

Guidelines to design digital graphic novels portraying emotional social phenomena using critical systems heuristics and HCI principles

DD Pretorius
22458603

Dissertation submitted in fulfillment of the requirements for the degree Magister Scientiae in Computer Science at the Vaal Triangle Campus of the North-West University

Supervisor: Prof. Roelien Goede
Co-supervisor: Ms. JT Terblanche

April 2016

ACKNOWLEDGEMENTS

My Masters degree is without a doubt the most difficult qualification I have ever completed. Not as a result of the degree itself, but because of the tumultuous two years that accompanied it. Two years filled with engagement, marriage, a new house as well as a terrible car crash and saying goodbye to a beloved father after years of battle against illness. It was rough, but through it all, God was faithful.

The ability and strength needed to complete the final stretch of this dissertation after losing my father on the 11th of October 2015 is something only God could have provided. I promised my dad I would be strong and I feel that completing this degree on time was my way of showing him that I was doing just as he asked. Dad, I love you. I miss you. This dissertation is for you and my awesome mom. Mom, you are a pillar of strength and I am so grateful that I get to share this experience with you. This dissertation is as much yours as it is mine. Without you as a role model, I would never have aspired to challenge my boundaries and persevere through all the challenges life has thrown at me. I love you very much – thank you for giving me the opportunity to make my dreams a reality. I appreciate all you have ever done for me – I would not be here if it were not for you.

To my superhero of a husband, thank you for all your love and support. I share this degree with you as well. For all the dishes you washed, dinners you made, bunnies you bought, tears you dried and tempers you calmed – thank you. Thank you for always loving me, for better and for worse. I look forward to closing this chapter in our lives and moving forward to new adventures with you.

To my friends, thank you for being absolutely amazing! You will never know how grateful I am for each one of you. You are my family and I could not imagine life without you.

Last and certainly not least, thank you to my awesome supervisors. Through this bumpy journey, I am so grateful to have had you as my co-pilots. Thank you for sharing both the good and bad times with me. Thank you for making all of this possible!

Truly, I can do all things through Christ who strengthens me!

Philippians 4:13

ABSTRACT

The goal of the Mandela27 project is to promote intercultural dialogue between South Africa and the European Union regarding historic cultural events that took place during the Apartheid era in South Africa. One facet of the Mandela27 project is the development of a digital graphic novel that should inform young adults about the emotional social phenomenon of conditions of prison life during the time of Nelson Mandela's incarceration in a medium that they find engaging and entertaining.

A review of literature revealed that there are currently no guidelines for creating digital graphic novels portraying emotional social phenomena. This study aims to develop guidelines for the design of digital graphic novels portraying emotional social phenomena using critical systems heuristics and human-computer interaction principles. This is achieved through a review of literature pertaining to digital graphic novels, human-computer interaction and emotion. Applicable guidelines from each of the aforementioned literature reviews are combined into a set of proposed guidelines which are incorporated into the design and development of the Mandela27 digital graphic novel.

The design and development of the Mandela27 digital graphic novel will occur according to the five phases of action research. These phases of action research will be guided by critical systems heuristics in order to ensure that the needs of both those involved (ex-political prisoners) and affected (target audience) are met.

Ex-political prisoners are asked to relay their stories of incarceration in Robben Island Prison. Themes are created from the aforementioned stories and are incorporated into the narrative of the Mandela27 digital graphic novel. The developed digital graphic novel is evaluated by members of the target audience in order to evaluate its aesthetic appeal. Recommendations from the evaluation are incorporated into the design of the final version of the digital graphic novel.

The final conclusions of the study are drawn by providing a list of proposed guidelines for the design of digital graphic novels portraying emotional social phenomena using critical systems heuristics and human-computer interaction principles. A digital graphic novel is created based on the principles of critical systems heuristics.

Keywords: digital graphic novels, emotional social phenomena, critical systems heuristics, human-computer interaction, methodology enhancement, action research, design science research

Table of Contents

1	Chapter One: Introduction to the Study	1
1.1	Introduction	1
1.2	Concepts central to the study.....	2
1.2.1	Critical systems thinking.....	2
1.2.2	Critical systems heuristics	2
1.2.3	Graphic novels	3
1.2.4	Human-computer interaction	4
1.3	Research methodology concepts	5
1.3.1	Paradigms	5
1.3.2	Positivism	6
1.3.3	Interpretivism.....	6
1.3.4	Critical social research theory	7
1.3.5	Design science research	7
1.3.6	Mixed methods.....	7
1.4	Research methodology	8
1.4.1	Critical research	8
1.4.2	Interpretive methods.....	9
1.4.3	Design science research methodology.....	9
1.5	Research methods	9
1.5.1	Action research	9
1.5.2	Interpretive research	12
1.5.3	Design science research	12
1.6	Problem statement and motivation for the study	13
1.7	Objectives of the study	14
1.7.1	Primary objective.....	14
1.7.2	Secondary objectives	14

1.8	Research design and methodology	15
1.8.1	Aspects of research methodology used in this study	15
1.8.2	Research plan for this study	16
1.8.3	Rigor and evaluation of method	19
1.8.4	Contribution of the study	20
1.9	Ethical considerations	20
1.10	Chapter classification	20
2	Chapter Two: Research Methodology	22
2.1	Introduction	22
2.2	Research paradigms in information systems.....	25
2.2.1	Positivism	25
2.2.2	Interpretivism.....	26
2.2.3	Critical social research theory	26
2.2.4	Design science research	27
2.2.5	Mixed methods.....	27
2.2.6	Paradigms appropriate for this study.....	30
2.3	Methodology: General guidelines	33
2.3.1	Critical social theory research methodology	33
2.3.2	Interpretive research methodology	36
2.3.3	Design science research methodology.....	37
2.3.4	Research methodology principles applied in this study	39
2.4	Research methods	42
2.4.1	Critical social theory research method - Action research	43
2.4.2	Action research applied in this study	48
2.4.3	Interpretive research methods.....	49
2.4.4	Data Collection.....	50
2.4.5	Data Analysis	53
2.4.6	Interpretive methods used in this study	59

2.4.7	Design science research method	60
2.4.8	Design science research method used in this study	65
2.5	Research plan for this study	67
2.6	Ethics adopted in this study	68
2.7	Conclusion	69
3	Chapter Three: Critical Systems Heuristics	71
3.1	Introduction	71
3.2	Systems and systems thinking	71
3.2.1	Objectives	73
3.2.2	Environment	73
3.2.3	Resources	73
3.2.4	Components	74
3.2.5	Management	74
3.2.6	Systems Thinking	75
3.2.7	The adaptive whole	75
3.2.8	Five principles of systems thinking	76
3.2.9	Hard vs soft systems	78
3.2.10	Performance of a system	81
3.2.11	Frankfurt school	82
3.3	Critical Social Theory	83
3.3.1	Rational vs. polemical reasoning	84
3.4	Critical Systems Heuristics	85
3.5	Initial answers to the 12 boundary questions	92
3.6	Reflection of Critical Systems Heuristics applied to this study	96
3.7	Conclusion	96
4	Chapter Four: Digital Graphic Novels	98
4.1	Introduction	98

4.2	Context of digital graphic novels within the research structure of this study	98
4.3	An overview of digital graphic novels	99
4.4	Design rules for digital graphic novels.....	102
4.5	Benefits of digital graphic novels.....	110
4.6	Guidelines for creating digital graphic novels	111
4.7	Conclusion	113
5	Chapter Five: Human-Computer Interaction.....	114
5.1	Introduction	114
5.2	An overview of Human-Computer Interaction.....	115
5.3	The human in HCI	117
5.3.1	Characteristics of humans.....	118
5.3.2	Design principles for humans	129
5.4	Computer in HCI.....	132
5.5	Interaction in HCI.....	133
5.5.1	Interaction framework.....	135
5.5.2	Interaction styles	136
5.5.3	The use of HCI principles in interaction.....	138
5.5.4	What are the HCI principles?	139
5.5.5	Chosen HCI principles for this study	144
5.6	HCI enriched guidelines for creating digital graphic novels	151
5.7	Conclusion	154
6	Chapter Six: Emotion.....	157
6.1	Introduction	157
6.2	Overview of emotions and emotional social phenomena	157
6.3	Emotion and sight.....	163
6.4	Emotions and sound.....	165
6.5	Emotions and HCI	166

6.6	Emotions in digital graphic novels	167
6.7	Emotion-enriched principles for creating digital graphic novels portraying emotional social phenomena	168
6.8	Summary	172
7	Chapter Seven: Diagnosis.....	174
7.1	Introduction	174
7.2	Initial answers to boundary questions	174
7.2.1	Sources of motivation.....	175
7.2.2	Sources of control	176
7.2.3	Sources of expertise.....	177
7.2.4	Sources of legitimation	179
7.3	Research design – <i>Diagnosing</i> phase.....	180
7.3.1	Data collection.....	180
7.3.2	Data analysis.....	185
7.4	Conclusions from the data.....	191
7.4.1	Theme 1: Daily life in Apartheid	192
7.4.2	Theme 2: Youth in the Apartheid Era	195
7.4.3	Theme 3: Life in Robben Island Prison	198
7.4.4	Theme 4: Exercise in Robben Island Prison	201
7.4.5	Theme 5: Meals in Robben Island Prison.....	203
7.4.6	Theme 6: Hunger Strikes in Robben Island Prison	206
7.4.7	Theme 7: Censorship in Robben Island Prison	207
7.4.8	Theme 8: Punishment in Robben Island Prison	209
7.4.9	Theme 9: Lawyers in Robben Island Prison.....	211
7.4.10	Theme 10: Secret messages in Robben Island Prison.....	212
7.4.11	Theme 11: Education in Robben Island Prison	214
7.4.12	Theme 12: Views of Ex-political Prisoners	216

7.5	Summary	218
8	Chapter Eight: Action Planning and Action Taking	219
8.1	Introduction	219
8.2	Problem identification	221
8.3	Motivation for the development of a digital graphic novel.....	221
8.4	Objectives of a solution	221
8.5	Design and development.....	223
8.6	Summary	232
9	Chapter Nine: Demonstration and Evaluation	234
9.1	Introduction	234
9.2	Research design – <i>Evaluating</i> phase.....	236
9.2.1	Data collection.....	236
9.2.2	Data analysis.....	238
9.3	First demonstration.....	241
9.3.1	Participant detail.....	244
9.3.2	Code all the text	244
9.3.3	Assess the coding consistency	245
9.3.4	Conclusions from the data.....	245
9.3.5	Improvements identified through the data analysis of the first evaluation	253
9.4	Demonstration of second version	254
9.4.1	Participant detail.....	258
9.4.2	Code all the text	259
9.4.3	Assess the coding consistency	259
9.4.4	Conclusions from the data.....	260
9.4.5	Improvements identified through the data analysis of the second evaluation	267

9.5	The incorporation of the identified themes into the digital graphic novel	268
9.5.1	Incorporation of the <i>Artwork</i> theme	268
9.5.2	Incorporation of the <i>Camera Movement</i> theme	268
9.5.3	Incorporation of the <i>Character</i> theme	269
9.5.4	Incorporation of the <i>Colours</i> theme	269
9.5.5	Incorporation of the <i>Design</i> theme	269
9.5.6	Incorporation of the <i>Sound</i> theme	269
9.6	Final version of the digital graphic novel	269
9.6.1	Interface Design	269
9.6.2	Daily Life in Apartheid	272
9.6.3	Youth in the Apartheid Era	272
9.6.4	Life in Robben Island Prison	272
9.6.5	Exercise in Robben Island Prison	274
9.6.6	Meals in Robben Island Prison.....	276
9.6.7	Hunger Strikes in Robben Island Prison.....	278
9.6.8	Censorship in Robben Island Prison	279
9.6.9	Punishment in Robben Island Prison	281
9.6.10	Lawyers in Robben Island Prison	283
9.6.11	Secret Messages in Robben Island Prison.....	285
9.6.12	Education in Robben Island Prison	286
9.6.13	Views of Ex-political Prisoners	288
9.7	Implementation.....	289
9.8	Summary	290
10	Chapter Ten: Specifying Learning	291
10.1	Introduction	291
10.2	Reflection on research aims and objectives	291

10.2.1	Secondary objectives in the <i>Diagnosing</i> phase	291
10.2.2	Secondary objectives in the <i>Action Planning</i> phase	293
10.2.3	Secondary objectives in the <i>Action Taking</i> phase	294
10.2.4	Secondary objectives in the <i>Evaluating</i> phase	294
10.2.5	Secondary objectives in the <i>Specifying Learning</i> phase	295
10.2.6	Primary objective of the study	295
10.3	Research evaluation.....	295
10.3.1	Principles for validation of action research	296
10.3.2	Principles for validation of critical research	300
10.3.3	Principles for validation of interpretive research.....	301
10.4	Research discussion	302
10.4.1	Reflection on proposed guidelines	306
10.5	Limitations of the study.....	308
10.6	Further study considerations	308
10.7	Chapter summary.....	308
	Reference List	310
	Appendix A	319
	Appendix B	320

List of Figures

Figure 1.1: The five iterative phases of action research (Baskerville, 1999:14).
 11

Figure 1.2: Graphical representation of the process model of design science research as proposed by Peffers et al. (2006:89)..... 13

Figure 1.3: An adaptation of the action research cycle (Baskerville, 1999:14) and the design science research process (Peffers et al., 2006:93) to represent the research structure of this study..... 18

Figure 2.1: Elements relevant to any piece of research (Checkland & Holwell, 1998:13). 23

Figure 2.2: An adaptation of the action research cycle (Baskerville, 1999:14) and the design science research process (Peffers et al., 2006:93) to represent the research structure of this study..... 32

Figure 2.3: The five iterative phases of action research (Baskerville, 1999:14).
 45

Figure 2.4: Elements relevant to any piece of research (Checkland & Holwell, 1998:13) 46

Figure 2.5: Cycle of action research in human situations (Checkland & Holwell, 1998:15) 47

Figure 2.6: The design science research knowledge base (Gregor & Hevner, 2013:344). 61

Figure 2.7: The roles of knowledge in design science research as illustrated by Gregor and Hevner (2013:344)..... 62

Figure 2.8: The evolution of knowledge in design science research as depicted by Gregor and Hevner (2013:A5). 62

Figure 2.9: Adapted design science research process model (Peffers et al., 2006:93). 64

Figure 2.10: An activity framework for design science research (Venable, 2006:17). 65

Figure 2.11: Integration of both proposed action research processes in this study. 68

Figure 3.1: Example of a rich picture depicting the hypothesis testing research process of natural science (Checkland & Holwell, 1998:12). 80

