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# Chapter 13
# Virtual Reality and Psychotic Disorders


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## Introduction

In the early years of virtual reality in mental healthcare several reviews were published (Gregg and Tarrier 2007; G. Riva 2002; 2003; 2005). None of them mentions work done on virtual reality with psychotic disorders yet, though some early work was starting to get published around the same time. There are different psychotic disorders with each their own specified combination of symptom domains, symptom intensity and duration. Wood et al. (2011) suggest a dimensional staging of psychosis, ranging from psychotic-like experiences to severe persistent psychotic episodes. A large body of research is accumulating showing psychotic symptoms can be seen as a transdiagnostic and extended phenotype found in the general population (J. van Os and Reininghaus 2016). When psychotic experiences persist, transition to a psychotic disorder becomes a possibility. The main recognizable symptom domains of psychotic disorders are hallucinations and delusions. Hallucinations are perceptions a person experiences without a corresponding external stimulus. Hallucinations can occur for all five senses. Patients with a psychotic disorder for example often experience auditory hallucinations such as hearing voices. These voices can be

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commentary, give orders to the patient or call them names. Delusions are beliefs people have about the external reality which are strongly maintained despite strong evidence to the contrary or despite what almost everybody else (of a person's culture or subculture) believes. The most common delusion found in psychotic disorders is the persecutory delusion (paranoia). People with a persecutory delusion feel others (known or unknown) spy on them, pursue them and threaten their safety (van der Gaag, 2012) Hallucinations and delusions often cause anxiety and make the patient avoid (social) situations, which can be treated with exposure therapy. Other symptom domains of psychotic disorders are negative symptoms and impaired cognition. Patients with negative symptoms experience an diminished emotional expression and avolition. Impaired cognition is about learning deficiencies, whether insufficiently thought or thwarted by deficits. For both negative symptoms and impaired cognition training can help patients learn to master new skills. There are some additional symptom domains in psychotic disorders, but these don't play a part in virtual reality (yet). See Box 13.1 for an overview.

**Box 13.1 Symptom Domains of Psychotic Disorders**

1. **Delusion**: fixed beliefs despite evidence to the contrary.
2. **Hallucination:** perceptions without a corresponding external stimulus
3. **Disorganized Speech:** examples are neologisms, loose associations and perseveration.
4. **Abnormal Psychomotor Behaviour**: unusual movement or gestures
5. **Negative Symptoms**: diminished emotional expression and avolition.
6. **Impaired cognition**: deficienties can be found particularly in memory, attention and executive functioning.
7. **Depression:** a state of low mood and activity
8. **Mania**: a state of elevated mood and activity

(Heckers et al. 2013)

Even though more effective treatment options in medicine and psychotherapy have become available for psychotic disorders over the last decades, they do not work (well) for every patient. They can suffer from persistent symptoms and a substantial group of patients experiences functional limitations (Galderisi et al. 2013; Üçok and Ergül 2014; Zimmermann et al. 2005). Virtual reality could help us improve our understanding of psychotic disorders and improve treatment by providing an accessible and realistic environment for both practice and exposure exercises. Two studies published from the same group showed that (brief) virtual experiences were safe and acceptable for patients with psychosis (Fornells-Ambrojo et al. 2008) and for patients assessed with an at risk mental state for psychosis (Valmaggia et al. 2007), opening up possibilities for further research. A more recent review confirms safety and acceptability of using virtual reality with people experiencing psychotic symptoms (Rus-Calafell et al. 2017). An interesting publication on virtual reality for psychotic disorders was the 2008 article by Daniel Freeman 'Studying and

Treating Schizophrenia using Virtual Reality: a new paradigm'. In this article Freeman outlines seven possible uses of virtual reality for psychosis, as can be seen in Box 13.2. In two of the categories Freeman mentions, assessment and treatment, scientific research has made a decent start. A review by Veling et al. (2014) gives an update on virtual reality assessment and treatment in psychosis. Virtual reality applications for assessment and treatment seem to have great potential for enhancing our understanding of psychotic disorders and expanding the therapeutic toolbox with virtual training environments and exposure in virtual environments. Systematic review shows that, while promising, applications for assessment and treatment are in their infancy, and for most other categories of use work is just starting (Valmaggia et al. 2016). New treatments are being researched even if we don't fully understand the underlying effective mechanisms yet. This is common in psychology, and the interaction between treatment and exploring effective components gives opportunities direction to future research.

