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Computer games supporting cognitive behaviour therapy in children

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Abstract

Therapeutic computer games might enhance children's motivation for psychotherapy, facilitate their understanding of important therapeutic concepts, structure therapy sessions, enhance treatment of migrant children and disseminate evidence-based treatment approaches. The game *Treasure Hunt* was developed to support cognitive behaviour therapy with children who come into treatment for various mental health problems.

To evaluate the applicability and appropriateness of the game, 124 therapists answered a questionnaire on their impression of *Treasure Hunt* three months after download. Of these, 42 consented to participate in the further evaluation and sent questionnaires of 218 children in whose therapy *Treasure Hunt* had been used. A limitation of these data is an eventual positive bias, as therapists with a positive attitude towards therapeutic computer games may have been more likely to participate. Data show that the vast majority of children were satisfied their therapist had used the game during treatment. Therapists used *Treasure Hunt* for a broad range of diagnoses. They judged the game as helpful in the explanation of cognitive-behavioural concepts, used it as reinforcement and

reported it enhanced child motivation for psychotherapy and strengthened the therapeutic relationship with the child.

Introduction

As computers and internet have become a normal part of life for millions of children (Bremer, 2005), there is growing interest to use the innovative potential of computer games for health purposes. For children with chronic disease like diabetes, asthma or cancer, several video games have been developed in order to enhance treatment compliance. A recent review identified 25 computer games promoting health related behaviour change (T. Baranowski, Buday, Thompson, & Baranowski, 2008). One of the first health games was *Packy & Marlon* for diabetic children; it was shown to improve self-management in a six-month controlled trial (Brown et al., 1997). Later, the same authors developed *Bronkie the Bronchiosaurus* for children with asthma. This game increased self-care behaviour, asthma-related self-concepts and social support in asthmatic children (Lieberman, 2001). *Re-Mission*, a video game addressing issues of cancer treatment and care for adolescents, was shown to improve treatment adherence in adolescents undergoing cancer therapy (Kato, Cole, Bradlyn, & Pollock, 2008).

Video games trying to change children's diets show promising results as well. *Squire's Quest*, a game integrating meal-specific behavioural change techniques has been reported to increase daily fruit and vegetable servings of school children (Cullen, Watson, Baranowski,

Baranowski, & Zakeri, 2005). Dance simulation video games have been used successfully to increase physical exercise in overweight children (Lanningham-Foster, Jensen, & Foster, 2006; Unnithan, Houser, & Fernhall, 2006). Recently, the NIH has released two games, *Nanoswarm* and *Escape from Diab* (www.escapefromdiab.com) aimed at reducing the rate of diabetes II in children and adolescents (T. Baranowski, Baranowski, Thompson, & Buday, 2011).

As to psychotherapy, no child therapist can ignore how fascinated children are by computers and video games. More than twenty years ago, Gardner (1991) suggested to integrate commercial computer games into child psychotherapy in order to observe the child's repertoire of problem-solving strategies. More recently, Griffiths (2003) described the positive therapeutic prospects of video games, but up to now, only a few video games for psychotherapy exist. This is rather astonishing, as there are several ways by which psychotherapy might profit from health games (Brezinka, 2008). First, games that incorporate therapeutic messages might increase a child's motivation for psychotherapy. Second, such games can offer attractive electronic work assignments that enable children to repeat and rehearse basic psycho-educational concepts they have learned during therapy sessions. Third, a psychotherapeutic game matching the theoretical orientation of the therapist might help him / her to structure therapy sessions and to explain important concepts in more than one way and with a metaphor and means attractive to most children. Fourth, playing a psychotherapeutic game may make contact between the therapist and the child easier because it is less direct. This potential of a computer game might facilitate

treatment of very introvert children who do not want to talk to the therapist, but also of children with Asperger's syndrome, for whom direct contact with a person is often difficult. For adolescents, who are often reluctant seeking help for mental problems, playing a video game in therapy has been shown to make contact easier (Coyle, Doherty, & Sharry, 2009). Fifth, mental health games translated into different languages may enhance treatment of migrant children who can play the games in their own language and share their content with parents and siblings. Last but not least, mental health games incorporating evidence-based treatment approaches may enhance dissemination of these approaches in the community.

Several documented health games for child and adolescent psychotherapy exist up to now. The Israeli game *Earthquake in Zipland*, based on family therapy and released in 2005, was developed to support psychotherapy of children whose parents have divorced (www.ziplandinteractive.com). The scope of *Personal Investigator*, a therapeutic game based on solution focused therapy, is to motivate adolescents for psychotherapy (Coyle, Matthews, Sharry, Nisbet, & Doherty, 2005). An evaluation of its use in 22 adolescents showed promising results (Coyle, et al., 2009), although it appeared to be less successful for youngsters with learning difficulties.

