

PSYCHOTHERAPY BASED GAME DESIGN FOR HEALING BRAIN TUMOR
IN CHILDREN

SADAF SAJJAD

UNIVERSITI TEKNOLOGI MALAYSIA

PSYCHOTHERAPY BASED GAME DESIGN FOR HEALING BRAIN TUMOR
IN CHILDREN

SADAF SAJJAD

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy (Computer Science)

Faculty of Computing
Universiti Teknologi Malaysia

FEBRUARY 2017

This dissertation is dedicated to my Father Syed Shahid Abbas, Mother Dr. Shaheen Shahid, Husband Dr. Sajjad Mohsin and my Children Ali and Anusha.

I love you all.

ACKNOWLEDGEMENT

Foremost, I would like to acknowledge my supervisor, Prof. Dr. Abdul Hanan Abdullah for agreeing to offer as my supervisor and for his endurance and advice during many occasions as I completed my dissertation. I would like to thank my thesis committee, Prof. Dr. Abdullah Zawawi, Dr. Mohd Shahrizal and Prof. Dr. Hasbullah Idris for their direction, dedication, insightful comments and hard questions. Special gratitude to my lab mates; Ali Shahid, Siti Salmah, Juliet Gaithuru and Tasneem Jaber, thanks for the fun and support at thesis submission and defense time. I greatly look forward to having all of them as colleagues in the years ahead. Additionally, I would like to thank Pakistan Ministry of Information Technology, ICT R&D funds for providing me the funding for accomplishing my dreams on such a challenging work. I truly appreciate all of their funding as I navigated this process.

I have been blessed with very loving and helpful parents who have always stressed the importance of education and I know that this respect for education has, in some way, shaped my morals and made me the person that I am today. Nothing has made the importance of life more apparent to me than my two kids. My son Ali Mohsin helped me in making my presentations very attractive. My daughter Anusha Sajjad is a sunshine for me. My course work from Malaysia was possible only due to her bright smile she gave me when I was leaving for pursuing the studies. She is a biggest contributor to this work.

As for my husband Dr. Sajjad Mohsin, I find him my most enthusiastic cheerleader; he is my best friend; and he is an amazing husband and mentor. I am grateful to my husband not just because he has given up so much to make my career a priority in our lives, but because he has seen me through the ups and downs of the entire PhD process and believed in me. I had an academic background of Clinical Psychology and he believed that there is also a Computer Scientist in me. Without a doubt, he is the only contributor to my interest in Computer Science that helped me to get this day.

ABSTRACT

Brain tumor is the second largest deadly disease in children. Diagnosis of brain tumor in children may lead to other problems including psychological distress. Recent research has proven that health games have been effective for the management of psychological problems. There is still lack of psychotherapeutic game design that would help patients to alleviate psychological distress. Therefore this research proposes automation of psychotherapy using game design. The proposed game design integrates psychotherapy into it. The psychotherapy design consists of play therapy and guided imagery therapy to make a play guided imagery therapy (PGIT). The existing Mechanics, Dynamics and Aesthetics (MDA) game design framework has been enhanced into Mechanics, Dynamics, Aesthetics and Therapy (MDA-T) framework to facilitates the development of game that includes psychotherapy aspect in the design. The therapeutic game is developed and experimented on children with brain tumor. Two groups were formed with one group played the game and other group acts as a control group. Both the groups have undergone established psychological testing before and after playing the game. The results prove that the group that played the game had shown remarkable improvement as compared to their results before game playing. On the other hand, the control group has shown no significant improvement. The four psychological symptoms that represent the main indicators of brain tumor patients are measured. They are anxiety, depression, aggression and disruptive behavior. The results of the experiment shows that, anxiety and depression of the children have been reduced by more than 30%, and, anger and disruptive behavior are reduced by 20% and 5% respectively. In conclusion, the proposed therapeutic game has contributed toward producing positive behavioral changes in children with brain tumor.

ABSTRAK

Tumor otak adalah penyakit berbahaya yang kedua terbesar pada kanak-kanak. Diagnosis tumor otak pada kanak-kanak boleh membawa kepada masalah lain termasuk tekanan psikologi. Penyelidikan terkini telah membuktikan bahawa permainan kesihatan boleh memberi kesan kepada masalah pengurusan psikologi. Masih terdapat kekurangan dalam reka bentuk permainan psikoterapi yang boleh membantu pesakit untuk mengurangkan tekanan psikologi. Oleh itu kajian ini mencadangkan automasi psikoterapi menggunakan reka bentuk permainan. Reka bentuk permainan yang dicadangkan mengintegrasikan psikoterapi ke dalam permainan tersebut. Reka bentuk psikoterapi terdiri daripada terapi bermain dan terapi imej yang dibimbing untuk membuat permainan berpandu berasaskan terapi imejan (PGIT). Rangka kerja reka bentuk permainan yang sedia ada seperti Mekanik, Dinamik Estetik (MDA) telah dipertingkatkan ke rangka kerja Mekanik, Dinamik, Estetik dan Terapi (MDA-T) untuk memudahkan pembangunan permainan yang merangkumi aspek psikoterapi dalam reka bentuk. Permainan terapeutik dibangunkan dan diuji kepada kanak-kanak yang menghadapi tumor otak. Dua kumpulan telah dibentuk dengan satu kumpulan bermain permainan ini dan kumpulan lain bertindak sebagai kumpulan kawalan. Kedua-dua kumpulan telah menjalani ujian psikologi sebelum dan selepas bermain permainan tersebut. Dapatan membuktikan bahawa kumpulan yang bermain permainan ini telah menunjukkan peningkatan yang ketara berbanding dengan keputusan mereka sebelum bermain permainan tersebut. Sebaliknya, kumpulan kawalan tidak menunjukkan sebarang peningkatan yang ketara. Empat gejala psikologi yang mewakili petunjuk utama pesakit tumor otak diukur. Gejala tersebut adalah kebimbangan, kemurungan, agresif dan tingkah laku yang menimbulkan gangguan. Dapatan kajian menunjukkan bahawa, kebimbangan dan kemurungan kanak-kanak telah dikurangkan sebanyak lebih daripada 30%, dan kemarahan serta tingkah laku yang menimbulkan gangguan dikurangkan sebanyak 20% dan 5%. Kesimpulannya, permainan terapeutik yang dicadangkan telah menyumbang ke arah penghasilan perubahan tingkah laku yang positif pada kanak-kanak yang menghadapi tumor otak.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xv
	LIST OF FIGURES	xvii
	LIST OF ABBREVIATIONS	xix
	LIST OF APPENDICES	xx
1	INTRODUCTION	1
	1.1 Overview	1
	1.2 Problem Background	1
	1.3 Problem Statement	5
	1.4 Research Questions	6
	1.5 Research Aim	7
	1.6 Research Objectives	7
	1.7 Research Scope	7
	1.8 Thesis Organization	8
2	LITERATURE REVIEW	10
	2.1 Introduction	10
	2.2 Psychotherapy	12
	2.2.1 Psychological Disorders	12
	2.2.2 The Treatment of Psychological Disorders	13
	2.2.3 Talk-Based therapeutic care	14
	2.2.4 The Goals of Psychotherapy	15

2.2.5	Modalities of Psychotherapy	16
2.2.6	Major School of Thoughts for Psychotherapy Theories	16
2.2.6.1	Psychodynamic Approaches	17
2.2.6.2	Humanistic Approaches	18
2.2.6.3	Cognitive Behavioral Approaches (Imagery Therapy)	18
2.2.6.4	Review on Effect of Imagery Psychotherapy	21
2.2.6.5	Expressive Approaches (Play Therapy)	23
2.2.6.6	Eclectic-integrative Approaches	24
2.2.7	Working of Psychotherapy: When and How does Therapy work Best and What Hinders Successful Results?	25
2.2.8	The Client Therapist Relationship in a Process of Psychotherapy	26
2.2.9	Overview and Conclusion of Psychotherapy	27
2.3	Technology and Psychotherapy	30
2.3.1	Review of Current Technology Uses in Psychotherapy	32
2.3.2	General Uses	32
2.3.3	Technology uses in Therapist trainings	32
2.3.4	Computer Technology Mediated Supervision	33
2.3.5	Tutoring Systems Based on Computer Technology	33
2.3.6	Learning Environments based on Computer Systems	34
2.3.7	Computerized Psychological Testing and Diagnosis	35
2.3.8	Clinical Performance Data based System	35
2.3.9	Monitoring of Patient Treatment Response through Computer	36
2.3.10	Online Information Systems for Psychotherapy	36
2.3.11	Computer Supported Psychotherapy	37

2.3.12	Cognitive Behavioral Therapies in Computers	37
2.3.13	Computer Assisted treatment as a Secondary Tool	38
2.3.14	Therapy by Computer	39
2.3.15	Multimedia Storytelling	40
2.3.16	Psychotherapeutic Computer Games	41
2.3.17	Virtual Reality Treatments	43
2.3.18	Future Possibilities of Use of Psychotherapy and Technology	43
2.3.19	Psychotherapy into Computer Environments	44
2.3.20	Self-Expression and Storytelling	45
2.3.21	Adaptability	45
2.3.22	Online and Home Care Systems	45
2.3.23	Outcome Monitoring and Feedback	46
2.3.24	Human Computer Interaction Issues	46
2.3.25	Overview and Conclusion of Technology and Psychotherapy	46
2.4	Psychological Problems and Psychotherapy with Brain Tumor Patients	47
2.4.1	Physical Effect of Brain Tumor	48
2.4.2	Psychological Effect of Brain Tumor	49
2.4.3	Conclusion from Studies about Physical and Psychological Effect of Brain Tumor	50
2.5	Game Studies and Relation with Human Computer Interaction (HCI)	51
2.5.1	Conclusion from Studies about Game Studies and Relation with HCI	52
2.6	Literature Survey for Available Health Games	53
2.6.1	Serious Computer Game	53
2.6.2	Health Computer Games	56
2.6.3	Psychological mechanisms behind positive effects on health games on children	57
2.6.4	Reviewed Studies: Various Health Games	59
2.6.5	Health Video Games for Specific Purpose	59

	2.6.5.1	Packy and Marlon Game for Diabetes	59
	2.6.5.2	Computer Bio Feedback and Operation IBD Game for Bowl and Bladder Dysfunction	60
	2.6.5.3	Bronkie the Bronchiasaurus and Watch, Discover, Think Game for Asthma	60
	2.6.5.4	Heart Sense Computer Game for Awareness of Heart Attack Patients	61
	2.6.5.5	Squire Quest Game for Improving Dietary Habits	61
	2.6.5.6	Barcode ED Game for chronic kidney disease (CKD) patients	62
	2.6.5.7	SnowWorld Game for Burn Patients	62
	2.6.5.8	Re-mission for Cancer Patients	62
2.6.6		Video Health Games Available Commercially	63
	2.6.6.1	Managing Side Effects in Cancer Patients through Commercial Video Game	63
	2.6.6.2	Physical Fitness Therapy through Commercial Video Games	63
	2.6.6.3	Anxiety Management through Commercial Games	66
2.6.7		Overview and Conclusion on Serious Gaming	67
2.7		Game Design Frameworks	68
	2.7.1	Game Design	68
	2.7.2	Related Work on Frameworks for Designing Computer Games	70
	2.7.2.1	MDA Framework	70
	2.7.2.2	Rules, Play and Culture Framework	71
	2.7.2.3	HBTS Framework	71
	2.7.2.4	DPE Framework	72

