Chapter 12
Using Virtual Reality and Other Computer Technologies to Implement Cognitive-Behavior Therapy for the Treatment of Anxiety Disorders in Youth

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Introduction

Among the therapeutic strategies used in the treatment of anxiety, behavioral approaches featuring exposure to aversive stimuli occupy a central role. Research on the effectiveness of cognitive-behavior therapy (CBT) in the treatment of anxiety disorders generally places exposure at the heart of therapeutic change. In fact, these studies have shown their empirical effectiveness in adults as well as children (Barrett 2009; Carr 2009; Cartwright-Hatton et al. 2004). Despite their proven effectiveness, exposures can present significant challenges to the therapist as well as the client (see Bouchard et al. 2004; Davis et al. 2009).

Confronting a phobic stimulus may, for example, generate significant anxiety in clients, mobilizing routine avoidance strategies, and as a consequence undermine client motivation. In fact, during exposure clients may be reticent or may even stop therapy for the fear of being exposed to a highly frightening object or situation. In order to lessen the anticipated anxiety that the client feels toward the exposure exercises in vivo, the therapist can integrate relaxation or breathing exercises before the

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exposure exercises or employ imaginal exposure. This last strategy may be inconvenient or involve a high cost/benefit ratio. One of the difficulties is that the therapist cannot directly know what the client thinks or is exposed to during the imaginal exposure exercises, which diminishes therapist control over circumstances that could influence the success of the intervention. For example, in imaginal exposure, it is difficult for the therapist to predict the intensity of arousal generated by the phobic stimulus. It is equally impossible to verify if, during the exercise, the exposure process is affected by cognitive avoidance or if the client is avoidant by distracting himself[1] or by thinking of something else.

During in vivo exposure, the therapist possesses some, albeit limited, control over the environment and on the variables surrounding the exposure process (Bouchard et al. 2003). For example, predicting and controlling animal behavior during exposure for the treatment of an animal-type phobia often represents a difficult challenge for the therapist. Dogs can become overly excitable and jump or bark more than anticipated. Although it can be useful to push exposure to limits that surpass everyday life situations (e.g., asking an arachnophobic child to touch a tarantula, or requesting a child who suffers from contamination obsessions to touch a series of dirty objects), it is most useful when a therapist can control the amount and extent of exposure (Kendall et al. 2005). It is also potentially therapeutic to vary the context during the process of exposure (e.g., exposing an arachnophobic youth to spiders of different sizes, or exposing a child who fears injections to either a chaotic or calm atmosphere, with or without adult support, when taking a blood sample or receiving a vaccination) in order to offer preferentially greater habituation as well as more opportunities for generalization of knowledge. The ultimate objective for controlling and varying the parameters of exposure is to maximize and stabilize gains incurred by the client. In certain circumstances, this effect can be achieved by exposing the youth over and above what natural conditions permit.

When exposing the child to situations that are potentially alarming or provocative, the therapist is at times confronted with the difficulty of maximizing the level of anxiety that can be tolerated by the child, while facing the fearful object. A situation that should arouse little anxiety can, at the time of exposure, prove to be more anxiety provoking than anticipated. For example, a child might panic at the sight of a dog that has more threatening behaviors than those foreseen in the exposure hierarchy (e.g., a dog that barks or is overly active during the first contact with the child). Problems with the exposure experiment (e.g., an elevator malfunctioning or especially loud thunder during a session of exposure with a child that is frightened of storms) or other unpredictable situations (e.g., a traffic jam or a road accident during an exposure exercise with a phobic adolescent in a car) can disrupt the exposure experiment, forcing a higher level of exposure in the hierarchy, but can also hamper the alliance the patient has with the therapist or his trust in the therapeutic process.

[1] For consistency, “he” and “him” will be used to represent both boys and girls.

In vivo exposure can present other difficulties related to the specificity of certain anxiety concerns and certain provocative situations. These situations may be challenging or impossible to create. For example, the therapist has limited capability to control weather conditions necessary for in vivo exposure for a phobia of storms, or similar difficulty creating a hierarchy of safe fire exposure for a child presenting with posttraumatic stress following a residential fire. The psychologist may also have difficulty recruiting volunteers in order to carry out the necessary exposure exercises in the treatment of certain types of anxiety concerns. Consider the treatment of social anxiety, where children are incapacitated by the fear of speaking in front of the class. The actual classmates required in order to recreate the exposure environment (the class) are not usually available at the time of the client's therapy, may not be interested in participating in such an activity, may not want to participate in the exposure, or may not be respectful of or understand the therapeutic process or confidentiality that is required. In other cases, confidentiality concerns might render in vivo exposure difficult, as it might be in the case for this socially phobic child who fears speaking in front of the class. Therapists who want to establish an exposure hierarchy for in vivo situations are frequently confronted with almost insurmountable challenges, most notably when the time comes to expose their clients to phobic stimuli.

Beyond difficulties associated with exposure strategies, other factors may hinder the use of this therapeutic approach. Economically speaking, the expense incurred in participating in certain types of exposure (e.g., exposure to overcome the fear of flying on an airplane), the costs of professional resources (fees for longer term therapeutic approaches, loss of time for the therapist and for the client), as well as the cost of therapy equipment, constitute variables that can affect the decision of children, their families, and adults to engage in therapy (Stephens and Joubert 2001). Other factors such as the difficulty of children to adhere to a treatment regime, the lack of flexibility in the schedules of families, and the lack of trained professionals in certain geographic areas add to the set of difficulties that can limit the accessibility of psychological services offered to individuals in need.

The arrival of new technologies in the field of mental health can offer greater alternatives to the more traditional methods of exposure as well as make up for the previously mentioned limitations. The development of new information and technologies of communication (computers, cell phones, CD/DVD, Internet, virtual reality, etc.) now permits better access to and greater availability of psychotherapeutic treatments. Virtual reality (VR), for example, as an alternative exposure method, allows us to reduce some of these obstacles. Notably, VR offers greater control over the environment and phobic stimuli, assures greater confidentiality for the clients, can enhance the desirability of the intervention for children, can make therapy engaging and attractive, and at the same time may reduce certain costs.