At the Department of Child and Adolescent Psychiatry of the University of Zurich, *Treasure Hunt*, a mental health game based on principles of cognitive behaviour therapy (CBT), was released in 2008 to support treatment of eight to thirteen year old children with various disorders.

Data on its appropriateness and applicability will be presented here. The recently released therapeutic video game *Ricky and the Spider* for children with a diagnosis of obsessive-compulsive disorder (OCD) aims at disseminating an evidence-based treatment approach in the community and will be discussed in the final part of this paper.

Materials and Methods

Materials

Treasure Hunt, released in 2008 and available in English, German, Dutch and Greek, was developed to support cognitive-behavioural treatment (CBT) of children. The theoretical background of the game is cognitive-behavioural, as CBT is one of the best-researched and empirically supported treatment methods for children (Weisz, Doss, & Hawley, 2005), both with internalizing disorders such as depression and anxiety (Kendall, 1998), as with externalizing disorders such as oppositional defiant disorder or conduct disorder (Kazdin, 1997; Lochman, 1992). Each of the six levels of *Treasure Hunt* corresponds to a certain step in cognitive-behavioural treatment and represents basic concepts of CBT for children such as the distinction between thoughts, feelings, and behaviour, the influence of thoughts on our feelings or the notion of helpful and unhelpful thoughts. These basic concepts are described in thoroughly evaluated and widely used treatment programmes like *Coping Cat* (Kendall, 1990), *Friends for Children* (Barrett, 2000) and *Think good - feel good* (Stallard, 2003).

Treasure Hunt takes place aboard an old ship inhabited by Captain Jones, Felix the ship's cat and Polly the ship's parrot. Captain Jones, an experienced sailor - but not a pirate - leads the child through the game, whereas the parrot embodies the help-menu. Captain Jones has found an old treasure map in the hull of his ship. However, to solve its mystery, he needs the help of a child. Tasks take place in different parts of the ship – on deck, in the galley, in the dining room of Captain Jones and in the shipmates' bunks. For each completed task, the child receives a sea star. The old treasure map has a dark spot in the shape of a sea star at six important places. The child and Captain Jones will only be able to read what is written there when they place the missing sea star on the map. After having solved all the tasks, the last mission consists of a recapitulation of the previous exercises. Once the child has solved this last problem, he/she will find out where the treasure is buried. One of the most crucial parts of the game is dedicated to the hunting of unhelpful (= negative automatic) thoughts by means of a first person shooter. The child has to catch a flying fish to be able to read and hear the unhelpful thought written on it and replace it by a helpful one.

Before joining Captain Jones on the final search for the treasure, the child receives a sailor's certificate that summarizes what he/she has learnt through the game and that is signed by Captain Jones and the therapist.

In order to make the game attractive for children with reading and / or learning difficulties, the text is not only written, but also spoken. All tasks are spoken by voices of children

(two boys and two girls) in order to allow maximal immersion of the child into the game. The main figure, Captain Jones, is deliberately a man, and the child is led through the game by a man's voice – an innovative means to deplete the current lack of male therapists and thus of adult male models for boys in psychotherapy.

Table 1 summarizes the therapeutic content of the game. As can be seen, each of the six levels of the game corresponds to a certain step in cognitive-behavioural treatment, representing basic concepts of CBT for children. Thus, *Treasure Hunt* can be described as a broadband-CBT-game covering issues that are relevant in the treatment of various disorders. Not more than one level of *Treasure Hunt* should be played during a therapy session. After each session, a homework sheet with therapeutic assignments is given to the child. The child also has to remember the password with which it will gain access to the next level of the game.

Insert Table 1

Treasure Hunt is a 2.5 D Flash adventure game programmed with Actionscript. Flash was used to guarantee platform independence, as only a Flash compatible internet browser is needed and no programme has to be installed. Both PC and Mac versions of the game are available. As the budget for *Treasure Hunt* was limited (25.000 USD), the technical level was kept simple, without the added features of 3-D graphics, and with only few animations. This has the advantage that

Treasure Hunt needs only little space on the hard disk, can be downloaded quickly and also runs on older computers which makes it attractive for professionals from countries all over the world.

Treasure Hunt is not a self-help game and should be played under guidance of a therapist. It is a tool for professionals (licensed clinical psychologists, psychotherapists and child psychiatrists) who have to legitimize themselves, agree to the conditions of use and then can download it for free. In turn, they are asked for donations to finance the website and further development of the game.