	2.7.2.5	MSAT Framework	72
	2.7.2.6	Player Centric and AGE Framework	72
	2.7.2.7	The Game-Based Learning Framework	73
	2.7.2.8	6-11 and MDI Frameworks	74
	2.7.2.9	Overviewed Conclusion on Selecting Framework for Game Design	74
2.8		Discussion	76
	2.8.1	Choronological Discussion	76
	2.8.2	Overall discussion on the Literature Review	81
2.9		Conclusion on Current Problem and Research Gap	82
2.10		Summary	83
3		RESEARCH METHODOLOGY	84
	3.1	Introduction	84
	3.2	Overview of the Research Methodology	84
	3.3	Literature Review Leading to Problem Formulation	86
	3.4	Formulation of the Research Problems	86
	3.5	Selection of the Psychotherapy and Game Design	86
	3.5.1	Selecting Type of Psychotherapy in Research Process	86
	3.5.2	MDA Framework selection for the Design Methodology	88
	3.6	Participatory Design Methodology for making a Game Environment	89
	3.7	Implementation of the Proposed Design	90
	3.7.1	Therapy Game Story Plotting: Therapy Design Phase 1	90
	3.7.2	Survey for Game Environment: Therapy Design Phase 2	91
	3.7.3	Therapy Game Brain Environment: Therapy Design Phase 3	92
	3.8	Evaluations for the Proposed Methodology	93
	3.8.1	Evaluation through Cognitive Walkthrough (Expert Evaluation by Psychotherapist)	93

3.8.2	Heuristic Evaluations	94
3.8.3	Evaluation of the Design on Brain Tumor Patients	95
3.8.4	Evaluation of the Game with Comparison of another Game	95
3.8.5	Evaluating the Interface through Expert Evaluation (Oncologists)	96
3.8.6	Formal Method for Enhanced Game Design	97
3.9	Discussion on Research Evaluation Methods	97
3.10	Summary	98
4	EVOLVING PSYCHOTHERAPY BASED GAME DESIGN	99
4.1	Introduction	99
4.2	Fusion of Two Psychotherapies	99
4.3	Use of MDA Approach to evolve a psychotherapy based design	100
4.4	Usability Aspect of Game using Participatory Design through Surveys	105
4.4.1	Enemy Character Design and Animation	105
4.4.2	Weapons Survey and Modeling	108
4.4.3	Music Selection	112
4.5	Sounds	115
4.6	Amplification of the Dialogues	116
4.7	Adding Voice Over in Weapon Morphing	117
4.8	Final development of the Therapy game	119
4.9	3D Brain Environment and Levels	121
4.10	Summary	123
5	EVALUATION AND VALIDATION	125
5.1	Introduction	125
5.2	Cognitive Walkthrough	125
5.2.1	Preparation Phase of Cognitive Walkthrough	126
5.2.2	Evaluation Phase of Cognitive Walkthrough	130

	5.2.3	Conclusion/Discussion of Cognitive Walkthrough	136
5.3		Heuristic Evaluation on Usability, User Interface (UI) and User Experience (UX)	137
	5.3.1	Conclusion Results on Heuristic Evaluations	148
5.4		Performance Evaluation of the Tested System on Brain Tumor Children	148
	5.4.1	Application of Psychotherapy Embedded Game Design on Brain Tumor Children	149
	5.4.2	Process of Evaluation on Brain Tumor Experimental and Control Group	149
	5.4.3	Discussion on Performance Evaluation on Brain Tumor Children	155
5.5		Design Usability Evaluation of the Therapy game (PGIT) in Comparison to Re-mission Game	156
	5.5.1	Comparative Analysis on Psychological Symptoms	156
	5.5.1.1	Methodology for Participants for Comparing PGIT with Re-mission	157
	5.5.1.2	Interventions	157
	5.5.1.3	Experimental design	157
	5.5.1.4	Procedure	158
	5.5.1.5	Results Related to Design Usability Evaluation on Psychological Symptoms	158
	5.5.1.6	Discussion on Results of Design Usability Evaluation on Psychological Symptoms	162
	5.5.2	Content Analysis for comparison of both games	163
	5.5.2.1	Findings of interviews of PGIT game	163
	5.5.2.2	Findings of interviews on Re-mission	164
	5.5.2.3	Discussion on Content Analysis for Comparison of Games	165

5.5.3	Measuring Interest Level of Gamers on PGIT and Re-mission	166
5.5.3.1	Method and Procedure	166
5.5.3.2	Participants	166
5.5.3.3	Evaluation iGEQ questionnaire on Interest Level	166
5.5.3.4	Comparative Results on Interest Level	168
5.5.3.5	Discussion on the Interest Level for both Games	176
5.5.4	Overall Discussion on Design Usability Evaluation of the Therapy game (PGIT) in Comparison to Re-mission Game	176
5.6	Evaluation feedback from Oncologists	177
5.6.1	Discussion for Oncologist Feedback	181
5.7	Formal Method Representation of MDA to MDA-T	181
5.7.1	Discussion on Formal Representation of MDA to MDA-T	187
5.8	Analysis and Discussion on all Evaluations	187
5.9	Summary	188
6	CONCLUSION AND FUTURE DIRECTIONS	190
6.1	Introduction	190
6.2	Conclusion	190
6.3	Effective and appropriate psychotherapy for com- puter game design	191
6.4	Effective video game design with an embedded psychotherapy.	192
6.5	Computer game that can serve as a therapist for psychological symptoms of brain tumor children.	194
6.6	Contribution to Knowledge	195
6.7	Future Research Directions	196
	REFERENCES	198
	Appendices A – C	220 – 224

LIST OF TABLES

TABLE NO.	TITLE	PAGE
2.1	Modality, Therapeutic Techniques and Interventions	29
2.2	Health Games Comparison	67
2.3	Chronology of Psychotherapy	77
2.4	Chronology of Psychotherapy 20th Century and beyond	78
2.5	Computer Game Evolution	79
4.1	MDA goals in accordance with the requirements of PGIT game design.	103
4.2	Favorite weapon for fighting	111
4.3	Music Sample through survey	113
5.1	Tasks, input, steps to be performed and desired output	127
5.2	Tasks, input, steps to be performed and desired output Cont.(i)	128
5.3	Tasks, input, steps to be performed and desired output Cont.(ii)	129
5.4	Summary of evaluations by experts	131
5.5	Summary of evaluations by experts Cont.(i)	132
5.6	Summary of evaluations by experts Cont.(ii)	133
5.7	Summary of evaluations by experts Cont.(iii)	134
5.8	Summary of evaluations by experts Cont.(iv)	135
5.9	Visibility of system status	139
5.10	Match between system and the real world	140
5.11	User Control and Freedom	141
5.12	Consistency and Standard	142
5.13	Error Prevention	143
5.14	Recognition rather than recall	144
5.15	Flexibility and efficiency of use	145
5.16	Aesthetics and minimalist design	146
5.17	Help users recognize, diagnose and recover from errors	147
5.18	There are means for error prevention and recovery	147
5.19	Experimental Groups results on Beck Inventory	150

5.20	Regression test applied on experimental group	152
5.21	Control Group results on Beck Inventory	152
5.22	Regression test applied on control group	153
5.23	Percentages of post-tests in control and experimental group	154
5.24	Mean, SD, and t value of groups on pre-test and post-test of BSCI-Y	159
5.25	Mean, SD, and t value of groups on levels pre-test and post-test of BDI-Y	160
5.26	Mean, SD, and t value of groups on pre-test and post-test of BANI-Y	161
5.27	Mean, SD, and t value of groups on pre-test and post-test of BDBI-Y	162
5.28	Brief summary of response by the cancer patients who played PGIT	164
5.29	Brief summary of response by the cancer patients who played Re-mission. Effects of Re-mission on subjective well being of patients	165
5.30	Evaluation of player's first experience for Re-mission	169
5.31	Evaluation of player's first experience for PGIT	170
5.32	Average evaluation of eight player's experience for Re-mission.	171
5.33	Average evaluation of eight player's experience for PGIT	172
5.34	Average evaluation of eight player's for Re-mission	173
5.35	Average evaluation of eight player's for PGIT	173
5.36	Expert Evaluation feedback (Oncologists)	178
5.37	Expert Evaluation feedback (Oncologists) Cont. (i)	179
5.38	Expert Evaluation feedback (Oncologists) Cont. (ii)	180

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.1	Organization of the literature review	11
2.2	Computer in a client therapist relationship	30
2.3	Serious Games Types	54
2.4	Serious games application areas (Wijers, 2009)	55
2.5	Evolution of the number of serious games (1950 to 2000)	56
2.6	Different application areas of health games	57
2.7	Designing Computer Based Games.	69
2.8	MDA Games Design	71
2.9	Mapping of Multidisciplinary fields	80
3.1	Overview Model of Research Methodology	85
3.2	Systematic Architecture of Therapy Game Design	92
3.3	Systematic Architecture of Therapy Design implementation	93
4.1	The fusion of two therapies to evolve PGIT	100
4.2	Psychotherapy based Game design	101
4.3	Screenshot of the game showing the NPC characters	104
4.4	Screenshot of the game showing the fruits	104
4.5	Screenshot of the game showing health bars status	105
4.6	Sample of Category 1 drawings	106
4.7	Sample of Category 2 drawings	107
4.8	Sample of Category 3 drawings	107
4.9	2D sketch for a tumor extracted from the common features	107
4.10	Character Pencil Sketch of the Enemy	108
4.11	Character Morph Cycle in Drawing	109
4.12	Digitized Character Morph Cycle	109
4.13	Rendering 3D model of enemy character	110
4.14	Rendered 3D model of enemy character	110
4.15	Arrangement of music components on the layers	112
4.16	Composition matching survey	114
4.17	Recording voice-over in Jet Audio	116
4.18	Amplification of the dialogues through AVS Audio Editor	117

4.19	Morphing of white blood cells into a weapon	118
4.20	Voice-overs of the Cinematic	118
4.21	Visualization of the overall stepwise technical design	119
4.22	Visualization of the first person shooter game	120
4.23	Scene view of Unity 3D	120
4.24	Pickup placement in game environment	121
4.25	Unity3D game scene environment	121
4.26	Level cave modeled in Autodesk Maya 3D	122
4.27	Power pickup modeling	122
4.28	Level 1 Screen Shot 2	123
4.29	Level 1 Complete	123
5.1	Virus engulfed the player, and the player was not able to shoot	136
5.2	Fireballs have accumulated	136
5.3	Graph of Experimental Groups results on Beck Inventory	151
5.4	Graph of Control Group results on Beck Inventory	153
5.5	Graph of percentages of post-tests in both groups	154
5.6	Marginal Means of Pre and Post Intervention BSCI	159
5.7	Marginal means of Pre and Post intervention on BDI-Y	160
5.8	Marginal means of Pre and Post intervention on BANI-Y	161
5.9	Marginal means of Pre and Post intervention on BDBI-Y	162
5.10	Comparison of average experience for Re-mission and PGIT	174
5.11	Average Response of eight player's for 14 questions	174
5.12	Comparison of average SD for Re-mission and PGIT	175
5.13	Average SD for eight player's for 14 questions	175
5.14	Comparison of Average Experience and Average SD	176
5.15	Enhanced Architecture of Game Design	182
5.16	Formal Schema for MDA-T (a)	183
5.17	Formal Schema for MDA-T (b)	184
5.18	Formal Schema for MDA-T (c)	185
5.19	Formal Schema for MDA-T (d)	186
5.20	Formal Schema for MDA-T (e)	186