This chapter will present various new information technologies used in CBT of anxiety disorders with children, adolescents, and adults, beginning with those requiring more direct professional involvement with equipment or expertise in computer technologies (VR) and ending with more self-directed computer involvement (Internet).

Using VR to Implement CBT

The development of video games as well as the evolution of 3D environments during the last two decades, has inspired several researchers to create virtual environments with the goal of developing new assessment, intervention, and training techniques linked to health and education. A recent review of the literature by St-Jacques et al. (2007) concluded that the use of new technologies such as VR with young children has been focused primarily on the fields of physical and mental health and education. In psychology, for example, one of the biggest advances in technology in the treatment of anxiety is probably the use of VR as a method of exposure (Botella et al. 2009). As defined by several authors, VR designates a set of technologies that permits an individual to interact in real time with a 3D virtual environment, using his senses and innate skills all at once. This new technology can also be defined as being a form of advanced interface between a human and a computer. This interface permits the user to immerse himself and interact with the virtual environment (Pratt et al. 1995). With the aid of immersive hardware (immersion helmet—referred to as a head mounted display or HMD—fitted with screens and headphones, a computer, a joystick, and a motion tracker) and real-time 3D rendering software, the individual is immersed in a 3D environment, in which he behaves as if in real life (Wiederhold and Wiederhold 2005). Because of the immersion, VR is expected to afford a form of exposure that is more potent than merely presenting phobic stimuli on a computer monitor (a form of exposure that was not perceived to be very effective for children according to two case reports presented by Nelissen et al. 1995).

Rothbaum et al. (1995), Wiederhold et al. (1998), and Lamson (1997) published the first studies employing VR with adults as a method of exposure in the field of clinical psychology. Since then, several studies have demonstrated the effectiveness of this new therapeutic tool in the treatment of various anxiety disorders in adults (Anderson et al. 2004; Côté and Bouchard 2008; Klinger et al. 2005; Wallach et al. 2009). In children, however, few studies exist on the use and effectiveness of VR in the treatment of anxiety (St-Jacques et al. 2007; see Table 12.1). A pilot study using a single-case multiple baseline across participants design conducted by Bouchard et al. (2007) with nine children demonstrated the interest, feasibility, and effectiveness of conducting in virtuo (i.e., in VR) exposure with children suffering from spider phobia.

In a controlled outcome study, Gutiérrez-Maldonado et al. (2009) randomly assigned 36 school-age children (aged 10–15 years) suffering from school phobia to either a no treatment control condition or to 5 CBT sessions. The treatment included relaxation and both imaginal and in virtuo exposure. Two virtual scenarios were used, both with an easy (approaching and entering the school) and a difficult level (performing activities in the classroom). Overall, the participants in the virtual environment could go to a school and find their classroom while encountering other kids in the corridors, finding and taking a seat in the class, answering questions, giving an oral speech, receiving criticism from other children, etc. However, the involvement in the virtual environment was not highly immersive, as it was done on a 17-inch

Table 12.1 Summary of methodology in studies using VR with children suffering from anxiety disorders

References	Design	Diagnosis	Random assignment	Conditions	No.	Outcome measures	Results
Bouchard et al. 2007	Multiple baseline across participants with a 6-month follow-up	Spider phobia	Yes	3-week baseline 4-week baseline 5-week baseline	9	Daily self-monitoring, Spider Phobia Questionnaire for children, Fear Survey Schedule for Children, Spider Phobia Beliefs Questionnaire for Children	Significant treatment effect
Gutiérrez-Maldonado et al. 2009	Group design	School phobia/ refusal	Yes	In virtuo versus no treatment	36	School Fears Inventory, School Refusal Assessment Scale, Fear Survey Schedule for Children—Revised, State-trait Anxiety Inventory for Children	In virtuo > no treatment
St-Jacques et al. 2010	Group design, with assessment at pretreatment, after two-thirds of the treatment, and posttreatment, with a 6-month follow-up	Spider phobia	Yes	In vivo versus in virtuo	31	Spider Phobia Questionnaire for Children, Spider Phobia Beliefs Questionnaire for Children, BAT	In virtuo = in vivo
Doré and Bouchard 2006	Multiple baseline across participants with a 12-month follow-up	Social phobia	Yes	2-week baseline 3-week baseline 4-week baseline	5	Liebowitz Social Anxiety Scale, Confidence as a Speaker Questionnaire, Fear of Negative Evaluation, Beck Depression Inventory	Significant treatment effect

computer monitor instead of using a HMD and a motion tracker. Nevertheless, the results were positive and revealed significant improvements from pretreatment to posttreatment.

