); (8) the user is now allowed to sit and gamble 20 virtual dollars; (9) the user continues gambling more money and keeps playing as long as desired.
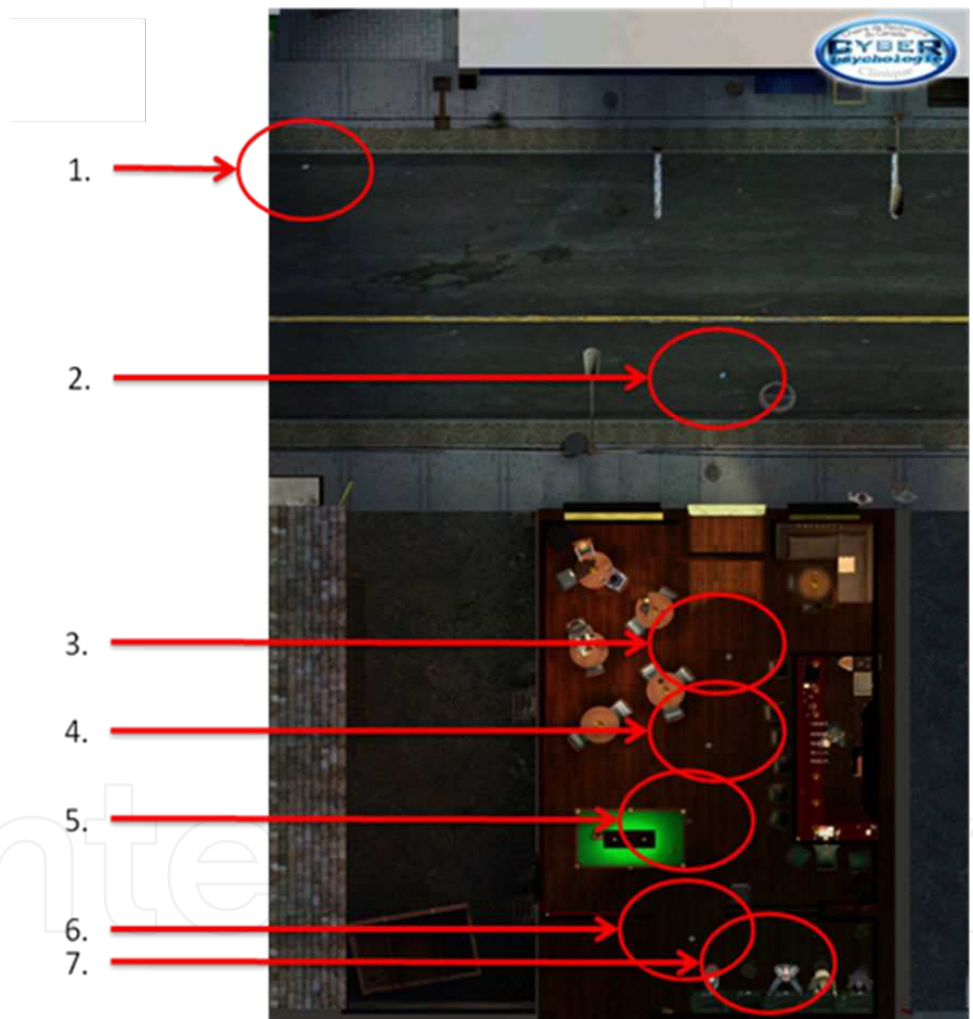

Figure 3. Birds-eye view of the virtual bar and first seven steps of the hierarchy

The objective with the hierarchy of pre-identified steps is to allow the user to progress gradually in the environment. During the immersion, the therapist can invite the user to stop at each step and observe the environment. Users can also be encouraged to share their thoughts and feelings at different steps. Users should always be told they can end their progression or the immersion whenever they want. It is noteworthy that the two last steps of the hierarchy

were not used in the pilot clinical trial because gambling was not permitted in the treatment centers [20], but they are used in one center involved in the current randomized clinical trial. Therapists should use their clinical judgement when assessing gambler's urges to gamble, emotional stability and readiness to move to the next steps, as they always remain accountable for the safety of their patients.