Figure 3.2: Hard vs soft systems perspectives adapted from Checkland and Scholes (1999:A11).	81
Figure 3.3: The 'eternal triangle' of boundary judgements, facts, and values (Ulrich, 2000:6).	88
Figure 3.4: Table of boundary categories (Ulrich, 2000:256).	90
Figure 3.5: Adaptation of elements relevant to any piece of research (Checkland & Holwell, 1998:13).	97
Figure 4.1: Page excerpt from the graphic novel Sandkings (Martin, 1986).	100
Figure 4.2: Screenshot of a page layout in The Thrill Electric (Moore & Reppion, 2015).	101
Figure 4.3: Each frame of the digital graphic novel page is zoomed into on click (Moore & Reppion, 2015).	101
Figure 4.4: Page excerpt that illustrates a subject-to-subject movement (Johns & Frank, 2012:10).	104
Figure 4.5: Page excerpt that demonstrates how frames guide the reader's view (Johns & Frank, 2012:13).	105
Figure 4.6: Possible use of images to represent or evoke emotion adapted from McCloud (2011:118).	106
Figure 4.7: Example of how words dictate a reader's interpretation of a character's expression adapted from McCloud (2011:94).	109
Figure 5.1: Example of error message that incorporates hearing, sight and touch.	118
Figure 5.2: Adaptation of graphical representation of the visual angle of two objects of different sizes (Dix et al., 2004:17).	120
Figure 5.3: Translations between components (Abowd & Beale, 1991:76).	136
Figure 5.4: The consistency principle incorporated in the structure of The Thrill Electric (Moore & Reppion, 2015).	145
Figure 5.5: The consistency principle incorporated in the structure of The Thrill Electric (Moore & Reppion, 2015).	145
Figure 5.6: The navigation bar from The Thrill Electric (Moore & Reppion, 2015).	146
Figure 5.7: An error prevention method used by the Windows operating system when a user tries to enter a backslash in a file name.	146

Figure 5.8: An error prevention method used by the Windows operating system when a user tries to enter a backslash in a file name.	147
Figure 5.9: The 'back' button in a web browser (www.google.com).....	147
Figure 5.10: Instruction screen in The Thrill Electric (Moore & Reppion, 2015).	148
Figure 5.11: Google landing page (www.google.com).....	148
Figure 5.12: The help menu from The Thrill Electric (Moore & Reppion, 2015).	149
Figure 5.13: The organisation of content within The Thrill Electric (Moore & Reppion, 2015).	150
Figure 5.14: Google's voice recognition search function (www.google.com).....	150
Figure 5.15: Google's usability feedback page (http://www.google.com/usability/).	151
Figure 5.16: Adaptation of the research structure that reflects the role of HCI principles in this study.	156
Figure 6.1: An adaptation of the action research cycle (Baskerville, 1999:14) and the design science research process (Peppers et al., 2006:93) to represent the research structure of this study.....	173
Figure 8.1: An adaptation of the action research cycle (Baskerville, 1999:14) and the design science research process (Peppers et al., 2006:93) to represent the research structure of this study.....	220
Figure 8.2: Example of the incorporation of actual entities on Robben Island in the digital graphic novel.	226
Figure 8.3: The first frame of the digital graphic novel.	227
Figure 8.4: The first page of the digital graphic novel.	229
Figure 9.1: An adaptation of the action research cycle (Baskerville, 1999:14) and the design science research process (Peppers et al., 2006:93) to represent the research structure of this study.....	235
Figure 9.2: The first frame of the demo page.....	242
Figure 9.3: The second frame of the demo page.....	242
Figure 9.4: The third frame of the demo page.	242
Figure 9.5: The fourth frame of the demo page.	242
Figure 9.6: The fifth frame of the demo page.....	243
Figure 9.7: The first version of the demo page.	243

Figure 9.8: Changes made to the colours of the first frame of the digital graphic novel.	255
Figure 9.9: Changes made to the colours and detail in the second frame of the digital graphic novel.	255
Figure 9.10: Changes made to the colours and detail in the third frame of the digital graphic novel.	256
Figure 9.11: Changes made to the colours of the fourth frame of the digital graphic novel.	256
Figure 9.12: The second version of the demo page.	257
Figure 9.13: The main menu of the digital graphic novel.	270
Figure 9.14: An example of the interface within the digital graphic novel.	271
Figure 9.15: An interactive scene portraying life inside Robben Island Prison.	272
Figure 9.16: An interactive scene portraying exercise in Robben Island Prison.	274
Figure 9.17: An interactive scene portraying meals in Robben Island Prison.	276
Figure 9.18: An frame portraying hunger strikes in Robben Island Prison.	278
Figure 9.19: A frame portraying censorship in Robben Island Prison.	279
Figure 9.20: A frame portraying punishment in Robben Island Prison.	281
Figure 9.21: A frame portraying lawyers in Robben Island Prison.	283
Figure 9.22: An interactive scene portraying secret messages in Robben Island Prison.	285
Figure 9.23: A frame portraying education in Robben Island prison.	286
Figure 9.24: An interactive scene that incorporates views of ex-political prisoners.	288

List of Tables

Table 2.1: Different combinations of mixed methods quoted from Mingers and Brocklesby (1997:491).....27

Table 2.2: A proposed set of principles for critical research quoted from Myers and Klein (2011:25).35

Table 2.3: Proposed principles for interpretive field research quoted from Klein and Myers (1999:72).36

Table 2.4: Guidelines for design-science research in information systems quoted from Hevner et al. (2004:83).....37

Table 2.5: Design Evaluation Methods quoted from Hevner et al. (2004:86).38

Table 2.6: An application of principles for critical research proposed by Myers and Klein (2011:25).39

Table 2.7: An application of principles for interpretive field research proposed by Klein and Myers (1999:72).....41

Table 2.8: An application of guidelines for design-science research in information systems as proposed by Hevner et al. (2004:83).....42

Table 2.9: A summary of the content analysis process as summarised from Zhang and Wildemuth (2009:3).53

Table 2.10: Key coding differences between conventional, direct and summative approaches (Hsieh & Shannon, 2005:1286).56

Table 2.11: Example of a coded transcript using the coding method illustrated by Maree (2007:106).57

Table 2.12: Implementation of design science research method adapted from Peffers et al. (2006:89).....66

Table 3.1: Four perspectives for examining selectivity (Ulrich, 2005:8).....89

Table 3.2: Checklist of 12 boundary questions (Ulrich, 1987:279).....91

Table 3.3: Initial answers to the checklist of 12 boundary questions as given by Ulrich (1987:279).92

Table 4.1: Proposed guidelines for creating digital graphic novels portraying emotional social phenomena using critical systems heuristics and HCI principles.111

Table 5.1: Important concepts of the human and their impact on the design of a digital graphic novel.....127

Table 5.2: Common interface styles and their key attributes (Dix et al., 2004:136).	137
Table 5.3: Summary of several HCI principles given in literature.	139
Table 5.4: Weighted HCI rules according to their frequency of use (Hinze-Hoare, 2007:8).....	143
Table 5.5: Proposed guidelines for creating digital graphic novels portraying emotional social phenomena using critical systems heuristics and HCI principles.	152
Table 6.1: Summary of popular emotional design theories.....	161
Table 6.2: Proposed guidelines for creating digital graphic novels portraying emotional social phenomena using critical systems heuristics and HCI principles.	168
Table 7.1: Key factors of prison life during incarceration in Robben Island Prison.	181
Table 7.2: Principles for the design of the narrative and characters in a digital graphic novel.	181
Table 7.3: Questions posed to the participants of the focus groups and interviews.....	182
Table 7.4: Details of participants of focus groups and interview.	185
Table 7.5: Adapted summary of the content analysis process as summarised from Zhang and Wildemuth (2009:3).	186
Table 7.6: Summary of most frequent codes discovered in focus groups and interview.	189
Table 7.7: Codes merged due to high degree of similarity.	190
Table 7.8: Code occurrence frequencies for codes in the Daily life in Apartheid code family.	192
Table 7.9: Code occurrence frequencies for codes in the Youth in the Apartheid era code family.	195
Table 7.10: Code occurrence frequencies for codes in the Life in Robben Island Prison code family.....	198
Table 7.11: Code occurrence frequencies for codes in the Exercise in Robben Island Prison code family.....	202
Table 7.12: Code occurrence frequencies for codes in the Meals in Robben Island Prison code family.....	204

Table 7.13: Code occurrence frequencies for codes in the Hunger strikes in Robben Island Prison code family.	206
Table 7.14: Code occurrence frequencies for codes in the Censorship in Robben Island Prison code family.	208
Table 7.15: Code occurrence frequencies for codes in the Punishment in Robben Island Prison code family.	209
Table 7.16: Code occurrence frequencies for codes in the Lawyers in Robben Island Prison code family.	211
Table 7.17: Code occurrence frequencies for codes in the Secret Messages in the Robben Island Prison code family.	212
Table 7.18: Code occurrence frequencies for codes in the Education in Robben Island code family.	214
Table 7.19: Code occurrence frequencies for codes in the Views of ex-political prisoners code family.	216
Table 8.1: Roles of each expert in the design of the digital graphic novel.	224
Table 9.1: List of questions mapped to headings of proposed guidelines.	236
Table 9.2: Adapted summary of the content analysis process as summarised from Zhang and Wildemuth (2009:3).	239
Table 9.3: Summary of all codes from the first focus group.	244
Table 9.4: Code occurrence frequencies for codes in the Artwork code family.	246
Table 9.5: Code occurrence frequencies for codes in the Camera Movement code family.	247
Table 9.6: Code occurrence frequencies for codes in the Character code family.	249
Table 9.7: Code occurrence frequencies for codes in the Colours code family.	249
Table 9.8: Code occurrence frequencies for codes in the Design code family.	251
Table 9.9: Code occurrence frequencies for codes in the Sound code family.	252
Table 9.10: Proposed changes and the guidelines to which they correlate.	254
Table 9.11: Summary of all codes from the second and third focus groups.	259
Table 9.12: Code occurrence frequencies for codes in the Artwork code family.	260
Table 9.13: Code occurrence frequencies for codes in the Camera Movement code family.	262

Table 9.14: Code occurrence frequencies for codes in the Colours code family.	264
Table 9.15: Code occurrence frequencies for codes in the Design code family.	265
Table 9.16: Code occurrence frequencies for codes in the Sound code family.	266
Table 10.1: Proposed guidelines for creating digital graphic novels portraying emotional social phenomena using critical systems heuristics and HCI principles.	302
Table 10.2: Guidelines incorporated in each screenshot of the digital graphic novel presented in this study.	307

List of Code Excerpts

Code Excerpt 7.1: Codes for P2’s response to P6’s question of P2’s experience of Jetty One.....188

Code Excerpt 7.2: Example of response that addresses multiple topics.189

Code Excerpt 7.3: Example of code families191

Code Excerpt 7.4: Participant’s responses related to living conditions in the Apartheid era.194

Code Excerpt 7.5: Participants’ responses related to how the youth viewed bad living conditions as the norm during Apartheid.196

Code Excerpt 7.6: Participants’ responses relating to the ballie.200

Code Excerpt 7.7: Participants’ responses related to the breaking of Olympic records within Robben Island Prison.203

Code Excerpt 7.8: Participants’ responses related to the sharing of food in Robben Island Prison.204

Code Excerpt 7.9: Participant’s responses related to the successful use of hunger strikes to attain permission for prisoners to study beyond matric.207

Code Excerpt 7.10: Participant’s responses related to the censorship of letters.208

Code Excerpt 7.11: Participants’ responses related to the punishment in which they did not receive food for a day whilst placed in isolation.210

Code Excerpt 7.12: Participant’s responses related to lawyers in Robben Island Prison.....211

Code Excerpt 7.13: Participants’ responses related to the spreading of secret messages via pots.....213

Code Excerpt 7.14: Participant’s responses related to prisoners teaching their comrades that which they have learnt.215

Code Excerpt 7.15: Example of a view of an ex-political prisoner.217

Code Excerpt 9.1: Example of a participant’s separation of artwork and colour.246

Code Excerpt 9.2: Participants’ responses regarding the need for finer detail in the artwork of the digital graphic novel.246

Code Excerpt 9.3: Participants’ responses regarding the need for slower camera movement in the digital graphic novel.....248

Code Excerpt 9.4: Participant’s response regarding the main character of the digital graphic novel.	249
Code Excerpt 9.5: Participants’ responses regarding the need for the use of a wider array of colours in the digital graphic novel.	250
Code Excerpt 9.6: Participants’ responses regarding their approval of the overall design of the digital graphic novel.	251
Code Excerpt 9.7: Participants’ responses regarding their views of narration and subtitles in a digital graphic novel.	253
Code Excerpt 9.8: Participants’ responses regarding their approval of the chosen art style.	261
Code Excerpt 9.9: Participants’ responses regarding their difficulty reading because of the camera movement.	263
Code Excerpt 9.10: Participants’ responses regarding their preference for a wider array of colours.	264
Code Excerpt 9.11: Participants’ responses regarding the incorporation of movement in the digital graphic novel.	265
Code Excerpt 9.12: Participants’ responses regarding their preference for narration in the digital graphic novel.	267

1 Chapter One: Introduction to the Study

1.1 Introduction

Nelson Mandela is one of the most well-known freedom fighters of our time. With his recent passing, news about the 'struggle hero' has spread throughout the world. The story of his fight for equal rights for all is one that has been told countless times through many mediums. To many, the reality of Apartheid in South Africa is a memory fresh in their minds. However, the majority of younger generations within South Africa cannot really relate to Apartheid, as they have been born into a free and democratic country where all citizens possess equal rights. It is important to recount the pivotal social events that ultimately led to the establishment of our democratic country of South Africa in order to serve as both a warning to future generations about the danger of social hierarchies and a reminder of the triumph of the human spirit over adversity.

This study forms part of the Mandela27 Project which aims to recount the various social events that took place both in South Africa and Europe during the 27 years of Mandela's incarceration. An interactive physical display will be disseminated in museums in England, Belgium, Sweden and South Africa where members of the public will be able to view a 'Cultural Timeline' that displays a year-by-year recollection of cultural events in both Europe and South Africa. Another facet of the interactive physical display is a digital graphic novel that will depict the prison life of an individual incarcerated during the time of the Apartheid regime. The purpose of the digital graphic novel is to serve as an engaging medium through which the experiences of ex-political prisoners of Robben Island Prison are portrayed to members of the target audience. The target audience of the digital graphic novel created in this study is young adults between the ages of 16-25 years of age.

This study covers both the aesthetic and content selection aspects of the design and development of the Mandela27 digital graphic novel.

1.2 Concepts central to the study

This section will discuss concepts that are central to the study.

1.2.1 Critical systems thinking

According to Ulrich (2002:72), critical systems thinking can be defined by three commitments – critique, emancipation, pluralism.