LIST OF ABBREVIATIONS

AGE	-	Action, Gameplay, Experience
AI	-	Artificial Intelligence
BAI	-	Beck Anxiety Inventory
BANI	-	Beck Anger Inventory
BDBI	-	Beck Disruptive behavior Inventory
BDI	-	Beck Depression Inventory
BSCI	-	Beck Self Concept Inventory
CBT	-	Cognitive Behavior Therapy
CKD	-	Chronic Kidney Disease
DPE	-	Design, Play, Experience
GEQ	-	Game Experience Questionnaire
HBTS	-	Holistic, Boundary, Temporal, Structural
HCI	-	Human Computer Interaction
IBD	-	Irritating Bowel Disease
iGEQ	-	in-Game Experience Questionnaire
IT	-	Information Technology
MDA	-	Mechanics, Dynamics, Aesthetics
MDA-T	-	Mechanics, Dynamics, Aesthetics, Therapy
MDI	-	Mechanics, Dynamics, Impression
MSAT	-	Mechanics, Story, Aesthetics, Technology
NPC	-	Non Player Character
PD	-	Participatory Design
PGIT	-	Play Guided Imagery Therapy
PI	-	Personal Investigator
SPSS	-	Statistical Package for Social Sciences
UI	-	User Interface
UX	-	User Experience
WBC	-	White Blood Cell
WDTA	-	Watch, Discover, Think and Act
WTO	-	Working Things Out

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Game Play	220
B	Sample Figures of 3D Level Designing	221
C	List of Weapons	224

CHAPTER 1

INTRODUCTION

1.1 Overview

New computer games are launched on an almost daily basis. These games have applications in various capacities from military trainings to health care and from education to cultural training, information, sports etc. Games made for the purpose of training, education or improving health is usually referred to as serious games. One of the most important aspects in developing serious game is “Game Design”. Game design documents the creative, conceptual, technical and functional aspects of game. Every game has to be custom design depending on its intended usage. There are no specific set of rules for serious game design but common principles can be applied to these games. Health games are meant for the purpose of targeting the psychological aspect of people and are important for the improvement of health behaviors, positive behavioral modification and self-management of deadly illnesses as well as encouraging and sustaining psychological wellbeing. One of the second largest deadly diseases in children is brain tumor which causes many psychological problems among them and these problems can be dealt with success if some form of psychotherapy is applied on such patients. Health games can be used for such a purpose. The psychological health games need psychological harmony in their design in order to be effective.

1.2 Problem Background

Diagnosis of any kind of cancer may lead to mental health problems and psychological distress thus causing them to have high level of anger, anxiety and may distort their self-concept (Pinkerton *et al.*, 2007). Brain tumor is the second largest deadly disease in children and studies by Wellisch *et al.* (2002) have shown

that 50% of the patients and perhaps 80% of the brain tumor patients are suffering from depression (Price *et al.*, 1997). Depression is a state of low mood and a symptom which appears after certain trauma or bad experience. It may lead to severe mental and physical conditions. It is believed by researchers that depressive behavior of the people is usually due to the traumas they have faced in the past and one of the ways to recover from it is the use of some form of psychotherapy (McCabe, 2007). Psychotherapy is a treatment based on the relationship between a therapist and patient, to produce change in feelings, thoughts and actions. For treatment, psychotherapist makes systematic use of psychological theories to devise and direct intervention. The level of psychotherapy specifies the level of training regarding the treatment. Current research confirms that psychotherapy is an effectual conduct for psychiatric disorders. Psychotherapy heals patient's problems, and appreciating psychotherapeutic techniques (Bateman, 1995). Two such psychotherapies are imagery psychotherapy and play therapy.

The idea of utilizing imagery psychotherapy as a therapeutic involvement in health is established on the basis that images could have direct or indirect effect on health. Visuals stimuli communicate and manipulate the perceptions while providing imaginary views. This is considered to be a tool for various perspectives in helping people to cope with mental problems. This technique has a history, in early ages where drawings and colors were used to indicate certain meaning for decision. In the Arnheim theory real life situations are appropriate for viewing of images. Act of seeing is not a simple stimulus-response action but it is actually a cognitive activity which helps the capacity to craft and classify individual meaning (O'Neil, 2011). Visual display of information is the extension of a therapy utilizing the curative properties. This therapy uses activities through the use of imaginative scenes, intended to improve mental problems and skills. Researchers have shown that people who received imagery psychotherapy has shown marked improvement in their behaviors over the people who did not receive psychotherapy and also more positive attitude towards life was observed (Astin *et al.*, 2003). Similarly play therapy is a form of psychotherapy used for children in which play is used to communicate to resolve some psychosocial tasks. This is thought to help them towards better social and emotional growth and researches has shown improvement in mental health of children after utilizing this therapy with problematic children (Moustakas, 1955). This therapy helps children in many ways. The concept behind it is that children may play out traumatic or difficult life experiences in order to make sense of present problems and may cope with the future problems. Bratton *et al.* (2005) have explained that the outcomes of the play therapy may be general e.g. a reduction in anxiety and raised self-concept, or more specific such as a change in behavior and improved social relations. Play therapy may have different forms as per the requirement of a problem. However a psychotherapist

is a must requirement for conducting such a therapy.

Targeting brain tumor in children to solve their problematic behaviors related with the diagnosis of their disease through the use of psychotherapy video game can be one use of the technology. Radiation therapies like stereotactic radio surgery, immunotherapy, and vaccine therapy are given to the brain tumor patients as a primary treatment and it is a must but during these treatments the psychological state of body should not be ignored because psychological treatments have also contributed for better prognosis reports for such patients (McCabe, 2007).

Imagery psychotherapy and play therapy for children has been doing well in advancing relaxation, soothing anxieties and facilitating children in numerous way, (Garrett and Norris, 1985). In order to examine the effect of imagery therapy a study was conducted on depressed white blood cell (WBC) counts, over a 90-day period. All the patients showed significant increases in their WBC count, even though they possess diseases/illnesses that could cause the decrease in WBC count. The experiment conducted by Troesch *et al.* (1993) found that individuals who took part in guided imagery sessions not only scored better on both mood scores and quality of life scores than those who did not. Rather, even after sessions were complete, the scores continued to improve in the experimental group, giving clear indication that guided imagery is effective in improving mood and quality of life in cancer patients.

Psychological therapies can reduce the mental health problem focusing on the symptoms highlighted. Therapy can make patients handle the behaviors and mental stress stages. Regarding brain tumor some therapies act as a healing tool. The problem is that many psychotherapists know little about video games such as World of Warcraft and Second Life. They may let go gaming as insignificant. When people come to treatment with problems, it is important to remember that they are trying to cope with them in the best way they can. With that in mind, therapists can offer a reflective and engaging partnership with their clients, working toward the goal of helping them to be authentic and compassionate in a world that can be extremely stressful. Meeting the needs of the competing goals of psychological therapy through conventional techniques of psychotherapy is extremely challenging due to the shortage of psychotherapists and the need to create an appropriate therapy environment. Technology nowadays is providing many human like solutions in different aspects of life from education to treatments.

The role of serious gaming in managing health is one of the examples for the use of management of difficult or problematic behaviors. Health games can help patients develop specific skills needed to manage illnesses in a cost-effective, easily distributed way (Kato, 2010). Several games, have been developed on the treatment of health through games. Elementary principles for a game design generally include basic idea, problems to solve, game rules and mechanisms of feedback for health purposes. But one more thing that has to be considered while designing a health game is the message of the game and the interest in the game.

A popular health game, Re-mission has been developed by Hope Lab for cancer patients in which the player manages realistic and life threatening side effects related to cancer with the purpose of better understanding and handling physical disease (Tate and Haritatos, 2009). Re-mission was the first game made for cancer patients and proved effective with regard to decrease in anxiety and depression level of the patients but it was meant for teenagers. There is no such therapeutic game made for children. Re-mission game was a third person shooter game, hence does not provide the explanation of self-empowerment which is essential to fight any enemy and hence cannot fulfill the therapeutic requirements. They have introduced their own design principles by following some medical mechanism of disease identification and then full testing of disease and symptoms but the game is meant for teenagers only and the design does not contain any form of known psychotherapy into it.

Another health related serious game is Personal Investigator (PI) (Coyle *et al.*, 2005b). It is designed to engage adolescents in psychotherapy through a computer aided model. This game is developed to cope with the mental health problems like anxiety, social skill problems and depression. In this game the Solution Focus Therapy (SFT) is used as a therapeutic model because it focuses on the goal oriented approach as computer games do.

‘Treasure Hunt’ is the very first psychotherapeutic computer game made based on the rules of behavior enhancement (Brezinka, 2008). It targets children high quality attraction for video games in order to maintain psychotherapy. This collective adventure game which is for eight to twelve year old children is not developed for replacing the therapist but to advise engaging electronic homework assignments and practice the main educational concepts that have been adopted during therapy.

Many frameworks for making game designs has been explained for the health as well as entertainment games, for example, Hunicke *et al.* (2004) has proposed

a MDA Framework for game design. MDA stands for Mechanics, Dynamics and Aesthetics. Mechanics illustrates the game at algorithms level. Dynamics shows the run-time behavior of the game as system and Aesthetics demonstrates the emotional reactions induced in the player. This game developed an approach that is flexible enough to make changes in the aesthetic part. It is difficult to propose a game design that is safe for multiple targets because several designs are technically very sound but are not close to heart of players. A game must have psychological synchronization if it is to have psychotherapeutic impact on its audience.

It was found that the existing solutions for targeting the therapeutic aspect are not addressing the psychological problems of the brain tumor children in time and especially children are not aware of what is going inside their body. The reality for them is too hard to understand. However they are really good in imagination and play. The physical aspects of these children are dealt as a priority but the fact that mental state can affect the physical state is ignored. There is also a lack of game design which can work as a therapist itself when the psychotherapist is not available.

Therefore, to design an appropriate therapy game for brain tumor cancer children a design is desired to be proposed in which psychotherapy is embedded and can be provided without the physical presence of the psychotherapist. Computer technology is utilized in every area of life and hence can be utilized to generate psychotherapeutic game for children with brain tumor. Psychotherapy for use with the illness-related psychological problems is a very important aspect as explained in the background and thus it should not be ignored.