2.2. Before using VR with pathological gamblers

Before introducing patients to VR, therapists should always assess the presence of any health conditions that could provoke or aggravate VR-induced unwanted side-effects, often called cybersickness [25,26]. Cybersickness is not a disease but a reaction which could occurs during or after an immersion in a virtual environment. It is similar to motion sickness and essentially includes three categories of symptoms: (1) visual symptoms (eyestrains, blurred vision, headaches), (2) disorientation (vertigo, imbalance) and (3) nausea (vomiting, dizziness) [25]. These symptoms are normal, temporary and can be prevented to some extent. For example, people under the influence of alcohol or other psychoactive drugs should not be immersed in a virtual environment. Also, VR shouldn't be used with patients presenting medical conditions such as serious cardiac problems, epilepsy, vestibular problems, and migraines (see [26] for a more exhaustive list). People suffering from comorbid psychotic disorders should probably not be immersed in VR because of their difficulties with reality testing.

Even in users in good health condition, cybersickness have to be assessed throughout the immersions. Different questionnaires, such as the Simulator Sickness Questionnaire [25], allow clinicians to monitor these symptoms when they use VR. In sum, the therapist's evaluation of his patient's health and his clinical judgement are always necessary before conducting immersion in VR and to pursue the immersions. In research settings, in order to prepare the patient to *in virtuo* exposure to gambling-related cues and control for the effect of novelty, it is common to start with an immersion in a training environment. The purpose of a training environment is to allow the user to learn how to use the equipment in a context devoid of stimuli eliciting strong emotions or cravings. It also offers a good opportunity for clinicians to assess the presence of cybersickness, as some symptoms may be confounded with physiological symptoms of arousal and cravings (e.g., sweating).

Since the virtual environments induce real cravings to gamble [19], it is very important for the clinician to determine if the patient is ready for such an exercise and implement strategies to cope with strong urges if they occur. The immersion in a gambling situation has to be conducted by trained therapists. Gamblers who's cravings have been stimulated during a therapy session should be followed closely by the staff to ensure that this experience is positively integrated emotionally, is not destabilizing the patient too much, and is leading to a positive therapeutic outcome instead of a worsening of the situation. Because it is more difficult to check on gamblers after an immersion session that elicited urges to gamble in an outpatient setting, clinical wisdom suggest using this technique in inpatients settings until its safety has been documented. In addition to urges induced by the immersion, other factors could put the gambler at risk for discomfort or relapse. These risks are usually implicitly controlled in a residential treatment facility, where access to cues associated with gambling and other

addictions are absent. However, although VLT are not available on the premises of a residential facility, they are in the virtual environments, and this environment may be accessible if it is stored in an unlocked room of the residence. Seeing alcoholic beverages during an immersion in VR could elicit emotional reactions in a gambler who also has issues with alcohol. Witnessing people enjoying gambling in a virtual casino can trigger sadness in a person who must accept to become abstinent. Again, the take home message is that VR is a clinical tool that must be used by mental health professional using their clinical judgment.

As mentioned earlier, in the context of the treatment of pathological gambling, three specific moments are suggested for the use of VR immersion: (a) at the beginning of treatment, to identify high risk situations and erroneous perceptions about gambling, (b) at mid treatment, to implement cognitive restructuring of dysfunctional beliefs, and (c) at the end of therapy, to practice relapse prevention techniques.

2.3. Illustration of the four sessions of VR immersion in the virtual bar

2.3.1. First immersion: Identifying high risk situations

Before the identification of high risk situations with the help of the virtual environment, it is important to prepare the patient for the immersion. As mentioned previously, an evaluation of the user's health condition should be done before using VR. Cybersickness should also be discussed with patients and it is recommended to use a training environment to allow users to feel more comfortable with the equipment. Since the virtual environments induce a desire to gamble, therapists have to inform their patients of this possible consequence. It is also important to discuss the objective of the session with the patient before starting the immersion. Users should be encouraged to express out loud their feelings and thoughts during the immersion. Communication with the user is always possible during immersion in VR and is important to pace the progression of the immersion. However, constant verbal interventions from therapist could make some users feel less present in the virtual environment since it could be a continuous reminder that the situation is not real. Clinicians can use brief questions or 0-10 scales to measure users' desire to gamble, self-efficacy or cybersickness for example. Since the patient in the virtual environment doesn't have a visual contact with his therapist, every questionnaire or scale used should be presented in detail before the immersion.

