Virtual Reality Protocol: An Instrument to Assess Alcohol-Dependent Individuals

Elena Gatti Ph.D. Candidate¹, Riccardo C. Gatti, Ph.D², Tiziana Lops M.S.², Rosanna Massari M.S.², Cinzia Sacchelli M.S.², Giuseppe Riva Ph.D.¹,³

¹. Department of Psychology, Catholic University of Milan, Italy
². National Service Care, Dipartimento Dipendenze, ASL Città di Milano, Milan, Italy
³. Applied Technology for Neuro-Psychology Lab, Istituto Auxologico Italiano, Milan, Italy
elena.gatti@unicatt.it

Abstract
The use of virtual reality (VR) in the form of a simulated real context can provide a realistic environment in which to study complex naturalistic behaviour (Calhoun, Carvalho, Astur, Pearson, 2005). Virtual Reality’s usually used in clinical psychology to assess and care for anxiety, panic disorder and agoraphobia, binge eating and eating disorders, autism and in sexual deviance or to cue reactivity in controlled simulated tasks with nicotine-dependent patients or in drunk drivers (Bordnik, Graap, Copp, Brooks, Ferrer, Logue, 2005; Freeman, Liossis, Schonfeld, Sheelhan, Siskind, Watson, 2005; Freeman, Liossis, Schonfeld, Sheelhan, Siskind, Watson, 2005). On the other hand, it has been explored less in alcohol-dependent subjects. The aims of this article are to: describe a protocol in which interpersonal and intrapersonal factors of alcoholics are assessed using virtual reality; and verify the application of the VR protocol on a patient who asks for an assessment at the National Service Care for Alcohol Abuse. The VR protocol provides all the information that a service care worker receives from an interview, but the time for collecting the information is shorter; the patient is more satisfied than in a traditional evaluation process, and at the end of the VR session the patient expressed a higher motivation for change and willingness to engage in behavior that limits her drinking habits.

Introduction
The use of Virtual Reality (VR) in clinical psychology can provide a good assessment instrument and basis of therapeutic programs for psychological deficits and psychopathology. Previous studies have suggested that VR can be effective in clinical assessment and treatment (Hodges, Boltr, Mynatt, Ribarsky & Van Teylingen, 1993; Hodges et al., 1995; North, North & Coble, 1997) because VR can simulate the real world. In fact, one of the main advantages of a virtual environment for a clinical psychologist is that it can be used in a medical facility, thus avoiding the need to venture into public situations. Clinical psychology and rehabilitation specialists use VR to provide a new human-computer interaction paradigm in which users are not only simply eternal observers of images on a computer display, but are active participants within a computer-generated three dimensional virtual world (Riva, et al., 2003). Within VR, the participants are able to assess their problems and can learn to manage problematic situations related to their disturbance. The key characteristics of VR are both the high level of control of the interaction with the tool without the constraints usually found in computer systems and the enriched experience provided for the patient. Virtual environments are highly flexible and programmable. They enable the therapist to present a wide variety of controlled stimuli and to measure and monitor a wide variety of patient responses (Riva, et al., 1999). In fact, VR can be considered a special, sheltered setting where the patient can start to explore and act without feeling threatened by social pressure. In a VR environment patients can control their behavior and choices and monitor their emotions, so they can learn new ways to behave and new forms of emotional control (Molinari & Riva, 2004). The capacity to control emotions and actions is the first step to improving the sense of self-efficacy that precedes the change (Bandura, 2001). In fact, controlled studies show that VR produces significant changes in physiological, emotional, cognitive and behavioral aspects in the patients (Riva, 2005).
Today, VR is used in anxiety, panic disorder and agoraphobia treatments, in binge eating and eating disorder assessment and therapy, in autism educational programs and in treatment for sexual deviance (Riva, 2005). In binge eating, obesity and anorexia, VR is used successfully because virtual environments are efficient in moving the patient’s attention from addictive behavior to VR use (Li, 2005). Several studies show the importance of VR: the patients increase their body awareness during an assessment session and they learn useful strategies in order to change their dysfunctional behaviors during treatment (Bacchetta, Baruffi & Molinari, 2001; Perpina, Botella & Banos, 2003, Fernandez-Aranda, 2003).