**Box 13.2 Seven Possible Uses of Virtual Reality for Psychotic Disorders According to Freeman (2008)**

1. Symptom assessment
2. Establishing symptom correlates
3. Identification of predictive variables
4. Identification of differential predictors
5. Identifying environmental predictors
6. Establishing causal factors
7. Developing treatment

When new technologies become available the first logical step is to translate and enhance existing research methods and treatments using the new medium. Virtual reality has been following a similar path. Social skills training is done with virtual people instead of real people, a 3D-virtual maze is used instead of a 2D-maze on the computer and paranoia is researched with virtual social situations instead of real (staged) ones. Virtual reality technology offers new possibilities for such core research and should continue. But a parallel path to follow would be to think outside of the box and use virtual reality to re-innovate healthcare for psychotic disorders. This chapter aims to give a general overview of the scientific work done on virtual reality in the assessment and treatment of psychotic disorders and addresses future challenges and possibilities.

## Assessment

One of the possible uses of virtual reality for psychotic disorders is assessment. A review on using virtual reality in objectifying the process of diagnosing psychiatric disorders (van Bennekom et al. 2017) shows a variety of behavior and symptoms

could potentially be assessed. A review on using virtual reality in assessment of psychosis suggests it to be a promising method for establishing cognitive deficits and relevant clinical symptoms (M. Rus-Calafell et al. 2017). On the assessment of two symptom domains of psychotic disorders some first research has been done; the assessment of (persecutory) delusions and the assessment of impaired cognition. Also, studies on the assessment of hallucinations and negative symptoms are starting to emerge.

## *Assessment of Delusions and Hallucinations*

A common symptom of psychosis is paranoia. Paranoia in particular is a symptom that is inextricably connected to the social environment. Environmental factors have been associated with the development of psychotic symptoms such as paranoia (van Os et al. 2010; Wim Veling et al. 2006). In the Camberwell walk study (Ellett et al. 2008) the effects of exposure to one specific deprived urban environment on thirty individuals with persecutory delusions were studied. The individuals showed increased levels of anxiety, negative beliefs about others and jumping to conclusions. Their paranoia also increased. Freeman (2008) describes that studying paranoia using virtual reality applications has several advantages. In some cases suspiciousness about other people in real life may indeed be valid concerns. Because virtual reality gives the researcher complete control over the social environment, any paranoid thoughts that are grounded in reality can be ruled out. Also, strange behavior of other people in the social environment in real life may be an interaction effect with the behavior presented by the paranoid patient. If a paranoid person behaves divergent or awkward, other people in the environment are bound to take notice and react to this. Another advantage of virtual reality is the level of control about the social environment that is possible. While real-life social situations are variable, virtual reality can be used to create consistent social environments each time. A study (Fornells-Ambrojo et al. 2008) on the safety and feasibility of the use of virtual reality on people with persecutory delusions compared twenty paranoid patients with twenty non-clinical individuals. Each participant spent 4 min in an underground train with neutral virtual humans using a head-mounted display. A high percentage (65%) of the participants with persecutory delusions experienced paranoid thoughts about the neutral virtual humans in the virtual train. Interestingly, this percentage did not differ significantly from the non-clinical group. Other findings showed that the virtual reality experience did not raise symptoms of anxiety or simulator sickness. During the follow-up no side effects were reported by the participants. A study (Veling et al. 2016) linking virtual social environments and paranoia compared Fifty-five patients with recent onset psychotic disorder, 20 patients at ultra high risk for psychosis, 42 siblings of patients with psychosis, and 53 controls.. Subjects participated in five experiments with different levels of social stress during which they walked in a virtual café (see Fig. 13.1) for about 4 min. The effect of three suspect environmental factors for paranoia was tested: density of virtual