For this first immersion in VR, 20 minutes should be enough to go through the identified steps in the virtual environment. It is also possible to repeat the user's progression through the environment multiple times. The goal of the session is to detect as many stimuli, behaviors and dysfunctional thoughts associated with situations that represent a high risk of gambling. During the immersion, the therapist says: "*Please behave naturally and say openly what comes through your mind during this visit in the bar. You can describe what you see that triggers the desire to gamble, your thoughts and ideas, your observations, what you would do in such a situation, or it you think of situations you would avoid because you could lose control of your desire to gamble.*" The therapist is encouraged to explore the situation with the patient, ask if some elements could trigger urges (e.g., walking pass an ATM located close to a place where it is possible to gamble, on a payday). The therapist must pay attention to patient's behaviors that would be represen-

tative of gambling patterns (e.g., a patient once checked both his left and right pocket for money, revealing his habit of putting some money in his right pocket to increase his winning chances). When the therapist has gathered enough information, or if the patient asks to end the immersion, the patient should be asked to walk out of the bar before actually taking off the HMD. In some case, it has been revealing to ask patient to go back to the ATM and return the money they didn't use. Since the first session of immersion takes place at the beginning of therapy, it is normal for most gamblers to feel an urge to gamble during or after exposure to gambling related cues. Thus, therapists can decide to discuss more thoroughly the identified high risk situations with their patients, and it is wise to dedicate the last minutes of the session to try to reduce the gambler's craving. Some patients are shocked by the strength of their reactions; despite the fact this is a simulation. This can be explored as a motivation for the therapy (e.g., starting the discussion with "*If this makes you react so strongly, imagine how it would be in a real life situation. What conclusion can we draw from this regarding your own situation?*"). Table 1 summarizes the essential instructions for the first session of immersion.

Before the immersion	During the immersion	After the immersion
• Prepare your VR session (e.g., launch program) • Assess patient's health condition. • Explain cybersickness. • Practice with a training environment. • Inform about inducing and managing cravings. • Explain the objectives of the session.	• Guide the patient through the different steps. • Encourage the patient to openly share all feelings and thoughts. • Ask about high risk situations and perceptions about gambling. • Use your creativity to gather as much relevant information as possible. • Observe the presence of cybersickness. • Write down all information relevant to high risk situations (stimuli, thoughts, emotions, behaviors, etc.).	• Verify the actual desire to gamble. • Reduce patient's urge to gamble, if any. • Observe a reduction in cybersickness, if any. • Discuss the identified high risk situations and perceptions about gambling. • Assess perceived self-efficacy to control gambling. • Use other therapeutic techniques if needed (e.g., motivational interviewing).

Table 1. Key points for therapists to remember for the first immersion in VR

2.3.2. Second and third immersions: Conducting cognitive restructuring

It is now time for therapists to exploit VR to challenges patients' dysfunctional beliefs while emotionally aroused. Dysfunctional thoughts contributing to the pathological gambling [2,6,21] fall into two large categories: (a) those about specific maintaining factors underlying pathological gambling and, (b) those about perceived control toward one's own gambling behavior. The second category plays a significant role to maintain pathological gambling but is addressed more thoroughly in the session devoted to relapse prevention [21] and should not be targeted before enough therapy time has been allocated to other maintaining factors. Several erroneous and dysfunctional beliefs are involved in the treatment of gambling

addiction [21], including illusory perception of control[2] regarding games of chance (e.g., "I have a trick to beat the odds and make money"), gambling as a positive source of pleasure (e.g., "I feel good when I'm playing"), gambling as an effective solution to avoid negative mood (e.g., "Gambling allows me to forget my problems"), facilitating / permissive beliefs (e.g., "It's all right to play today and I'll bet only 20$"), going to a gambling place to socialize with other gamblers (e.g., "I have fun with other people sharing my passion"), superstitions (e.g., "If I press the button quickly three times I have more chances to win because 3 is a lucky number"), and beliefs specific each game (e.g., for VLT, "This machine is due to pay because it has not been used for a while and the previous player lost a lot of money on it").