In a process study addressing motivation toward CBT with in virtuo exposure involving 31 arachnophobic children between 8 and 16 years of age, St-Jacques et al. (2010) compared motivation to complete a treatment consisting essentially of VR or in vivo exposure. The treatment intended for the experimental VR group included 4 sessions of in virtuo exposure followed by 1 session of in vivo exposure, while the "gold standard" control group had 5 sessions of in vivo exposure. The results of this study suggested that the children's motivation to complete VR treatment did not differ significantly from that expressed by children enrolled in the traditional treatment format. However, the authors noted that with several children, the VR treatment elicited higher rates of anticipatory fear, especially at the start of treatment. The unknown nature of the virtual environment was suggested as the basis of this phenomenon. The authors further indicated that before immersion, children did not know what to expect during immersion or how to react if, from their perception, the virtual situation became too frightening. In addition, while some children expressed the feeling of not being able to accomplish the task, others were afraid of remaining "imprisoned" in the HMD and not being able to escape in case of danger. Others perceived the experience in a negative way, imagining that the scenario in the virtual environment resembled a horror film. In light of this information, the authors suggested that the treatment program and the virtual environment should be better introduced and presented to children, and their concerns should be discussed before the treatment begins in order to make sure they are not frightened by the virtual environment. Their research also suggests that there may be a difference between the perception of virtual provocative stimuli (spiders) in children and adults. The research team in the St-Jacques et al. (2010) study suggested that, based on clinical impressions, children showed a greater tendency to evaluate the phobic stimuli in a more negative manner than adults. This observation dovetails with other clinical trials conducted by the same team with adults. Before entering a virtual environment, the children tended to think that the virtual spider would be more frightening, disgusting, and dangerous than did the adults. Yet, studies conducted by Harris and Reid (2005), indicate that virtual environments that present a diversity of activities offering challenges and opportunities to succeed, while at the same time giving the child the feeling of efficacy and control, tend to retain the involvement of the child in the completion of a virtual task (Harris and Reid 2005). St-Jacques et al. (2010) also followed-up with the clients 6 months posttreatment. They reported that comparison between both forms of exposure confirmed the effectiveness of using VR as a substitute for in vivo exposure, as efficacious outcomes remained after 6 months.

A preliminary study has also been conducted with 5 adolescents, between 15 and 17 years of age, diagnosed with social phobia (Doré and Bouchard 2006). They received a CBT program consisting mostly of in virtuo exposure for up to 8 sessions to treat their fear of public speaking by making oral presentations in front of small and large virtual audiences. The goal was to document the efficacy and credibility of in virtuo exposure with adolescents when using virtual environments populated

with virtual adult characters. Results of the multiple baseline across participants design indicated a decrease in anxiety symptoms, with a complete remission for one participant, partial remission for three other participants, and no change for the remaining one. However, all participants noticed broader positive changes in their social relationships, which were also supported by questionnaire results. The treatment was considered acceptable, although the experiment highlighted the need for the adolescents to give speeches in front of virtual adolescents instead of virtual adult characters.

In summary, the authors of the four studies reported several advantages. Among these advantages are the possibility of adapting the environments to the treatment needs of the client, the capacity of ensuring increased control over the variables surrounding the exposure, the possibility of having the exposure occur in a series of impossible or questionably safe real situations, as well as the possibility of giving care gradually while respecting the child's therapeutic pace. As previously discussed, when the therapist uses VR as a method of exposure, he possesses greater control over the environment, which allows the client to be exposed gradually to situations that he dreads, in a safe and protected environment. Exposure safety constitutes an interesting aspect of this method, in particular regarding the exposure of children to situations involving potential physical harm or injury. Information can be given to the client gradually, in small controlled doses, in order that he can progressively master the necessary strategies to face his fears or manage his anxiety in everyday life. Finally, more than just allowing children to experience new situations in safety, the use of VR allows preservation of confidentiality of the therapeutic process with children and their families (Botella et al. 2009; Glantz et al. 2003; For a review of ethical issues when conducting exposure, see Chap. 10). Conducting in virtuo exposure is not done exactly as in vivo as at least two additional concepts must be understood by the therapist: presence and cybersickness.

The Feeling of Presence

Several variables can influence the impact of immersion in a virtual environment. Presence, or more specifically the feeling of "being there" in the virtual environment, even though the individual is not "really" there physically, has also been dubbed as the illusion of nonmediation (i.e., not noticing that the experience is created by a technology medium; Lombard and Ditton 1997). Feeling present occurs while an individual is immersed in a virtual environment that assails at least one and ideally several senses at the same time (vision, hearing, touch, smell, etc.). It can be observed when the child acts in the virtual environment as if he was in a physical environment (Lombard and Ditton 1997). The individual therefore continues to express physical, sensory, and emotional responses toward the virtual objects or people in this environment, as if he really found himself there. Presence seems to be a complex and multidimensional perception experience, formed from sensorial information and a set of cognitive processes. In fact, the feeling of presence seems strongly related

to the capacity of paying attention to or to focusing on a task, to the capacity of being able to set aside or ignore the equipment generating the virtual environment, as well as to the person's emotional state (Price and Anderson 2007; Riva et al. 2007; Robillard et al. 2003; Wiederhold and Wiederhold 2005).

Two instruments relevant for the measurement of the feeling of presence have been adapted for children, the *Child Presence Questionnaire* and the *Child Immersive Tendencies Questionnaire* (St-Jacques et al. 2010). The 19-item *Child Presence Questionnaire* was developed to describe the subjective properties of the immersion that allow the child to feel present within a virtual environment. The items were adapted from the adult version of the *Presence Questionnaire* (Witmer and Singer 1998) and reworded to be better understood by children, and reduced in number (based on the factorial loadings of the adult version). The rating scale was simplified to a three point scale (0 = none, 1 = slightly, 2 = a lot). Examples of items include "What I experience in the virtual environment seemed natural," "My actions in the virtual environment seemed real," and "I felt that I was in the virtual environment." Although some authors have expressed criticism of the adult version of the *Presence Questionnaire* as being a better measure of the properties of the immersion than of the subjective feeling of the user (Bouchard et al. 2008; Robillard et al. 2002; Slater 1999), this test is still the most frequently used measure of the feeling of presence.

The *Child Immersive Tendencies Questionnaire* was also adapted by St-Jacques et al. (2010) from the adult version of *Immersive Tendencies Questionnaire* by Witmer and Singer (1998). Like the presence measure, original items were reworded, reduced in number, and the rating scale was modified to "never," "sometimes," or "often." The goal of this instrument is to measure factors that, according to Witmer and Singer (1998), increase the likelihood of feeling present, such as "feeling so involved in a movie that you are not aware of things around you," "feeling so involved in a videogame that you have the impression of being in the game," or "becoming involved in daydreams to the point of not being aware of things happening around you." This instrument is usually administered to predict who would respond best to immersions in virtual environments, and to compare samples to document the potentially detrimental impact of differences in immersive tendencies.

