



Games for a Good Cause: Serious Games in Social Development and Medical and Rehabilitation Therapy

Badar Al Lawati^(✉)

DePaul University, Chicago, IL 60604, USA
ballawat@mail.depaul.edu

Abstract. Playing games has often been associated with negative behaviors like playing and not taking things seriously or even wasting time. However, more recently researchers started looking at the positive impacts of playing games or what became to be known as serious games. This study examines the major publications in the usage of serious games in therapy, training, and behavior development. The study analyzed the most cited papers in the field and evaluate what has been done so far.

Keywords: Serious games · Therapeutic games · Game design

1 Introduction

Salen & Zimmerman defined the game design process to emphasize the relationship of the game with its player, when they wrote “*Game design is the process by which a game designer creates a game, to be encountered by a player, from which meaningful play emerges*” [1]. Games have been used in different environments outside the entertainment and fun fields. Majority of the initial research that was conducted on video games was to evaluate the negative impacts of playing digital games. However, there was also an interest in the positive impacts of computer games [2]. This research attempts to evaluate the previous research conducted on the usage of serious video games for therapeutic and training purposes.

2 Methodology

This paper is an attempt to survey the field and evaluate all the publications of usages of serious games. The initial idea was to search certain keywords on the major databases. The keywords were a combination of Hedonic, Serious, Educational, Learning, Therapeutic. They were combined with each of the following keywords: Game, Gamification, User experience, play experience, User behavior, Education, Training, Technology, Technical, IS, System, Business, Marketing, Management, Service, E-Commerce, Online, Streaming, HCI, Communication, Social, Adoption, Enjoyment, Entertainment, Multimedia, Game play. The 75 unique combinations of these keywords were then searched for on the major scientific databases including: ACM, IEEE,

PsycInfo, ABI, Science Direct, and Science Citation Index. The top 100 results were then exported to an Excel sheet with about 7500 search results. Reviewing these articles wasn't doable while keeping the research up to date. So, a decision was made to use the same keyword combinations and instead of the different databases, a single "Google Scholar" search was performed, and the 10 most highly cited results were exported for review. However, that would still be a long project with about 750 articles to be reviewed. So, we decided to reduce the number of keywords and use the 4 most important keywords: Therapeutic Games, Training Games, Serious Games, & Educational Games. The search for these keywords was performed on Google Scholar and the top 25 most cited papers were collected for each keyword search (total of 100 articles were downloaded and evaluated).

The final review was conducted, and this paper is the general outcome of evaluating the most highly cited papers related to therapeutic, serious, and training games on Google Scholar.

3 Previous Research

Computers, technology, & the internet are becoming a normal part of life for millions of people especially children [3], and with that there has been an increased interest in utilizing those technologies for health purposes. For years, video games were associated with entertainment and fun. However, interest in other types of games has been increasing recently. Serious games for instance, is one of the areas where video games have caught researchers interest, specifically serious games in therapeutic sessions [4, 5]. *"Game-based methods and concepts and game technology are combined with other ICT technologies and research areas applied to a broad spectrum of application domains ranging from training, simulation, and education to sports and health or any other social relevant topic or business area"* [6].

Many researches have attempted to define serious games over the years, however one of the most comprehensive definitions is the one introduced by the Guardiola and co-authors [7] where they define serious games as: *"A serious game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome. But a serious game is combined with a defined real life objective"*. They explain that the main difference between a regular video game and serious games is when designing serious games there is an attempt to impact the real life of the player.

Video games are used to help motivate patients & develop skills, and they are being used in physiotherapy, occupational therapy, & psychotherapy [4, 8, 9]. Nearly 30 years ago, Gardner [10] argued that children's repertoire of problem solving strategies can be observed better through integrating commercial video games in child's psychotherapy. And McCallum confirmed that: *"Computer games and personalized health share the ability to place the individual in the center of the action, they provide challenges that match the skills of the player"* [11].

In their article [6] the researchers discuss exergames: *"which are a combination of methods and concepts of serious games, adaptation and personalization, authoring*

and sensor technologies". They proposed a framework for serious games in sports and health aiming to motivate players to sustain regular workouts and improve into healthier lifestyles.