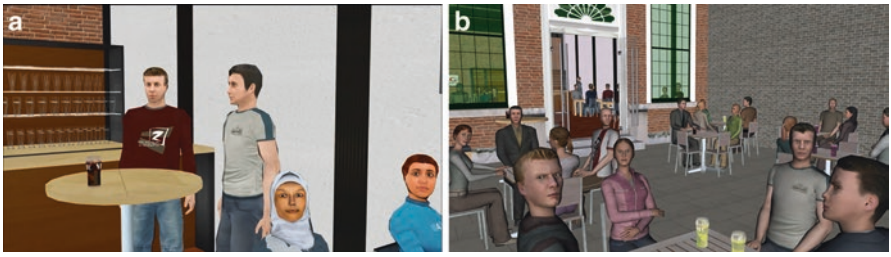


**Fig. 13.1** Virtual café

visitors (being in a crowded or less crowded environment) and ethnicity of the virtual humans (café visitors with a person's own or from another ethnicity group) and hostility (avatars looked in an angry, hostile fashion at participants). Most participants showed some degree of paranoid thoughts about the virtual humans. Paranoia and subjective distress increased with degree of social stress in the virtual environment. Psychosis liability and pre-existing symptoms positively impacted the level of paranoia and distress in response to social stress.

Another study (Fornells-Ambrojo et al. 2013) looking into threat evaluation in a controlled virtual social environment again found people with persecutory delusions to report the same levels of paranoia as non-clinical participants. Thematic analysis of interviews from participants about the decision making process involved, showed that people with persecutory delusions are able to use a similar range of strategies when judging potential threat in a non-anxious making neutral environment. However, they were found less likely than controls to engage in active hypothesis-testing. They were found to favor their experienced affect in the environment as evidence of persecutory intention. More extensive research with a non-clinical population has been done by (Freeman et al. 2008a, b). They performed a large study (N = 200) with members of the general public, in which a substantial minority reported paranoia about virtual humans when exposed to a neutral social situation (train). This paranoia was predicted by anxiety, worry, perceptual anomalies and cognitive inflexibilities, similar factors as are found to predict paranoia in patients with persecutory delusions. (Freeman et al. 2010a, b) continued using virtual reality to investigate a possible continuum of delusional beliefs by researching three groups with different levels of paranoia, namely a nonclinical group with low paranoia (N = 30), a nonclinical group with high paranoia (N = 30) and a group with persecutory delusions (N = 30). The experienced levels of paranoia in the virtual environment differed significantly for each of the groups. Overall, the results of the study were consistent with the notion that there is a spectrum of paranoia in the general population. Together these studies show the research benefit virtual reality brings as the accumulated virtual reality research provides growing evidence for the notion that paranoia is a common trait that can be found in the general population, but in severe forms is a symptom of psychotic disorders. This also means that in an early development state of a virtual environment, its ability to evoke paranoid thought could initially be evaluated with a non-clinical sample and only involving

a clinical sample at a later stage. This ability could even be further enhance by priming individuals by showing video and let them read text about aggression prior to exposure in the virtual environment (Isnanda et al. 2013).

But why do some people get paranoid in a social environment, while other people get socially anxious? Virtual reality can help differentiate not only between patients and healthy controls, but also between overlapping symptoms. A large study (Freeman et al. 2008a, b) on differential prediction between paranoia and social anxiety assessed two hundred non-clinical individuals. All participants were exposed to a neutral virtual environment for 5 min, representing a train ride between two stops. The study showed that paranoia and social anxiety share many predictive factors such as anxiety, depression, worry and interpersonal sensitivity. However, experienced perceptual anomalies were a distinct predictor only for paranoia. The presence of these perceptual anomalies increased the risk for paranoia, yet decreased the risk of social anxiety. Research shows the level of self-confidence also affects the occurrence of paranoia (Atherton et al. 2016). Patients do not only have difficulties with interpreting social situations, but distortions in reality perception, self-image and dysfunction in emotional processing seem to complicate their interaction with the environment even more. Perceptual anomalies or distortion in reality perception is a common manifestation in schizophrenia. Sorkin et al. (2008) created a virtual environment in which incoherencies could be found. Examples of these incoherencies are a red cloud, a guitar producing trumpet sounds and a giraffe grazing in a local store. Patients with schizophrenia (N = 43) and healthy controls (N = 29) were asked to detect the incoherencies. The healthy controls were reliably able to do so. Of the patients group, 88% failed in the task. They had specific difficulties when de incoherency was audio-visual, and this was significantly correlated with the PANSS hallucinations scale.