Side Effects/Cybersickness

A few factors can cause negative side effects during an immersion in VR. For example, if the head device (HMD) is too heavy for the child, wearing it for an extended time may cause neck strain. If the HMD is too tightly secured on the individual's head, this may cause a minor headache or some iatrogenic claustrophobia. Hours of nonstop use of an HMD could also cause tension in oculomotor muscles since the child would be constantly keeping his eyes fixed in the same position. Other side effects are associated with the user's movement in the virtual environment (Lawson et al. 2002), especially if the technology used is not processing the information quickly enough. During an immersion, the lag time between the information sent by

the vestibular system, indicating that the head is moving, and the visual information that is sent by the computer to the visual system, providing additional information to the brain that the head is in motion, can create in certain individuals unpleasant sensations referred to as cybersickness (Flanagan et al. 2004). Similar to the symptoms of motion sickness or to the sensations felt on a merry-go-round or Ferris wheel, cybersickness can present as a form of nausea, dizziness, headache, sweating, spatial disorientation, or postural instability (Lawson et al. 2002; Nichols 1999; Sharples et al. 2008). Despite the fact that most researchers report progressive reduction of cybersickness over time (Howarth and Hodder 2008), others emphasize the unpleasant effects of cybersickness may demotivate certain users (Nichols 1999). In using in virtuo exposure in the treatment of anxiety disorders, it is also important not to confound signs of anxiety (e.g., sweating, dizziness) with potential side effects of the immersion. Nevertheless, studies conducted during the last decade show that only a minority of individuals do not benefit from in virtuo treatments by the reason of these physical inconveniences, and that these side effects are usually brief and minor in adults (Botella et al. 2009; Bouchard et al. 2009) and children (St-Jacques et al. 2010).

The side effects of an immersion in VR can be assessed with the *Side Effects of an Immersion in Virtual Reality (Cybersickness) for Children* questionnaire (*SEIVR-C*; St-Jacques et al. 2010). This self-report measure consists of 10 items (plus an open-ended question) assessing on a 3 point scale (0 = none, 1 = slightly, 2 = a lot) symptoms such as headache, eye-strain, or nausea. It is an adaptation of the adult version of the *Simulator Sickness Questionnaire* (Kennedy et al. 1993). It is recommended to administer the *SEIVR-C* before and after the immersion, to control for physical symptoms already present in the individual before the immersion. For example, Bouchard et al. (2009) found that some people may report more symptoms before than after the immersion, which could be in part attributable to apprehension toward the upcoming immersion. Although Bouchard et al. concluded that cybersickness should not be a source of worry for care providers, they recommend measuring it routinely to confirm that VR immersions are not inducing significant side effects.

In 2005, St-Jacques and Bouchard compared the side effects experienced by children and adults postimmersion. The sample consisted of 23 children between 8 and 16 years of age (15 boys, 8 girls) and 35 adults between 18 and 60 years of age (22 women and 13 men). The participants' task consisted of exploring two virtual environments following a predetermined path for 10 minutes. One of the environments was likely to induce more side effects as it involved more active exploration of a vast virtual and complex environment, as opposed to other one that was less challenging. Participants were assessed for side effects induced by the immersion (cybersickness) at pre-experiment and post-experiment, as well as at 24 hours post-experiment. While immersed, participants were asked to rate verbally, on a 0–10 scale, the intensity of their side effects. Head motion was assessed, at a sampling rate of 10 times per second, and this data showed that children were moving their head significantly more (i.e., 3 times more head rotations) than adults, a behavior which should induce more side effects. The average intensity of cybersickness symptoms was rated with the *SEIVR-C* at 3.0 in the child sample (from a potential range between 0 and 20),

compared with 6.4 in the adult sample ($p < 0.05$). On the brief measure where children reported verbally during the immersion, no significant differences were observed, with an average rating of 2.5 on a 0–10 scale. The 24-hour follow-up confirmed that side effects remained minimal. This study is reassuring, as it documents that side effects are minimal in children. Nevertheless, it is probably safer to continue to monitor and document potential side effects until more data become available.

In summary, VR can be productively used to conduct exposures with children, adolescents, and adults suffering from anxiety disorders. The outcome studies available so far are promising but there is still a need to conduct large randomized control trials with various anxiety disorders to confirm its efficacy and effectiveness, especially so with children and adolescents. Experimenters and clinicians should pay attention to factors such as presence and side effects in order to get the most out of the virtual experience. It also seems important that clinicians address the expectations and apprehensions of individuals toward the virtual experience before the exposure session. Some children, for example, may expect the virtual stimuli to be more frightening than they really are.

Using Computers and Nonimmersive Technologies to Implement CBT

The use of computers in the CBT of anxiety disorders does not have to be limited to immersive situations. In the wave of integrating new information technologies in the healthcare system, the use of the computer as a clinical tool is becoming an acceptable alternative, especially if this avenue can avoid potential technical and financial hardships associated with traditional treatment formats. In fact, with North American families, owning a home computer has become the norm rather than the exception. In addition, Internet access appears to be widespread throughout the world. USC's Annenberg School released its 2008 findings of world Internet access, detailing the global impacts of online technologies in everyday life (Annenberg School for Communication 2008). Approximately 88% of young Americans have access to the Internet, lagging behind 95% of Canadians, 96% from the Czech Republic and Macao, 98% from Israel, and 100% of young Britons. This report also reveals that the majority of youth (88%) report they are confident using a computer. This accessibility and skill of young people using computers have led several researchers to question the feasibility as well as the efficiency of the integration of computer software in the treatment of childhood anxiety.