Previous intensive research was performed by Swank [12] where they explored the use of games in relation to the theoretical structure of social learning, cognitive behavior, psychoanalytic, and gestalt theories from many of the classical studies within the literature. They state that the origins of gaming in therapy go all the way back to the 70's, but games can be one or a mixture of these types:

- Games that involve physical skill, and the outcome relies on participants' gross and fine motor skills
- Games of strategy, which focuses on rational problem solving
- Games of chance, which results in outcomes uncontrolled by the participants

Swank [12] argued that it all depends on the therapists' judgment on which type of game they should use with each patient. Depending on what kind of therapy is anticipated, the type of game can be defined. Each game would have some therapeutic components within it, and those components could be:

1. Games can enhance the therapeutic process by assisting with reducing resistance present during the beginning stage of therapeutic process including the anxiety of entering therapy
2. Games create a natural environment allowing clients to relax which enables the expression of feelings with less conscious
3. Games assist in creating a safe place promoting a relaxed atmosphere, which leads to the development of natural communication
4. Games allow players to learn and try out behaviors to determine whether they are socially acceptable or no

There has been an attempt to design an evaluation method for games used in therapy. Mader and co-authors [13] introduced a new model to analyze therapeutic games. They introduce a game called: "Le Village Aux Oiseaux", which was built through a partnership between 4 game makers and 2 research labs, with the intention to help the therapy of Alzheimer's patients. This game was the basis for the design model they introduced later on in their research. The objective behind this model was:

- They wanted to analyze existing therapeutic games to find their interesting features
- The model is intended to facilitate the game designer's work during the design process.

The model is simply based on the relationship between the therapy, the player, & the game, and their underlying relations and its importance in designing games for therapy. In order to properly evaluate each game, the researchers suggest that the analysis focuses on each of the 3 main elements and ask the following questions [13]:

- Therapy: the most important element of therapy within the model is: What the therapy can improve? What is intended and what is expected?
 - Expected short-term therapeutic value: e.g. burning calories, improving attentional network

- Expected long-term therapeutic value: e.g. definitive recovery, life-long supporting therapy
 - Scientific proof of efficiency: e.g. long-term effects demonstrated, to be evaluated, discussed
 - Scientific references: Do similar useful games features have been scientifically evaluated in other games?
- Player: the most important element of the player within the model is: to understand what the target is able to do and learn regarding its health condition.
- Age range
 - Gender
 - Particular conditions: e.g. early states of the Alzheimer disease, motor control loss in upper limb
 - Abilities: Regarding their age and particular conditions, which are the knowledge and abilities (i.e. motor control and cognitive functions) of the player? Are they likely to present other particular conditions?
- Game: the model proposes to analyze the gameplay of therapeutic games from the challenge (goals, feedbacks, scores, and difficulty) and variability perspectives.
- Input system: How does the player interact with the game?
 - Output system: How does the game convey information?
 - Goals: Are there appealing goals? Are they short, mid or long-term goals?
 - Feedbacks: Which means are used to communicate with the player? Are they informative on the player performance or progression?
 - Score: What does the score mean? (e.g. player performance, player progression, health improvement) Is the score informative on the progression towards mid or long-term therapeutic goals?
 - Difficulty: How is the difficulty level chosen? (e.g. adaptive, manually chosen by the player, manually chosen by another person) If adaptive, how does it work? Which parameters of the game are modified by the difficulty level?
 - Variability: Does the game propose enough variability? (e.g. the player is always doing the same sequence of actions, the player learns regularly to master new patterns, the player can choose his own path within the game, the player has to create new strategies to progress)
 - Usability: What are the minimal abilities and knowledge necessary to play the game? Does the game features tutorials and explanations?
 - Expected positive side-effect: What can the game provide to the player that is not part of the therapy itself?
 - Reported serious uses: Have the game or analyzed features been used for another serious purpose?

3.1 Video Games in Rehabilitation Therapy

Occupational therapy practices change over time, especially with the vast evolution of science and technology, *“Technological advancement continually influence our current practice and occasionally they create new tools for intervention”* [14]. In virtual reality the individuals have the opportunity to forget about the surroundings,

where technology is able to provide a natural environment, allowing the patients to focus on the task in the simulated environment [15].

In their paper, Halton [14] discusses how virtual environments work as simulators and how beneficial they are overall. They present some of the challenges in these environments based on the previous literature. Finally, it introduces the Nintendo Wii as a practical example of Virtual Environments, it talks about practically using the Wii at the Glenrose Rehabilitation Hospital. They finally present how beneficial it is for therapy if rehabilitation, engineering, computer science, and industry would partner together to create something ultimate.