Critical systems thinking undertakes the continuous endeavour of attempting to uncover hidden assumptions nestled within the seemingly unbiased opinions of different schools of thought within the commitment of critique. The commitment of critical systems thinking to emancipation is focused on the full development of a person as an individual. The commitment to emancipation assists in the identifying of unequal power relations and boundary judgements, which are in turn incorporated within the further understanding of the identified problem area as a system (Schecter, 1991:214). Finally, the commitment to pluralism maintains that not one single approach to systems thinking is the best, and that therefore, there is no single school of thought that is able to cater to the needs of the entire spectrum of problem situations (Schecter, 1991:214).

1.2.2 Critical systems heuristics

Critical systems heuristics was conceived by Werner Ulrich (1987:277) in order to assist involved and affected parties in dealing with justification break-offs in terms of their a priori judgements. These judgements are called ‘boundary judgements’ because they define the boundaries of the reference system against which a person validates his arguments (Ulrich, 2002:72). Boundary judgements determine the ‘facts’ and ‘values’ of a person and as such, have a vital role in determining the meaning behind and merits of an argument (Ulrich, 2005:2). According to Ulrich (2005:2), in order to achieve productive communication, it is vital to clarify, both with ourselves and other involved parties, which reference system is assumed in a particular discussion.

Critical systems heuristics can be viewed as the first systematic attempt to provide a philosophical foundation as well as a practical framework for critical systems thinking (Ulrich, 2002:72). Critical systems heuristics is defined as ‘a critical methodology for

identifying and debating boundary judgements' (Ulrich, 2002:73). To achieve this, critical systems heuristics requires 3 requisites to be essential (Ulrich, 1987:277):

- To impart a clear understanding of the meaning, inevitability, and critical significance of justification break-offs.
- To provide a conceptual framework that can be used by involved and affected parties in order to justification break-offs and boundary judgements.
- To offer a tool for convincing argumentation to all parties.

Critical systems heuristics is used to guide each phase of the action research phases adopted in this study. Critical systems heuristics is discussed in more detail in Chapter 3.

1.2.3 Graphic novels

This section will discuss the definition, history and benefits of digital graphic novels.

1.2.3.1 Definition and history

Although graphic novels and comic books are two separate entities, they tend to have a shared history. In fact, graphic novels grew out of the comic book movement of the 1960's via writers who sought to make use of the comic book format to address topics of a more 'adult' nature (O'English *et al.*, 2006:173). After winning a prestigious Pulitzer Prize in 1992, *Maus: A Survivor's Tale* served as a pioneer for other graphic novels such as *Ghost World* (Clowes, 1997), *Fun Home* (Bechdel, 2006), and *Watchmen* (Moore & Gibbons, 1987) as graphic novels began to evolve into a genre entirely of their own. While some graphic novels carried on themes from their comic book predecessors such as superheroes and fantasy, others took it a step further by dealing with issues that include wars, civil rights, history, drugs, sexually transmitted diseases, dealing with disabilities and even family dynamics (Gorman, 2002:42).

1.2.3.2 Benefits of graphic novels

Graphic novels can serve as an exciting medium that meets the high need of stimulation that is preferred by generations that grew up surrounded by television and the Internet (Short & Reeves, 2009:417). These individuals are now accustomed to

receiving a great deal of both visual and verbal stimulation (Wolf, 1996:124). According to Tabachnick (2007:28), the graphic novel is also well suited to the contemporary age due to its unique and comforting combination of the qualities of both book and screen.

Another benefit of graphic novels lies in the multimedia principle which states that people learn more from words and pictures that are combined rather than from words alone (Mayer, 2008:766). Furthermore, the spatial continuity principle states that people learn better when corresponding words and pictures are presented near to each other rather than far from each other on the page or screen (Mayer, 2008:764).

Finally, the researcher believes that the use of graphic novels aids in bridging both racial and cultural divides by offering a 'neutral' canvas upon which historical facts can be portrayed. This concept is evident in *Maus: A Survivor's Tale* (Spiegelman, 2005).

Digital graphic novels are discussed in more detail in Chapter 4. The purpose of the aforementioned literature review is to aid in the formulation of guidelines for creating digital graphic novels portraying emotional social phenomena.

1.2.4 Human-computer interaction

In order for a computer to be used effectively and to be accepted by its intended users, it needs to be well designed (Preece *et al.*, 1994:5). The term 'well-designed' does not imply that a computer needs to be designed in such a way as to accommodate every prospective user, but rather to be designed to cater for the capabilities and needs of the users for which it was intended (Preece *et al.*, 1994:5). Theory and practice are united in the field of human-computer interaction (HCI) as it aims to better understand both the designs that users need as well as the design processes involved in their creation (Smith-Atakan, 2006:2).

There are two major challenges that HCI designers are faced with (Preece *et al.*, 1994:8):

- How to keep up with the rapid changes that occur within the field of technology.
- How to ensure that their designs exhibit good HCI while utilising the functionality of the new technology to its full potential.

There are four main concerns in HCI: the humans, the computers, the tasks that are performed, and the support a computer provides a user in achieving a task (usability) (Dix *et al.*, 2004:5). In order for a computer to allow a human to successfully accomplish a task, it needs to satisfy three 'use' words (Dix *et al.*, 2004:5):

- Useful – the user needs to be able to accomplish what is required through the use of the computer (e.g. sending an email).
- Usable – the user needs to accomplish the task easily and in a natural manner (e.g. pressing a 'k' key should produce the letter 'k' and not 'z').
- Used – the computer should be attractive, fun, engaging, etc., and as a result make individuals want to use it.

In order to design a successful computer, designers need to be mindful of the capabilities and limitations of humans and account for these in the design of a human-computer interface. It is also important to bear in mind that designers themselves are not 'typical users' (Norman, 2002:155). In order to successfully produce a device that is useful, usable, and used it is important to design for the intended human user.

Human-computer interaction is discussed in more detail in Chapter 5. The purpose of this literature review is to enrich guidelines for creating digital graphic novels portraying emotional social phenomena.

1.3 Research methodology concepts

This section will discuss the different research methodology concepts as well as the research methodologies that are applied in this study.

1.3.1 Paradigms

Myers (1997:244) identifies three research paradigms: positivist, interpretive, and critical social theory. Each of the aforementioned paradigms has its own underlying epistemological assumptions, ontological assumptions and aims. Epistemological assumptions refer to the nature of knowledge, while ontological assumptions refer to the nature of reality (Flowers, 2009:1). Vaishnavi and Kuechler (2004) state that

design science research also has its own metaphysical assumptions and therefore is treated as a paradigm of its own.

1.3.2 Positivism

In the positivism paradigm, the epistemological assumption is that reality is interpreted as being everything that can be sensed through smell, taste, touch, sound, and sight. Comte (1868:4) states that in the positivism paradigm, the researcher is not concerned with the origin or destination of the subject under observation, but rather, through observation and reasoning, with the discovery of the laws that govern the phenomena surrounding the subject. The ontological assumption of positivism is based on realism – i.e. reality is objective and can be defined through observing its measurable properties that are unrelated to the researcher and his instruments (Myers & Avison, 1997:241). This assumption results in facts being investigated within the positivist paradigm as opposed to the values associated with those facts. The aim in positivism is to measure the impact that particular variables have on a situation.

1.3.3 Interpretivism

The underlying ontological assumption of interpretivism is that individuals establish and assign their own personal meanings to their surroundings and that they accordingly justify their actions within their environment (Flowers, 2009:3). According to Flowers (2009:3), interpretivists believe that meaning is constantly reconstructed over time through different experiences. This continuous reconstruction results in many different interpretations being conceived by different individuals. The ontological assumption of relativism applies within the interpretivism paradigm, which means that each individual experiences and interprets an object or situation in their own manner. Interpretivists therefore believe that there are multiple realities and that one has to understand the reality (or knowledge) relative to the person who perceived it (Denzin & Lincoln, 2003:3). This will facilitate the correct interpretation of an individual's meanings and subsequently positively contribute to the building of theory. In the interpretivism paradigm the aim is to understand a phenomenon from an individual's or group's perspective (Crossan, 2003:54). The epistemological assumption of interpretivism assumes that the researcher cannot detach himself from what he knows. It also assumes that the researcher and the object of investigation are linked through

how the researcher understands the world around him which, in turn, is a result of how he understands himself and those around him (Flowers, 2009:3). It is therefore imperative for the researcher to uncover and understand the values and contextual factors that have an influence on the interpretations made by different individuals (Flowers, 2009:3).

1.3.4 Critical social research theory

The underlying ontological assumption of critical social research theory is that there is always a set of social associations between two parties where one party is oppressive of the other (Harvey, 1990:2). The epistemological assumptions of critical social research delve into historically specific, oppressive, social structures in an attempt to uncover any underlying facts (Harvey, 1990:3). The aim of critical social research is to emancipate the oppressed party and in doing so bring about a change in the problem environment (Checkland, 1997:670).

1.3.5 Design science research

Vaishnavi and Kuechler (2004) state that the epistemological assumption of design science research is that a researcher can be certain of the authenticity of a certain fact and further understand it through the process of construction/circumscription. That is to say, an artefact is created and information is only considered reliable when the artefact functions in a predictable manner. Predictable functionality is acquired through iterative stages of development. According to Vaishnavi and Kuechler (2004), the ontological assumption of design science research is that reality exists in different 'world-states'. Although this assumption may seem to correlate with the interpretivist paradigm, it should not be confused with the idea of relativism. Unlike the interpretivist paradigm, design science researchers believe in a single, underlying physical reality that remains constant and serves to limit the amount of different world-states. Flowing from the epistemological assumptions, the aim of design science research is to create an innovative and predictably functioning artefact.

1.3.6 Mixed methods

The core concept of mixed methods is to make use of more than one methodology (or parts of different methodologies) that exist within different paradigms in order to

conduct a research study (or single intervention) that encompasses an array of research aspects (Mingers & Brocklesby, 1997:491). An overview of a few possibilities of mixed methods research is given in Chapter 2.

For the purposes of this study, methodology enhancement is used. The overall paradigm and methodology of the study is critical social research theory with techniques from different paradigms being incorporated within the various phases of the research study structure.

The mixed methods approach was selected for this study because of the following attractive attributes (Mingers & Brocklesby, 1997:492):

- The mixed methods approach allows research to be conducted on complex, real-world problems due to the freedom to combine techniques from different paradigms in order to focus attention on the different aspects of the research environment.
- An intervention often takes the form of a process rather than a single event. This process consists of different phases that contain their own unique problems and tasks. The combination of methodologies that are useful in each unique phase of the overall process is desirable.

The aforementioned research methodology concepts will be discussed in further detail in Chapter 2.

1.4 Research methodology

In this section, more insight will be given into the selected research methodologies that are applied in this study.

1.4.1 Critical research

Myers and Klein (2011:24) propose a set of general guidelines that serve to summarise the key concepts of critical research by combining ideas derived from philosophical literature. The guidelines were compiled to help the critical researcher by summarising the fundamental factors of critical research. The principles for critical research as proposed by Myers and Klein (2011:25) are incorporated in this study and are discussed in Chapter 2.

1.4.2 Interpretive methods

Interpretive field research is used to collect data during the *Diagnosing and Evaluating* phases of this action research study. Klein and Myers (1999:72) proposed principles for interpretive research in an information systems environment. The aforementioned principles are incorporated in this study are discussed in Chapter 2.

1.4.3 Design science research methodology

The design science research methodology is used within the *Action Planning* and *Action Taking* phases of the action research cycle adopted in this study. The digital graphic novel is created using this methodology. Hevner *et al.* (2004:83) propose seven guidelines for design science in information systems research. These guidelines serve to clarify the requirements for successful design science research. These are incorporated into the study in order to guide the design process of the digital graphic novel during the *Action Planning* and *Action Taking* phases of the action research study. The guidelines for design science research in information systems as proposed by Hevner *et al.* (2004:83) are incorporated in this study and are discussed in Chapter 2.

1.5 Research methods

Research methods are a systematic way of uncovering new knowledge about a particular topic. The structure of a research method is determined by both the assumptions and paradigms discussed in previous sections as well as the general principles given in the preceding sections. The following section provides a brief summary of the research methods that will be employed in this study.

1.5.1 Action research

Blum (1955:1) defines action research as a simple two-stage process:

- Diagnostic Stage – In this stage, the researcher and the subjects of the research work in unison in order to evaluate the social situation. Once this is done, theories regarding the nature of the research domain are then formulated.
- Therapeutic Stage – Change experiments are conducted in this stage by introducing changes and studying their results.

Baskerville (1999:6) distinguishes four characteristics of information systems action research. These are:

- Action research seeks to increase understanding about an immediate social situation. Emphasis is placed on the complex and varying quality of the social situation within the information systems domain.
- Action research aids in increasing scientific knowledge while assisting in practical problem solving. In doing so, two significant characteristics of the process is produced, namely:
 - Highly interpretive assumptions are made about the observation.
 - The researcher intervenes within the problem environment.
- Action research is a collaborative effort that serves to enhance the capabilities of the relevant actors. A participatory type of observation is required within this characteristic. Enhancing capabilities is relative to the previous capabilities of both the subjects and the researcher and is an inevitable result of collaboration. The extent to which this characteristic is achieved, and the balance between the actors, will depend on the setting of the social situation.
- Action research is largely applicable in order to understand the change processes within social systems.

According to Baskerville and Wood-Harper (1996:235) the model domain of the action research method is a social setting that exhibits the following features:

- Active involvement by the researcher, from which, both the researcher and organisation is expected to benefit.
- Immediate application of knowledge acquired where there is not a sense of an observer that is detached from the situation, but rather a sense of an active participant who seeks to make use of any new knowledge that is based on an explicit, clear conceptual framework.
- Linking of theory and practice through research which is typically cyclical.

Figure 1.1 illustrates the five iterative phases of action research. The five iterative phases of action research are (Baskerville, 1999:14):

- Diagnosing – identification of the primary problems are the underlying cause for the organisation’s desire for change.
- Action Planning – involves collaboration between researchers and practitioners in order to determine which actions should serve to relieve or improve the primary problems identified in the diagnosing stage.
- Action Taking – implementation of the planned action takes place here with researchers and practitioners collaborating in the active intervention into the client organisation by causing certain changes to be made.
- Evaluating – outcomes from the action-taking phase are evaluated by the researchers and practitioners.
- Specifying Learning – knowledge gained in this phase is provided to others.