In the context of other addictions, Virtual Reality has been used to assess cue reactivity in controlled simulated tasks with drug-dependent patients or in drunk drivers (Bordnik, et al., 2004; 2005; Calhoun, Carvlho, Astur & Pearlson, 2005), but it is less explored in alcohol-dependent subjects where the assessment and therapy involve the use of a traditional case history. The semi-structured interview is the main approach used to explore the circumstances that have led to the first appointment being made and exploring the alcoholic’s history. Sometimes, this procedure is considered threatening for the patients because they may enter with the expectation that if they admit the reality of their behaviour they are putting themselves at risk. Patients may believe they are exposing themselves to the reaction of a person they do not know, and they may be afraid of being demeaned by stranger (Edwards, Marshall & Cook, 2006). There are therefore potentially good, apparent reasons for which a patient adopts a defensive posture of protection against these risks. If history taking is clumsily handled and the initial relationship not sympathetically established, the interview will be interpreted as attack and defences are rapidly brought into play. The history obtained will then be filtered through these defences and be inaccurate. The stereotype of the drinker as someone who “never tells the truth” will have been confirmed, so it can be another risk in evaluating the patient (Edwards, Marshall & Cook, 2006). The disadvantages that stem from neglect of the dynamic interactions of the initial interview are not only that the information obtained will be wrong and the assessment technically unsatisfactory, but also that damage will be done to what should have been the initiation of the treatment. The risks described above could be very dangerous for the assessment of the individual and for the therapy program, so we want to explore the use of virtual reality and its empowerment in case-history setting.

Moreover the first screening has to assess the family history of the patient, previous illness, drinking history, typical recent heavy drinking day, influence of drinking on personality, quantity of consumption and the salience of drinking in a patient’s life and subjective awareness of compulsion to drink. This information is very important in describing the patient’s personality, and his or her habits and lifestyle, but the therapist doesn’t have a lot of time to spend on the case history, so VR could be used to make the assessment process easier.

The aims of this article are: to describe a protocol in which the personality and social behaviour of alcoholics are assessed using virtual reality; and determine if there is a change in self efficacy and motivation improvement before and after protocol session. Specifically, the VR protocol could be used as an instrument to evaluate case history and symptoms and to improve the patient’s motivation towards accepting treatment and therefore changing behavior. Thus, virtual reality protocol investigates Intrapersonal factors (Emotional Management and Self Esteem) and Environmental factors (Relational Competences and Social Pressure). During the protocol, the therapist analyzes both verbal and non-verbal behaviour focusing on emotional responses, interactions with the virtual environment and the content of individual answers. In particular, it is expected that VR may improve motivation, self efficacy and awareness in the patient and so enhance the therapy.

Protocol
The protocol is based on four different virtual environments: the park; the apartment, the workplace and the restaurant. It was developed within the NeuroVR Project, a cost-free virtual reality platform based on open-source software. It offers the clinical professional a cost-free VR
Editor, which allows non-experts to easily modify a virtual world, best suiting the needs of the clinical setting.

The therapist observes the user’s non-verbal behaviour when he/she explores the apartment in which there are many emotional stimuli (wine, alcohol, beers etc…). In particular, the therapist observes: muscular contractions, facial expressions, leg or arm movements and patient’s discussions. The therapist uses different questions to help patients synthesize information and reach conclusions on their own. Usually the therapist poses hypothetical and neutral questions (for example: What do you feel when you see these bottles? What kind of emotions do you feel? Would you like to take one of these bottles? Which one?).

The structure of interaction is that the user stands still wearing the head mounted display. He or she handles a joy pad to move up and down within the virtual environment. In the first environment – the park - the interaction has three main goals: teaching the user how to move in the virtual environments; relaxing the user, and making a preliminary evaluation of both emotional and relational dimensions without direct links to alcohol use.

After the park session, the therapist may customize the two following environments according to the needs of the alcohol-dependent subject. There are two choices: the empty apartment and the alcoholic apartment. In both environments it’s possible to add drinks, bottles of vine, food, features and individuals (family, friends, the boss etc…).

In the empty apartment there are no people and only the essential features. In this environment the main goals of the assessment are to explore the patient’s habits, living conditions of the patient and family links. The therapist invites the user to look at the house by just rotating his or her head and body and asking the patient to imagine that this apartment is his or hers. The therapist asks if the patient likes the house, is happy, if the house lacks anything, and if he or she wants to change something. At the end of the questions, the patient closes their eyes and the therapist changes the environment.

In the alcoholic apartment there are some bottles of wine, beer, food and cigarettes in the kitchen, sitting room and in the roof garden. The therapist explores the nature and strength of the family and social links; evaluates the emotional arousal when the subject interact with significant others, such as their partner or children, or significant objects such as bottles of wine and drinks; and verifies the patient’s typical in-home alcohol consumption patterns. The therapist introduces this context by saying: “Once in this house lived an alcoholic man/woman who drank a lot. Now, you can look around the apartment.”