On the other hand, video games are also being widely used in brain injuries rehabilitation. In their article [16] the researchers discuss how can the design of simple video games have a positive impact on stroke rehabilitation patients. Their target patients in the study were the upper limb stroke rehabilitation patients. Their idea is to develop custom low-cost video games that can be deployed at home, as most of the video games used in rehabilitation revolve around a functional activity. However, it has been argued that integrating games into virtual reality environments can be highly motivating to patients. From the game design theory, the researchers have identified two main design principles that are related to rehabilitation:

1. Meaningful Play: a clear relation between the user's action and the system's outcome.
2. Challenge: have a balanced challenge level so it is not too easy that makes it boring, nor too difficult making it impossible to win and lose interest.

The researchers were able to design few simple games, test them, and analyze the results. The analysis showed positive impact on patients using these simple game designs with clear goals.

Using games doesn't serve to only improve the rehabilitation process, but the researchers [17] also argue that the journey of motor skills rehabilitation can be very boring to patients, especially the elderly ones. The researchers performed a comprehensive search on all different design criteria created in the past literature, criteria included:

- Designing for stroke rehabilitation:
 - Adaptability to motor skill level
 - Meaningful tasks
 - Appropriate feedback
 - Therapy - Appropriate
- Designing to entertain the elderly:
 - Appropriate cognitive challenge
 - Simple objective/interface
 - Element of social activity
 - Appropriateness of genre
 - Creation of new learning

After compiling the list of papers that meet the search criteria, they evaluated the commercially available used games in rehabilitation and performed an analysis of how these games comply with the design criteria. The majority of these games scored high

on their criteria, which indicates that using games in therapy can actually engage patients into the rehabilitation process.

In their paper, [18] the researchers discuss the usage of games in stroke rehabilitation patients and how a portion of stroke patients can expedite their rehabilitation journey through performing 100 s of daily repetitions of motions with their affected limbs. They discuss the possible impacts of strokes on different people and how different patients react to different rehabilitation techniques differently. Most of these techniques are based on certain motion activities the patient will perform on a daily basis to enhance their affected motion abilities. The objective of their research is to create a game authoring system in which therapists can create or customize games for use by individual patients. Based on the initial analysis they performed in correspondence with therapists, it showed that the main concern is the lower extremity rehabilitation in post-stroke rehabilitation to re-gain mobility while in the rehabilitation, however the upper extremity rehabilitation can happen in sessions after discharge or while at home. They analyze current gaming platforms available in the commercial market and what games therapists are currently using in post-stroke rehabilitation. After many brainstorming sessions with the therapists, they identified 3 main attributes in the space of rehabilitation game design:

- Social Context
- Type of Motion required
- Cognitive Challenge

They finally share some of the lessons learned while conducting this study when it comes to designing games for post-stroke rehabilitation:

- Making games playable for a broad range of stroke patients
- Ensuring that games are valuable for a therapeutic perspective
- Making games fun and challenging

Another study to verify the usage of video games in long-therapy for post-stroke patients was the research introduced by Alankus et al. [19]. They focused on the complications and the problems that could happen when the patient is performing therapy alone (at home), where people with limited motion often compensate for the lack of motion in one joint by moving another one. This eventually creates another problem rather than solving the original one. The objectives behind this study were:

- An iterative, formative study of a method for detecting torso compensation.
- A validation study that quantifies our torso compensation method's error as compared to a motion capture system.
- An iterative, formative study of a game design, requiring therapeutic exercise and eliciting natural compensation.
- An iterative, formative study of in-game compensation feedback mechanisms that discourage compensation.
- A summative study comparing compensation behavior in versions of our game with five different operant-conditioning strategies for reducing compensation.

The outcomes of their research were a methodology to reliably sense compensatory torso motion in the context of shoulder exercises done by persons with stroke as well as

designing and experimenting evaluation of operant-conditioning-based strategies for games that aim to reduce compensatory torso motion.