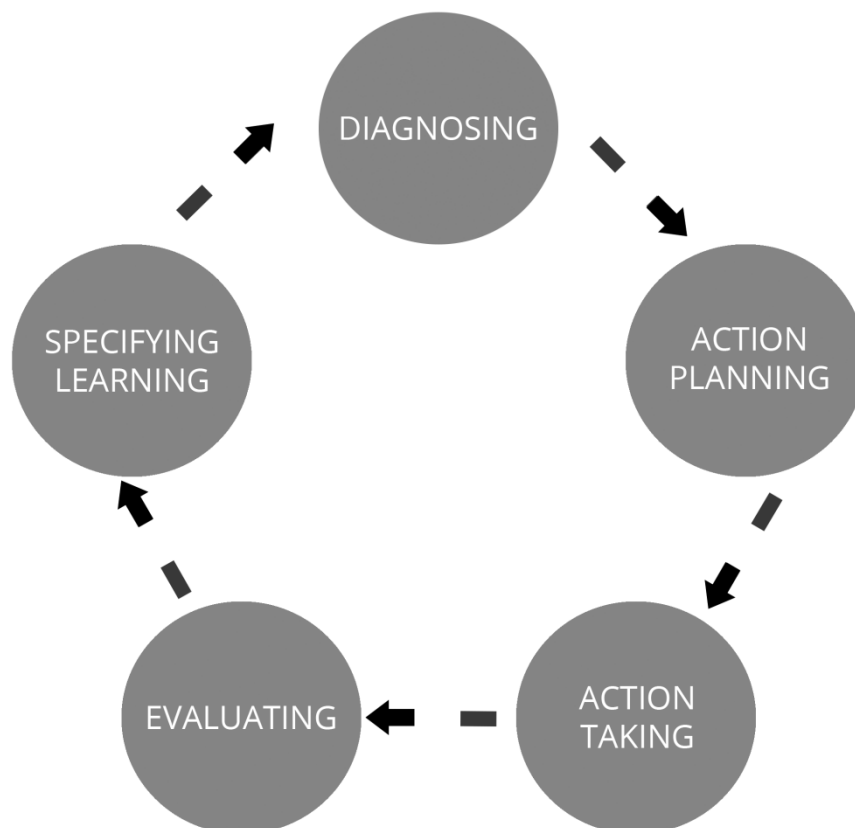


Figure 1.1: The five iterative phases of action research (Baskerville, 1999:14).

This study incorporates the five phases of action research. Action research is discussed in detail in Chapter 2.

1.5.2 Interpretive research

Interpretive data collection and analysis is used within the *Diagnosing and Evaluating* phase of the action research cycle.

1.5.2.1 Interpretive data collection

In general, interpretive studies aim to understand phenomena by interpreting the meanings that individuals assign to them (Myers, 1997:245). This can be done through the collection and analysis of qualitative data. A semi-structured interview and semi-structured focus groups are employed in the data collection during the *Diagnosing and Evaluating* phases of the action research cycle adopted in this study. The aforementioned methods are discussed in Chapter 2.

Once the data collection process is complete, the gathered data is then analysed in order to elicit meaning from it.

1.5.2.2 Interpretive data analysis

Once data has been collected, it must be analysed in order to be of any real value to the study. Hermeneutics and content analysis are used to analyse the data collected in this study and are discussed in Chapter 2.

1.5.3 Design science research

Peppers *et al.* (2006:89) propose a process model of design science research that is comprised of six activities – problem identification and motivation, objectives of a solution, design and development, demonstration, evaluation and communication. Each of the aforementioned phases are discussed in Chapter 2.

Figure 1.2 provides a graphical representation of the process model of design science research as proposed by Peppers *et al.* (2006:89).

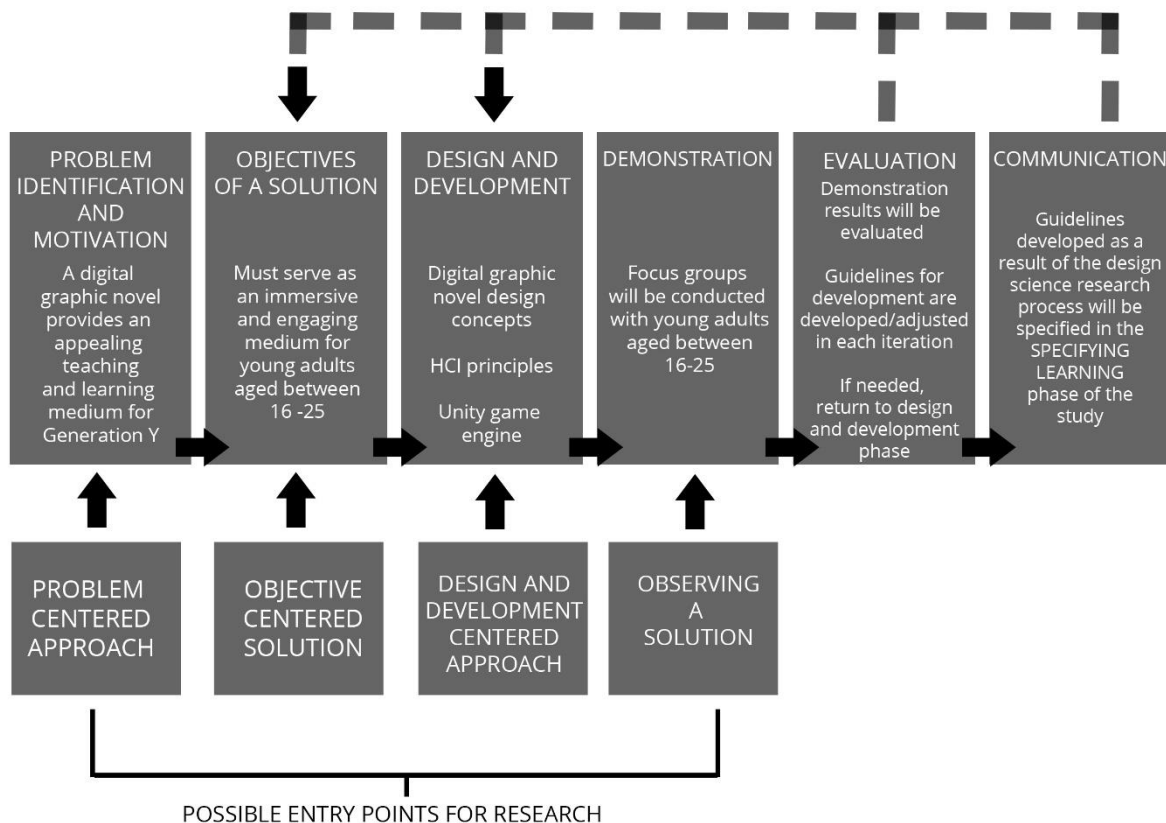


Figure 1.2: Graphical representation of the process model of design science research as proposed by Peffers et al. (2006:89).

1.6 Problem statement and motivation for the study

According to the founders of the Mandela27 project, little is known in the European Union about historic cultural events in South African and vice versa, although most people are familiar with the Apartheid regime that inspired many of the aforementioned cultural events. The Mandela27 project aims to promote intercultural dialogue amongst the European Union and South Africa. The created digital graphic novel should inform young adults about the conditions of prison life during the time of Nelson Mandela's incarceration in a medium that they find engaging and entertaining.

The aim of the study is to develop guidelines for the design of digital graphic novels portraying emotional social phenomena using critical systems heuristics and human-computer interaction principles. A digital graphic novel is developed to portray the experiences of political prisoners in Robben Island Prison from 1970 – 1990 to a target audience of young adults between the ages of 16-25.

Graphic novels can serve as an exciting medium that meets the high need of stimulation that is preferred by generations that grew up surrounded by television and the Internet (Short & Reeves, 2009:417). These individuals are now accustomed to receiving a great deal of both visual and verbal stimulation (Wolf, 1996:124). According to Tabachnick (2007:28), the graphic novel is also well suited to the contemporary age due to its unique and comforting combination of the qualities of both book and screen.

It is imperative to ensure that accurate data is collected with regard to the recollection of events in Robben Island Prison. Critical systems heuristics will be useful in guiding the study and providing a reliable means of ensuring that the needs of both those involved (ex-political prisoners) and affected (target audience) are met.

It is also important to ensure that the developed digital graphic novel is properly designed and portrays the emotions associated with the emotional social phenomenon. A literature review of digital graphic novels, human-computer interaction and emotion will help to ensure that the aforementioned needs are met.

The research question for this study is as follows: What guidelines should be followed in order to design a digital graphic novel portraying emotional social phenomena by using critical systems heuristics and human-computer interaction principles?

1.7 Objectives of the study

The following research objectives have been formulated for the study:

1.7.1 Primary objective

The primary objective of this study is to develop guidelines for the design of digital graphic novels portraying emotional social phenomena using critical systems heuristics and human-computer interaction principles. A digital graphic novel is developed to portray the experiences of political prisoners in Robben Island Prison from 1970 - 1990.

1.7.2 Secondary objectives

In order to achieve the primary objective, the following objectives have been formulated for the study according to the phases of action research:

1. *Diagnosing*:
 - a. To understand how critical systems heuristics can guide the process of understanding of the experiences of the ex-political prisoners (Chapter 3).
 - b. To understand the experiences of the ex-political prisoners who were incarcerated in Robben Island Prison (Chapter 7).

2. *Action Planning*:
 - a. To plan the first version of the digital graphic novel.
 - b. To research the digital graphic novel genre and propose guidelines for creating a digital graphic novel portraying emotional social phenomena (Chapter 4).
 - c. To study human-computer interaction (HCI) principles and further enrich the proposed guidelines for creating a digital graphic novel portraying emotional social phenomena (Chapter 5).
 - d. To research emotion and further enrich the proposed guidelines for creating a digital graphic novel portraying emotional social phenomena (Chapter 6).

3. *Action Taking*: To incorporate the proposed guidelines in the creation of a digital graphic novel that portrays the experiences of the ex-political prisoners of Robben Island Prison while serving as an engaging medium for the target audience (Chapter 8).

4. *Evaluating*: To interpret the reactions of South African members of the target audience toward the developed digital graphic novel in order to further refine it (Chapter 9).

5. *Specifying Learning*: To develop guidelines for the design of digital graphic novels portraying emotional social phenomena using critical systems heuristics and human-computer interaction principles (Chapter 10).

1.8 Research design and methodology

The following section provides an overview of the research design and methodology employed in this study.

1.8.1 Aspects of research methodology used in this study

Critical social research, using action research is used within this study. Interpretive research methods are used in the *Diagnosing* and *Evaluating* phases of the action research project. For the design of the digital graphic novel, design science research

are applied within the *Action Planning* and *Action Taking* phase of the action research cycle employed in this study.

1.8.2 Research plan for this study

This study is conducted as per the five phases of the action research cycle. Each phase makes use of different research methods in order to achieve its purpose. The purpose of each phase of the study is as follows:

- *Diagnosing*
 - To determine what are the core elements that the ex-political prisoners found important to relay in their stories about the emotional social phenomenon they experienced.
 - This is done through conducting semi-structured focus groups and an interview with ex-political prisoners. Literature studies are performed on the topic of critical systems heuristics in order to further understand the data collected through interpretive methods.
- *Action Planning*
 - A literature study of digital graphic novels is performed to help guide the planning and design of the digital graphic novel.
 - Guidelines for the creation of a digital graphic novel are developed.
 - A literature study of HCI principles is performed to help guide the planning and design of the digital graphic novel.
 - Guidelines for using HCI principles in the creation of a digital graphic novel portraying emotional social phenomena are developed.
 - A literature study of emotion is performed to help guide the planning and design of the digital graphic novel.
 - Guidelines for the incorporation of emotion in the creation of a digital graphic novel portraying emotional social phenomena are developed.
 - To plan and design the layout of a digital graphic novel that portrays an emotional social phenomenon.
- *Action Taking*
 - To create a digital graphic novel that portrays an emotional social phenomenon according to the proposed guidelines.

- Design science research is incorporated in the creation of the digital graphic novel.
- *Evaluation*
 - To determine the success of the digital graphic novel that portrays an emotional social phenomenon amongst youth.
 - Interpretive methods in the form of semi-structured focus groups held with members of the target audience are used to determine the success of the digital graphic novel. This phase is combined with the evaluation phase in the design science research section of this study.
- *Specifying Learning*
 - To specify guidelines for using critical systems heuristics and human-computer interaction principles to create a digital graphic novel that portrays emotional social phenomena.

The research structure of this study can be represented graphically as illustrated in Figure 1.3.

GUIDELINES TO DESIGN DIGITAL GRAPHIC NOVELS PORTRAYING EMOTIONAL SOCIAL PHENOMENA USING CRITICAL SYSTEMS HEURISTICS AND HCI PRINCIPLES

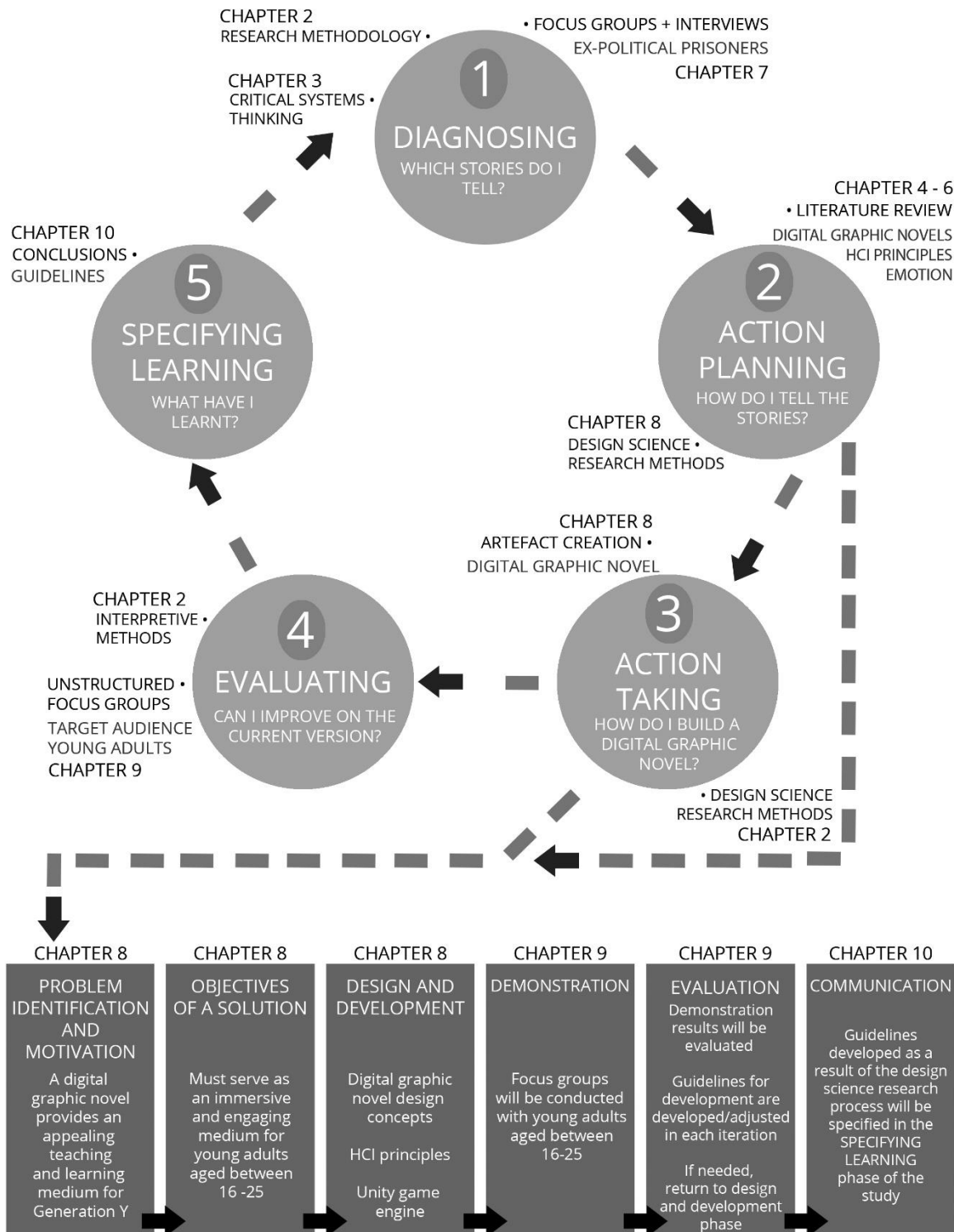


Figure 1.3: An adaptation of the action research cycle (Baskerville, 1999:14) and the design science research process (Peppers et al., 2006:93) to represent the research structure of this study.