The assessment, case conceptualisation and previous therapy sessions, including the first immersion in VR, should have provided the therapist with a good understanding of the specific beliefs that maintain the patients gambling addiction. These beliefs are usually addressed by therapists using traditional cognitive restructuring techniques, which essentially involves helping patients identifying core beliefs and challenging them. Exercises that have been developed for traditional CBT packages [for more information, see 1,6,7,10, 21] can be used during the immersions in the virtual bar. At immersions 2 and 3, the patient is invited to wear the HMD and walk through the nine steps previously explored, until he or she reaches a desire to gamble that is sufficiently strong yet manageable. The therapists can then ask about thoughts that give the urge to gamble, challenge them, and help the patient come with thoughts that give control over the urge to gamble. Dysfunctional thoughts occurring before, during and after typical gambling sessions should be questioned. Because these thoughts are strongly believed in, it will probably take more than one session to counteract all of them, which explains why two sessions are devoted to this step. Exercises to conduct after the immersion are important to continue master the skills of cognitive restructuring and gain confidence in the more adaptive and functional beliefs. Moreover, having the patient emotionally aroused makes it even more difficult to create doubt, revise erroneous beliefs and reframe the situation. Presenting the technique of cognitive restructuring, detailing the key role of dysfunctional thoughts and initiating cognitive restructuring should either be introduce before the immersion, or *in virtuo* at the first step of the hierarchy, before emotional arousal influences objectivity. Finally, it is important to underline that cognitive restructuring is not a heated logical debate between the patient and the therapist; it is a set of tool where the therapist constructively guide the patient to develop thoughts reflecting more accurately the realities of gambling and that are in line with their goal of putting an end to pathological gambling. When the session is over, we again encourage the patient to exit the bar and go to the ATM to put back the money in his or her bank account. This is another interesting moment to observe dysfunctional thoughts and behaviors and to foster motivation.

These two immersions are good opportunities for therapists to: (a) have access to emotions in patients that appear very rational; (b) work on potential situations of denial (e.g., when patients are describing reactions that do not correspond to what is observed *in virtuo*);

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2 Note the distinction between illusion of control towards the possibility to win at a game of chance, which is targeted during immersions 2 and 3, and the illusion of control toward oneself that is addressed during the immersion devoted to relapse prevention.

(c) observe physiological reactions associated with cravings, (d) catch dysfunctional beliefs and behaviors associated with expectations to win; (e) increase perceived self-efficacy to challenges strongly held beliefs when emotions are blurring logical thinking, and (f) tests the believability and strength of alternative more functional beliefs. More than two sessions may be necessary and future research will show what are the most efficient ways to use VR for cognitive restructuring.

2.3.3. Fourth immersion: Practicing relapse prevention techniques

This session occurs toward the end of the treatment and by then gamblers should already have learned different skills to build their self-efficacy about refraining from gambling. Before this last immersion in VR, the therapist should always verify with their patients if they wants to proceed with the immersion since it will confront them with gambling situations and could induce cravings. The main goal of this immersion is to increase patients' feeling of control over the desire to gamble. Relapse prevention exercises can be practiced in multiple contexts with the virtual environments. In the virtual bar, the user can rate his self-efficacy at any of the nine hierarchy steps in order to determine which situations to choose for the exercise. It is recommended to pick an easier situation to start with (i.e. where the gambler thinks he could easily resist temptation to engage in the behavioral chain of excessive gambling) and to follow with a more difficult situation (i.e. the gambler believes he would have a hard time resisting urges to gamble). For example, one relapse prevention technique could be to replace thoughts that increase the user's desire to gamble with thoughts that increase his feeling of control over himself in situation [10, 11, 21, 24]. The last session of immersion could also be very helpful for gamblers who believe they still can gamble small amounts of money without losing control. The therapist could allow the patient to virtually gamble 20$ and encourage him to observe his reactions in this situation. An important arousal or an overwhelming urge to gamble more money could be good indicators for the patient that he can't allow himself to gamble even small amounts without relapsing. The ability of the patient to resist his desire to gamble should be strongly reinforced by the therapist during and after the VR immersion. As it was the case for all other immersions, the immersion should end with the patient walking out of the bar. At this moment, if the user's desire to gamble is still high, more CBT interventions should be proposed. In this context, the virtual environment could also be considered as an assessment tool to verify gambler's readiness to end the treatment. The patient and the therapist can use the last immersion to identify the most appropriate behavioral techniques in different contexts and discuss the gambler's preferred exercises. The advantage of VR is to offer a naturalistic environment to test the skills acquired during the treatment, without actually having to leave the office and go in a place where it is possible to play at games of chance.