Dewis et al. (2001) were one of the first to use a nonimmersive exposure program assisted by computer to treat the fear of spiders in children. In a controlled study (see Table 12.2) conducted with 28 children between 10 and 17 years of age, these researchers compared the efficacy of a vicarious exposure program displayed on a computer monitor versus that of an in vivo exposure program. The results of three exposure sessions (45 minutes) administered to children indicated that the use of the nonimmersive vicarious exposure program had a clinically significant effect

Table 12.2 Summary of the methodology in studies using computers and nonimmersive technologies to implement CBT with children suffering from anxiety disorders

References	Design	Diagnosis	Random assignment	Conditions	No.	Outcome measures	Results
Dewis et al. 2001	RCT with 1-month follow-up	Spider phobia	Yes	In vivo exposure guiding an avatar (vicarious exposure), Waitlist	28	BAT, SUDS, Spider Phobia Questionnaire Individualized Phobic Target Impairment	In vivo > vicarious = waiting list
Khanna and Kendall 2008	Case report	Various anxiety disorders	No	One group	18	Feasibility and acceptability	*CCAL* is well received
Khanna and Kendall 2010	RCT with 3-month follow-up	Various anxiety disorders	Yes	CBT, *CCAL*, Control (computer-assisted information and support)	49	Dx (ADIS-P) Clinician severity ratings, Child Depression Inventory Multidimensional Anxiety Scale for Children	*CCAL* = CBT > control
Cunningham et al. 2009	Case studies with 3-month follow-up	GAD or SAD	No		5	ADIS-C-IV, Spence Children's Anxiety Scale-C/P, Children's Automatic Thought Scale, Barriers to Treatment Participation Scale	40% success based on the ADIS-C-IV, Clinical gains on the self-report

on symptoms of anxiety-related fear of spiders. Despite the pre effect or post effect sizes, the computer-directed treatment program allowed children to maneuver a virtual arachnophobic adult model in several scenarios facing spiders. The computer program with the youth sample was not as effective as what the authors previously observed with an adult sample (see Gilroy et al. 2000, 2003). A significant pretreatment to posttreatment improvement was noted on the phobic targets, but results on that measure, and in other measures, were not significantly higher than in the control condition, while in vivo exposure was clearly effective. Several methodological limitations might explain the difference between the results obtained by the two clinical groups. Among the possibilities, the authors mention the insufficient number of subjects (9 children by group); a large disparity between the types of exposure, and the program was not graphically adapted for children (vicarious virtual models were represented by an adult using simple black and white images, etc). A pioneer of its kind, this project seems nevertheless to have inspired and opened the door to other researchers who now work elaborating and validating software that can be used in the treatment of anxiety in children and in adolescents.

The Camp Cope-A-Lot Program (Khanna and Kendall 2008)

In the line of innovations of assisted therapeutic interventions, *Camp Cope-A-Lot* (CCAL; Khanna and Kendall 2008) is an interactive software treatment for children. Based on a program of CBT and the empirically supported *Coping Cat* program, described by Kendall and Hedtke in 2006, *CCAL* software consists of 12 treatment sessions and is intended for children between 7 and 13 years of age who suffer from separation anxiety, social anxiety, or generalized anxiety disorder. The therapeutic treatment strategies are found in the form of activities concerning emotion management techniques, relaxation training, cognitive restructuring techniques, exposure activities (vicarious and in vivo), a system of positive reinforcement, and problem solving.

The treatment protocol takes place in a virtual vacation camp where the children are accompanied by other virtual campers and experience numerous exciting adventures, but the adventures are also quite provocative for anxious children. The children go to an amusement park, give an artistic presentation, meet a new person, speak in public, and sleep in the dark. For the first 6 sessions, the child advances at his own pace in an independent manner. The objective of these sessions is to help the child develop anxiety management skills in a way that helps him to understand and prepare for the exposure exercises in vivo. The subsequent sessions are dedicated to exposure activities and should be completed with the help of a coach. Two sessions at the end of the program are directed toward parents.

The *CCAL* program is conceived as a way to guide the child step-by-step in the planning and implementation of the exposure exercises. These exercises which take place in imagination and in vivo provide different levels of anxiety provocation. They are illustrated by a series of videos as well as animated examples. At the end of each

step, or when the child completes his homework, he is reinforced by earning time to play a video game. This system of reinforcement was developed according to an operant conditioning approach similar to that of a token economy, with the objective to positively reinforce the efforts and accomplishments of the child overall during the real exposure situations. Throughout the treatment, the main character and his friends act as models for the child. These characters, with the help of concrete examples, demonstrate the usefulness of the learned strategies by teaching the child how to use them in the management as well as in the anticipation of different anxious situations that could occur either at school or at home. The exercises that are to be done at home are presented in the form of camp challenges: the "cope-a-lot contests." At the end of each step, the child is given a challenge to be completed during the week and recorded afterward in a supplementary workbook.

The clinical use of such a computerized treatment is less complex than VR and does not require specialized psychology training. It was conceived to be used by a wide variety of professionals working with children. The *CCAL* CD provides an extra tool that can contribute to optimizing pediatric services, especially in environments where professional resources specializing in anxiety treatment using CBT are scarce. On an empirical level, this program offers preliminary data on the acceptance and feasibility of the program (Khanna and Kendall 2008). Using data obtained from children between 7 and 12 years of age and from 8 therapists with a cognitive behavior orientation, the program was assessed favorably by the children and the therapists. Among the children participating in the trial, 18 presented with an anxiety disorder diagnosis (separation anxiety, social anxiety, or generalized anxiety) and 12 were drawn from the general population. The latest study on the clinical feasibility and effectiveness of this program (Khanna and Kendall 2010) involved 49 anxious children between 7 and 13 years of age as well as a group of school and clinical psychologists, without specific training in CBT. At posttreatment, *CCAL* youth demonstrated impressive gains of no longer meeting criteria for their principal anxiety diagnosis, compared with a traditional individual CBT or control condition consisting of a computer-assisted education program: *CCAL* 81%, *CBT* 70%, and control 19%. Parents and children rated all treatments acceptable, with *CCAL* and *CBT* getting higher program satisfaction, and maintaining significant treatment gains at follow-up. *CCAL* is available commercially (www.cope-a-lot.com). It contains a relaxation script which can be downloaded, a selection of videos depicting children involved in the exposure process, a system of reinforcement, the treatment material, and a printable version of the coaching manual and child's workbook.