1.8.3 Rigor and evaluation of method

This study will employ the five principles for validation of action research as prescribed by Heikkinen *et al.* (2012:8):

1. Principle of historical continuity
 - a. Analysis of the history of action: how has the action evolved historically?
 - b. Emplotment: how logically and coherently does the narrative proceed?
2. Principle of reflexivity
 - a. Subjective adequacy: what is the nature of the researcher's relationship with his/her object of research?
 - b. Ontologic and epistemologic presumptions: what are the researcher's presumptions of knowledge and reality?
 - c. Transparency: how does the researcher describe his/her material and methods?
3. Principle of dialectics
 - a. Dialogue: how has the researcher's insight developed in dialogue with others?
 - b. Polyphony: how does the report present different voices and interpretations?
 - c. Authenticity: how authentic and genuine are the protagonists of the narrative?
4. Principle of workability and ethics
 - a. Pragmatic quality: how well does the research succeed in creating workable practices?
 - b. Criticalness: what kind of discussion does the research provoke?
 - c. Ethics: how are ethical problems dealt with?
 - d. Empowerment: does the research make people believe in their own capabilities and possibilities to act and thereby encourage new practices and actions?
5. Principle of evocativeness
 - a. Evocativeness: how well does the research narrative evoke mental images, memories or emotions related to the theme?

Evaluation of the critical research application of this study will be conducted by determining whether the principles of Klein and Meyers (1999:72) and Myers and Klein (2011:25) have been met. This will be reflected on in Chapter 10.

1.8.4 Contribution of the study

The aim of this study is to develop guidelines for the design of digital graphic novels portraying emotional social phenomena using critical systems heuristics and human-computer interaction principles. No such guidelines could be found in literature. Since graphic novels appeal to young people, these guidelines can help other designers of digital graphic novels.

1.9 Ethical considerations

Ethical considerations for this study are:

- Ensuring voluntary participation of all participants
- Acquiring permission to use participant feedback
- Ensuring the confidentiality of the ex-political-prisoners
- Gaining permission to interview ex-political-prisoners of Robben Island

The development of the digital graphic novel falls within the scope of the Mandela27 project as a whole, which is part-funded by the EU and has received the necessary ethical clearance pertaining to all project-related content.

This study was also granted ethical clearance by the ethics committee of the Faculty of Economic Sciences and IT in the North-West University: Vaal Triangle Campus.

1.10 Chapter classification

The study consists of the following chapters:

Chapter 1: Introduction and motivation of the study – The context and scope of this study is introduced in this chapter along with the problem statement, motivation and objectives of the study.

Chapter 2: Research methodology – The selected research methodology for this study is discussed in this chapter.

Chapter 3: Critical systems heuristics – Systems thinking, critical social theory and critical systems heuristics are discussed in this chapter.

Chapter 4: Digital graphic novels – The context of digital graphic novels within the research structure of this study is discussed in this chapter. An overview of digital graphic novels is also presented along with design rules, benefits and guidelines for creating digital graphic novels. Proposed guidelines for creating digital graphic novels are presented at the end of this chapter.

Chapter 5: Human-computer interaction – Human-computer interaction is discussed in this chapter. Human-computer interaction enriched guidelines for creating digital graphic novels are proposed at the end of this chapter.

Chapter 6: Emotion – Emotion is discussed in this chapter. The discussion will include topics such as emotion and sight, emotion and sound, emotion and HCI, and emotion in digital graphic novels. Emotion-enriched guidelines for creating digital graphic novels portraying emotional social phenomena are proposed at the end of this chapter.

Chapter 7: Diagnosing – The process followed in the *Diagnosis* phase of this study is reported on in this chapter. Themes identified as important experiences of the ex-political prisoners of Robben Island Prison are presented in this chapter.

Chapter 8: Action planning and action taking – In this chapter, the proposed set of guidelines (Chapter 6) are combined with answers to Ulrich's 12 boundary questions (Chapter 7) and the identified *Diagnosis* themes (Chapter 7) in order to create a digital graphic novel.

Chapter 9: Evaluation – In this chapter, the created digital graphic novel is demonstrated and evaluated in focus groups conducted with members of the target audience. After each evaluation, proposed improvements are incorporated into the digital graphic novel. Screenshots of the completed digital graphic novel are presented in this chapter along with a discussion of how the digital graphic novel is implemented.

Chapter 10: Specifying learning – The final version of the proposed guidelines for creating digital graphic novels is presented in this chapter. The problem statement and objectives of the study are also addressed in this chapter.

2 Chapter Two: Research Methodology

2.1 Introduction

The aim of this study is to formulate a set of guidelines to aid in the development of digital graphic novels that will be used to portray emotional social phenomena. Critical systems heuristics (CSH) and human-computer interaction (HCI) principles are used in the formulation of these guidelines. The research process is governed by a framework of thinking which is embodied within a research methodology. This chapter seeks to inform the reader about the selected research methodology in order to assist the reader in understanding the structure of the study.

In their depiction of the action research process they used to develop the soft systems methodology, Checkland and Holwell (1998:13) give an illustration of the relationship between a framework of ideas (F) or paradigm, the methodology (M) used and the area of application (A). Figure 2.1 illustrates the elements that Checkland and Holwell (1998:13) find relevant to any piece of research. Specific ideas within the framework of thinking are incorporated in the methodology in order to examine an area of concern. Specifying learning is key to any research process and, as indicated, it occurs on all three aspects (F, M and A).

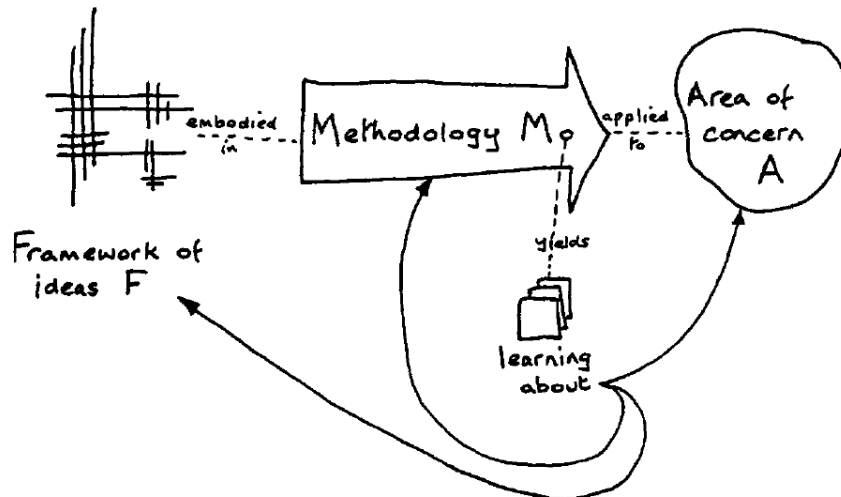


Figure 2.1: Elements relevant to any piece of research (Checkland & Holwell, 1998:13)¹.

In this chapter, the ontological and epistemological assumptions of each paradigm or framework of ideas (“F” in Figure 2.1) are investigated (Section 2.3). By contrasting the different ontological and epistemological assumptions of each paradigm, an informed decision is then made regarding which paradigm to incorporate within the study.

The methodological guidelines (“M” in Figure 2.1) of the chosen paradigm are then explored in order to study guidelines that will direct the research process of this study (Section 2.4).

Once the guidelines have been discussed, the practical application of the research paradigm (part of “A” on Figure 2.1) will be investigated (Section 2.5). The chosen research paradigm guides the practical manner in which the study will participate in the research process. Data collection and data analysis methods will then be investigated in the context of the practical application of the research process.

Finally, the research plan of the study in terms of the philosophical, methodological, and practical aspects is illustrated in Section 2.6.

¹ Checkland intended for his ‘rich pictures’ to be displayed as is. Therefore, they have not been altered to fit into the format of the other images in this dissertation.

As a precursor to the topics of interest within this chapter, the definition and significance of research needs to be understood. This corresponds to the “Yields learning about” part in Figure 2.1 and is presented in Section 2.2.

Creswell (2012:3) defines research as “a process of steps used to collect and analyse information to increase our understanding of a topic or issue”. He further states that research consists of three steps, namely:

- The posing of a question.
- The collection of data in order to resolve the question.
- The communication of an answer to the question.

Creswell (2012:4) further provides three reasons that substantiate the significance of research. These are:

- Research contributes towards our current knowledge: This means that research adds to existing knowledge about a specific research problem, which enables us to form a deeper understanding of problem environments.
- Research improves practice: Through the review of past research results and knowledge generated by previous studies, researchers can improve the current form of practice in order to offer a more efficient solution to a problem.
- Research informs policy debates: Research results may influence policy makers to incorporate various systems or artefacts into their environment. For example, the proven efficacy of digital graphic novels in a classroom may influence school committee members to include them in an English or history class.

Defining a research process before conducting a study enables the mapping out the entire study (Myers, 2008:19). This is due to the fact that the research process is comprised of the following (Myers, 2008:19):

- Philosophical assumptions
- Research method
- Data collection techniques
- Data analysis techniques
- How the study is written up
- How the findings are published

In addition, simply providing an answer to a research question does not suffice in terms of academic research (Oates, 2006:32). Oates (2006:32) further states that in order for a research study to be recognised as having contributed to the current knowledge base, the findings and processes will first need to be scrutinised by other academics. In order to convince other academics that the researcher is capable of conducting research and that the research project is viable, the research process should be clearly defined (Myers, 2008:20).

2.2 Research paradigms in information systems

This section will examine paradigms or frameworks of ideas ('F' in Figure 2.1). Kuhn (1970:23) defines a paradigm as "an accepted model or pattern". Adapting from Guba and Lincoln (1994:107), a research paradigm can be defined as a set of beliefs that guide the research process. Myers (1997:244) identifies three research paradigms: positivist, interpretive, and critical social theory. Each of the aforementioned paradigms has its own underlying epistemological assumptions, ontological assumptions, and aims. Epistemological assumptions refer to the nature of knowledge, while ontological assumptions refer to the nature of reality (Flowers, 2009:1). Vaishnavi and Kuechler (2004) state that design science research also has its own metaphysical assumptions and is therefore treated as a paradigm of its own.

2.2.1 Positivism

In the positivism paradigm, the ontological assumption of positivism is based on realism – i.e. reality is objective and can be defined through observing its measurable properties that are unrelated to the researcher and his instruments (Myers & Avison, 1997:241). This assumption results in facts being investigated within the positivist paradigm as opposed to the values associated with those facts. The epistemological assumption is that reality is interpreted as being everything that can be sensed through smell, taste, touch, sound, and sight. Comte (1868:4) states that in the positivism paradigm, the researcher is not concerned with the origin or destination of the subject under observation, but rather, through observation and reasoning, with the discovery of the laws that govern the phenomena surrounding the subject. The aim, therefore, in positivism is to measure the impact that particular variables have on a situation.

2.2.2 Interpretivism

The underlying ontological assumption of interpretivism is that individuals establish and assign their own personal meanings to their surroundings and that they accordingly justify their actions within their environment (Flowers, 2009:3). According to Flowers (2009:3), interpretivists believe that meaning is constantly reconstructed over time through different experiences. This continuous reconstruction results in many different interpretations being conceived by different individuals. The ontological assumption of relativism applies within the interpretivism paradigm, which means that each individual experiences and interprets an object or situation in their own manner. Interpretivists therefore believe that there are multiple realities and that one has to understand the reality (or knowledge) relative to the person who perceived it (Denzin & Lincoln, 2003:3). This will enable the researcher to correctly interpret an individual's meanings and subsequently positively contribute to the building of theory. In the interpretivism paradigm the aim is to understand a phenomenon from an individual or group perspective (Crossan, 2003:54). The epistemological assumption of interpretivism assumes that the researcher cannot detach himself from what he knows. It also assumes that the researcher and the object of investigation are linked through how the researcher understands the world around him, which, in turn, is a result of how he understands himself and those around him (Flowers, 2009:3). It is therefore imperative for the researcher to uncover and understand the values and contextual factors that influence the interpretations made by different individuals (Flowers, 2009:3).

2.2.3 Critical social research theory

The underlying ontological assumption of critical social research theory is that there is always a set of social associations between two parties where one party is oppressive of the other (Harvey, 1990:2). The epistemological assumptions of critical social research delve into historically specific, oppressive, social structures in an attempt to uncover any underlying facts (Harvey, 1990:3). The aim of critical social research is to emancipate the oppressed party and in doing so, to bring about a change in the problem environment (Checkland, 1997:670).

2.2.4 Design science research

According to Vaishnavi and Kuechler (2004), the ontological assumption of design science research is that reality exists in different 'world-states'. Although this assumption may seem to correlate with the interpretivist paradigm, it should not be confused with the idea of relativism. Unlike the interpretivist paradigm, design science researchers believe in a single, underlying physical reality which remains constant and serves to limit the number of different world-states. Vaishnavi and Kuechler (2004) state that the epistemological assumption of design science research is that a researcher can be certain of the authenticity of a certain fact and further understand it through the process of construction/circumscription. That is to say, an artefact is created and information is only considered reliable when the artefact functions in a predictable manner. Predictable functionality is acquired through iterative stages of development. Flowing from the epistemological assumptions, the aim of design science research is to create an innovative and predictably functioning artefact.

2.2.5 Mixed methods

The core concept of mixed methods is to make use of more than one methodology (or parts of different methodologies) that exist within different paradigms in order to conduct a research study (or single intervention) that encompasses an array of research aspects (Mingers & Brocklesby, 1997:491). Table 2.1 gives an overview of a few possibilities of mixed methods research.