An interesting study was conducted by Cheng et al. [20], where the researchers argue that different game design patterns affect the impact on brain injury rehabilitation. They discuss that brain injury therapists use a mixture of commercial and specifically designed games in their therapy. They mainly look at the design elements (that usually impact the patients' engagement with the game) and at how much those games meet the therapy objectives and goals. They explain that there is a big gap in the literature when it comes to research conducted on the impact of game designs in brain injury therapy. This paper argues that research on game design patterns is beneficial because [20]:

1. *“Game design patterns have the capacity to capture the information about brain injury rehabilitation needs in a fixed structure to facilitate expansion of game design knowledge”*
2. *“Patterns have the ability to distill abstract game design knowledge from a large amount of data about how well existing games worked in therapy into a set of coherent and tangible exemplars”*
3. *“Patterns as a common language can serve as a valuable tool to facilitate effective communication and mutual understanding among game designers and therapists”*

They collected data from a dataset that contains 566 games therapy cases and analyzed them to generate a list of 14 efficacy-centered game design patterns. These patterns focus on game design considerations when addressing therapeutic goals in brain injuries rehabilitation.

3.2 Video Games in Pain Management

Many studies have used video games as a distractor in managing pain. The idea behind it is that distraction consumes some degree of the attentional capacity that otherwise would be dedicated to pain perception [9]. In their paper [21], the authors discussed how video games can be used as distractors in pain management, especially in children, and argued that:

- Videogames are likely to engage much of a person's individual active attention because of the cognitive and motor activity required.
- Videogames allow the possibility to achieve sustained achievement because of the level of difficulty (i.e. challenge) of most games during extended play.
- Videogames appear to appeal most to adolescents.

Another attempt to use video games as a distraction in managing pain was the research introduced by Parry et al. [22], where they argue that interacting with video games like the Nintendo Wii & Play Station Eye Toy encourages range of motions while distracting from pain. Their objective was to evaluate the specific demands of interactive video games in relation to use in burn therapy goals and how will that determine their therapeutic benefits and guide their use in burn rehabilitation. They study the upper extremity motion of 24 healthy children while interacting with 2 interactive games (that have been used in burn therapy in the past). Their analysis

supported the idea that interactive video games offer activities with therapeutic potential to improve range of motion for burn patients.

3.3 Video Games in Training & Skills Development

A recent study [23] analyzed how playing video games can enhance visual attention and identified an: *“Increased ability to process information over time and an increase in the number of visual items that can be apprehended”*. It also discussed spatial distribution, which: *“enhanced allocation of spatial attention over the visual field”*. The study found a positive correlation between playing video games and visual attention processing. Note that virtual reality video games that include a simulation training, can potentially help in acquiring complex real life skills, where skill transfer wouldn't require force feedback if the visual information compensates [24].

In their paper [24], the researchers discuss the contribution of playing video games on the surgical skills surgeons develop while performing laparoscopic surgeries and suturing. The hypothesis was that younger surgeons might acquire surgical skills faster than their older colleagues due to their past video games exposure. Previous studies have also shown that exposure to video games can lead to better skills in video endoscopic procedures. 31 surgeons have participated in this study, all from the same hospital. After analyzing the results, there was a significant positive relationship between playing video games and enhancing surgical skills in a laparoscopic environment [24].

3.4 Video Games in Behavior Development

A recent suggestion was made to utilize appealing video games to develop the moral level of the youth [25, 26]. Thoma and the co-authors [27] assumed that moral development is related to moral behavior. However it is argued that behavior values are developed by the youth through their interaction with other youth groups [25, 28]. It is also argued that *“basic moral norms and principles are structures arising through experiences of social interaction”* [29]. And thus, individuals are influenced by natural behavior norms and are likely to want to belonging in a group, allowing us to determine in high context the individual's behavior based on the groups moral behavior [30].

In their paper [31], the researcher discusses how they used the “Moral Development Measure MOTEC” [32] in measuring the effects of playing a video game for a period of time on moral development. Then the moral levels were categorized according to Bull's theory of four stages of moral development [33]. The study used 6 indices of moral development, and 3 of those indices (moral stages, punishment, and post transgressional reactions) revealed a positive effect on the participants [31].