At the end of brief tale, the therapist asks some general questions and focuses the patient’s attention on drink bottles and asks some questions like: “How do you feel when you see these bottles?” or “Would you like to take one of these bottles? Which ones?” or “Would you like somebody to drink which? Who?” or “How long have you been drinking for?” or “How many bottles do you drink a day?” If the user says that he/she usually drinks at home, the therapist can investigate the emotional management proposing a bad situation and a pleasant situation.

Figure 1. The Park

Figure 2. Alcoholic Apartment
When the patient is in the house the therapist proposes a new situation, a job interview. Here the therapist wants to explore the sense of self-efficacy, the capacity to face an anxious task, the locus of control and the decision-making processes of the patient. The environment is an office in which the patient has an interview. The main goals are to investigate emotional management in a performance task, explore the sense of self-efficacy, examine behavior before and after the job interview, and understand if alcohol has a role for the patient in performance situations. The patient is asked a series of questions like “How do you feel when you come back home after work?” or “Do you usually speak with your colleagues?” At the end, the therapist introduces the patient to an office in which there are some people and asks about current job satisfaction and job expectations. If the patient is a student, the protocol provides a “student version” in which the student has to take an exam at the university. If the patient is a housewife, the protocol provides a “housewife version” in which the therapist explores the sense of efficacy, the level of satisfaction, the family links, and the housewife’s hobbies outside the home.

The last environment is the restaurant in which there are two rooms: a bar and a dining room. The patient enters in the bar and can drink an aperitif, then goes to eat in the dining room. Here, the therapist observes the behaviours of participants in a social context. The assessment has three main goals: to explore the subject’s behaviour when somebody invites him or her to drink; explore the influence of social pressure on drinking behaviour; and evaluate emotional arousal when the subject interacts with significant others not related to the family, such as his or her boss.

At the end of the session, the subject can take off the head mounted display and the therapist proposes a brief debriefing to comment on the experience. In particular, the therapist summarizes the principal aspects of the interview, specifically emotional management, level of arousal when the subject sees and interacts with alcohol, the family relationship and the management of drinking behavior.

CASE STUDY

This is the case of Maria, a housewife who lives in a northern Italian city. It shows with particular clarity the ability of the proposed approach in dealing with some features of alcoholism disturbance: alcohol abuse on a daily basis without motivation to change her situation. The following describes the history, the measures, and the assessment with the VR approach.

Case history

Maria is 55 years old and she is a Swedish immigrant. She has lived in Italy for twenty years and she speaks Italian very well. She asked for an appointment at National Service Care for alcohol abuse and she has been admitted for an assessment program. She has been drinking alcohol for five years but in the last period the situation has gotten worse. She drinks white wine, one to two liters a day. Maria shows a lot of features consistent with a possible alcohol abuse diagnosis: use of substances for a long period, constant desire to consume alcohol and reduction of social activity and relationships due to alcohol consumption (DSM IV, 1994). For a primary investigation of these symptoms, the patient was asked to give her medical history and to complete two questionnaires.
Method

Measures
In addition to the protocol described above patients are asked to complete the following questionnaires

- The Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1976; Dazzi, Pedrabissi, & Santinello, 2004) assesses the personality structure. The Italian version of the scale contains 69 dichotomised items; an example of which is “I’m a happy person”. According to Eysenck, it’s possible to devise three personality structures: extraversion, neuroticism and liar.

- Motivation Assessment of Change (MAC 2-A; Spiller & Zavan, 2005) measures the motivation of change. We use the alcoholism version. It contains 36 items and the participants were required to indicate how true each statement was for them on a 6-point Likert scale that ranged from false to true. It allowed to measurement of the changing steadies according to Transtheoretical Model (Prockasca, DiClemente & Norcross, 1992).

- Generalized self-efficacy questionnaire (Schwarzer & Jerusalem, 1995) assesses the sense of self-efficacy in the individual. The test contains ten 5-point Likert scale items ranging from 0 (not true) to 4 (really true). High scores indicate higher levels of self-efficacy.

- ITC SOPI (Lessiter, Freeeman, Keogh & Davidoff, 2001) is divided in two parts, A and B. Part A investigates the level of satisfaction after the VR session; part B investigates feelings, emotions and sensations during the VR session.