Table 2.1: Different combinations of mixed methods quoted from Mingers and Brocklesby (1997:491).²

Name	Description	Multi-paradigm	Example
Methodological isolationism	Using only one methodology, or techniques from only one paradigm	Single	Soft systems methodology (SSM) only; hard operational research (OR) techniques only
Methodology enhancement	Enhancing a methodology with techniques from another	Single	Cognitive Mapping used in SSM

² This table was quoted directly from the authors and therefore the capitalisation format was not changed.

Methodology selection	Selecting whole methodologies as appropriate to a particular situation	Multiple	Jackson Systems Development (JSD) used in SSM
Methodology combination	Combining whole methodologies in an intervention	Multiple	Using Interactive Planning and VSM
Multimethodology	Partitioning methodologies and combining parts	Multiple	Using Cognitive Mapping and Systems Dynamics

For the purposes of this study, methodology enhancement will be used. The overall paradigm and methodology of the study will be critical social research theory with techniques from different paradigms being incorporated within the various phases of the research study structure (see Figure 2.2).

The mixed methods approach was selected for this study because of the following attractive attributes (Mingers & Brocklesby, 1997:492):

- The mixed methods approach allows research to be conducted on complex, real-world problems due to the freedom to combine techniques from different paradigms in order to focus attention on the different aspects of the research environment.
- An intervention often takes the form of a process rather than a single event. This process consists of different phases that contain their own unique problems and tasks. The combination of methodologies that are useful in each unique phase of the overall process is desirable.

The feasibility of mixed methods can be determined through discussion of three problem areas (Mingers & Brocklesby, 1997:495):

- Philosophical feasibility – the thesis of paradigm incommensurability states that because the fundamental assumptions of each paradigm differ, the researcher should choose the specific rules under which to practice the techniques adopted from other paradigms. In other words, the researcher must commit to a single paradigm, although the sequential movement from one paradigm to another within the different phases of the research is regarded as permissible. Techniques are not determined by paradigms and can be detached from their

associated paradigms in order to assist in different types of research. Provided that the researcher is aware of the implications of using different methods or paradigms within the overall paradigm, the use of the mixed methods approach would appear to have a great advantage.

- Cultural feasibility – this problem area can be seen as an issue for two reasons. Firstly, a methodology's preferences are not randomly dispersed. They are a reflection of the physical, environmental, and institutional confines in which communities of individuals who are like-minded tend to gather. The level of comfort that an individual experiences within a specific paradigm is likely to depend on the personal beliefs, worldviews, values, cognitive style, and personality of the individual. Secondly, the basic assumptions that an individual has about the world around them, as well as their values and beliefs, are gradually formed through long periods of social and cultural exposure. This may also lead to further difficulty in an individual's shift from one paradigm to another. Bearing the aforementioned in mind, if we agree that each paradigm has its specific set of both implicit and explicit operational premises, we will have to concede that operating between different paradigms is not a simple, straightforward affair.
- Cognitive feasibility – cognition can be viewed as the mental process of handling data. Studies have been conducted to observe the relationship between different data handling preferences, personality types, and research preferences. These studies have shown a correlation between methods contained in specific paradigms and certain personality types. For example, a more analytical researcher may prefer to work with accurate, exact, and consistent data. This researcher will prefer to work with quantitative data and methods. On the other hand, a more 'humanist' researcher would prefer to interact with others and make use of personalised, explanatory accounts. This researcher would prefer to work with qualitative data and methods. This implies that a researcher may need to do more than merely learn about a new paradigm, but also be actively involved in all available opportunities to develop

experience and practice in the new, unfamiliar techniques that accompany a new paradigm.

To summarise and conclude the discussion on multimethodology, we can view the concept of multimethodology as an approach for linking parts of different methodologies that may be from different paradigms (Mingers & Brocklesby, 1997:503). In order to do this, different methodologies should be researched in order to identify where valuable links can be created, bearing in mind that moving a technique from one methodology (perhaps even paradigm) to another may result in its context and interpretation being changed (Mingers & Brocklesby, 1997:504).

2.2.6 Paradigms appropriate for this study

The purpose of this study is to develop guidelines for the design of digital graphic novels portraying emotional social phenomena using critical systems heuristics and human-computer interaction principles. Within this study, two oppressed parties have been identified – ex-political prisoners and young adults who have to learn about emotional social phenomena. Ex-political prisoners need to be emancipated through having their stories told, while young adults need to be emancipated through the provision of an immersive and engaging medium that will enable them to learn about the stories of the ex-political prisoners.

Although positivism (scientific method) can be used to produce highly accurate research results in an empirical study, it is difficult to apply to a human situation as change is the only constant (Checkland & Holwell, 1998:11). Similarly, due to the epistemological assumption of relativism, interpretivism will also not be used to govern this study, as change and intervention play a crucial part in this research process. This means that, unlike in interpretivism, the researcher focuses on intervention rather than on only understanding the problem.

The design science research method is also adopted in this study because of the need to create a digital graphic novel. Design science requires the creation of an artefact that introduces a new and innovative solution to a real-world problem (Gregor & Hevner, 2013:337). This requirement is fulfilled within this study, as one of the outputs will be a digital graphic novel that portrays emotional social phenomena. The digital

graphic novel will solve the problem of ex-political prisoners not having their stories told as well as the problem of portraying the experiences of the ex-political prisoners in a manner that is immersive and engaging. This paradigm will only be adopted within the critical social research theory paradigm during the *Action Planning* and *Action Taking* phases of the research process.

Therefore, the critical social theory paradigm will govern this study. In addition, within the critical social theory paradigm, it is assumed that all problem statements, alternative problem solutions, and the reflection and assessment of results will be dependent on the prior beliefs of those involved pertaining to the 'whole system' that is under study (Ulrich, 2005:1). This assumption is crucial to the gathering of authentic, reliable information regarding sensitive topics of emotional social phenomena such as the experiences of the ex-political prisoners.

Critical social theory has a pragmatic nature (Ulrich, 2007:1111). This means that different methods from different paradigms can be incorporated during critical social theory research. In this study, the action research process will be used to implement the critical social theory research paradigm (see Section 2.4). The five phases of action research are diagnosing, action planning, action taking, evaluation, and specifying learning (Baskerville, 1999:14). Within the five phases of action research, various methods will be used to perform the research, namely:

1. Diagnosing – Critical social research using interpretive methods
2. Action Planning – Design science research methods
3. Action Taking – Design science research methods
4. Evaluation – Interpretive methods
5. Specifying Learning – Critical social research

The interaction between these phases can be better understood when represented in a diagram (see Figure 2.2).

GUIDELINES TO DESIGN DIGITAL GRAPHIC NOVELS PORTRAYING EMOTIONAL SOCIAL PHENOMENA USING CRITICAL SYSTEMS HEURISTICS AND HCI PRINCIPLES

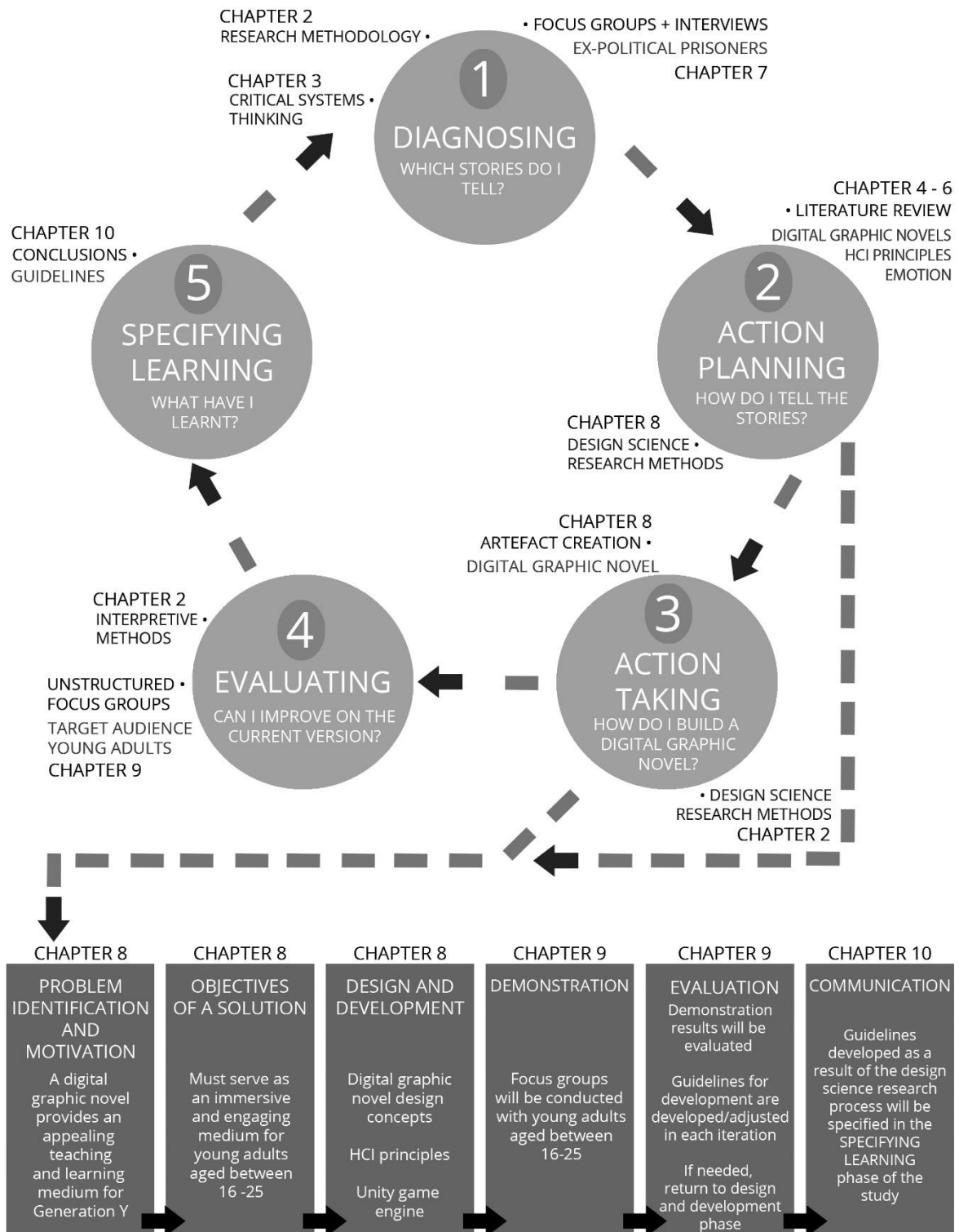


Figure 2.2: An adaptation of the action research cycle (Baskerville, 1999:14) and the design science research process (Peppers et al., 2006:93) to represent the research structure of this study.

The finalisation of the philosophical assumptions of the study now allow for the investigation of the methodological principles that will be applied as a result.

2.3 Methodology: General guidelines

As illustrated in Figure 2.1, the chosen paradigm (F) informs the methodology (M) employed within the research process. Creswell (2003:5) defines a methodology as a strategy that is used to associate methods with outcomes. This section provides the general guidelines for conducting critical social theory research and design science research. These guidelines will be reflected on in Chapter 10 for self-evaluation of the work conducted.

2.3.1 Critical social theory research methodology

Harvey (1990:19) provides a summary of the following critical social theory research principles:

1. Critical social research seeks to uncover the underlying assumptions of the individuals participating in the research. These assumptions are normally overlooked in other paradigms, but through the unveiling and interpretation of these assumptions, the researcher is able to understand their origins and how they affect an individual's worldview (Harvey, 1990:20). Within the critical social research theory paradigm, the key methodological factor is the need to uncover the ever-present underlying selectivity of claims made by the individuals within a problem environment (Ulrich, 2005).
2. The principle of totality is applied within critical social research theory due to the fundamental belief that social phenomena do not exist as entities on their own but are rather interrelated to form a greater whole. As a result, a social phenomenon should not be studied as an isolated event, but rather as a subsection of a greater system.
3. Essence is regarded as the principal concept that enables the process of deconstruction to take place. In other words, what does an individual really mean when he makes a statement and how can that be used to further understand his worldview?

4. Critical researchers are more concerned with actions that bring about change in a problem environment as opposed to the actions of the individuals within that problem environment.
5. It is the role of the researcher to reveal the nature of ideologies present within a problem environment. This is achieved by identifying the essence of a social interaction and then removing it from the underlying framework by the process of dialectical deconstruction and reconstruction.
6. Critical social researchers are of the opinion that the structure of a problem environment is greater than the sum of its component parts. These interrelated and interdependent components can only be understood by viewing them in terms of the entire structure as a whole.
7. When conducting critical research, more emphasis is placed on the situations surrounding historical facts, rather than the facts themselves. In addition, the circumstance of the researcher is also taken into account.
8. When faced with a problem situation, the researcher attempts to break down the circumstance into its key elements. By doing so, the researcher is able to better study the interrelations between the elements, and thus uncover the overall structure of the situation. Once this is achieved, the researcher attempts to reconstruct the situation in order to identify the ideology and oppressive structure that needs to be changed and so result in a change in the problem environment.

Myers and Klein (2011:24) also propose a set of general guidelines that serve to summarise the key concepts of critical research by combining ideas derived from philosophical literature. The guidelines were compiled to help the critical researcher by summarising the fundamental factors of critical research. Because critical research will be used as the overall paradigm of the study, Table 2.2 summarises the proposed set of principles for critical research.

Table 2.2: A proposed set of principles for critical research quoted from Myers and Klein (2011:25).

The Element of Critique
<p>1. The principle of using core concepts from critical social theorists</p> <p>This principle suggests that critical researchers should organize their data collection and analysis around core concepts and ideas from one or more critical theorists.</p> <p>Example: Ngwenyama and Lee (1997:145) use core concepts from Habermas to critique information richness theory.</p>
<p>2. The principle of taking a value position</p> <p>Critical theorists advocate values such as open democracy, equal opportunity, or discursive ethics. These values drive or provide the basis for principles 4 through 6.</p> <p>Example: Adam (2005) examines how ethics may be more effectively integrated into critical IS research.</p>
<p>3. The principle of revealing and challenging prevailing beliefs and social practices</p> <p>This principle suggests that critical researchers should identify important beliefs and social practices and challenge them with potentially conflicting arguments and evidence.</p> <p>Example: Doolin (2004:343) considers how a medical information system was supposed to help administrators to ensure efficiency and financial viability, but he challenges the underlying beliefs and assumptions of the system using concepts from Foucault.</p>
The Element of Transformation
<p>4. The principle of individual emancipation</p> <p>Alvesson and Willmott (1992:432) state that all critical social theory is oriented toward facilitating the realization of human needs and potential, critical self-reflection, and associated self-transformation.</p> <p>Example: Kanungo (2004:407) demonstrates how a field labourer in an Indian village was able to receive credit and training using the data available in the local knowledge centre to improve her standard of living.</p>
<p>5. The principle of improvements in society</p> <p>This principle suggests that improvements in society are possible. The goal is not just to reveal the current forms of domination, but to suggest how unwarranted uses of power might be overcome (although the critical theorist should not assume any special position of authority). Most critical theorists assume that social improvements are possible, although to very differing degrees.</p> <p>Example: Kvasny and Keil (2006:23) make recommendations with regard to how the provision of social services (using IT) for historically disadvantaged groups might be improved.</p>
<p>6. The principle of improvements in social theories</p> <p>All critical theorists believe that our theories are fallible and that improvements in social theories are possible. Critical researchers entertain the possibility of competing truth</p>

claims arising from alternative theoretical categories, which can guide critical researchers in their analyses and interventions.