The researchers in article [34] points the difficulty therapists face in engaging with adolescents who experience increased mental health problems. Unfortunately, most of those patients don't receive therapy help, and if they do, only few of them would fully engage with therapists. A report from the US General Surgeons [35] discuss the main reasons for these difficulties as:

- Feeling that no person or service could help.
- Feeling the problem was too personal to tell anyone
- Feeling they could handle the problem on their own

The researchers describe the work done in building a 3D game based on a therapy design model that will help adolescents with mental health problems to fully engage with therapists. They suggest that computers can assist in the communication between therapists and teenagers. They build the game and test it in a session with few candidates. They divided the approach into 5 therapeutic conversational strategies:

1. Setting Goal: knowing what do we want to achieve?
2. Recognizing Exceptions: assessing the patient in case the symptoms are not present to repeat the activity/task when it is more acute
3. Coping: help patients learn new techniques in dealing with their problems
4. Identifying resources: Help identify resources to help with therapy like family and friends
5. The Miracle Question: “Imagine you woke up tomorrow and the problem was solved, how would your life be different?”

Additionally, the researchers [36] discuss how a specially designed game was used for cognitive behavior therapy with children who come into treatment for various mental health problems. They attempted to evaluate the applicability and appropriateness of the game and 124 therapists were asked to answer a questionnaire on their impression of the “Treasure Hunt” game after using it for 3 months. Next, 42 of those therapists volunteered to participate in further evaluations and sent questionnaires to 218 children in whose therapy the game Treasure Hunt was used. The analysis showed a positive impact on the children that used the game in therapy.

4 Conclusion and Final Thoughts

The usage of commercially available games in therapy, training and education started almost half a century ago. Since then, practitioners agreed that although they are able to use those commercially available games, there is a need to design specific games that can assist more effectively in therapy, education, & training. The high cost of designing such games seems to be the main barrier to such action. Nevertheless, there are few successful attempts where game designers joined forces with therapists and designed specific games to support rehabilitation therapy. However, those initiatives were limited in scope and didn't generate any major awareness.

Annex A

See Table 1

Table 1. The number of citations as of Feb 24th, 2019

Citation	Number of citation
Salen, K., K.S. Tekinbaş, and E. Zimmerman, Rules of play: Game design fundamentals. 2004: MIT press	6833
Connolly, T.M., et al., A systematic literature review of empirical evidence on computer games and serious games. 2012. 59 (2): p. 661–686	1653
Bremer, J.J.C. and A.P. Clinics, The internet and children: advantages and disadvantages. 2005. 14 (3): p. 405–428	83
Annema, J.-H., et al. Videogames in therapy: a therapist's perspective. In Proceedings of the 3rd International Conference on Fun and Games. 2010. ACM	85
Sawyer, B. and P. Smith. Serious games taxonomy. in Sides from the Serious Games Summit at the Game Developers Conference. 2008	331
Göbel, S., et al. Serious games for health: personalized exergames. In Proceedings of the 18th ACM international conference on Multimedia. 2010. ACM	197
Guardiola, E., et al., Du jeu utile au jeu serieia (serious game). 2012(1): p. 85–91	10
Burdea, G.C.J.M.o.i.i.m., Virtual rehabilitation-benefits and challenges. 2003. 42 (05): p. 519–523	350
Griffiths, M.J.C.c.p. and psychiatry, The therapeutic use of videogames in childhood and adolescence. 2003. 8 (4): p. 547–554	109
Gardner, J.E.J.P.T., Research, Practice, Training, Can the Mario Bros. help? Nintendo games as an adjunct in psychotherapy with children. 1991. 28 (4): p. 667	116
McCallum, S.J.S.H.T.I., Gamification and serious games for personalized health. 2012. 177 (2012): p. 85–96	248
Swank, J.M.J.I.J.o.P.T., The use of games: A therapeutic tool with children and families. 2008. 17 (2): p. 154	24
Mader, S., S. Naffcin, and G. Levieux. How to analyse therapeutic games: the player/game/therapy model. In International Conference on Entertainment Computing. 2012. Springer	37
Halton, J.J.O.t.n., Virtual rehabilitation with video games: A new frontier for occupational therapy. 2008. 9 (6): p. 12–14	141
Schultheis, M.T. and A.A.J.R.p. Rizzo, The application of virtual reality technology in rehabilitation. 2001. 46 (3): p. 296	505
Burke, J.W., et al., Optimising engagement for stroke rehabilitation using serious games. 2009. 25 (12): p. 1085	488
Flores, E., et al. Improving patient motivation in game development for motor deficit rehabilitation. in Proceedings of the 2008 International Conference on Advances in Computer Entertainment Technology. 2008. ACM	214

(continued)

Table 1. (continued)