## *Assessment of Negative Symptoms and Impaired Cognition*

Dysfunction in emotional processing is found in many patients with psychotic disorders. Park et al. (2009a) used virtual reality to simulate social encounters with virtual humans expressing happy, neutral or angry emotions. Twenty-seven patients with schizophrenia and twenty-seven healthy controls participated in the study. The patient group reported experiencing a significantly higher level of state anxiety in response to the interactions with happy virtual humans than the control group. This state anxiety with happy virtual humans correlated significantly with measures of negative symptoms such as social anhedonia, blunted affect and emotional withdrawal. The findings suggested interference in the experience of pleasure in social interactions in patients with schizophrenia. In a study with twenty schizophrenia patients and twenty control subjects, Dyck et al. (2010) found that emotion recognition impairments not only emerged when emotions were expressed by natural faces but also when the emotion was expressed by a virtual face. Confirming the usability of virtual faces to explore mechanisms of emotion recognition. Souto et al. (2013)

experimented with emotional recognition in a small trial with twelve patients with schizophrenia and twelve controls. Their results showed the emotions of happiness and anger to be better recognized by both groups compared to other emotions. Difficulties arose in the recognition of both fear and disgust. Bekele et al. (Bekele et al. 2017) show virtual reality can be used to research differences in the way individuals with schizophrenia process and respond to emotional faces compared with healthy control participants. Again, the benefit of all these virtual reality studies is to establish new insights.

Virtual environments can be used as a measure of cognitive functioning (Zawadzki et al. 2013). Such studies on memory (García-Montes et al. 2014; Spieker et al. 2012; Weniger and Irle 2008; Wilkins et al. 2013a; b) and visuo-spatial mechanisms (Thirioux et al. 2014) give us a better understanding of the processes in the brain that play a role in psychotic disorders. (Sorkin et al. 2005, 2006) attempted to develop an automatic tool for the diagnosis of schizophrenia. They studied sensory integration within working memory using a navigation task through a virtual reality maze. Thirty-nine patients with schizophrenia and twenty-one healthy controls participated in the study. They developed a procedure for classification based on the cognitive performance profile of the participants in the virtual maze. The classification system correctly predicted 85% of the patients with schizophrenia and all of the controls. Using virtual reality for the assessment of prospective memory has shown good construct validity, test–retest reliability, sensitivity and specificity in the context of first-episode schizophrenia (Man et al. 2016). However, because people suffering from mental disorders other than schizophrenia also regularly experience similar cognitive problems the question rises whether the current tools could be used to diagnose schizophrenia or rather assess more general problems with cognitive performance. A lack of cognitive flexibility has previously been linked with schizophrenia. Mental rigidity seems to hinder individuals in being able to discover or employ alternative solutions. A study on the assessment of cognitive flexibility (Han et al. 2012) found virtual reality to be an ecological valid measure for cognitive flexibility in patients with schizophrenia.