Example: Habermas modified his ideas in response to debates with Foucault and Gadamer. Conversely, Foucault and Gadamer modified their positions.

Within the field of critical social theory, critical systems heuristics (CSH) is defined as “a critical methodology for identifying and debating boundary judgments” (Ulrich, 2002:73) and as such, will be adopted in this study. However, Chapter 3 is dedicated to this subject and therefore, it will not be covered here.

2.3.2 Interpretive research methodology

Interpretive field research will be used to gather data for this study as indicated on Figure 2.2 during the diagnosis and evaluation phases of this action research study. Klein and Myers (1999:72) proposed principles for interpretive research in an information systems environment. Table 2.3 gives a summary of the aforementioned principles that will be used in this study.

Table 2.3: Proposed principles for interpretive field research quoted from Klein and Myers (1999:72).

Principle	Description
The fundamental principle of the hermeneutic circle	Suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.
The principle of contextualization	Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.
The principle of interaction between the researchers and the subjects	Requires critical reflection on how the research materials (or “data”) were socially constructed through the interaction between the researchers and participants.
The principle of abstraction and generalization	Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general

	concepts that describe the nature of human understanding and social action.
The principle of dialogical reasoning	Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings (“the story which the data tell”) with subsequent cycles of revision.
The principle of multiple interpretations	Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it.
The principle of suspicion	Requires sensitivity to possible “biases” and systematic “distortions” in the narratives collected from the participants.

2.3.3 Design science research methodology

The design science research methodology will be used within the action-taking phase of the action research cycle as depicted in Figure 2.2. The digital graphic novel will be created using this methodology. Hevner *et al.* (2004:83) propose seven guidelines for design science in information systems research. These guidelines serve to clarify the requirements for successful design science research. These will be incorporated into the study in order to guide the design process of the digital graphic novel during the action planning and action taking phases of the AR project, as illustrated in Figure 2.2. Table 2.4 summarises the design science research guidelines that will be further discussed in Chapter 6.

Table 2.4: Guidelines for design-science research in information systems quoted from Hevner et al. (2004:83).³

Guideline	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.

³ The terms ‘design-science research’ and ‘artifact’ are quoted directly from the authors and therefore differ from the spelling of these terms in the rest of the document.

Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

As mentioned in guideline 3, evaluation is an integral component of the design science research process because it serves to provide feedback that is essential to the following iterations of artefact construction (Hevner *et al.*, 2004:85). It is important to conduct a thorough evaluation during each iteration in order to ensure that problem areas in the current iteration are addressed. Table 2.5 summarises the design evaluation methods as proposed by Hevner *et al.* (2004:86).

Table 2.5: Design Evaluation Methods quoted from Hevner et al. (2004:86).⁴

1. Observational	Case Study: Study artifact in depth in business environment.
	Field Study: Monitor use of artifact in multiple projects.
2. Analytical	Static Analysis: Examine structure of artifact for static qualities (e.g., complexity).
	Architecture Analysis: Study fit of artifact into technical IS architecture.

⁴ The term 'artifact' is quoted directly from the authors and therefore differs from the spelling of this term in the rest of the document.

	Optimization: Demonstrate inherent optimal properties of the artifact or provide optimality bounds on artifact behaviour.
	Dynamic Analysis: Study artifact in use for dynamic qualities (e.g., performance).
3. Experimental	Controlled Experiment: Study artifact in controlled environment for qualities (e.g., usability).
	Simulation – Execute artifact with artificial data.
4. Testing	Functional (Black Box) Testing: Execute artifact interfaces to discover failures and identify defects.
	Structural (White Box) Testing: Perform coverage testing of some metric (e.g., execution paths) in the artifact implementation.
5. Descriptive	Informed Argument: Use information from the knowledge base (e.g., relevant research) to build a convincing argument for the artifact’s utility.
	Scenarios: Construct detailed scenarios around the artifact to demonstrate its utility.

The appropriate research methodology principles for this study are discussed in the following section.

2.3.4 Research methodology principles applied in this study

This section provides a summary of the manner in which the appropriate sets of principles or guidelines are incorporated within the study.

Table 2.6: An application of principles for critical research proposed by Myers and Klein (2011:25).

Principle	Application within this study
The Element of Critique	
The principle of using core concepts from critical social theorists	The core concepts of Werner Ulrich’s Critical Systems Heuristics (Ulrich, 2005) will be adopted in this study.
The principle of taking a value position	The researcher is of the position that youth will be more inclined to read about emotional social phenomena if they are presented in a digital graphic novel format.

	The researcher is also of the position that the ex-political prisoners will benefit more by having their stories told in the form of a digital graphic novel.
<p>The principle of revealing and challenging prevailing beliefs and social practices</p> <p>This principle suggests that critical researchers should identify important beliefs and social practices and challenge them with potentially conflicting arguments and evidence.</p>	<p>It is often believed that content of a serious nature should be relayed in a 'serious' form of communication and that digital graphic novels are for entertainment purposes alone. However, young people have admitted that they would be far more inclined to learn about emotional social phenomena if it were presented in the form of a digital graphic novel. Also, a serious topic such as the Holocaust, was successfully discussed through the use of a graphic novel called <i>Maus: A Survivor's Tale</i> (Spiegelman, 2005).</p>
The Element of Transformation	
<p>The principle of individual emancipation</p>	<p>Ex-political prisoners will be emancipated through telling their stories to others. Young adults will also be emancipated by being given the opportunity to learn through an immersive medium.</p> <p>The aforementioned applies to all the individual ex-political prisoners who will be interviewed, as well as the individual young adults who will interact with the digital graphic novel.</p>
<p>The principle of improvements in society</p>	<p>Allowing the ex-political prisoners to have their stories told while providing young people with an immersive and engaging medium through which to learn about them contributes towards historical awareness. It is important for a society to be aware of its history for many reasons including economic development (Nunn, 2009:88). Young people will be presented with a fun, immersive medium through which to learn about emotional social phenomena such as ex-political prisoners.</p>
<p>The principle of improvements in social theories</p>	<p>This study demonstrates that critical systems heuristics can be beneficial to the development of a digital graphic novel that portrays emotional social phenomena.</p>

Table 2.7: An application of principles for interpretive field research proposed by Klein and Myers (1999:72).

Principle	Description
The fundamental principle of the hermeneutic circle	When interpreting an interview or focus group, understanding the whole will take place through understanding the parts, and vice versa. The answer will be analysed in terms of: <ul style="list-style-type: none"> • The question • The entire interview • The answers of the other participants
The principle of contextualization	A generalised social and historical background of the ex-political prisoners of Robben Island Prison will be provided. The selection of the participants of the focus groups within the evaluation phase of the action research cycle will be explained. The history of the researcher to the study is provided in order to aid the audience in understanding the interpretations of the researcher.
The principle of interaction between the researchers and the participants	Methods used to construct the data obtained in this study are discussed, as well as the character of the interactions between the researcher and the participants.
The principle of abstraction and generalisation	Content analysis is used in the interpretation, abstraction and generalisation of coded data in the <i>Diagnosing</i> phase of the action research cycle. Content analysis is used in the interpretation, abstraction and generalisation of coded data in the <i>Evaluating</i> phase of the action research cycle.
The principle of dialogical reasoning	The interplay between the existing theory and findings obtained in the analysis of the focus groups is a key factor in establishing the principles for the development of the digital graphic novel portraying emotional social phenomena.
The principle of multiple interpretations	The data is analysed twice and enough evidence will be provided for auditing purposes.
The principle of suspicion	It is accepted that all answers are a representation of the specific prisoner's reality that serves as a message that he would like to convey.

Table 2.8: An application of guidelines for design-science research in information systems as proposed by Hevner et al. (2004:83).⁵

Guideline	Description
Guideline 1: Design as an Artifact	A digital graphic novel portraying emotional social phenomena is created.
Guideline 2: Problem Relevance	Ex-political prisoners of Robben Island Prison wish to have their stories told to the youth. Young people desire a more immersive and engaging medium through which to learn about emotional social phenomena such as Apartheid.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Guidelines are developed for developing digital graphic novels about emotional social phenomena through the use of critical systems heuristics and human-computer interaction principles.
Guideline 5: Research Rigor	The principles prescribed by Heikkinen <i>et al.</i> (2012:8), Klein and Meyers (1999:72) and Myers and Klein (2011:25) are used in the evaluation of the artefact.
Guideline 6: Design as a Search Process	HCI principles are incorporated within the design and creation of the artefact. This ensures that an effective artefact is produced while satisfying the laws within the problem environment.
Guideline 7: Communication of Research	The findings of the research study are communicated in the form of guidelines that summarise the core findings of the study.

The identification of methodological guidelines will guide the researcher during the practical stage of the research process.

2.4 Research methods

The following section addresses the practical guidelines of critical social theory research (action research), interpretive research and design science research (see

⁵ The terms 'design-science research' and 'artifact' are quoted directly from the author and therefore differ from the spelling of these terms in the rest of the document.

Figure 2.2). Action research is a research method of critical social theory research and will therefore be conducted during this study (Myers, 2008:61).

2.4.1 Critical social theory research method - Action research

Kurt Lewin developed action research while he was at the Research Center for Group Dynamics (University of Michigan) (Myers, 2008:57). His main aim when developing the research method was to apply social psychology theories to real-world problems. Once the theory was applied to the problem situation, learning took place from the experience and the body of knowledge was improved upon by either adapting existing theory or by proposing new theory (Myers, 2008:57).

Blum (1955:1) defines action research as a simple two-stage process:

- Diagnostic Stage – In this stage, the researcher and the subjects of the research work in unison in order to evaluate the social situation. Once this is done, theories regarding the nature of the research domain are then formulated.
- Therapeutic Stage – Change experiments are conducted in this stage by introducing changes and studying their results.

Baskerville (1999:6) distinguishes four characteristics of information systems action research. These are:

- Action research seeks to increase understanding about an immediate social situation. Emphasis is placed on the complex and varying quality of the social situation within the information systems domain.
- Action research aids in increasing scientific knowledge while assisting in practical problem solving. In doing so, two significant characteristics of the process is produced, namely:
 - Highly interpretive assumptions are made about the observation.
 - The researcher intervenes within the problem environment.
- Action research is a collaborative effort that serves to enhance the capabilities of the relevant actors. A participatory type of observation is required within this characteristic. Enhancing capabilities is relative to the previous capabilities of both the subjects and the researcher and is an inevitable result of collaboration.

The extent to which this characteristic is achieved, and the balance between the actors, will depend on the setting of the social situation.

- Action research is largely applicable in order to understand the change processes within social systems.

According to Baskerville and Wood-Harper (1996:235), the model domain of the action research method is a social setting that exhibits the following features:

- Active involvement by the researcher, from which, both the researcher and organisation is expected to benefit.
- Immediate application of knowledge acquired where there is not a sense of an observer that is detached from the situation, but rather a sense of an active participant who seeks to make use of any new knowledge that is based on an explicit, clear conceptual framework.
- Linking of theory and practice through research which is typically cyclical.

Figure 2.3 illustrates the five iterative phases of action research. The five iterative phases of action research are (Baskerville, 1999:14):

- Diagnosing – identification of the primary problems are the underlying cause for the organisation's desire for change.
- Action Planning – involves collaboration between researchers and practitioners in order to determine which actions should serve to relieve or improve the primary problems identified in the diagnosing stage.
- Action Taking – implementation of the planned action takes place here with researchers and practitioners collaborating in the active intervention into the client organisation by causing certain changes to be made.
- Evaluating – outcomes from the action-taking phase are evaluated by the researchers and practitioners.
- Specifying Learning – knowledge gained in this phase is provided to others.

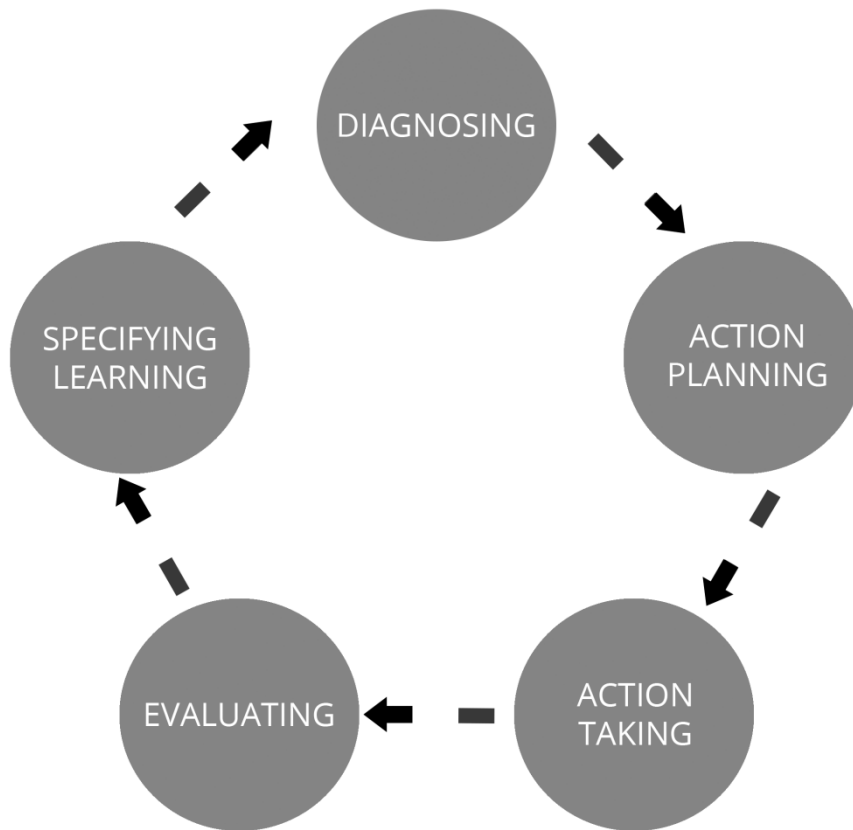


Figure 2.3: The five iterative phases of action research (Baskerville, 1999:14).

Although not represented in Figure 2.3, Baskerville (1999:11) believes that the researcher “must impose a clear, mutually agreed theoretical framework on the situation, in order for explicit, general lessons to emerge from the research”. Checkland and Holwell (1998:13) explicitly illustrate this in Figure 2.4 (F). Baskerville (1999:11) further characterises the ideal domain of the action research method as being a social setting that is comprised of the following:

1. An actively involved researcher who anticipates benefits for the organisation and the researcher himself.
2. Acquired knowledge that can be applied immediately that brings out a sense of the researcher being an active participant who seeks to make use of any new knowledge that is founded on a clear and explicit conceptual framework.
3. Research is a (typically) cyclical process that serves to link both theory and practice.