1.3 Problem Statement

Embedding psychotherapy into a game design can clearly be the important line of research into serious health video game designs which has not yet used in previous designs. The previous games such as Re-mission, Personal Inventory and Treasure Hunt showed that there are reactive approaches in terms of game designs of health game as several designs are technically very sound but may not be closer to heart of player due to lack of involvement of the players cognitive interests themselves. Menestrina (2007) have proved the involvement of the end-users in the development of a health game that is truly user oriented. Participatory design or in general terms involving the users must be taken into account for the design of health games. Games

such as Re-mission though meant for cancer patients have not involved the end users in its design. Therefore there is a need to use proactive approach in designing a game so that the adaptation becomes natural and support for those having behavior problems associated with physical illnesses such as brain tumor may be targeted. Lastly designing a computer game for brain tumour children with psychotherapy into it will minimize the role of psychotherapist in the oncology ward who is rarely available in every hospital. Hence, the issue of unavailability of a therapist to solve psychological problems related with diagnosis of brain tumour in children are the main problem to solve in this research by proposing an effective game design for a psychotherapeutic purpose.

In this thesis an attempt has been made to propose psychotherapeutic game design, which can work as a psychotherapist in the unavailability of therapist for the children suffering from brain tumor, through involving the children in developing the therapeutic game. Hocine and Gouaïch (2011) emphasized the importance of embedding psychotherapy into a game design and this work has addressed the involvement of psychotherapy into a game design for health games, targeting brain tumor in children.

1.4 Research Questions

The open issues discussed above lead to some research questions. The following research questions are addressed in this research:

- i Which psychotherapy or combination of psychotherapy can be embedded into a computer game design?
- ii How can health game design be enhanced to make it a therapy design for brain tumor in children?
- iii How can the computer game be served as therapist for children problematic behaviours with brain tumor?

1.5 Research Aim

The aim of this research is to propose psychotherapy game design for children suffering from brain tumor, by introducing the psychotherapy into the game design, thereby making it possible to provide psychotherapy through a computer game for the related psychological problems of this disease.

1.6 Research Objectives

The following research objectives are to be achieved during the research work. These objectives are in the perspective of the research questions mentioned in section 1.4.

- i To propose a suitable existing psychotherapy or combination of therapies that can be embedded into a game design.
- ii To enhance existing computer game design and propose a new game design for the children with brain tumor.
- iii To integrate the proposed game design into a computer game that can serve as a therapist for psychological symptoms of brain tumor children.

1.7 Research Scope

The scope of this research covers the following points:

- i The study focuses on finding and embedding a suitable combination of psychotherapy in design of computer health games.
- ii The research is restricted to the use of imagery psychotherapy and play psychotherapy for embedding into a computer game design and other form of therapies are out of scope for this research..
- iii The proposed psychotherapy game design is implemented using Adobe Photoshop, 3D Max and Unity.
- iv The proactive involvement of the children is ensured by involving them in the creation of game environment for the proposed design.

- v The proposed design is tested on the children suffering from brain tumor and is particularly designed for children with age range 10 to 14 years.
- vi The change in behaviour such as anger, disruptive behaviour, self-concept, aggression, anger and anxiety of brain tumor children before and after playing the game is verified through a standardized psychological inventory testing module.
- vii The MDA framework has been chosen to design the game with psychotherapy.
- viii The scope of this study is limited to the effects of psychotherapy based game design only on children suffering from malignant brain tumor and it does not apply on other cancers.
- ix The Beck Psychological Inventory Tool is utilized in this study due to its variability in measuring five most accurate psychological problems which are originated after the diagnosis. The test is specially designed for the purpose. The scope does only cover the testing from Beck Inventory.

1.8 Thesis Organization

The rest of the thesis is organized as follows.

Chapter 2 describes an exhaustive literature review of the area of study, background, problems, solutions and evaluations. A comprehensive exploration on the existing literature in the available approaches for game design, serious health games and the available game designs of health games, effect of playing computer games for dealing with anxiety and pain control, psychotherapy and effect of imagery therapy and play therapy on problematic behaviors of brain tumor children are presented in chapter 2.

Chapter 3 highlights the flow of research methodology, which is used in this research. This is followed by survey steps of the proposed game environment. Research design procedures of the game design are explained such as MDA design and justification for choosing MDA design. The two chosen therapies are described in detail. Evaluation methods are elaborated.

Chapter 4 outlines the design detail of introducing the suggested therapy part using the MDA framework and it presents the proposed psychotherapy play and

imagery model in which game design with therapy is evolved. The proposed steps to design the game and proposed enhanced game design are evaluated through the standardized methods used in HCI.

Chapter 5 explains the proposed design validation with the brain tumor children. Expert evaluation, user evaluation, user interface evaluation and user acceptance evaluation has been performed.

Chapter 6 presents the conclusion, describes the contributions made by this study, and suggests directions for future research.

REFERENCES

- Aarseth, E. (2003). Playing research: Methodological approaches to game analysis. In *Digital Arts and Cultures Conference Papers.*, pages 1–7. Fine Arts Forum, Digital Arts and Cultures.
- Al-Azawi, R., Ayesh, A., Kenny, I., and AL-Masruri, K. A. (2013). A generic framework for evaluation phase in games development methodologies. In *In Science and Information Conference (SAI).*, pages 237–243. IEEE.
- Allen, D. H. (1984). *Using Computers in Clinical Practice: Psychotherapy and Mental Health Applications.*, pages 329–334. Haworth Press, New York, 1st edition.
- Alvarez, J. and Michaud, L. (2008). Serious games. advergaming, edugaming, training and more. *IDATE, Montpellier.*
- Annema, J. H., Verstraete, M., Vanden Abeele, V., Desmet, S., and Geerts, D. (2010). Videogames in therapy: a therapist's perspective. In *Proceedings of the 3rd International Conference on Fun and Games.*, pages 94–98. Leuven, Belgium: ACM.
- Annetta, L. A. (2010). The "i's" have it: A framework for serious educational game design. *Review of General Psychology*, 14(2):105.
- Anthony, K. (2003). *Technology in Counselling and Psychotherapy*, article in a book *The use and role of Technology in Counselling and Psychotherapy*, pages 13–35. Palgrave Macmillan.
- Anthony, K. and Lawson, M. (2002). The use of innovative avatar and virtual environment technology for counselling and psychotherapy.
- APA (2016). *Media psychology and technology.*
- Assay, T. P. and Lambert, M. J. (1999). *The Heart and Soul of Change: What Works in Therapy*, pages 23–55. American Psychological Association, Washington, DC.
- Astin, J. A., Shapiro, S. L. and Eisenberg, D. M., and Forays, K. L. (2003). Mind-body medicine: state of the science, implications for practice. *Journal of the American Board of Family Practice*, 16:131–147.
- Bailey, B. W. and McInnis, K. (2011). Energy cost of exergaming: a comparison

- of the energy cost of 6 forms of exergaming. *Archives of Pediatrics & Adolescent Medicine*, 165(7):597–602.
- Baranowski, T., Baranowski, J., Cullen, K. W., Marsh, T., Islam, N., Zakeri, I., Honess-Morreale, L., et al. (2003). Squire's quest!: Dietary outcome evaluation of a multimedia game. *American Journal of Preventive Medicine*, 24(1):52–61.
- Barr, P., Noble, J., and Biddle, R. (2007). Video game values: Human–computer interaction and games. *Interacting with Computers*, 19(2):180–195.
- Bateman, A. W. (1995). The treatment of borderline patients in a day hospital setting. *Psychoanalytic Psychotherapy*, 9(1):3–16.
- Battino, R. (2005). *Metaphoria: Metaphor and Guided Metaphor for Psychotherapy and Healing*. Crown House Publishing.
- Bauer, S., Percevic, R., Okon, E., Meermann, R., and Kordy, H. (2003). Use of text messaging in the aftercare of patients with bulimia nervosa. *European Eating Disorders Review*, 11(3):279–290.
- Baum, D. D. and Lane, J. R. (1976). The application of the 'bug in ear' communication system for training of psychometrists. *Counselor Education and Supervision*, 15(4):309–310.
- Beale, I. L., Kato, P. M., Marin-Bowling, V. M., Guthrie, N., and Cole, S. W. (2007). Improvement in cancer-related knowledge following use of a psychoeducational video game for adolescents and young adults with cancer. *Journal of Adolescent Health*, 41(3):263–270.
- Beck, A. T. and Beamesderfer, A. (1974). *Assessment of depression: the depression inventory*. S. Karger.
- Beck, A. T., Ward, C., Mendelson, M., et al. (1961). Beck depression inventory (bdi). *Arch Gen Psychiatry*, 4(6):561–571.
- Beck, J. S., Beck, A. T., and Jolly, J. B. (2005). *Manual for early Childhood Measurement and Evaluation for children and adolescence*. San Antonio, TX: Psychological Corporation., 2nd edition.
- Bekker, M., Beusmans, J., Keyson, D., and Lloyd, P. (2003). Kidreporter: A user requirements gathering technique for designing with children. *Interacting with Computers*, 15(2):187–202.
- Berger, T. (2004). Computer-based technological applications in psychotherapy training. *Journal of Clinical Psychology*, 60(3):301–315.
- Bers, M. (2001). Identity construction environments: Developing personal and moral values through the design of a virtual city. *The Journal of the Learning Sciences*,

- 10(4):365–415.
- Bers, M., Gonzalez-Heydrich, G., and DeMaso, D. (2003). Use of a computer-based application in a pediatric hemodialysis unit: A pilot study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 42(4):493–496.
- Betker, A. L., Szturm, T., Moussavi, Z. K., and Nett, C. (2006). Video game-based exercises for balance rehabilitation: a single-subject design. *Archives of Physical Medicine and Rehabilitation*, 87(8):1141–1149.
- Beutler, L. E. and Harwood, T. M. (2000). *Perscriptive Therapy: a practical guide to Systematic Treatment Selection*. Oxford University Press, New York, 1st edition.
- Beutler, L. E. and Harwood, T. M. (2004). Virtual reality in psychotherapy training. *Journal of Clinical Psychology*, 60(3):317–330.
- Bhat, S. R., Goodwin, T. L., Burwinkle, T. M., Lansdale, M. F., Dahl, G. V., Huhn, S. L., and Fisher, P. G. (2005). Profile of daily life in children with brain tumors: an assessment of health-related quality of life. *Journal of Clinical Oncology*, 23(24):5493–5500.
- Bickmore, T. W. and Picard, R. W. (2004). Toward caring machines. In *Proceedings of CHI Conference on Human Factors in Computing Systems*, Vienna, Austria.
- Bjork, S. and Holopainen, J. (2004). *Patterns in Game Design*. USA: Charles River Media., USA: Charles River Media.
- Blackman, S. (2005). Serious games... and less. *ACM Siggraph Computer Graphics*, 39(1):12–16.
- Blake, R. L. and Bishop, S. R. (1994). The bonny method of guided imagery and music (gim) in the treatment of post-traumatic stress disorder (ptsd) with adults in the psychiatric setting. *Music Therapy Perspectives*, 12(2):125–129.
- Bloom, L., Eardley, R., Geelhoed, E., Manahan, M., and Ranganathan, P. (2004). Investigating the relationship between battery life and user acceptance of dynamic, energy-aware interfaces on handhelds. In *Mobile Human-Computer Interaction-MobileHCI 2004*, pages 13–24. Springer.
- Bowman, D. A., Gabbard, J. L., and Hix, D. (2002). A survey of usability evaluation in virtual environments: classification and comparison of methods. *Presence: Teleoperators and Virtual Environments*, 11(4):404–424.
- Brathwaite, B. and Schreiber, I. (2009). *Challenges for game designers*. Course Technology.
- Bratton, S. C., Ray, D., Rhine, T., and Jones, L. (2005). The efficacy of play therapy with children: A meta-analytic review of treatment outcomes. *Professional*