Real-life functioning is impaired for many individuals with a psychotic disorder, so Greenwood et al. (Greenwood et al. 2016) created a virtual shopping environment for assessment. They found the virtual functional shopping measures to enhance the predictions of real life performance, over and above existing cognitive testing. Another real-life behavior that can be assessed by using virtual reality is medication adherence. Medication is often used in the treatment of psychotic disorders, but medication compliance is a problem. One of the reasons for poor compliance is impaired cognition. A virtual reality study (Baker et al. 2006) using a virtual apartment, including helpful tools such as a clock and a reminder note on the refrigerator, studied medication compliance behavior in patients (N = 25) and controls (N = 18). The results demonstrated that the participating patients showed more difficulty in being able to comply with the medication regime than controls. The results suggest possible future use of such a virtual task as a measure of medication compliance. Virtual social environments were also used in a study to assess social behavior in patients with schizophrenia (K.-M. Park et al. 2009b). A head-mounted display

was used to present a 3D-virtual environment in which the subjects socially interacted with an virtual human. Social performance was measured. A significant difference was found in functional skills between the twenty-four female patients and fifteen healthy females. The research also showed the virtual assessment technique to be sensitive to change in social competence, making it possible to use it for short-term clinical trials. In real life social situations are often complex, and Han et al. (2014) took a step in creating a more complex virtual social environment to assess abnormal social characteristics in patients with schizophrenia (N = 23) compared with healthy controls (N = 22). They created a virtual three-party conversation task which included emotion-laden situations and both speaking and listening phases in the conversation. Patients with schizophrenia were found to have an active avoidance of eye-contact during the three-party conversation. Though overall research is limited yet and more development is needed, virtual environments do seem to be able to complement the existing methods for assessment of symptoms and behaviors in patients with a psychotic disorder.

Virtual reality also offers new creative options to explore mechanisms. Using a person's height as a marker for social status and authority, Freeman et al. (2014) manipulated the height of participants in the virtual social environment. They experienced, in randomized order, a train ride between stations while attributing either their normal height or a reduced height. Interestingly, reducing a person's height in the virtual social environment did indeed result in more negative views about the self in relation to other people. People also experienced increased levels of paranoia when their height was reduced, but this was fully mediated by the changes in social comparison.

## Treatment

The second category in which virtual reality is explored for psychotic disorders is treatment. Virtual reality techniques are used for enhancing established therapies such as skills training and virtual reality assisted therapies (M. Rus-Calafell et al. 2017). Cognitive behavioral therapy is often used in treating avoidance behavior when people experience delusions or hallucinations. Skills training can be used when treating the symptom domains negative symptoms, social skills and impaired cognition.

### *Treatment in Delusions and Hallucinations*

Can virtual environments also be used for the treatment of social anxiety in people with psychosis? Symptoms of social anxiety in people with a psychotic disorder are common, even after their psychotic symptoms are in remission (Achim et al. 2011). Virtual environments using video capture were developed (Gega et al. 2013) in a

pilot study to answer this question. The environments were used as a complement to cognitive behavior therapy. Six patients recovering from psychosis and suffering from social anxiety used interaction exposure in a virtual environment in their treatment program. Interesting about the video capture system was that participants were able to actually see a life-sized projection of themselves interact in the social environment. Results suggest the use of virtual reality could help patients understand the role of avoidance and the use of safety behaviors in the development and maintenance of symptoms. The next step would be to see if practicing cognitive and behavioral techniques such as exposure in virtual social environments enables patients to change their behavior in real life.