Procedure
The patient usually has three appointments with the National Service Care, and in the second appointment the VR protocol is employed. Maria’s first appointment was taken by a National Service Care worker who collected her medical history and completed her clinical record. At the end of the interview, the patient completed MAC 2-A (Spiller & Zavan, 2005) and Generalized Self-Efficacy Scale (Schwarzer & Jerusalem, 1995). In the second appointment the researcher presented the VR session and applied the protocol. Then, there was a debriefing and the administration of ITC SOPI (Lessiter, Freeeman, Keogh & Davidoff, 2001). In the last appointment, the researcher and the national service care worker gave a briefing of the assessment’s procedure and underlined the principal aspects of patient’s problems and disturbances. They proposed the treatment and the patient was sent to a specialist. At the end of the appointment the patient completed MAC 2-A (Spiller, Zavan, 2005), Generalized Self Efficacy Scale (Schwarzer & Jerusalem, 1995) and EPI (Eysenck, Eysenck, 1976; Dazzi, Pedrabissi & Santinello, 2004).

Maria’s protocol
When Maria entered the first environment, the park, she learned to move with the joy pad and head mounted display and decided to sit down on a bench. She said she likes this park because it is quiet, and there is sun and open air. She would like to meet a man to start a conversation and have a newspaper. She doesn’t want to see her husband. She relaxes and then closes her eyes, then the researcher changes environment. She enters an apartment and says she doesn’t like the house because it is too perfect and not very welcoming. She would like to change the furniture, the pictures and add some plants and flowers. The therapist begins to ask questions and the patient freely describes her history. She only drinks white wine. She bought the bottles at the supermarket and she drank all the bottles in a day. She doesn’t keep wine in the house. She usually drinks in the morning because when she gets up she hasn’t got the strength to do housework. The day is too long and empty. During the day she drinks wine, when she is at home, alone. She doesn’t like drinking with other people. On the other hand, in her house she feels sure of herself and she has built a little world with few objects, no relations and the bottles of wine.

She started drinking five years ago when she divorced her husband. He was very aggressive and beat her and their son. The divorce was both a good choice but also a difficult choice. She didn’t
have a job and so she didn’t have any money for her and her son. Now her son is grown up so he is independent and she feels useless. The alcohol is a way to stop her from feeling alone and facing difficult situations. When the therapist presented a pleasant situation and then a bad situation, the patient gave the same answer; she drinks a lot of wine alone and she goes to bed because she is tired. She doesn’t express any emotion. The patient is a housewife so the protocol analyzes the sense of self-efficacy and the quality of her life. The patient says that she wants a clean house but she only does the principal activities because she is always tired psychologically. She is worried for her son because she wants everything right for him. If she can’t do everything for him she feels guilty.

In the past she tried to find work but she was nearly always unsuccessful; today she does the occasional job for cash in hand. She spends nearly all her spare time at home so she can drink quietly and in private. Her only hobby is gardening and so when she gardens she drinks less than usual.

In the last environment (the restaurant) the patient says that she doesn’t like the restaurant because there are too many people, but if she has to go to the restaurant she will drink just like the others. If her friends invite her to go out for a drink she drinks so as not stand out because she’s afraid of being different. Also in this situation she drinks white wine but at the table prefers water. After drinking she feels tired and therefore goes to sleep without feeling guilty.

At the end of the VR session the therapist conducted debriefing which underlines: the difficulty in finding a balance between the past and the present. In the last years Maria has had to face a multitude of change: her son’s growing up and his independence, loneliness due to being without a partner, starting menopause, and economic problems. Alcohol has therefore become a way to relieve her suffering and to help her carry out her daily routine.

**Outcome**

Personality test shows a normal personality structure with neurotic traits; in fact the total score of neuroticism scale is 16; one point over the norm (Eysenck & Eysenck, 1976; Dazzi, Pedrabissi, & Santinello, 2004). Other scales are inside the normal range of values. The MAC 2-A is interesting, because there is a difference between the past and the present. Before the VR session, Maria focused her life on drinking and she was sure that she would never have stopped drinking because she hadn’t got the strength and the courage and she didn’t know any solution for her problem. A week after the VR session, the answers on MAC 2 were very different. Maria was still worried about drinking, but now she understood that there is a way to change her situation through the help of Alcoholism Service’s workers, and that the most important way to change is from within herself. In fact the question: “I think I’ll drink forever” in the first administration, Maria’s answer was “Quite true” (Likert point 4); in the second administration she answered “Not true” (point 1). The questionnaire also asks “I can’t resist the temptation to drink”, and at the beginning Maria answered “Really true” (Likert point 6), two weeks after the first appointment and after a week of VR sessions she answered “Half true” (Likert point 3). At the second administration, the total scores in “Desire/Temptation Scale” indicate that the desire to drink was less important for Maria; on the other hand the power of change and willingness increased. For total scores see table 2. In the third appointment, Maria also discussed her attempt to control her drinking through tight controls imposed upon herself.