The Cool Teens CD-ROM for Anxiety Management with Adolescents (Cunningham and Wuthrich 2008)

The software *Cool Teens* CD is based on the basic principles of CBT and derived from the Cool Kids therapist-guided group anxiety program (Cunningham et al. 2006). Divided into 8 therapy modules, this program is aimed at youth between 13 and

17 years of age. It is based on cognitive restructuring and exposure techniques, but also utilizes psychoeducation, coping skills exercises, and relapse prevention. Clinically, the program is aimed at adolescents presenting anxiety concerns (social anxiety, separation anxiety, generalized anxiety, specific phobia, or obsessive-compulsive traits). The treatment protocol is spread over a period of 8–12 weeks. The eight modules are presented on the main welcome page of the CD and can be completed in 30–60 minutes. *Cool Teens* is less structured than the *CCAL* previously described. Even though the authors suggest a sequence to follow to complete the modules, the teenager can decide for himself on what pace and in what order he completes the different treatment modules, according to the severity of his symptoms and the amount of time he can dedicate to therapy. Notwithstanding the fact that this software was developed to be used in a flexible and autonomous way, a minimum of professional accompaniment may be necessary in order to maintain the interest and motivation of the participants throughout treatment. The support of a therapist ensures the progression of the youth throughout the different modules and supports them in the therapeutic process. The therapist's support can be offered with brief telephone contact or by e-mail. During parent participation, parents receive information on the program but they are not directly involved in the computer therapy of their teen. The authors recommend however that the adolescent identify a mentor (a friend, a member of the family, or a significant person) who could aid and help to integrate the sessions and offer support during the exposure sessions during treatment, if needed.

Empirically, the *Cool Teens* CD offers promising but limited research data. One series of case studies conducted with 5 adolescents between 14 and 16 years of age, revealed promising results on the effectiveness of this program (Cunningham et al. 2009). In the pilot project, the treatment modules lasted 15–30 minutes every 2 weeks, and a CBT-trained therapist provided a follow-up session by telephone. At the end of 12 treatment sessions, the researchers observed that two adolescents did not meet the diagnostic criteria (Table 12.2) and these gains were maintained at 3-month follow-up. The authors also noted clinically meaningful improvements. Adolescent satisfaction regarding the program was evaluated with the help of a questionnaire regarding youth preferences and attitudes. As adolescents commonly are resistant in adhering to psychological treatment (Rickwood et al. 2007), an inventory involving obstacles that could affect the teen's therapeutic motivation and investment was integrated into the evaluation. All modules of the program were rated positively.

Other publications on the *Cool Teens* CD program provide information on the clinical validation phases (Cunningham et al. 2006; Cunningham and Wuthrich 2008; not included in Table 12.2 as these are not outcome studies; a larger outcome study has been announced by the authors). Cunningham et al. assessed the adolescent's satisfaction regarding this new form of treatment, specifically the capacity of the program to preserve their confidentiality and to lessen the stigma associated with the use of mental health services (Cunningham et al. 2006). The adolescents' opinions regarding the clinical material of *Cool Teens* CD (Cunningham and Wuthrich 2008) show that in general they appreciated the program's visual graphics, the audio messages, and the explanatory diagrams, as well as the navigation system. On the other hand, they had less appreciation for the interactive exercises integrated in

the program. Pilot participants have identified the principal obstacle interfering with their treatment is finding time to complete the modules (Cunningham et al. 2006; Cunningham and Wuthrich 2008; Cunningham et al. 2009).

Globally, introduction of these new forms of CBT treatment manuals includes several advantages. Computer-based programs can reduce treatment costs by providing complementary information and exercises. It may also increase motivation to come to therapy. The new information and communication technologies that are integrated so well in this latest generation's way of life permits professionals to better adapt their clinical tools to the needs of youth and their families. In addition, a psychologist who proposes treatment including a video game or Internet-interactive activities may more easily establish confidence in a client and increase motivation and interest for the treatment, than if only using traditional treatment strategies (Griffiths and Christensen 2006). Finally, with the help of the Internet, parents of children can better understand and support the therapeutic process of their child through the online version of the treatment programs. The constraints in terms of time (inflexible work hours, incompatible schedules, etc.) for parents as well as therapists become more easily managed.

In sum, early studies appear promising, and results from Khanna and Kendall (2010) show that using computers to deliver CBT to youth suffering from anxiety disorders is effective. As with any self-help treatment program, clinical skills may still be required at some point to tailor the treatment to the specific needs of each child, especially when the time comes to expose the child to a unique phobic object or situation. The integration of treatment programs assisted by computer can also compensate for the lack of services and the limited numbers of professional specialized resources in rural regions or more distant geographic locations.

Using the Internet to Implement CBT

The generations of people born after the 1970s are being raised in a world where technological advancement is part of their daily reality. Known as the "children of the millennium," or more often by the expression, "Generation Y" or "NET generation" (McCrindle 2006; Pouget 2008), these cohort generations are increasingly more at ease with new and evolving information technologies and are quite gifted in terms of knowledge about computer science (Cheng 1999; Peattie 2007). Video games, e-mail, chatting, instant messaging, texting, blogs, and social networking are just a few of the activities done online by today's youth (Subrahmayam and Greenfield 2008). In 2009, the census data from the Pew Internet and American Life Project team revealed that 93% of North American youth, between 12 and 17 years of age used the Internet daily, and 89% of those youth did so from their homes (Jones and Fox 2009). These percentages are witness to the omnipresence of these media in the daily life of every child and adolescent, socially, recreationally, and educationally (Bussière and Gluszynski 2004; Lévesque 2007).