Methods

In order to evaluate the applicability and appropriateness of the game, between September 2008 and December 2009 all users received a first questionnaire by e-mail, inquiring after the country of origin, the professional training of the therapist (child psychiatrist or licensed clinical psychologist), the working situation (private practice or institution such as child guidance clinic, child mental health service, school counselling service or child psychiatry department), the therapeutic orientation of the therapist (CBT or other), the years of professional experience and the degree of satisfaction with *Treasure Hunt*.

All users who answered the first questionnaire were asked whether they were willing to cooperate for the further evaluation of *Treasure Hunt.* Those who consented received two additional questionnaires by email, one for the child and one for the therapist, which were to be

completed at the end of treatment. The questionnaire for the therapist inquired after the country and the working situation, the therapeutic orientation and the length of professional experience. It also asked for the ICD-10-diagnosis of the specific child in question. In several European countries (Switzerland, Germany, Belgium, Netherlands, Austria), an official ICD-10-diagnosis is necessary for psychotherapy to be financed by health insurances. The questionnaire, however, did not investigate how this diagnosis was given. Due to the extensive professional training of users, diagnoses were deemed reliable, since they were given by professionals. The questionnaire also contained questions concerning the length of treatment, the moment when the game was introduced during therapy and the ways the therapist felt supported by the game in treatment of the specific child. Last but not least, IQ-data of the child were asked for. IQ-data were grouped into three categories - below average (< 85), average (between 85 and 115) and above average (above 115).

The questionnaire for the child inquired about gender and age, whether the child had appreciated the game, which level was judged the favourite and which the most difficult one, what the child had learned from the game and whether he / she had suggestions for new tasks in the game.

There were two assessment points: one for those therapists who answered the questionnaire three months after download of the game and the second for the subgroup of those

therapists who consented to collaborate and send in questionnaires at the end of treatment of a specific child.

Results

Data on the applicability and appropriateness of *Treasure Hunt* reported here have a clear limitation - the lack of a control group. Moreover, a positive bias can not be excluded, as therapists with a positive attitude towards therapeutic computer games may have been more likely to download *Treasure Hunt,* answer the first questionnaire and participate in the further evaluation of the game.

Distribution. Since its introduction in June 2008, *Treasure Hunt* counts more than 1900 professional users (child psychiatrists and clinical child psychologists) from 35 countries. This does not mean they all use the game in their practice – but it is a sign for the keen interest in video games for child psychotherapy. While professionals from English- , German- and Dutch- speaking countries report to use the game regularly, therapists of the other countries downloaded *Treasure Hunt* probably out of curiosity. The Greek version of the game is released by the Greek Institute for Behaviour Therapy in Athens; no data on the number of Greek professionals working with the game are reported here. For the German, Dutch and English version of *Treasure Hunt,* more than 400 applications from social workers, nurses, teachers, physiotherapists and parents were turned

down, as their training is not comparable to that of a child psychiatrist or a clinical psychologist. In many European countries (Switzerland, Germany, Austria, Netherlands, Belgium), costs of psychotherapy are only covered by health insurances if the treatment is offered by a licensed child psychiatrist or clinical psychologist.

First impression by therapists. Between September 2008 and December 2009, 555 questionnaires were sent out by email. 176 users (31.5%) answered; however, 52 questionnaires were incomplete, leaving 124 for statistical analysis. 98.4% of these questionnaires came from German-, English- or Dutch-speaking countries. 118 users (95,2%) judge *Treasure Hunt* a useful instrument for child psychotherapy. The major part of users work in a private practice (n = 72; 58.1%), however, institutions such as child guidance clinics, school counselling services or child psychiatry departments are frequent users as well (n = 49; 39.5%). The average professional experience of users is 10.24 years (SD = 8.23) with a minimum of one and a maximum of 36 years, indicatin that *Treasure Hunt* is used by both inexperienced and very experienced psychotherapists.

Further evaluation by therapists and children. To evaluate the appropriateness of Treasure Hunt, 42 therapists from five countries (Switzerland, Germany, Belgium, Netherlands, and Egypt) were willing to cooperate. They received the second questionnaire (one for the child and one for the therapist) to complete at the end of treatment. The 42 therapists sent in questionnaires of 218 children in whose treatment *Treasure Hunt* had been used.