- Psychology: Research and Practice.*, 36(4):376–390.
- Breggin, P. R. (1998). Risks and mechanism of action of stimulants. In *NIH consensus development conference program and abstracts: Diagnosis and treatment of attention deficit hyperactivity disorder*, pages 105–120.
- Brezinka, V. (2008). Treasure hunt-a serious game to support psychotherapeutic treatment of children. *Studies in Health Technology and Informatics.*, 136:71–76.
- Brown, J. R., Van Dam, A., Earnshaw, R., Encarnação, J., Guedj, R., Preece, J., Shneiderman, B., and Vince, J. (1999). Human-centered computing, online communities, and virtual environments. *Computer Graphics and Applications, IEEE*, 19(6):70–74.
- Brown, S. J. and Lieberman, D. A. (1997). Educational video game for juvenile diabetes: Results of a controlled trial. *Medical Informatics.*, 22(1):77–89.
- Bruckman, A. S. (1997). *MOOSE Crossing: Construction, Community, and Learning in a Networked Virtual World for Kids*. PhD thesis, PhD Dissertation, Media Lab, Massachusetts Institute of Technology.
- Bruner, J. (1990). *Acts of Meaning*. Harvard University Press, Cambridge, MA.
- Bruner, J. S. (1986). *Actual Minds, Possible Worlds*. Harvard University Press, Cambridge, MA.
- Buckner, J. C., Brown, P. D., O’Neill, B. P., Meyer, F. B., Wetmore, C. J., and Uhm, J. H. (2007). Central nervous system tumors. *Mayo Clinic Proceedings.Elsevier*, 82(10):1271–1286.
- Burke, J. W., McNeill, M., Charles, D. K., Morrow, P. J., Crosbie, J. H., and McDonough, S. M. (2009). Optimising engagement for stroke rehabilitation using serious games. *The Visual Computer*, 25(12):1085–1099.
- Burns, D. S. (2001). The effect of the bonny method of guided imagery and music on the mood and life quality of cancer patients. *Journal of Music Therapy.*, 38(1):51–65.
- Butcher, J. N. (2004). Computers in clinical assessment: Historical developments, present status and future challenges. *Journal of Clinical Psychology*, 60(3):331–345.
- Capuzzi, D. and Gross, D. R., editors (2003). *Counselling and Psychotherapy: Theories and Interventions*. Prentice Hall.
- Caspar, F. (1998). *Neural Networks and Psychopathology*, article in a book A connectionist view of psychotherapy, pages 88–131. Cambridge University Press, Cambridge, England, 1st edition.

- Caspar, F. (2004). Technological developments and applications in clinical psychology: Introduction. *Journal of Clinical Psychiatry*, 60(3):221–238.
- Castelnuovo, G., Gaggioli, A., Mantovani, F., and Riva, G. (2003). New and old tools in psychotherapy: The use of technology for the integration of traditional clinical treatments. *Psychotherapy: Theory, Research, Practice, Training.*, 40(1-2):33–44.
- Cavanagh, K., Zack, S. Z., Shapiro, D. A., and Wright, J. H. (2003). *Technology in Counselling and Psychotherapy*, article in a book Computer programs for Psychotherapy, pages 143–164. Palgrave Macmillan.
- Ceranoglu, T. A. (2010). Video games in psychotherapy. *Review of General Psychology*, 14(2):141.
- Chechele, P. J. and Stoffe, G. (2003). *Technology in Counselling and Psychotherapy.*, article in a book Individual therapy online via email and Internet Relay Chat., pages 39–58. Palgrave Macmillan.
- Clark, B. and Schoech, D. (1984). *Using Computers in Clinical Practice: Psychotherapy and Mental Health Applications.*, article in a book A Computer-Assisted Therapeutic Game for Adolescents: Initial Development and Comments., pages 335–353. Haworth Press, 1st edition.
- Clark, D. M. (1999). Anxiety disorders: Why they persist and how to treat them. *Behaviour Research and Therapy*, 37:S5–S27.
- Constantinou, C., Papas, K. A., and Constantinou, A. I. (2009). Caspase-independent pathways of programmed cell death: the unraveling of new targets of cancer therapy? *Current cancer drug targets*, 9(6):717–728.
- Cooper, A., Delmonico, D. L., and Burg, R. (2000). Cybersex users, abusers, and compulsives: New findings and implications. *Sexual Addiction & Compulsivity: The Journal of Treatment and Prevention*, 7(1-2):5–29.
- Corey, G. (2001). *Case approach to counseling and psychotherapy*. Cengage Learning.
- Coursol, D. H. and Lewis, J. (2000). Cyber supervision: Counselor supervision in a technological age. Report, A report to American Counseling Association/ERIC/CASS.
- Coyle, D., Doherty, G., Matthews, M., and Sharry, J. (2007). Computers in talk-based mental health interventions. *Interacting with Computers*, 19(4):545–562.
- Coyle, D., Doherty, G., and Sharry, J. (2005a). Adaptable computer gaming for adolescent psychotherapy presenter. *Cyberpsychology & Behavior*, 8(4):311–312.
- Coyle, D., Doherty, G., and Sharry, J. (2005b). The design of computer systems for talk-based mental health care interventions. *Trinity College Dublin Technical*

Report.

- Coyle, D., Matthews, M., Sharry, J., Nisbet, A., and Doherty, G. (2005c). Personal investigator: A therapeutic 3d game for adolescent psychotherapy. *Interactive Technology and Smart Education.*, 2(2):73–88.
- Dandeneau, S. D. and Baldwin, M. W. (2004). The inhibition of socially rejecting information among people with high versus low self-esteem: The role of attentional bias and the effects of bias reduction training. *Journal of Social and Clinical Psychology*, 23(4):584–603.
- De Lisi, R. and Wolford, J. L. (2002). Improving children's mental rotation accuracy with computer game playing. *Journal of Genetic Psychology.*, 163(3):272–282.
- Delminco, D. L. and Burg, R. (2013). Cybersex users, abusers, and compulsives: New findings and implications. *Cybersex: The Dark Side of the Force: A Special Issue of the Journal Sexual Addiction and Compulsion*, page 5.
- Dillon, R. (2010). *On the Way to Fun: an Emotion Based Approach to Successful Game Design*. A K Peters/CRC Press.
- Dix, A. (2009). *Human-computer interaction*. Springer.
- Dix, A. J., Finlay, J. E., Abowd, G. D., and Beale, R. (1998). *Human-Computer Interaction*. Prentice Hall., Harlow, England: Prentice Hall.
- Donaldson, V. W. (2000). A clinical study of visualization on depressed white blood cell count in medical patients. *Applied Psychophysiology and Biofeedback*, 25(2):117–128.
- Egan, G. (2002). *The Skilled Helper: A Problem-Management and Opportunity-Development Approach to Helping*. Wadsworth Publishing, Pacific Grove, CA, US., 7th edition.
- Ekman, P. (1999). *Handbook of Cognition and Emotion.*, pages 45–60. John Wiley & Sons, Ltd., U.K., 1st edition.
- Ellis, H., Heppell, S., Kirriemuir, J., Krotoski, A., and McFarlane, A. (2006). *Unlimited Learning: Computer and Video Games in the Learning Landscape*. ELSPA, London: ELSPA.
- Eskelinen, M. (2001). The gaming situation. *Game Studies*, 1(1):68.
- Evans, R., Sparkes, A., and Jordan, N. (1999). A first experimental cd-rom for self study use in psychotherapy'. In *Proceedings of The 30th Annual Meeting of the Society for Psychotherapy Research, Braga, Portugal*.

- Eysenck, H. J. (1952). The effects of psychotherapy: an evaluation. *Journal of Consulting Psychology*, 16(5):319.
- Feltham, C. (2000). *Handbook of Counselling and Psychotherapy*, article in a book *Counselling and Psychotherapy in Context*, pages 1–21. Sage Publications.
- Fernández-Vara, C. (2009). Play's the thing: a framework to study videogames as performance. *Proc. of DiGRA, Innovation in Games, Play, Practice and Theory*.
- Flew, T. and Humphreys, S. (2005). *New Media: an introduction*, article in a book *Games: Technology, Industry, Culture.*, pages 101–114. Oxford University Press, Melbourne: Oxford University Press., 2nd edition.
- Freitas, S. and Jarvis, S. (2007). Serious games - engaging training solutions: A research and development project for supporting training needs. *British Journal of Educational Technology.*, 38(3):523–525.
- Freud, A. (1968). Acting out. *The International Journal of Psychoanalysis*.
- Gardner, J. E. (1991). Can the mario bros. help? nintendo games as an adjunct in psychotherapy with children. *Psychotherapy: Theory, Research, Practice, Training.*, 28(4):667–670.
- Garrett, P. and Norris, P. (1985). *Why Me?: Harnessing The Healing Power of The Human Spirit*. EP Dutton.
- Gasson (2003). Human-centered vs. user-centered approaches to information system design. *The Journal of Information Technology Theory and Application (JITTA)*, 5:29–46.
- Gee, J. P. (2003). *What video games have to teach us about learning and literacy*, volume 1. Palgrave Macmillan, New York, Palgrave MacMillian, 1 edition.
- Gega, L., Marks, I., and Mataix-Cols, D. (2004). Computer-aided cbt self-help for anxiety and depressive disorders: Experience of a london clinic and future directions. *Journal of Clinical Psychology.*, 60(2):147–157.
- Goldsworthy, R. (2002). Supporting the development of emotional intelligence through technology. *Computers in the Schools.*, 19(1/2):119 – 148.
- Goss, S., Anthony, K., Jamieson, A., and Palmer, S. (2001). Guidelines for online counselling and psychotherapy.
- Gould, J. D. and Lewis, C. (1985). Designing for usability: key principles and what designers think. *Communications of the ACM*, 28(3):300–311.
- Graves, L. E., Ridgers, N. D., and Stratton, G. (2008). The contribution of upper limb and total body movement to adolescents' energy expenditure whilst playing