Citation	Number of citation
Alankus, G., et al. Towards customizable games for stroke rehabilitation. in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. 2010. ACM	327
Alankus, G. and C. Kelleher. Reducing compensatory motions in video games for stroke rehabilitation. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. 2012. ACM	33
Cheng, J., C. Putnam, and D.C. Rusch. Towards efficacy-centered game design patterns for brain injury rehabilitation: A data-driven approach. In Proceedings of the 17 th International ACM SIGACCESS Conference on Computers & Accessibility. 2015. ACM	11
Redd, W.H., et al., Cognitive/attentional distraction in the control of conditioned nausea in pediatric cancer patients receiving chemotherapy. 1987. 55 (3): p. 391	257
Parry, I.S., et al., Commercially available interactive video games in burn rehabilitation: therapeutic potential. 2012. 38 (4): p. 493–500	31
Green, C.S. and D.J.N. Bavelier, Action video game modifies visual selective attention. 2003. 423 (6939): p. 534	2489
Rosser, J.C., et al., The impact of video games on training surgeons in the 21st century. 2007. 142 (2): p. 181–186	644
Sherer, M.J.C.J. and Behavior, Peer group norms among Jewish and Arab juveniles in Israel. 1991. 18 (3): p. 267–286	14
Sherer, M.J.J.o.y. and adolescence, Effects of group intervention on moral development of distressed youths in Israel 1985. 14 (6): p. 513–526.	15
Thoma, S.J., et al., Describing and testing a moderator of the moral judgment and action relationship. 1991. 61 (4): p. 659	121
Allen, R.F., College fields, from delinquency to freedom. 1970: Special Child Publications	16
Kohlberg, L.J.M.d., b.T. research, and s. issues, Moral stages and moralization: The cognitive-development approach. 1976: p. 31–53	4936
Sherer, M.J.C.J. and Behavior, The incarceration period and educational achievements of juvenile delinquents. 1983. 10 (1): p. 109–120	6
Sherer, M.J.C.i.H.B., The effect of computerized simulation games on the moral development of junior and senior high-school students. 1998. 14 (2): p. 375–386	24
Ziv, A.J.J.o.M.E., Measuring aspect of morality. 1976. 5 (2): p. 189–201.	26
Bull, N.J., Moral Judgement from Childhood to Adolescence (International Library of the Philosophy of Education Volume 5). 2010: Routledge	174
Coyle, D., et al., Personal Investigator: A therapeutic 3D game for adotescent psychotherapy. 2005. 2 (2): p. 73–88	134
General, U.S., Mental Health: A Report of the Surgeon General. A report to US Department of Health and Human Services. 1999	1
Brezinka, V.J.C.c.p. and psychiatry, Computer game supporting cognitive behaviour therapy in children. 2014. 19 (1): p. 100–110	50