Client characteristics. The children in whose treatment *Treasure Hunt* was used came from the following countries: Switzerland (n =107; 49.1%), Germany (n = 67; 30.7%), Belgium (n = 41; 18.8%), Netherlands (n = 2; 0.9%) and Egypt (n = 1; 0.5%). The questionnaire from Egypt was answered by a Dutch psychologist who treated Dutch ex-pat children. Gender distribution was 156 (71.6%) boys and 62 (28.4%) girls. 59 (27.1%) children had been treated in an institution such as a child guidance clinic or a child psychiatry department, and 159 (72.9%) in a private practice of a licensed child psychologist or child psychiatrist. Children were on average 10.35 years old (SD 1.86) with a range from 6 to 19 years of age, indicating that *Treasure Hunt* is more or less used for the age group it was designed for, with some variability. For 81 (37%) children, no IQ-test was available. However, these children were judged as average intelligent by their therapist. For 137 (63%) children, IQ-data were at hand. All children in the category below or above average had undergone IQ-testing. Distribution of IQs was: below average for 5 (2.3%) children, average (between 85 and 115) for 169 (77.5%) and above average (> 115) for 44 (20.2 %) children.

As to the child's mental health problem, therapists reported 23 different diagnoses, which were reduced to ten diagnostic categories plus one category called 'others' containing diagnoses such as emotional disorder, post-traumatic stress disorder or sexual abuse. Table 2 shows the rank order of diagnoses for which *Treasure Hunt* is being used.

Insert Table 2

The broad range of diagnoses indicates that therapists judge basic CBT concepts as important not only for children with internalizing disorders (i.e. anxiety and depression) but also for problems such as attention-deficit-hyperactivity disorder (ADHD), oppositional-defiant disorder (ODD) and Asperger Syndrome Disorder (ASD). As *Treasure Hunt* was not specifically designed for children with ASD, therapists were asked why they used the game for this diagnosis. The answer was that the child would more easily get in contact with Captain Jones (the main person of the game) than with the therapist.

Client feedback. 215 children (98.6%) reported being satisfied their therapist had used *Treasure Hunt* during treatment. This corresponds to the view of therapists, who judged that 215 children liked the game and three children did not. The three children who did not like the game did not give a reason. When asked for suggestions to change the game, the majority answered they liked the game as it was, while 72 children (33 %) suggested to add more levels with more tasks. The favourite level was Level 2 (29.4%), followed by Level 3 (17.9%). The most difficult level was the ego-shooter of Level 5 (56.9%).

Therapist feedback. The 42 therapists were asked in which way they perceived *Treasure Hunt* as helpful for the particular child in treatment. Multiple answers were allowed. As shown in Figure 1, the most frequent answer (n = 191, 87.6%) was the explanation of important CBT concepts, followed by the use of the game as reinforcement (n = 123, 56.4 %) and the enhancement of child motivation (n = 109, 50%). *Treasure Hunt* was judged to structure therapy

sessions for 68 children (31.2 %) and to strengthen the therapeutic relationship in the case of 61 children (28 %).

In 56 cases (25.7 %), therapists introduced the game right at the beginning of therapy, while for a substantial number of children, the game was used only later on (n = 136, 62.4%) or even towards the end of treatment (n = 26, 11.9%).

Insert Figure 1

Conclusion

The therapeutic video game *Treasure Hunt*, a broadband-CBT-game, was judged a useful instrument by the majority of users, who were only child psychiatrists or licensed clinical psychologists. The majority of users work in a private practice, however institutions such as a child guidance clinic or a child mental health service appeared regular users of the game as well. Treasure Hunt seems to be used by both inexperienced and very experienced professionals.

Results of 218 questionnaires of children who played *Treasure Hunt* in psychotherapy clearly show that the vast majority of children reported being satisfied their therapist had used the game during treatment. The age range of the children indicates that *Treasure Hunt* is more or less used for the age group it was designed for (ages 8 to 12). The broad range of mental health problems Treasure Hunt is used for indicates that therapists judge basic CBT concepts as

important not only for children with internalizing disorders, but also for children with ADHD, ODD or other disorders. While it is certainly important to know that children appreciated the game, this is not a sufficient argument for its use. More important was the opinion of therapists on the impact of the game on treatment success. The 42 therapists treating the 218 children reported that the game was helpful in the explanation of CBT concepts, was used as reinforcement, enhanced child motivation, structured therapy session and strengthened the therapeutic relationship with the child. A limitation of these data is an eventual positive bias, as therapists with a positive attitude towards therapeutic computer games may have been more likely to participate.