With respect to education, many studies report that children often use the Internet as a search engine to do academic activities and to interact socially, but also to discuss subjects more intimate in nature, such as their physical or mental health. One study conducted by Gray et al. (2005) indicated notably that for several youth between 11 and 19 years of age, the Internet constituted their first source of information in health fields (Gray et al. 2005). Santor et al. (2007) noted equally that connection to web sites related to health correlated positively with the use of health services in school environments (counselors, health centers) as well as with the number of subsequent referrals to physical and mental health professionals.

As for the integration of new information technologies in the domain of mental health, the Internet seems to occupy an increasingly dominant place. In fact, this type of media has become more and more used as a prevention and information tool, especially among adolescents. From the Latin *adolescere*, which translates "to grow," adolescence is a synonym for change (Marcelli and Braconnier 2008). This period is the turning point from childhood into adulthood. During this period, youth are confronted with multiple changes and new experiences that permit them to explore and discover their identity as well as their own values (Bee and Boyd 2007). Faced with challenges inherent in this transition period, youth may feel alone, or face questions or situations that may not be easy to discuss with an adult or even their peers (Lévesque 2007). Confidential and anonymous, the Internet is a source of information that sufficiently meets the needs and context of life of the latest generation (Borzekowski and Rickert 2001; Gould et al. 2002; Gray et al. 2005). However, it is not only children and adolescents that use the Internet in this way. New families and young parents from the Y generation also use this media more frequently as a source of information.

For this digital generation, however, the Internet is not only an informative media (Gray et al. 2005; Skinner et al. 2003). It also allows people to communicate, to maintain a social network, to receive support among peers, and even affords access to the clinical support of professionals (Skinner et al. 2003). In other words, more than being an attractive and popular means of information for today's youth (Peattie 2007), the Internet possesses the characteristics and necessary properties for the development of new forms of mental health intervention.

Known by the general term "cyberpsychology " (e.g., Botella et al. 2009), CBT programs offered on the Internet can involve direct contact with the therapist (e-therapy) or provide self-help treatment programs on the web (web-based therapy: the client goes to a web site, reads the information, follows the instructions, and fills out surveys and questionnaires). The therapy can also take place in real time, in a synchronized fashion (e.g., chatting, web cam, teleconference) or an asynchronous approach with the aid of texts, audio messages, and videotapes. These different treatment programs can be offered on an individual or group basis (Barak et al. 2008). As with any new technology or therapeutic innovation, initial years of implementation and research warrant cautious attention. Issues of cross-jurisdiction liability, licensure issues when providing therapy across states or countries, self-diagnosis,

risk evaluation and response, limits and challenges to confidentiality, loss of nonverbal information, "hacker" activity, and other unforeseen circumstances will require additional therapeutic consideration.

Developed and progressively validated over a few studies by Spence and her team in Australia, the *Brave-Online* program is a web therapy program intended for youth suffering from an anxiety disorder and their parents (Spence et al. 2006a). This program has two versions: the 16-session version for children between 7 and 12 years of age, and the 20-session version for adolescents between 13 and 17 years of age. Each version includes 6 and 7 sessions designed for parents. A few empirical studies have evaluated *Brave-Online* (see Table 12.3) and confirmed that the program follows a clinical protocol based on cognitive-behavior principles. This program graphically creates games and interactive activities to stimulate motivation and facilitate learning in youth. Parent sessions are based on psychoeducation activities. Conceived as parental coaching, the purpose of these sessions is to help parents accompany and support their children when they are confronted with more anxious situations (e.g., during exposure exercises).

Every week the treatment sessions are available from *Brave-Online* and take 60 minutes to complete. During the hour, youth progress in a sequential manner, through several web pages: lectures, exercises (questions/answers) illustrated by examples, and games (quizzes) that address the clinical material of each session. In order to generalize learning from computer sessions to daily life, youth engage in exposure exercises to apply the learned strategies to personally provocative situations during the week. Throughout therapy, therapist support is offered to the participants and to their parents by e-mail or telephone. The program is privately moderated, so the therapist can have direct access to the child's activities as well as to weekly reports, which permits therapeutic follow-up for each child. The therapist, through the electronic messaging system, can confirm a personalized contact; the messages can clarify specific concepts and enhance motivation. In addition, the participants also receive messages automatically reminding them to complete the next treatment session, or congratulating them for having completed each treatment session. Finally, the therapist communicates with the youth and his parents by telephone at the beginning of treatment and before the exposure. This telephone contact seems essential for the establishment of a fear hierarchy best adapted to the needs of the client. As far as the clinical tools are concerned, games and questionnaires are used to increase the interactive character of the program, which captures the youth's attention and helps in the comprehension of the transmitted information. For younger children, the clinical comprehension of the different key concepts is assured and reinforced by automatic messages (pop-ups) that appear each time that the child writes in a response.

The *Brave-Online* program has been used in the treatment of separation anxiety, social anxiety, generalized anxiety, and specific phobia with children and adolescents. It can be administered in an individual (March et al. 2009; Spence et al. 2008) or group therapy format (Spence et al. 2006a). The first version of the program was intended to be the part of a standard (face-to-face) CBT treatment. Spence et al. (2006b) initially conducted an outcome study with three groups of children between 7 and 14 years of age (one condition received a standard CBT program which would later become

Table 12.3 Summary of methodology in studies using the Internet to implement CBT with children suffering from anxiety disorders