There is ample evidence that CBT with in virtuo exposure can be used to treat anxiety disorders (Meyerbröker and Emmelkamp 2010; Opriş et al. 2012), and now evidence is emerging that it can also be used in treating anxiety disorders in patients with a psychotic disorder. But could CBT with exposure in virtuo also be used to treat the avoidance seen in reaction to delusions and hallucinations in psychotic disorders? Treating paranoia seems a likely first candidate, due to the role of anxiety and avoidance in the development and persistence of paranoid delusions. The earlier mentioned study by Veling et al. (2014) found patients experiences of paranoia in everyday life to correlate with the experience paranoia of in virtual social environments. Broome et al. (2013) showed healthy participants (N = 32) an urban street scene in virtual reality using a head mounted display. The virtual scene was based on an actual street in a local deprived area. They demonstrated that the virtual street scene was able to elicit more paranoia in the participants than a virtual indoor environment. These results support the notion that factors in the urban environment play a role in experiencing paranoid thoughts, and virtual social environments could be used as an exposure tool for therapists. An experimental study by Freeman (Freeman et al. 2016) showed even a brief virtual reality intervention on testing treat belief and dropping safety behavior can lead to impressive reductions in delusional conviction and real-world distress. An obvious next step in research would be to study CBT with in virtuo exposure for treating patients with a psychotic disorder. Currently a study (www.controlled-trials.com/ISRCTN12929657/) is being conducted in The Netherlands attempting just that. From technological perspective, a next step would be to enhance the therapist control over the stimuli in the virtual environment, giving them the ability to personalize it and to gradually increase the level of stimulating material during a session in virtual reality. Instead of focusing a single paranoia-evoking element in the virtual environment, Isnanda et al. (2014) developed a virtual restaurant environment (see Fig. 13.2) that included a large set of these elements such as facial expression of virtual restaurant visitors, their eye gaze directed towards the individual being exposed, snatches visitors' conversation or laughter, flash news messages on TV screens, people passing by who could also stop and look around. Using a non-clinical sample (N = 24), Isnanda et al. found that controlling the stream by which these events occur in the virtual environment could affect the number of paranoid comments made when people described their experience in the virtual restaurant environment.


**Fig. 13.2** Virtual restaurant

**Fig. 13.3** AVATAR Therapy

Virtual reality can also be used for developing novel therapeutic interventions. Leff et al. (2013) created a new approach to the treatment of auditory hallucinations, which they called 'AVATAR Therapy'. Patients suffering from auditory hallucinations often feel hallucinatory voices to be powerful and able punish the patient when ignoring its commands. With CBT patients learn to conduct behavioral experiments showing the voices to be uncomfortable but otherwise harmless. The AVATAR Therapy research group developed a computerized system that enables patients to create an avatar, as to give a face to go with their persecutory auditory hallucinations, and the therapist can modify his or her voice to talk with patients through the avatar. This enables a dialog between patient and this virtual persecutor. The therapist controls the attitude of the avatar towards the patient. Gradually the therapist changes the attitude of the avatar towards the patient from controlling to yielding, giving the patient more control in the dialogue. This proof of concept study and the recent pilot study (Craig et al. 2014) show promising results. The AVATAR therapy is currently being tested in a larger controlled study in the Institute of Psychiatry, Psychology and Neuroscience (King's College London) and the results are expected by 2017. Some replications of the AVATAR therapy study can be seen in Fig. 13.3.

### *Treatment of Negative Symptoms and Impaired Cognition*

Next to anxiety being a disabling factor in social situations, some patients might also lack some of the basic social skills needed to interact with other people. Virtual reality offers the possibility of training skills in a (social) environment developed for just that purpose. One of the problems people with a psychotic disorder face is low employment rates. Because employment is such an important part of autonomy, and building a life for yourself, this is a major concern. Bell and Weinstein (2011) developed a job interview skills training for people with psychiatric disability, among whom were patients diagnosed with schizophrenia. The goal was to provide an experience where participants could improve their job interview skills, reduce fear and increase their confidence about doing job interviews. One of the special features was ongoing feedback by an on-screen coach. The feasibility trial showed that participants found the virtual environment easy to use and thought the experience realistic and helpful. Participants indicated their anxiety lessened as their skills improved. Additional research on virtual reality job interview training specifically with individuals diagnosed with schizophrenia, shows trainees have greater odds of receiving a job offer and had to wait fewer weeks before receiving a job offer (Smith et al. 2015). A virtual job interview training could provide great help in the first steps towards employment. But could virtual reality also help in job training, improving patients chances to keep a job? Tsang and Man (2013) created a virtual reality based vocational training which they researched in a single, blinded, randomized clinical trial (N = 95). They developed a virtual shop to create a working environment for the participants, including a store room, entrance and inner shop where the trainee could interact with virtual costumers and practice problem-solving skills. Patients in the virtual reality training group showed improvement in cognitive functioning. Results also suggested that using virtual reality training may offer a better generalization effect than that of patients receiving a therapist-administered training; with the same training duration the virtual reality group performed better in real-life environments than the therapist group. A virtual reality-based vocational rehabilitation training program (Sohn et al. 2016) for people with schizophrenia found an improvement on general psychosocial function and on memory. Other researchers (Rus-Calafell et al. 2014) created a virtual reality program to be used in a social skills training intervention. The virtual reality program enabled patients meeting schizophrenia or schizoaffective criteria (N = 12) to practice social interventions with virtual humans. The program focused on the learning of social skills and provided positive or negative reinforcement. The virtual environments included conversational interaction with the virtual humans and special care was taken to include facial expressions. Results of the pilot study showed improvements in social anxiety and discomfort and social functioning. An important conclusion was that the use of the virtual reality program contributed to the generalization of the acquired skills of the patients to their everyday lives. Park et al. (2011) found that using virtual reality in role-playing for patients with schizophrenia may be particularly helpful for improving conversational skills and assertiveness. They also