A few potential difficulties have been identified from experience with pathological gamblers or *in virtuo* exposure for other disorders. The next section describes these problems and proposes clinical strategies to facilitate the intervention.

2.4. Potential problems during immersion and possible solutions

2.4.1. The patient presents an intense desire to gamble after the immersion

If the gambler feels an important craving to gamble after leaving the virtual environment, many strategies are available. First, therapists should anticipate this situation and plan their sessions to have enough time after the immersion to complete other interventions (e.g., at least 20 minutes). Sometimes, reviewing previous exercises or discussing other matters less related to gambling is enough to significantly reduce the desire to gamble. During the session, the therapist can also discuss with the patient his motivation to stop gambling and write down the negative consequences of this behaviour in his life. It can also be interesting for the therapist to ask his patient what he usually does when he has an urge to gamble (talking to someone, sports, breathing exercises, reading therapy notes). Finally, if the desire to gamble is still present at the end of the session it might be important to involve other experienced professionals (e.g. in a residential facility) or a patient's relative or members of support group (with his permission) to refrain engaging in gambling behaviors.

2.4.2. The patient doesn't want to stop at the different steps and consistently asks to gamble on the VLT

First, the therapist can disable the possibility to use the VLT by simply unpluging the pushbutton playing interface. Thus, the immersion in the virtual environment can be pursued and if the user sits in front of a VLT to gamble it will not be possible to activate the VLT. Since this strong desire to gamble is very similar to what the patient might face in real-life situations, it is a powerful context for interventions. Thus, it is important that the therapist helps the gambler realize that his craving to gamble and his loss of control over the situation are not virtual. Finally, the emotional arousal of the gambler can be helpful in the identification of high risk situations and erroneous perceptions about gambling. Once the automatic thoughts are identified, the therapist can apply cognitive restructuring to reduce the desire to gamble.

2.4.3. The patient doesn't feel any desire to gamble and is indifferent to the environment

Some patients have negative appraisals about the use of VR. For example, if the patient keeps telling himself that "it is not real" during the immersion, the possibility to practice *in virtuo* effective interventions is unlikely. Some gamblers might also think that the immersion is a "trap" or a "test". Thus, it is important for the therapist to verify the presence of these automatic thoughts and apply cognitive restructuring if necessary. If the patient is indifferent despite the absence of such automatic thoughts, it can also be helpful to ask the patient to narrate a previous session of gambling before the immersion or while he is in the virtual environment. The therapist can try to induce a desire to gamble with specific questions about favourite games, previous wins, etc… This last strategy should only be used with the patient's permission. If the gambler does not want or is not ready to face his desire to gamble, the therapist should respect his decision and focus on other interventions that do not involve VR.

2.4.4. The patient is uncomfortable with VR technology

If the patient is worried by the use of the virtual environment, more time could be needed to answer questions about the equipment or cybersickness, for example. The immersion in the training environment could also last longer to allow the user to navigate comfortably with the equipment.

2.4.5. Patient's high risk situations are not reproducible in VR

Even if the patient's high risk situations are not similar to what is occurring in the virtual environments, an immersion in VR can still be useful. The therapist can encourage the patient to at least try the immersion to verify his feelings in this context. The immersion in the virtual environment could then be presented as a new situation the patient might face one day (e.g. "An old friend asks you to go out at the bar even if you don't usually like going there"). However, in some cases, the relevant gambling stimuli are simply not there in the virtual environment (e.g., for a patient addicted to Poker or other games of cards). In these cases, the immersion may be irrelevant and the therapist has to rely on traditional tools such as imaginal exposure.

2.4.6. The therapist can't help the patient to verbalize his thoughts

The verbalization of high risk situations and perceptions about gambling is essential in the treatment of pathological gamblers. Therapists who feel less competent with this strategy should consult classical CBT treatment manuals [10, 21, 24] or seek clinical supervision with more experienced professionals.