References	Design	Diagnosis	Random assignment	Conditions	No.	Outcome measures	Results
Spence et al. 2006b	3 groups with 6- and 12-month follow-ups	Various anxiety disorders	Yes	Brave face-to-face, 1/2 Brave face-to-face plus 1/2 online, Waitlist	72	ADIS-P Spence Children's Anxiety Scale—revised Children's Manifest Anxiety Scale, Children's Depression Inventory, Child Behavior Checklist—revised	Brave = 1/2 Brave + 1/2 Brave Online > WL
Spence et al. 2008	Case study	Various anxiety disorders	No	Pilot study	2	ADIS-C/P Clinician rating, Spence Children's Anxiety Scale, Child Behavior Checklist—revised	Promising results
March et al. 2009	2 groups with 6-month follow-up	Various anxiety disorders	Yes	Brave-Online, No treatment	73	ADIS-C/P Clinician rating, Spence Children's Anxiety Scale—revised, Child Behavior Checklist—revised, CES-Depression scale	Brave Online > no treatment

the *Brave* program, the second condition received half of the *Brave* program face-to-face and the other half online, and the third condition was a waitlist control; see Table 12.3). The results proved to be clinically and statistically significant for both active treatments. The efficacy of the combined face-to-face and online program was slightly lower than the traditional face-to-face format, although this was not statistically significant.

These encouraging findings led the researchers to adapt the program for an online only version (Spence et al. 2008, see Table 12.3) and conduct a randomized control study with 73 children between 12 and 17 years of age (March et al. 2009). *Brave-Online* is associated with levels of satisfaction and credibility similar to those obtained by traditional CBT. As for treatment gains, March et al. (2009) indicated that compared with a no-treatment control group, the children following the program *Brave-Online* reported a significant reduction in anxiety symptoms. Treatment gains were not optimal at post treatment, although many were statistically significant compared with the waiting list, but at the 6 months follow-up the results were more positive, with 75% of the children in the online treatment condition no longer meeting the criteria for an anxiety diagnosis. Hence, the use of the *Brave-Online* program yielded small but significant effects at post treatment and further significant improvements were observed in the months posttreatment. March et al. (2009) suggested the weaker effect of the treatment, when compared with traditional treatment programs, and the delay in treatment improvement may be due to participants' delay in completion of therapy sessions. Indeed, many participants had not completed all the sessions by the time the posttreatment assessment was done. Almost half of the children completed the *Brave-Online* program between the posttreatment and the follow-up.

Results from the web-based *Brave-Online* program highlight the importance of treatment compliance issues, which is an important success factor in all self-help or minimal-therapist contact CBT packages. Nevertheless, the *Brave-Online* program is particularly interesting, in so far as it increases accessibility to psychological services, particularly in situations characterized by a lack of professional resources, with minimal therapist involvement. As the Internet becomes more accessible and allows the running of more powerful applications, the support used to access the program (e.g., CD-ROM) progressively evolves toward more widely accessible and portable technologies, such as Internet web sites and, implicitly, portable devices such as laptops and hand-held devices (e.g., iPad or smartphones). The Internet also facilitates dissemination and the possibility of minimal therapist contact through asynchronous media such as e-mails. Table 12.3 summarizes the different studies using the Internet to implement CBT with children and adolescents suffering from anxiety disorders.

Conclusion

As we have suggested throughout this chapter, the integration of new technologies in the treatment of anxiety disorders in children is a relatively recent practice but appears to be very promising. It may be particularly attractive to implement with

young people born after the 1980s, and also with families who work or reside in areas where access to treatment is limited. Even though there are limited initial data on the therapeutic effects of these new tools (Webb et al. 2008), the case and clinical efficacy studies completed to date and conducted during the initial phase of these programs demonstrate significant results as well as measures that justify and encourage the development of these new forms of intervention.

As well as allowing therapists to assume better control of the environment and over phobia-provoking stimuli during exposure exercises, the nonimmersive treatment programs assisted by computer are also accessible and affordable. The Internet turns out to be an interesting information and prevention tool for children as well as their parents. Since new technologies are being incorporated more and more into the daily habits of modern society, their integration into the treatment of anxiety disorders may also encourage increased adherence to treatment by children and youth, as well as ensure greater confidence in privacy and reduce the risk of feeling stigmatized by their peers. Among these advantages we also note the opportunity to adapt treatments to the particular needs of the client, the capability of greater control over the variables surrounding the exposure, and the possibility of giving graduated care while respecting the child's pace of treatment acceptance in uncommon and safe places, all the while adding the benefit of increased confidentiality of the therapeutic process.

Despite their many advantages, the use of these new technologies nevertheless includes certain challenges. In many studies reviewed in this chapter, the small sample sizes or the lack of adequate control groups invites tempered enthusiasm. In addition, the researchers who made the use of asynchronous (i.e., no real time interactions) treatment methods, such as consulting websites, were confronted with the difficulty of adapting anxiety levels to an appropriate exposure hierarchy according to the child's needs. The presence of comorbidity in anxious children and adolescents also represents a challenge for clinicians who foresee the integration of new technologies in their professional practices. Mental health treatment professionals would need to learn how to compensate for a lack of affective information when using computerized technology, in particular that created by the decrease in verbal and visual signals that permit a therapist to detect treatment resistance or adherence difficulties when working face-to-face with children.

Regarding VR, the presence of cybersickness or even the difficulty of immersing oneself in a virtual environment could limit the use of this new form of treatment with certain children. These difficulties seem to affect a minority of people. It is important to mention that on a clinical level, the new forms of intervention presented in this chapter may contribute in one way or another to the decrease in costs related to actual professional practices. However, certain computer tools remain expensive. Considering that the integration of new information technologies is relatively recent, little information is available on the long-term effects of cyberpsychological techniques. Some authors point out the danger of cyberdependence in youth, the risk of isolation, and the danger of depersonalization. Professional codes and ethical guidelines should be adapted for technological challenges in order to protect and preserve the well-being of children and their families. In conclusion, increasing numbers of

rigorous studies validate the scientific use of new information and communication technologies in the field of mental health. Computer technology for mental health remains a promising field, in constant evolution, whose innovation will certainly contribute to the advancement of knowledge and the improvement of care given to today's children, natives of the digital era.

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