- nintendo wii. *European Journal of Applied Physiology*, 104(4):617–623.
- Greist, J. H., Marks, I. M., Baer, L., Kobak, K. A., Wenzel, K. W., Hirsch, M. J., Mantle, J. M., and Clary, C. M. (2002). Behaviour therapy for obsessive compulsive disorder guided by a computer or by a clinician compared with relaxation as a control. *Journal of Clinical Psychiatry*, 63(2):138–145.
- Griffiths, M. (1997). Video games and clinical practice: Issues, uses and treatments. *British Journal of Clinical Psychology*, 36(4):639–641.
- Griffiths, M. D. (2004). *Handbook of Computer Game Studies*, article in a book *The Therapeutic Value of Video Games*, pages 161–171. MIT Press Cambridge, Massachusetts London, England.
- Grohol, J. M. (2000). *The Insiders Guide to Mental Health Resources Online*. Guilford Press, New York.
- Gruber, B. L., Hall, N. R., Hersh, S. P., and Dubois, P. (1988). Immune system and psychological changes in metastatic cancer patients using relaxation and guided imagery: A pilot study. *Cognitive Behaviour Therapy*, 17(1):25–46.
- Gruber, K., Moran, P. J., Roth, W., and Taylor, C. B. (2001). Computer-assisted cognitive-behavioral group therapy for social phobia. *Behavior Therapy*, 32(1):155–165.
- Guerney Jr, B. (1964). Filial therapy: Description and rationale. *Journal of Consulting Psychology*, 28(4):304.
- Haddock, G., Lowens, I., Brosnan, N., Barrowclough, C., and Novaco, R. W. (2004). Cognitive-behaviour therapy for inpatients with psychosis and anger problems within a low secure environment. *Behavioural and Cognitive Psychotherapy*, 32(1):77–98.
- Hambidge Jr, G. (1955). Therapeutic play techniques: Structured play therapy. *American Journal of Orthopsychiatry*, 25(3):601.
- Harter, S. (1977). A cognitive-developmental approach to children's expression of conflicting feelings and a technique to facilitate such expression in play therapy. *Journal of Consulting and Clinical Psychology*, 45(3):417–432.
- Hayes, E. and Silberman, L. (2007). Incorporating video games into physical education. *Journal of Physical Education, Recreation & Dance*, 78(3):18–24.
- Heinlen, K. T., Welfel, E. R., Richmond, E. N., and O'Donnell, M. (2003). The nature, scope and ethics of psychologists' e-therapy websites: What consumers find when surfing the webs. *Psychotherapy: Theory, Research, Practice, Training*, 40(1-2):112–124.

- Helander, M. G. and Skinnars, Ö. (2000). Use of cognitive walkthrough for evaluation of cockpit design. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, volume 44, pages 616–619. SAGE Publications.
- Hewett, T. T. (2005). Cognitive factors in design: overview and some implications for design. In *Proceedings of the 5th Conference on Creativity & Cognition*, pages 318–321. ACM.
- Hill, C. E. and Corbett, M. M. (1993). A perspective on the history of process and outcome research in counseling psychology. *Journal of Counseling Psychology*, 40(1):3–24.
- Hilty, D. M., Shayna, L. M., Urness, D., Yellowless, P. M., and Nesbitt, T. S. (2004). Clinical and educational telepsychiatry applications. *The Canadian Journal of Psychiatry*, 49(1):12–23.
- Hinds, P. S. (2010). Progress in quality of life in children and adolescents with cancer. In *Seminars in Oncology Nursing*, volume 26, pages 18–25. Elsevier.
- Hocine, N. and Gouaïch, A. (2011). Therapeutic games' difficulty adaptation: An approach based on player's ability and motivation. In *IEEE 16th International Conference on Computer Games (CGAMES)*, pages 257–261. IEEE.
- Hoffman, H. G., Patterson, D. R., Seibel, E., Soltani, M., Jewett-Leahy, L., and Sharar, S. R. (2008). Virtual reality pain control during burn wound debridement in the hydrotank. *The Clinical journal of pain*, 24(4):299–304.
- Hopps, S. L., Pepin, M., and Boisvert, J. (2003). The effectiveness of cognitive-behavioral group therapy for loneliness via inter relaychat among people with physical disabilities. *Psychotherapy: Theory, Research, Practice, Training*, 40(1-2):136–147.
- Hopson, J. (2002). The psychology of choice. *Gamasutra*, February, 2.
- Houston, T. K., Cooper, L. A., and Ford, D. E. (2002). Internet support groups for depression: A 1-year prospective cohort study. *Journal of Psychiatry*, 159(12):2062–2068.
- Hunicke, R., LeBlanc, M., and Zubek, R. (2004). Mda: A formal approach to game design and game research. In *Proceedings of the Challenges in Game AI Workshop, Nineteenth National Conference on Artificial Intelligence*, pages 1–5. San Jose. CA: ACM.
- IJsselsteijn, W., De Kort, Y., Poels, K., Jurgelionis, A., and Bellotti, F. (2007). Characterising and measuring user experiences in digital games. In *International Conference on Advances in Computer Entertainment Technology*, volume 2,

page 27.

- Izard, C. E. (1977). *Human Emotions*. New York: Plenum Press.
- Järvinen, A. (2009). Game design for social networks: interaction design for playful dispositions. In *Proceedings of the 2009 ACM SIGGRAPH Symposium on Video Games*, pages 95–102. ACM.
- Jaspers, M. W. (2009). A comparison of usability methods for testing interactive health technologies: methodological aspects and empirical evidence. *International Journal of Medical Informatics*, 78(5):340–353.
- Jinks, G. (2000). *Handbook of Counselling and Psychotherapy*, pages 122–151. Sage Publications, London.
- Jonassen, D. H., Carr, C., and Yue, H. (1998). Computers as mindtools for engaging learners in critical thinking. *Tech Trends*, 43(2):24–32.
- Jones, A. (1996). The use of computers to support learning in children with emotional and behavioural difficulties. *Computers in Education*, 26(1-3):81–90.
- Jørgensen, A. H. (2004). Marrying HCI/usability and computer games: A preliminary look. *NordiCHI '04 Proceedings of the third Nordic conference on Human-computer interaction*, pages 393–396.
- Karasu, T. B. (1986). The specificity versus nonspecificity dilemma: Toward identifying therapeutic change agents. *American Journal of Psychiatry*, 143(6):687–695.
- Kato, P. M. (2010). Video games in health care: Closing the gap. *Review of General Psychology*, 14(2):113–121.
- Kato, P. M., Cole, S. W., Bradlyn, A. S., and Pollock, B. H. (2008). A video game improves behavioral outcomes in adolescents and young adults with cancer: a randomized trial. *Pediatrics*, 122(2):e305–e317.
- Kelly, D. and Tangney, B. (2003). A framework for using multiple intelligences in an ITS. In *Proceedings of World Conference on Educational Media and Technology*, pages 2423–2430. Association for the Advancement of Computing in Education.
- Kenwright, M., Liness, S., and Marks, I. (2001). Reducing demands on clinicians' time by offering computer-aided self-help for phobia/panic. *British Journal of Psychiatry*, 179:456–459.
- Kleihues, P., Burger, P. C., and Scheithauer, B. W. (1993). The new WHO classification of brain tumours. *Brain Pathology*, 3(3):255–268.

- Kocsis, O., Fernández-Aranda, F., Kalapanidas, E., Lam, T., Ganchev, T., Jiménez-Murcia, S., Raguin, T., Santamaría, J. J., Kostoulas, T., and Katsaounos, N. (2009). Serious videogames as therapeutical tool for mental disorders: enhanced human computer interaction in playmancer. In *Proceedings of the 13th International Conference on Information Visualisation*.
- Kolcaba, K. and Fox, C. (1998). The effects of guided imagery on comfort of women with early stage breast cancer undergoing radiation therapy. In *Oncology Nursing Forum*, volume 26, pages 67–72.
- Koster, R. (2013). *Theory of fun for game design*. O'Reilly Media, Inc.
- Kozma, R. B. (1991). Learning with media. *Review of Educational Research*, 61(2):179–211.
- Krichevets, A., Sirotkina, E., Yevsevecheva, I., and Zeldin, L. (1994). Computer games as a means of movement rehabilitation. *Disability and Rehabilitation: An International Multidisciplinary Journal.*, 17(2):100–105.
- Krippendorff, K. (2012). *Content Analysis: An Introduction to its Methodology*. Sage.
- Kulik, C.-L. C. and Kulik, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior*, 7(1):75–94.
- Kulik, J. A. (1994). *Technology Assessment in Education and Training.*, pages 9–34. Routledge, Hillsdale, NJ.
- Landreth, G. L. (2012). *Play therapy: The art of the relationship*. Routledge.
- Lasse, H. (2011). Using serious games in computer science education. In *In Proceedings of the 11th Koli Calling International Conference on Computing Education Research.*, pages 83–88. Koli, Finland: ACM.
- Lathi, M. (2003). As we become machines: Corporealized pleasures in video games., *The Video Game Theory Reader*, pages 157–170.
- Lazarus, A. A. (1989). Why i am an eclectic (not an integrationist). *British Journal of Guidance and Counselling*, 17(3):248–258.
- Leahy, A., Clayman, C., Mason, I., Lloyd, G., and Epstein, O. (1997). Computerised biofeedback games: a new method for teaching stress management and its use in irritable bowel syndrome. *Journal of the Royal College of Physicians of London*, 32(6):552–556.
- Lee, H., Friedman, M. E., Cukor, P., and Ahern, D. (2003). Interactive voice response system (ivrs) in health care services. *Nursing Outlook*, 51(6):277–283.

- Lehmann, E. (1997). Interactive educational simulators in diabetes care. *Informatics for Health and Social Care*, 22(1):47–76.
- Levesque, R. (2007). *SPSS Programming and Data Management: A Guide for SPSS and SAS Users*. SPSS Inc., 4th edition.
- Levy, D. M. (1938). "release therapy" in young children. *Psychiatry*, 1(3):387–390.
- Lieberman, D. A. (2012a). *eHealth Applications: Promising Strategies for Behavior Change.*, an article in a book *Digital Games for Health Behavior Change: Research, Design, and Future Directions.*, pages 110–127. Routledge Communication Series. Routledge, New York, 1st edition.
- Lieberman, D. A. (2012b). Video games for diabetes self-management: Examples and design strategies. *Journal of Diabetes Science and Technology*, 6(4):802–806.
- Lipsey, M. W. and Wilson, D. B. (1993). The efficacy of psychological, educational, and behavioral treatment: Confirmation from meta-analysis. *American Psychologist*, 48(12):1181–1209.
- Litofsky, N. S., Farace, E., Anderson, F., Meyers, C. A., Huang, W., and Laws, E. (2004). Depression in patients with high grade glioma: results of the glioma outcomes project. *Neurosurgery*, 54(2):358–367.
- Litofsky, N. S. and Resnick, A. G. (2009). The relationships between depression and brain tumors. *Journal of Neuro-Oncology*, 94(2):153–161.
- Long, F. and Poskitt, H. (2003). Aerlingus.com—a usability case study. In *Proceedings of the Irish Ergonomics Society Annual Conference*, pages 42–47.
- Loome, J. R., Cottle, R. E., and McNiff, J. I. (1981). Pretrained individual manpower study. Technical report, DTIC Document.
- Maddison, R., Mhurchu, C. N., Jull, A., Jiang, Y., Prapavessis, H., and Rodgers, A. (2007). Energy expended playing video console games: an opportunity to increase children's physical activity? *Pediatric exercise science*, 19(3):334.
- Maheu, M. M. (2003). The online clinical practice management model. *Psychotherapy: Theory, Research, Practice, Training*, 40(1-2):20–32.
- Maier, S. F. and Watkins, L. R. (1998). Cytokines for psychologists: implications of bidirectional immune-to-brain communication for understanding behavior, mood, and cognition. *Psychological Review*, 105(1):83.
- Marks, I. (1999). Computer aids to mental health care. *Canadian Journal of Psychiatry*, 44(6):548–555.