found that motivation for the training and generalization of skills were greater for patients in the virtual reality role-playing group than for patients in a traditional role-playing group.

As mentioned under assessment, reality distortion is common in schizophrenia and interferes with one's ability to function. Could virtual reality be used to reduce reality distortion? Moritz et al. (2014) explored this concept in a trial with thirty-three patients diagnosed with schizophrenia. Patients were instructed to navigate through a virtual street on two occasions (noise vs no noise), meeting six different pedestrians. Patients were then asked to recall information about the facial affect of the pedestrians. Afterwards, error feedback was given by both a computer display and the experimenter. The paranoia score declined significantly at a medium effect size. Further research is needed to explore what happens in the learning process. Chan et al. (2010) explored the possibility to use virtual reality in a cognitive training program among older adults with schizophrenia. Participants were randomized in an intervention group (N = 12) or a control group (N = 15). After the 10-session program the intervention group performed significantly better in overall cognitive functioning than the control group. Overall, using virtual reality to learn new skills is a promising research area. Especially interesting is the trend that training skills in a virtual reality environment tend to generalize into real-life, because this is a common problem with traditional skill-training in a therapeutic setting.

## Conclusion and Future Developments of Virtual Reality and Psychosis

A systematic review (Alvarez-Jimenez et al. 2014) on internet- and mobile based intervention for the treatment of psychosis showed that 74–86% of the participating patients were able to use the web-based interventions effectively. Of the patients 75–92% perceived the interventions as positive and useful. A number of 70–86% completed the intervention or were engaged in it over the follow-up. Internet- and mobile interventions for psychosis are acceptable, feasible, and have potential to improve our mental healthcare. Ben-Zeev (2014) outlines some important advantages of new technologies such as increasing patients access to evidence based care. He also proposes that technology could facilitate new paradigms in treatment using things like wireless connections, sensors on telephones and tablets and the internet blended together, to help enhance the individual effectiveness of our treatments. Virtual Reality is part of this larger technological emergence we see in every-day life offering a range of tools, among which augmented reality and real-time applications such as Apps, to develop new evidence-based treatments and improve the understanding of psychotic disorders. Assessment and treatment are the two areas where most research on virtual reality and psychotic disorders has been done. Still, this research consists largely of proof-of-concept studies and small trials. Other possible uses for virtual reality are largely left unexplored yet. Most studies being

conducted explore the use of virtual reality for enhancing existing methods of assessment and therapy. A few studies are emerging that explore novel approaches in how virtual reality can be used in research on psychotic disorders. Not only is additional research necessary to add to the small body of existing science on the subject of virtual reality and psychotic disorders, it also challenges researchers to utilize the full range of potential of this new technology. Virtual Reality is part of a larger process in the research and treatment of psychotic disorders were we move away from the unreality of the therapist office towards the real-time reality of everyday life. Virtual reality brings the real world into the therapist office, while augmented reality and Apps will bring therapy into the real world. Ideally, in the future, we can offer patients interventions directly when the distress in real life occurs because smartphones and watches, augmented reality glasses and Apps help monitor and signal when problems occur. They could also instantly offer personalized interventions. Until eventually research and therapy fully merge with everyday life, leaving behind us the days where we can only try to approach it.

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