2.4.7. The patient is hesitant to try the immersion

Multiple studies have shown that exposure with pathological gamblers can have positive effects. A research by Echeburúa, Báez and Fernández-Montalvo [6] has indicated that an individualized intervention focused on stimulus control with graded *in vivo* exposure was better than cognitive restructuring or the combined use of these two treatment modalities. Two single case studies presented by Symes and Nicki [9] have resulted in considerable reductions in gambling behaviours after a treatment with exposure and response prevention. Therefore, if the patient is hesitant, the therapist must assess his fears, see if they are justified, and either not use VR or reassure the gambler and reframe his worries.

3. Using VR with gambling and co-occuring disorders

The validation study [19] and the pilot clinical trial [20] have indicated that the two virtual environments developed for the treatment of pathological gambling have a therapeutic potential for this specific addiction. Because a significant proportion of gamblers also suffer from substance abuse or dependence problems, the impact of other addictions on gambling

behaviours and patients' reaction to stimuli in the environment need to be considered in VR sessions.

The possibility of immersion in VR to induce cravings has been demonstrated for different substances. Virtual environments including specific stimuli have been shown to produce strong cue responses to cigarette [27], alcohol [28], cannabis [29], methamphetamine [30], and crack cocaine [31]. Recent studies have explored the possibility to use VR in the treatment of addictions as well. A research by Bordnick and colleagues [32] assessed the feasibility of VR skills training in a CBT smoking cessation program. Their results show that smokers who completed a VR skills training treatment (in addition of a nicotine replacement therapy) had lower cravings and self-reported smoking than participants who received nicotine replacement therapy only. Their self-efficacy ratings were also higher after treatment and at follow-up [32]. These results are promising, but more research is clearly needed to measure VR's efficacy as a tool in the treatment of addictions.

Nevertheless, this study and others show that VR can induce cravings for other addictions, which has two implications for the treatment of gambling: (a) the possibility of gamblers reacting emotionally to cues that are irrelevant to games of chances while in the virtual environment due to co-occurring disorders (e.g., co-occurring alcoholism and seeing an open bottle of beer on a table); and (b) the possibility for skilled therapist to use stimuli irrelevant to games of chance to conduct treatment that either target both gambling and the co-occurring disorder (e.g., practicing relapse prevention skills for gambling while close to a table with an open bottle of beer) or target the treatment of gambling in the context of emotions elicited by a co-occurring disorder.

Because virtual situations are designed to replicate the complex nature of day to day stressors, learning and practicing CBT skills in VR may be more representative of real life situations than in the therapist's office. Naturalistic settings like the virtual bar and casino described in this chapter include various stimuli that are associated with other addictions and could trigger unexpected reactions that are irrelevant to games of chances, such as cravings in people addicted to tobacco (e.g., two people are smoking at the entrance of bar), to alcohol (e.g. there are many open bottles of beer on tables and people drinking), to sex (e.g., the sexy waitress), etc. People suffering from co-occurring disorders unrelated to addictions can also react to cues in the virtual environments, as the virtual bar and casino include people from a variety of ages, skin tone, gender and revenues (which could trigger reactions in people suffering from social phobia or schizophrenia), a cat (e.g., for people suffering from cat phobia), food and people with various body shape (e.g., for people who are dissatisfied with their body image), a dark city atmosphere (e.g., for people suffering from agoraphobia), and an aggressive man hitting his VLT and leaving (e.g., for people suffering from posttraumatic stress disorder). Although these stimuli were not meant to be salient and strong enough to elicit reactions in the user, it is important for therapists to be aware of their existence. Actually, some therapist may even use these environments with people who suffer from a primary disorder other than gambling (e.g., practicing relapse prevention skills for alcohol using the open bottle of beer in the virtual bar, or using the virtual bar for *in virtuo* exposure with a phobic). It is important to recognize the existence of these contextual stimuli. It can help therapists preventing some unexpected

reactions in gamblers, but most of all it gives the opportunity to practice CBT skills in settings that resemble complex real life situations.