The broad range of mental health problems for which Treasure Hunt is being used is encouraging, as the text of the game is deliberately based not only on treatment programmes for anxious or depressed children (Kendall 1990; Barrett 2000; Stallard 2003), but also on programmes for children with anger management problems or behaviour disorders (Nelson & Finch, 1996). In fact, the association between thoughts, feelings and behaviour is as relevant for children with externalizing disorders as it is for children with internalizing disorders. Moreover, the concept of helpful and unhelpful thoughts is essential for children with aggressive behaviour as well. Research on these children has shown that they tend to attribute hostile intentions quickly and as a result justify their own aggressive reaction towards peers (Dodge & Rabiner, 2004; Lochman & Dodge, 1994). This is covered in *Treasure Hunt* by unhelpful thoughts like “he only did

that to trick me – that's so typical of him", "other children are mean to me on purpose", and "that's the way I am, there's nothing I can do about it", which can be counteracted with the helpful thoughts "perhaps he didn't mean it like that", "I am also not always nice to others" and "it is difficult to change, but I think I can do it".

The area of therapeutic video games has seen several new developments recently. The game *Ricky and the Spider,* like *Treasure Hunt* released by the Department of Child and Adolescent Psychiatry at the University of Zurich, is directed at children between 6 and 12 years of age meeting criteria for a diagnosis of obsessive-compulsive disorder (OCD). Although CBT, eventually combined with medication, is the treatment of choice for OCD in children (March & Foa, 2004), there is a shortage of therapists (March & Benton, 2007; Marrs Garcia et al., 2010) as well as a lack of developmentally appropriate treatments tailored to younger children (Freeman et al., 2007). The purpose of *Ricky and the Spider* is to encourage children and their therapists to fight OCD with CBT-strategies and thus enhance the dissemination of evidence-based treatment strategies in the community. *Ricky and the Spider* contains various elements of cognitive behaviour therapy that are based on CBT treatment approaches for children (March & Muelle, 1994; Piacentini, Langley, & Roblek, 2007) as well as adults with obsessive-compulsive disorder (Foa et al., 1983; Salkovskis, 1999). Up to now, not more than pilot data on the utilization of *Ricky and the Spider* are available.

The Irish game *Gnattenborough's Island* teaches basic principles of CBT to children aged nine years and above (www.peskygnats.com). First exploratory evaluations show promising results (Coyle, McGlade, Doherty, & O'Reilly, 2011). Like in *Treasure Hunt*, children have to recognize negative automatic thoughts and replace them by more helpful ways of thinking.

The game *RAGE-control*, under development at Children's Hospital Boston, is aimed at children with severe anger problems to gain control of their emotions. While shooting down space aliens in the game, the child wears a monitor that tracks heart rate during play. If the child gets overexcited and the indicator rises above a certain level, he / she loose the ability to shoot. Participants for a randomized treatment study are currently being recruited (http://harvardmagazine.com/2011/01/gaming-the-emotions).

At Rochester Institute of Technology, a computer game is being developed to help adolescents and young adults improve their self-control skills. Like *RAGE-control*, this game will incorporate biofeedback in order to help players learn to monitor the physiological manifestations of anxiety and stress (www.rit.edu/news/story.php?id=48502). Incorporating elements of anger management programmes for children (Lochman, 1992; Nelson & Finch, 1996) into therapeutic computer games seems a great opportunity to support treatment of a notoriously difficult and often non compliant client group. If computer games based on, for example, Dodge's theory of social-cognitive biases of aggressive children (Dodge, 2006) could help aggressive children to

reduce hostile attributional biases and ameliorate cognitive processing of potentially threatening situations, treatment of a challenging group of clients might become easier (Brezinka, 2010).

The creation of health games is usually described as very costly with large teams of diverse professionals, including professional artists and programmers (Baranowski et al., 2003). Yet, health games become rather expensive if they have to rival the look and feel of commercial games; the example of *Treasure Hunt* shows that it is possible to develop a therapeutic video game for a small budget. The fact that a game also runs on older computers may be an advantage for distribution to different countries around the world.

It is important to underline that therapeutic computer games can by no means replace child psychotherapy or the importance of a positive child-therapist relationship. Using a computer game in treatment does not mean that the therapist becomes a mere 'digitherapist' or that 'traditional' therapeutic methods such as writing, drawing, or role-playing lose their significance in the treatment of children and adolescents. In fact, therapeutic computer games will show their maximum potential only under the guidance of a therapist who has a positive relationship with the child and, therefore, can explain and comment on the concepts introduced in the game and link them to the specific problems of the child. This is also the reason why *Treasure Hunt* is exclusively distributed to professionals, as it will reach its maximum potential only with the guidance of a therapist.

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Figure 1. How doe therapists judge the effectiveness of Treasure Hunt with a particular child in question? Answers from 42 therapists for 218 children, multiple answers possible