References

1. Salen, K., Tekinbaş, K.S., Zimmerman, E.: *Rules of Play: Game Design Fundamentals*. MIT press, Boston (2004)
2. Connolly, T.M., et al.: A systematic literature review of empirical evidence on computer games and serious games. *Comput. Educ.* **59**(2), 661–686 (2012)
3. Bremer, J.J.C., Clinics, A.P.: The internet and children: advantages and disadvantages. *Child Adolesc. Psychiatr. Clin.* **14**(3), 405–428 (2005)
4. Annema, J.-H., et al.: Videogames in therapy: a therapist's perspective. In: *Proceedings of the 3rd International Conference on Fun and Games*, ACM, New York (2010)
5. Sawyer, B., Smith, P.: Serious games taxonomy. In: *Slides from the Serious Games Summit at the Game Developers Conference* (2008)
6. Göbel, S., et al.: Serious games for health: personalized exergames. In: *Proceedings of the 18th ACM international conference on Multimedia*, ACM, Florence (2010)
7. Guardiola, E., et al.: Du jeu utile au jeu sérieux (serious game). *Hermès, La Revue* **2012**(1), 85–91 (2012)
8. Burdea, G.C.: Virtual rehabilitation—benefits and challenges. *Methods Inf. Med.* **42**(05), 519–523 (2003)
9. Griffiths, M.: The therapeutic use of videogames in childhood and adolescence. *Clin. Child Psychol. Psychiatry.* **8**(4), 547–554 (2003)
10. Gardner, J.E.: Can the Mario Bros. help? Nintendo games as an adjunct in psychotherapy with children. *Psychol. Psychother. T.* **28**(4), 667 (1991)
11. McCallum, S.: Gamification and serious games for personalized health. *Stud. Health. Technol. Inform.* **177**(2012), 85–96 (2012)
12. Swank, J.M.: The use of games: a therapeutic tool with children and families. *Int. J. Play Ther.* **17**(2), 154 (2008)
13. Mader, S., Natkin, S., Leveux, G.: How to analyse therapeutic games: the player / game / therapy model. In: Herrlich, M., Malaka, R., Masuch, M. (eds.) *ICEC 2012. LNCS*, vol. 7522, pp. 193–206. Springer, Heidelberg (2012). https://doi.org/10.1007/978-3-642-33542-6_17
14. Halton, J.J.: Virtual rehabilitation with video games: a new frontier for occupational therapy. *Occup. Ther. Now* **9**(6), 12–14 (2008)
15. Schultheis, M.T., Rizzo, A.A.: The application of virtual reality technology in rehabilitation. *Rehabil. Psychol.* **46**(3), 296 (2001)
16. Burke, J.W., et al.: Optimising engagement for stroke rehabilitation using serious games. *Vis Comput.* **25**(12), 1085 (2009)
17. Flores, E., et al.: Improving patient motivation in game development for motor deficit rehabilitation. In: *Proceedings of the 2008 International Conference on Advances in Computer Entertainment Technology*. ACM, Yokohama (2008)
18. Alankus, G., et al.: Towards customizable games for stroke rehabilitation. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, New York (2010)
19. Alankus, G., Kelleher, C.: Reducing compensatory motions in video games for stroke rehabilitation. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, New York (2012)
20. Cheng, J., Putnam, C., Rusch, D.C.: Towards efficacy-centered game design patterns for brain injury rehabilitation: a data-driven approach. In: *Proceedings of the 17th International ACM SIGACCESS Conference on Computers & Accessibility*. ACM, New York (2015)

21. Redd, W.H., et al.: Cognitive/attentional distraction in the control of conditioned nausea in pediatric cancer patients receiving chemotherapy. *J. Consult. Clin. Psychol.* **55**(3), 391 (1987)
22. Parry, I.S., et al.: Commercially available interactive video games in burn rehabilitation: therapeutic potential. *Burns* **38**(4), 493–500 (2012)
23. Green, C.S., Bavelier, D.J.N.: Action video game modifies visual selective attention. *Nature* **423**(6939), 534 (2003)
24. Rosser, J.C., et al.: The impact of video games on training surgeons in the 21st century. *JAMA Surg.* **142**(2), 181–186 (2007)
25. Sherer, M.J.: Peer group norms among Jewish and Arab juveniles in Israel. *Crim. Justice Behav.* **18**(3), 267–286 (1991)
26. Sherer, M.: Effects of group intervention on moral development of distressed youths in Israel. *J. Youth Adoles.* **14**(6), 513–526 (1985)
27. Thoma, S.J., et al.: Describing and testing a moderator of the moral judgment and action relationship. *J. Pers. Soc. Psychol.* **61**(4), 659 (1991)
28. Allen, R.F.: *Collegefields, from delinquency to freedom*. Special Child Publications (1970)
29. Kohlberg, L.: Moral stages and moralization: The cognitive-development approach. *Moral development and behavior: Theory research and social issues*, 31–53 (1976)
30. Sherer, M.: The incarceration period and educational achievements of juvenile delinquents. *Crim. Justice Behav.* **10**(1), 109–120 (1983)
31. Sherer, M.: The effect of computerized simulation games on the moral development of junior and senior high-school students. *Comput. Hum. Behav.* **14**(2), 375–386 (1998)
32. Ziv, A.: Measuring aspects of morality. *J. Moral Educ.* **5**(2), 189–201 (1976)
33. Bull, N.J.: *Moral Judgement from Childhood to Adolescence* (International Library of the Philosophy of Education, vol. 5. Routledge, New York (2010)
34. Coyle, D., et al.: Personal investigator: a therapeutic 3D game for adolescent psychotherapy. *Interact. Tech. Smart Educ.* **2**(2), 73–88 (2005)
35. General, U.S., *Mental Health: A Report of the Surgeon General*. A report to US Department of Health and Human Services (1999)
36. Brezinka, V.: Computer games supporting cognitive behaviour therapy in children. *Clin. Child Psychol. Psychiatry* **19**(1), 100–110 (2014)