- Marks, I. M., Cavanagh, K., and Gega, L. (2007). *Hands-on Help: Computer-aided Psychotherapy*. Psychology Press.
- Marsella, S. C., Johnson, W. L., and LaBore, C. M. (2003). Interactive pedagogical drama for health interventions. Number 11th. *Artificial Intelligence in Education*.
- Mayo, M. (2007). Games for science and engineering education. *Communications of the ACM*, 50(7):30–35.
- McCabe, G. H. (2007). The healing path: A culture and community-derived indigenous therapy model. *Psychotherapy: Theory, Research, Practice, Training*, 44(2):148–160.
- McKinney, C. H. (1990). The effect of music on imagery. *Journal of Music Therapy*, 27(1):34–46.
- McNeil, B. J. and Nelson, K. R. (1991). Meta-analysis of interactive video instruction: A 10 year review of achievement effects. *Journal of Computer-Based Instruction*.
- Mead, G. H. (1898). The child and his environment. *Transaction of the Illinois Society for Child-Study*, 3:1–11.
- Menestrina, Z. (2007). Professional training, serious games and participatory design.
- Michael, D. and Chen, S. (2006). *Serious Games: Games that Educate, Train, and Inform*. Thomson Course Technology, Boston: Thomson Course Technology.
- Minami, T., Wampold, B. E., and Walsh, W. (2008). Adult psychotherapy in the real world. *Biennial review of counseling psychology*, 1:27–45.
- Miovic, M. and Block, S. (2007). Psychiatric disorders in advanced cancer. *Cancer*, 110(8):1665–1676.
- Mitchell, A. and Savill-Smith, C. (2004). The use of computer and video games for learning. *A review of the literature*.
- Morris, M. E., Kathawala, Q., Leen, T. K., Gorenstein, E. E., Guilak, F., Labhard, M., and Deleeuw, W. (2010). Mobile therapy: case study evaluations of a cell phone application for emotional self-awareness. *Journal of Medical Internet Research*, 12(2).
- Moustakas, C. E. (1955). Emotional adjustment and the play therapy process. *The Journal of genetic psychology*, 86(1):79–99.
- Mundt, J. C. (1997). Interactive voice response systems in clinical research and treatment. *Psychiatr Serv*, 48(5):611–612.
- Murphy, M. J. (2003). Computer technology for office-based psychological practice: Applications and factors affecting adoption. *Psychotherapy: Theory, Research,*

- Practice, Training.*, 40(1-2):10–19.
- Nacke, L. E., Nacke, A., and Lindley, C. A. (2009). Brain training for silver gamers: effects of age and game form on effectiveness, efficiency, self-assessment, and gameplay experience. *CyberPsychology & Behavior*, 12(5):493–499.
- Naparstek, B. (2007). Guided imagery: A best practice for pregnancy and childbirth. *International Journal of Childbirth Education*, 22(3).
- Neukrug, E. (1991). Computer-assisted live supervision in counselor skills training. *Counselor Education and Supervision.*, 31(2):132–138.
- Newman, M. G., Consoli, A. J., and Taylor, C. B. (1999). A palmtop computer program for the treatment of generalised anxiety disorder. *Behaviour Modification.*, 23(4):597–619.
- Niazi, M. A. (2011). *Towards a novel unified framework for developing formal, network and validated agent-based simulation models of complex adaptive systems.* PhD thesis, PhD Dissertation, University of Stirling.
- Nicholi, A. (1999). *The Harvard Guide to Psychiatry.* Belknap Press, Cambridge (MA): Belknap Press of Harvard University Press., 3rd edition.
- Nielsen, J. (1994). Heuristic evaluation. *Usability Inspection Methods*, 17(1):25–62.
- Norton, M., Wonderlich, S. A., Myers, T., Mitchell, J. E., and Crosby, R. D. (2003). The use of palmtop computers in the treatment of bulimia nervosa. *European Eating Disorders Review.*, 11(3):231–242.
- Numrich, S. K. (2008). Culture, models, and games: Incorporating warfare’s human dimension. In *IEEE Intelligent Systems.*, pages 58–61. IEEE.
- Oakley, C. (1994). Smack: A computer driven game for at-risk teens. computers in human services. *Computers in Human Services.*, 11(1-2):97–99.
- O’Connor, T. J., Cooper, R. A., Fitzgerald, S. G., Dvorznak, M. J., Boninger, M. L., VanSickle, D. P., and Glass, L. (2000). Evaluation of a manual wheelchair interface to computer games. *Neurorehabilitation and Neural Repair*, 14(1):21–31.
- O’Neil, K. E. (2011). Reading pictures: Developing visual literacy for greater comprehension. *The Reading Teacher.*, 4(9):533–537.
- Osgood-Hynes, D. J., Griest, J. H., Marks, I. M., Baer, L., Heneman, S. W., Wenzel, K. W., Manzo, P. A., Parkin, J. R., Spierings, C. J., Dottl, S. L., and Vitse, H. M. (1998). Self-administered psychotherapy for depression using a telephone-accessed computer system plus booklets: An open u.s.-u.k. study. *Journal of Clinical Psychiatry.*, 59(7):358–365.

- Palmer, S. (1996). *Stress Management and Counselling: Theory, Practice, Research and Methodology.*, pages 134–167. Stress Counselling Series. Cassell, London.
- Pangilinan Jr, P. H., Kelly, B. M., and Pangilinan, J. M. (2007). Depression in the patient with brain cancer. *Community Oncology*, 4(9):533–537.
- Papert, S. (1980). *Mindstorms: Children, Computers and Powerful Ideas.* Basic Books, Inc., New York, 2nd edition.
- Parkin, A. (2000). Computers in clinical practice: applying experience from child psychiatry. *British Medical Journal.*, 321(7261):615–618.
- Pasch, M., Bianchi-Berthouze, N., van Dijk, B., and Nijholt, A. (2009). Immersion in movement-based interaction. In *Intelligent Technologies for Interactive Entertainment*, pages 169–180. Springer.
- Patel, A., Schieble, T., Davidson, M., Tran, M. C., Schoenberg, C., Delphin, E., and Bennett, H. (2006). Distraction with a hand-held video game reduces pediatric preoperative anxiety. *Pediatric Anesthesia*, 16(10):1019–1027.
- Payne, M. (1997). *Modern Social Work Theory.* Palgrave Macmillan, Hampshire, UK., 2nd edition.
- Percevic, R., Lambert, M. J., and Kordy, H. (2004). Computer supported monitoring of patient treatment response. *Journal of Clinical Psychology.*, 60(3):285–299.
- Pickett, E. and Sonnen, C. (1993). Guided imagery and music: A music therapy approach to multiple personality disorder. *Journal of the Association for Music and Imagery*, 2:49–72.
- Pinkerton, R., G., S. A., and Mathay, K., editors (2007). *Evidence-Based Pediatric Oncology.* Blackwell Pub.
- Pizzo, P. A. and Poplack, D. G. (2011). *Principles and Practice of Pediatric Oncology.* Lippincott Williams & Wilkins, Philadelphia, PA: Lippincott Williams & Wilkins., 6th edition.
- Plutchik, R. (1984). Emotions: A general psychoevolutionary theory. *Approaches to Emotion*, 1984:197–219.
- Poels, K., Ijsselstein, W., and de Kort, Y. (2008). Development of the kids game experience questionnaire. *Proceedings of Meaningful Play 2008.*
- Prastawa, M., Bullitt, E., Ho, S., and Gerig, G. (2004). A brain tumor segmentation framework based on outlier detection. *Medical Image Analysis.*, 8(3):275–283.
- Price, S., Falcão, T. P., Sheridan, J. G., and Roussos, G. (2009). The effect of representation location on interaction in a tangible learning environment. In

- Proceedings of the 3rd International Conference on Tangible and Embedded Interaction*, pages 85–92. ACM.
- Price, T. R., Goetz, K. L., and Lowell, M. R. (1997). *The American psychiatric press textbook of neuropsychiatry.*, article in abook *Neuropsychiatric Aspects of Brain Tumors.*, pages 635–662. American Psychiatric Press., Washington: American Psychiatric Press.
- Proudfoot, J., Goldberg, D., Mann, A., Everitt, B., Marks, I., and Gray, J. (2003). Computerised, interactive, multimedia cognitive behavioural therapy reduces anxiety and depression in general practice: A randomized control trial. *Psychological Medicine.*, 33(2):217–227.
- Przeworski, A. and Newman, M. G. (2004). Palmtop computer-assisted group therapy for social phobia. *Journal of Clinical Psychology.*, 60(2):179–188.
- Pulsipher, L. (2012). *Game Design: How to Create Video and Tabletop Games, Start to Finish.* McFarland, North Carolina: McFarland.
- Radoff, J. (2011). Game player motivations. Online:< <http://radoff.com/blog/2011/05/19/game-player-motivations/>>. *Data dostępu*, 30.
- Rapkin, D. A., Straubing, M., and Holroyd, J. (1991). Guided imagery, hypnosis and recovery from head and neck cancer surgery: An exploratory study. *International Journal of Clinical and Experimental Hypnosis.*, 39(4):215–226.
- Rassin, M., Gutman, Y., and Silner, D. (2004). Developing a computer game to prepare children for surgery. *AORN journal*, 80(6):1095–1102.
- Redd, W. H., Jacobsen, P. B., Die-Trill, M., Dermatis, H., McEvoy, M., and Holland, J. C. (1987). Cognitive/attentional distraction in the control of conditioned nausea in pediatric cancer patients receiving chemotherapy. *Journal of Consulting and Clinical Psychology*, 55(3):391.
- Repenning, A. (2006). Excuse me, i need better ai!: employing collaborative diffusion to make game ai child’s play. In *Proceedings of the 2006 ACM SIGGRAPH Symposium on Videogames*, pages 169–178. ACM.
- Resnick, H. and Sherer, M. (1994). Computer games in the human services - a review. *Computers in Human Services.*, 11(1-2):17–29.
- Resnick, M. (2002). *The Global Information Technology Report: Readiness for a Networked World.*, pages 32–37. Oxford University Press, New York.
- Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational Technology Research and Development*, 44(2):43–58.