Virtual reality could be an instrument that has an impact on patients and helps them to change their behavior. In fact the ITC SOPI test that measures the level of engagement in virtual environments, underlines a very high ecology validity; the patient believes to really be in a virtual world so his/her experience is similar to an experience that he/she could experience in the real world. Moreover the emotions in VR environments are positive; in fact the score on the “Negative Affect Scale” is under the mean score (Ne= 1.6; M= 2.5). The VR protocol is therefore providing an engaging situation and a good experience for the patient, as shown in the table below (tab.1).
On the other hand, the self-efficacy scale didn’t show any change. The total score was the same at the beginning and at the end of the assessment process; probably because the VR protocol doesn’t provide an environment in which self-efficacy can improve; and the researcher doesn’t provide an explicit treatment but only an evaluation.

<table>
<thead>
<tr>
<th>TEST SUBSCALES</th>
<th>SCORE</th>
<th>NORMALITY</th>
<th>MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPI Neuroticism</td>
<td>0</td>
<td>N &lt; 8</td>
<td></td>
</tr>
<tr>
<td>EPI Lie</td>
<td>10</td>
<td>N &lt; 18</td>
<td></td>
</tr>
<tr>
<td>EPI Extraversion</td>
<td>16</td>
<td>N &lt; 15</td>
<td></td>
</tr>
<tr>
<td>ITC SOPI Spatial presence</td>
<td>2.88</td>
<td>M = 2.5</td>
<td></td>
</tr>
<tr>
<td>ITC SOPI Engagement</td>
<td>3.08</td>
<td>M = 2.5</td>
<td></td>
</tr>
<tr>
<td>ITC SOPI Ecological validity</td>
<td>4</td>
<td>M = 2.5</td>
<td></td>
</tr>
<tr>
<td>ITC SOPI Negative affects</td>
<td>1.6</td>
<td>M = 2.5</td>
<td></td>
</tr>
</tbody>
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Tab. 1: Tests scores administrated at only one time

<table>
<thead>
<tr>
<th>TEST SUBSCALES</th>
<th>BEFORE VR</th>
<th>AFTER VR</th>
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</thead>
<tbody>
<tr>
<td>MAC 2-A Internal shift</td>
<td>96</td>
<td>80</td>
</tr>
<tr>
<td>MAC 2-A Self efficacy</td>
<td>66</td>
<td>80</td>
</tr>
<tr>
<td>MAC 2-A Willingness to change</td>
<td>50</td>
<td>68</td>
</tr>
<tr>
<td>MAC 2-A Desire/temptation</td>
<td>50</td>
<td>34</td>
</tr>
<tr>
<td>MAC 2-A Power of change</td>
<td>34</td>
<td>50</td>
</tr>
</tbody>
</table>

Tab. 2: Tests scores before and after VR session

**Discussion**

Addictions are some of the more frustrating forms of psychopathology because they involve the whole person and all aspects of his or her social life, affect, relationships and work. The traditional instruments in evaluating this disturbance are well known and used in every national service care; but alcoholism service care operators complain about the difficulty of engaging the patient in treatment and creating an internal motivation to change. VR environments could be instruments to improve the motivation and engage the patient because it is a friendly and enjoyable experience in which the patient is collocated in an immersive context where he/she can test his/her behavior, attitudes emotions and understanding, with the therapist’s help. Indeed some aspects may emerge that in a face to face discussion could not. Moreover, the VR protocol assures a greater distance between patient and therapist. The patient is often ashamed to talk about the most difficult and secret aspects of his or her history when facing the therapist. On the other hand, if the patient is immersed in virtual reality he/she doesn’t focus on the fact that there is a therapist in the room; it is more likely that the patient can talk about his/her history more freely.

Maria’s case shows that the VR protocol is effective in bringing out the intrapersonal and interpersonal factors and the principal aspects of the patient’s case history: affects, relations, emotions, intentions and behaviour. When Maria entered the VR environment she talked about her story without stopping. The therapist learned about many aspects of her past and present life, her relationships, her family history, her attitudes, her intentions and her drinking habits. The advantage of VR is that the therapist obtains more information and the patient is calm and feels at ease. Maria’s tests administrated before and after the VR session underline that the VR protocol may have been an element that motivated Maria to begin a change in her drinking habits. In fact the answers at MAC 2-A were very different at the end of the assessment and they show a greater engagement in limiting her drinking and more motivation to really change. This VR protocol could be a new form of assessment in alcohol addiction. Of course, these results are preliminary, because it has been applied to only one case and the study is still in progress. In light of these results we intend to increase the sample size. Although the data are promising we have to test this approach in a controlled clinical trial comparing the VR assessment with traditional assessment.
References