For the skilled therapist, the existence of stimuli related to other substances or to other mental disorders offer opportunities to practice CBT skills and reinforce gamblers' self-efficacy in more challenging situations. The virtual casino and bar [19,20] offer multiple possibilities for working on multiple targets at the same time. For example, seeing the smokers at the door could provoke a nicotine craving in some patients, or a desire to drink could be induced by the multiple bottles of alcohol and people drinking at the bar. Therapists may have access to more dysfunctional beliefs and observe interactions between the two addictions when people with comorbid pathological gambling and alcoholism are in certain areas of the bar. Being in a virtual bar can facilitate the therapist's task of transferring skills learned with gambling with VLTs to addiction to alcohol. Practicing cognitive restructuring may become more difficult in the presence of several emotional triggers, but also richer in clinical material. Second, pathological gamblers with comorbid social phobia can work on interpersonal issues by using the virtual characters discussing in the casino. They can also use the proximity and attitude of virtual characters to make relapse prevention exercises more challenging. In these naturalistic contexts, VR presents the advantage of offering standardized environments in multiple declinations to conduct research or tailor exposure to patients' needs. Finally, a better understanding of contextual elements in situations leading to cravings (e.g., seeing signs indicating the presence of a VLT, accessibility of an ATM, seeing other people drinking) could lead to develop stronger CBT skills in pathological gambling and co-occurring disorders.

4. Conclusion

In sum, early experiments with two virtual environments have not only allowed our research team to measure the potential of an intervention tool that can induce cravings to gamble, but have also helped therapists discover new possibilities in the treatment of pathological gamblers. Multiple advantages of using immersion in VR have been identified by the therapists after the pilot clinical trial [20]. For example, therapists believed they could access more spontaneous reactions in more "rational" patients. It was also easier for them to access gamblers' emotional reactions and dysfunctional thoughts. Furthermore, the use of VR allowed them to reveal contradictions between patients' expressed ideas and their reactions or behaviours in the virtual environment. According to the therapists, the immersions in VR offered a great opportunity to assess patients' comprehension of new techniques, observe the integration of learned skills and reinforce self-efficacy. In addition, therapists believed immersion in VR allowed gamblers to acknowledge the physiological reactions associated with cravings and to properly evaluate their ability to control their cravings. Finally, therapists believed the use of VR could also eventually facilitate the identification of possible interventions for co-occurring disorders.

Taken altogether, results of the validation study, the clinical trial and clinicians' observations reveal that the integration of virtual reality in the treatment of pathological gamblers may leads

to significant therapeutic improvements. In addition, the available data suggest this modality is innocuous, at least in the context of a residential treatment facility.

More research still needs to be done to assess the true potential of immersion in VR for pathological gamblers. Future studies should measure the efficacy of virtual reality as a treatment tool in different contexts of intervention, such as: (a) in a complete CBT package, which includes cognitive restructuring, (b) physiological assessment of gamblers' reactions in high risk situations to identify risk of relapse and the need to pursue treatment, (c) patients allowed to gamble on the virtual VLTs or slot machines to observe their emotions, thoughts and behaviours, (d) increasing or optimizing the number of immersions, and (e) exploiting more efficiently the assets of the virtual casino. Future investigation could also address questions such as: (a) the difference between the immersive and less immersive version of the virtual environments, (b) the distinction between cybersickness and physiological signs of craving or withdrawal, (c) the influence of virtual reality-related variables such as presence, and (d) the systematic integration of cues associated to other addictions. It is important for researchers to understand that virtual reality is not only a treatment tool, but it also offers a standardized and controlled context to conduct research. For example, virtual environments could be used to observe the neurophysiology of gamblers during cravings while using an fMRI scan or measure the impact of alcohol consumption on gambling behaviours.

Finally, the dissemination of virtual environments for psychological intervention is another important concern. First, the costs of the equipment required for the immersive version of the virtual environments need to be considered. Second, proper training is prerequisite to use VR adequately and insure patients' safety. However, the benefits of such technology seem to outweigh its downsides. The control over the stimuli, interest of patients for this new kind of treatment, ease to access emotions, and possibility to work in a context similar to real-life while staying in a safe situation, are all great advantages of using VR with people suffering from pathological gambling.

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Author details

Stéphane Bouchard[1*], Claudie Loranger[1], Isabelle Giroux[2], Christian Jacques[2] and Geneviève Robillard[1]

*Address all correspondence to: stephane.bouchard@uqo.ca

1 Université du Québec en Outaouais, Gatineau, Canada

2 Université Laval, Québec, Canada

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