- Riva, G. (2005). Virtual reality in psychotherapy: review. *Cyberpsychology & behavior*, 8(3):220–230.
- Robertson, J. (2001). *The Effectiveness of a Virtual Role-Play Environment as a Story Preparation Activity*. PhD thesis, PhD Dissertation, Edinburgh University.
- Robertson, J. and Oberlander, J. (2002). Ghostwriter: Educational drama and presence in a virtual environment. *Journal of Computer Meditated Communication*, 8(1):0.
- Rochlen, A. B., Zack, J. S., and Speyer, C. (2004). Online therapy: Review of relevant definitions, debates and current empirical support. *Journal of Clinical Psychology*, 60(3):269–283.
- Rockville, M. (1999). Mental health: A report of the surgeon general. *US Department of Health and Human Services, National Institute of Mental Health, US Publication Service*.
- Rogers, C. R. (1940). The processes of therapy. *Journal of Consulting Psychology*, 4(5):161.
- Rogers, Y., Sharp, H., and Preece, J. (2011). *Interaction Design: Beyond Human-Computer Interaction*. John Wiley & Sons.
- Rolling, A. and Adams, E. (2009). *Fundamentals of Game Design*. New Riders, Berkeley, CA: New Riders, 2nd edition.
- Rosas, R., Nussbaum, M., Cumsille, P., Marianov, V., Correa, M., Flores, P., Grau, V., Lagos, F., López, X., López, V., et al. (2003). Beyond nintendo: design and assessment of educational video games for first and second grade students. *Computers & Education*, 40(1):71–94.
- Rouse III, R. (2010). *Game design: Theory and practice*. Jones & Bartlett Learning.
- Roy, S. (2003). State of the art of virtual reality therapy (vrt) in phobic disorders. *PsychNology Journal*, 1(2):176–183.
- Russell, W. D. and Newton, M. (2008). Short-term psychological effects of interactive video game technology exercise on mood and attention. *Educational Technology & Society*, 11(2):294–308.
- Salen, K. and Zimmerman, E. (2003). *Rules of Play: Game Development Fundamentals*. MIT Press, Cambridge: The MIT Press.
- Salomon, G. and Gardner, H. (1986). The computer as educator: Lessons from television research. *Educational Researcher*, 15(1):13–17.
- Sawyer, B. (2008). From cells to cell processors: the integration of health and video games. *Computer Graphics and Applications, IEEE*, 28(6):83–85.

- Schaefer, C. E. (2001). Prescriptive play therapy. *International Journal of Play Therapy*, 10(2):57.
- Scheirer, J., Fernandez, R., Klein, J., and Picard, R. W. (2002). Frustrating the user on purpose: a step toward building an affective computer. *Interacting with computers*, 14(2):93–118.
- Schell, J. (2008). *The Art of Game Design: A Book of Lenses*. Morgan Kaufmann, 1st edition.
- Schuemie, M. J. (2003). *Human-Computer Interaction and presence in virtual reality exposure therapy*. PhD thesis, PhD Dissertation, TU Delft, Delft University of Technology.
- Shaw, S. C., Marks, I. M., and Toole, S. (1999). Lessons from pilot tests of computer self-help for agora/claustrophobia and panic. *MD Computing: Computers in medical practice.*, 16(4):44–48.
- Sheff, D. (1994). *Video Games: A Guide for Savvy Parents*. Random House, 1st edition.
- Shegog, R., Bartholomew, L. K., Parcel, G. S., Sockrider, M. M., Mâsse, L., and Abramson, S. L. (2001). Impact of a computer-assisted education program on factors related to asthma self-management behavior. *Journal of the American Medical Informatics Association*, 8(1):49–61.
- Sicart, M. (2009). *The Ethics of Computer Games*. Massachusetts Institute of Technology (MIT) press, Massachusetts Institute of Technology press, Cambridge, London, England.
- Siek, K. A., Connelly, K. H., Rogers, Y., Rohwer, P., Lambert, D., and Welch, J. L. (2006). When do we eat? an evaluation of food items input into an electronic food monitoring application. In *Pervasive Health Conference and Workshops, 2006*, pages 1–10. IEEE.
- Sietsema, J. M., Nelson, D. L., Mulder, R. M., Mervau-Scheidel, D., and White, B. E. (1993). The use of a game to promote arm reach in persons with traumatic brain injury. *American Journal of Occupational Therapy*, 47(1):19–24.
- Silverman, B. and Holmes, J. (2001). Modeling emotion and behavior in animated personas to facilitate human behavior change: The case of the heart-sense game. *Health Care Management Science.*, 4(3):213–228.
- Simpson, S. (2003). *Technology in Counselling and Psychotherapy.*, an article in a book *Video Counselling and Psychotherapy in Practice*. Palgrave MacMillan, New York.

- Sinclair, J., Hingston, P., and Masek, M. (2007). Considerations for the design of exergames. In *Proceedings of the 5th International Conference on Computer Graphics and Interactive Techniques in Australia and Southeast Asia*, pages 289–295. ACM.
- Smith, E., Gomm, S., and Dickens, C. (2003). Assessing the independent contribution to quality of life from anxiety and depression in patients with advanced cancer. *Palliative Medicine.*, 17(6):509–513.
- Spencer, R., Nilsson, M., and Wright, A. (2010). Anxiety disorders in advanced cancer. *Cancer.*, 116(7):1810–1819.
- Squire, K. (2003). Video games in education. *International Journal of Intelligent Simulations and Gaming.*, 2(1):49–62.
- Squire, K. and Steinkuehler, C. (2005). Meet the gamers. *Library Journal.*, 130(7):38–41.
- Staalduinen, J. V. and Freitas, S. D. (2011). *Learning to Play: Exploring the Future of Education with Video Games*. New Literacies and Digital Epistemologies. Peter Lang Publishing Inc., New York, USA.
- Stark, D., Kiely, M., and Smith, A. (2002). Anxiety disorders in cancer patients: their nature, associations, and relation to quality of life. *Journal of Clinical Oncology.*, 20(14):3137–3148.
- Steinman, R. H. (2009). The cancer patient with anxiety and chronic pain. *International Association for the Study of Pain.*, 17(4):1–6.
- Suler, J. R. (2000). Psychotherapy in cyberspace: A 5-dimensional model of online and computer mediated psychotherapy. *CyberPsychology & Behavior.*, 3(2):151–159.
- Susi, T., Johannesson, M., and Backlund, P. (2007). Serious games - an overview. Technical Report HS-IKI-TR-07-001, School of Humanities and Informatics., School of Humanities and Informatics, University of Skövde, Sweden.
- Szer, J. (1983). Video games as physiotherapy. *Medical Journal of Australia.*, 1(0):401–402.
- Tate, D. F. and Zabinski, M. F. (2004). Computer and internet applications for psychological treatment: Update for clinicians. *Journal of Clinical Psychology.*, 60(2):209–220.
- Tate, R. and Haritatos, J. (2009). Hopelab's approach to re-mission. *International Journal of Learning and Media.*, 1(1):29–35.
- Teunissen, S. C. C. M., De Graeff, A., Voest, E. E., and De Haes, J. C. J. M. (2007). Are anxiety and depressed mood related to physical symptom burden? a study in

- hospitalized advanced cancer patients. *Palliative medicine.*, 21(4):341–346.
- Tongco, M. D. C. (2007). Purposive sampling as a tool for informant selection.
- Troesch, L. M., Rodehaver, C. B., Delaney, E. A., and Yanes, B. (1993). The influence of guided imagery on chemotherapy-related nausea and vomiting. *Oncology Nursing Forum.*, 20(8):1179–1185.
- Trout, J. and Christie, B. (2007). Interactive video games in physical education. *Journal of Physical Education, Recreation & Dance*, 78(5):29–45.
- Trudel, G., Marchand, A., Ravart, M., Aubin, S., Turgeon, L., and Fortier, P. (2001). The effect of a cognitive-behavioral group treatment program on hypoactive sexual desire in women. *Sexual and Relationship Therapy*, 16(2):145–164.
- Tusek, D. L. and Cwynar, R. E. (2000). Strategies for implementing a guided imagery program to enhance patient experience. *AACN Advanced Critical Care.*, 11(1):68–76.
- Unutzer, J., Choi, Y. and Cook, I. A., and Oishi, S. (2002). Clinical computing: A web-based management system to improve care for depression in a multicenter clinical trial. *Psychiatric Services.*, 53(6):671–678.
- Valentine, A. D., Passik, S. D., and Massie, M. J. (2002). *Cancer in the nervous system.*, article in a book *Psychiatric and psychosocial issues.*, pages 572–589. Oxford University Press, 2nd edition.
- Vasterling, J., Jenkins, R. A., Tope, D. M., and Burish, T. G. (1993). Cognitive distraction and relaxation training for the control of side effects due to cancer chemotherapy. *Journal of behavioral medicine*, 16(1):65–80.
- Verstegen, I. (2006). *Arnheim, Gestalt and art: a psychological theory.* Springer Science & Business Media.
- Walker, L. G., Walker, M. B., and Ogston, K. (1999). Psychological, clinical and pathological effects of relaxation training and guided imagery during primary chemotherapy. *British Journal of Cancer.*, 80(1-2):262–268.
- Watson, J. C. (2003). Computer-based supervision: Implementing computer technology into the delivery of counseling supervision. *Journal of Technology in Counseling.*, 3(1):1–13.
- Watters, C., Oore, S., Shepherd, M., Abouzied, A., Cox, A., Kellar, M., Kharrazi, H., Liu, F., and Otley, A. (2006). Extending the use of games in health care. In *System Sciences, 2006. HICSS'06. Proceedings of the 39th Annual Hawaii International Conference on*, volume 5, pages 88b–88b. IEEE.

- Webb, N. B. (1999). *Play therapy crisis intervention with children*. Guilford Press, 2nd edition.
- Weiner, B. and Graham, S. (1984). An attributional approach to emotional development. *Emotions, cognition, and behavior*, pages 167–191.
- Weisz, J. R. and Kazdin, A. E., editors (2010). *Evidence-based psychotherapies for children and adolescents*. Guilford Press.
- Wellisch, D. K., Kaleita, T. A., and Freeman, D., e. a. (2002). Predicting major depression in brain tumor patients. *Psycho-Oncology*, 11(3):230–238.
- Westera, W. and Nadolski, J. R. (2008). Serious games for higher education: A framework for reducing design complexity. *Journal of Computer Assisted Learning.*, 24(5):420–432.
- Whiston, S. C. and Sexton, T. L. (1993). An overview of psychotherapy outcome research: Implications for practice. *Professional Psychology: Research and Practice.*, 24(1):43–51.
- White, M. and Epston, D. (1990). *Narrative Means to Therapeutic Ends*. W. W. Norton & Company, New York, 1st edition.
- Widman, L. M., McDonald, C. M., and Abresch, R. T. (2006). Effectiveness of an upper extremity exercise device integrated with computer gaming for aerobic training in adolescents with spinal cord dysfunction. *The Journal of Spinal Cord Medicine*, 29(4):363.
- Wijers, A. F. (2009). Playing games is serious fun: A serious game for type 2 diabetes patients to enhance a healthy lifestyle. *Master Thesis. University of Twente*.
- Winn, B. (2008). The design, play, and experience framework. *Handbook of Research on Effective Electronic Gaming in Education*, 3:1010–1024.
- Wolf, A. W. (2003). The technology of psychotherapy: Introduction to the special issue. *Psychotherapy.*, 40(1-2):3–7.
- Wright, J. H., Wright, A. S., Salmon, P., Beck, A. T., Kuyendall, J., Goldsmith, J., and Zickel, M. B. (2002). Development and initial testing of a multimedia program for computer-assisted cognitive therapy. *American Journal of Psychotherapy.*, 56(1):76–86.
- Yates, F. (1996). Evaluation of the balance computer intervention. Unpublished Report.
- Zavagno, M. (2007). Adverblog.

- Zielke, A. M. and Evans, J. M. (2009). Serious games for immersive cultural training: Creating a living world. *Computer Graphics and Applications, IEEE.*, 29(2):49–60.
- Zyda, M. (2005). From visual simulation to virtual reality to games. *Computer.*, 38(9):25–32.