Within the action research cycle, changes in the framework of ideas, methodology, and area of concern can be anticipated. The tendency to change the framework of ideas, methodology, and area of concern in the study in which the researcher becomes immersed in real-life social situations results in the most significant principle of action research (Checkland & Holwell, 1998:13). The action research cycle as illustrated by Checkland and Holwell (1998:13) is shown in Figure 2.4. Although the figure was discussed in the introduction of the chapter, it will now be discussed from an action research perspective.

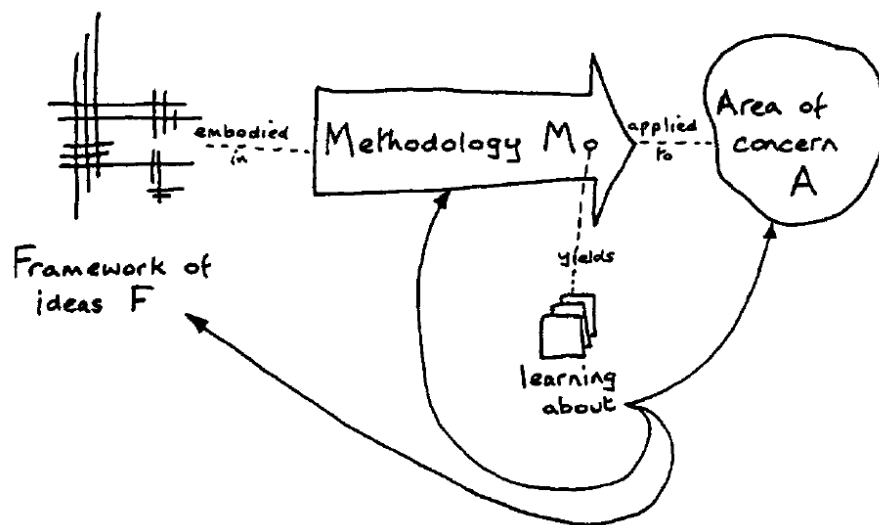


Figure 2.4: Elements relevant to any piece of research (Checkland & Holwell, 1998:13)⁶

Figure 2.5 depicts a picture by Checkland and Holwell (1998:15) illustrating the action research process in human situations. The action research process in human situations according to Checkland and Holwell is as follows (Checkland & Holwell, 1998:14):

1. The researcher who is interested in a specific theme declares his framework of ideas and methodology.
2. The researcher becomes involved as both a researcher and a participant in an environment in which his themes are of relevance.

⁶ Checkland intended for his 'rich pictures' to be displayed as is. Therefore, they have not been altered to fit into the format of the other images in this dissertation.

3. The researcher then works to affect change and bring about improvement in the environment. The degree of improvement is defined by others within the environment.
4. The researcher then reflects on the involvement phase. This is done by examining the situation with regard to the selected framework of ideas and methodology. Actions in earlier phases may need to be refined or redefined in context of the framework of ideas and methodology. Due to the evolutionary nature of real-world situations, it is the duty of the researcher to determine a break point from the situation where the action research cycle is terminated and the findings are reported.

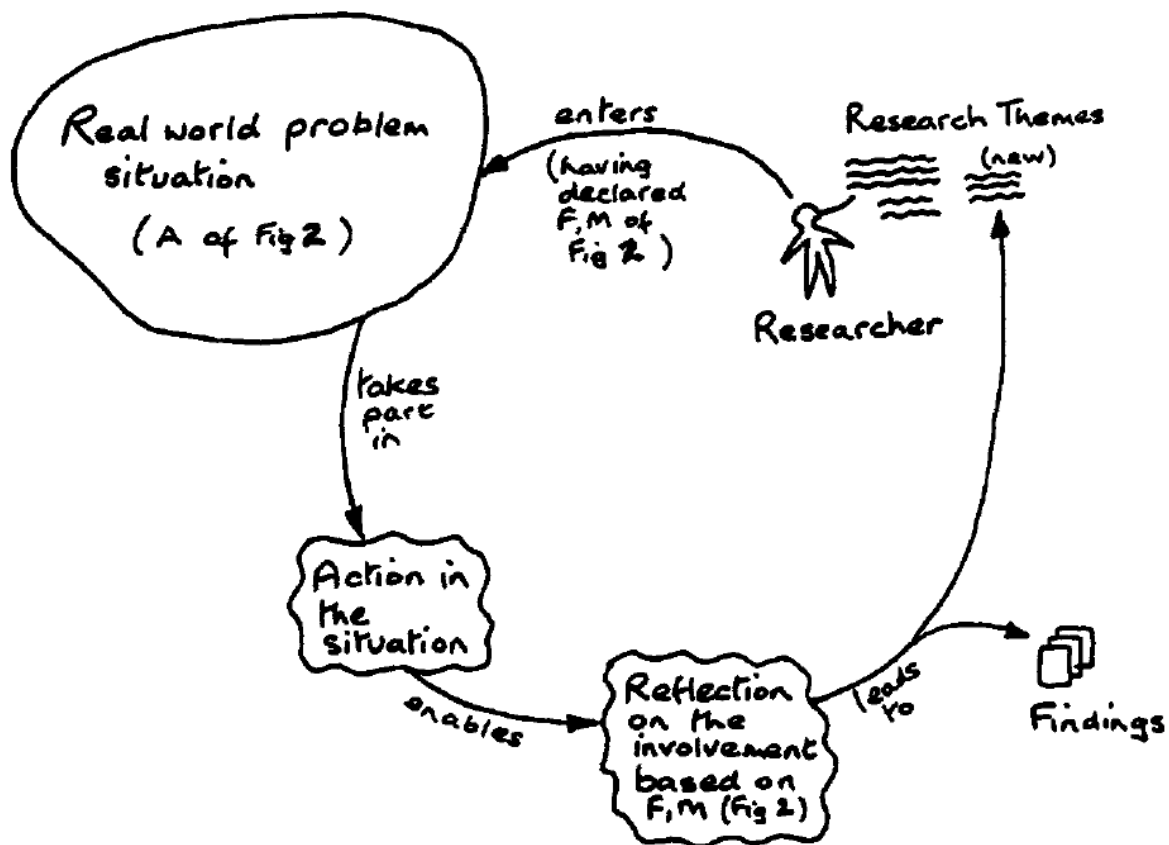


Figure 2.5: Cycle of action research in human situations (Checkland & Holwell, 1998:15)⁷

⁷ Checkland intended for his 'rich pictures' to be displayed as is. Therefore, they have not been altered to fit into the format of the other images in this dissertation. The reference to Figure 2 on the figure refers to Figure 2.4.

2.4.2 Action research applied in this study

This study will be conducted as per the five phases of the action research cycle. As demonstrated in Figure 2.2. Each phase will make use of different research methods in order to achieve its purpose. The purpose of each phase of the study is as follows:

- *Diagnosing*
 - To determine what are the core elements that the ex-political prisoners found important to relay in their stories about the emotional social phenomenon that they experienced.
 - This will be done through conducting semi-structured focus groups and an interview with ex-political prisoners. Literature studies will be performed on the topic of critical systems heuristics in order to further understand the data that is collected through interpretive methods.
- *Action Planning*
 - A literature study of digital graphic novels will be performed to help guide the planning and design of the digital graphic novel.
 - Guidelines for the creation of a digital graphic novel will be developed.
 - A literature study of HCI principles will be performed to help guide the planning and design of the digital graphic novel.
 - Guidelines for using HCI principles in the creation of a digital graphic novel portraying emotional social phenomena will be developed.
 - A literature study of emotion and emotional social phenomena will be performed to help guide the planning and design of the digital graphic novel.
 - Guidelines for the incorporation of emotion in the creation of a digital graphic novel portraying emotional social phenomena will be developed.
 - To plan and design the layout of a digital graphic novel that portrays an emotional social phenomenon.
- *Action Taking*
 - To create a digital graphic novel that portrays an emotional social phenomenon according to the proposed guidelines.
 - Design science research will be incorporated in the creation of the digital graphic novel.

- *Evaluation*
 - To determine the success of the digital graphic novel that portrays an emotional social phenomenon among youth.
 - Interpretive methods in the form of semi-structured focus groups held with members of the target audience will be used to determine the success of the digital graphic novel. This phase will be combined with the evaluation phase in the design science research section of this study.
- *Specifying Learning*
 - To specify guidelines for using critical systems heuristics and human-computer interaction principles to create a digital graphic novel that portrays emotional social phenomena.

2.4.3 Interpretive research methods

As indicated in the previous section and Figure 2.2, interpretive interviews are used in the diagnosing and evaluating phases of the action research project.

Before establishing data collection and analysis methods, it is important to establish the difference between the two types of data, namely – quantitative or qualitative. Quantitative data is commonly derived from research questions that have been developed according to something of a predictive and affirmative nature (Ellis & Levy, 2009:330). Examples of quantitative research questions are:

- On a scale of 1-10, to what extent does the visual appeal of a website affect its number of hits?
- Does the use of voice recognition software occur more amongst females than males?

Qualitative data is generally derived from research questions that are determined by a more exploratory and interpretive nature (Ellis & Levy, 2009:330). Examples of qualitative research questions are:

- How do older users define user-friendliness as opposed to younger users?
- Why does the addition of movement to static images enhance immersion?
- What aspects of a webpage are of most value to users?

Due to the interpretive and exploratory nature of this study, qualitative data will be used.

The interpretive research process starts by collecting data, followed by a cycle of data analysis and data collection until a theory is developed that fits all the available data. Over the years, grounded theory has evolved into a classical method for qualitative data collection and analysis in interpretive research. It is explained here to provide a description of the interpretive research process.

Grounded theory can be defined as a methodology that is used for the creation of theory that is grounded in data that is collected and examined (Strauss & Corbin, 1994:273). Within grounded theory, comparative analysis is used to generate theory through verifying properties using accurate evidence (Glaser & Strauss, 2009:28). Theory is developed within the grounded theory methodology through the back-and-forth of data collection and analysis in the comparative analysis method (Strauss & Corbin, 1994:273). Maree (2007:78) summarises Glaser and Strauss' steps for generating grounded theory as follows:

1. Data collection: This is achieved through social interaction in the form of participant interviews and observation, field studies, and focus groups.
2. Data analysis: Comparative analysis is constantly performed through the process of coding and categorising data gathered from the data collection step in order to reveal core ideas.
3. Delimiting of theory: Continuous process of confirming and disconfirming concepts relevant to the core ideas until there is no new data that is revealed.
4. The definition of theory: When a theory has been reached, the testing of the theory is not necessary to prove its validity.

Data collection and data analysis are key aspects of the interpretive research process and are discussed in the following sections.

2.4.4 Data Collection

In general, interpretive studies aim to understand phenomena by interpreting the meanings that individuals assign to them (Myers, 1997:245). This can be done through the collection and analysis of qualitative data. Qualitative data collection methods include (Maree, 2007:82):

- Documents – These include both unpublished and published documents, faxes, emails, letters, company reports, or any other document that is related to the study.
- Observation – This is done by documenting a person, event, or object without questioning or interacting with them.
- Interviewing – Essentially a two-way conversation between the researcher and a participant where the researcher is able to ask questions that are of relevance to the study.
- Focus groups – An interview strategy where the researcher interviews a group of participants with the assumption that communicating within a group will increase the range of responses while also serving to reawaken dormant memories and release personal inhibitions.

Interviews and focus groups will be employed in the data collection during the diagnosis and evaluation phases of the action research cycle as indicated on Figure 2.2.

Fontana and Frey (2000:363) describe four types of qualitative interviews:

- Structured interviews – In this form of interview, an entire script is prepared beforehand. These types of interviews are generally found within a survey environment in which the interviews are not necessarily conducted by the researcher. It is important to note that there is no room for improvisation when conducting this type of interview.
- Semi-structured interviews – This form of interview makes use of an incomplete script. This means that the researcher may have formulated a few questions before the interview, but there is room for improvisation. In this case, the interviewer is the researcher or a member of the research team.
- Unstructured interviews – Unstructured interviews are far less formal than the aforementioned types of interviews. There are no specific questions that need to be asked and the interview takes on a more conversational tone. Interviewees in unstructured interviews are free to answer as openly or abruptly as they like.
- Group interviews – In a group interview, one or more interviewers interview two or more participants. Group interviews may be structured or unstructured.

Maree (2007:88) provides keys to conducting a successful interview:

- Find an individual who possesses the most knowledge of the research area of concern in order to ensure the quality of the information.
- The participant should be enlightened as to what the aim of the interview is as well as how the information provided will be used. The participant should also confirm that he or she is participating in the interview voluntarily and that the information provided is true.
- It is important to structure the interview questions in an appropriate manner. For example, the use of questions with a 'yes' or 'no' answer should be avoided.
- The interview should not be too long.
- The interviewer should refrain from asking leading questions.
- The number of questions asked should be kept to a minimum. Instead, probing and clarification should be used in order to ensure that the participant's understanding and perception are correctly interpreted.
- Include a variety of different questions that range from experience questions to value questions and opinion questions, etc.
- The interviewer should not dominate the discussion.
- The interviewer should not judge, criticise, argue or disagree with the participant.
- The interviewer should listen intently.
- The interviewer should be aware of his or her body language as well as that of the participants. Non-verbal cues such as maintaining eye contact and maintaining good posture are also of importance.

According to Kitzinger (1995:299), a focus group is a form of group interview aimed at capitalising on the interactions between participants in order to generate data. Therefore, instead of the researcher being the only person asking questions, the participants are allowed to communicate between each other by asking questions, commenting on another individual's point of view and exchanging stories. The core idea behind the focus group centres on the fact that group dynamics may assist individuals to further explore, clarify and justify their point of view in a manner that cannot be achieved within a one on one interview setting. Kitzinger (1995:299) further states that group discussion is particularly fitting in instances where the interviewer has open questions and seeks to isolate the issues of importance of each of the

participants in their own words by encouraging participants to generate their own question amongst themselves and allowing them to pursue their own priorities.

Once the data collection process has been completed, the gathered data will then need to be analysed in order to elicit meaning from it.

2.4.5 Data Analysis

Once data has been collected, it must be analysed in order to be of any real value to the study. Qualitative data analysis methods include (Maree, 2007:101):

- Hermeneutics – This method enables the researcher to understand the data by providing a philosophical look of human understanding through the theory and practice of interpretation.
- Content analysis – This method involves the classification and summarisation of the data where similarities and differences are found within the content that either confirms or denies theory.
- Conversation analysis – A researcher employing this method focuses on the language, structure and patterns found within a conversation.
- Discourse analysis – This technique centres on the meanings of spoken and written words and why those meanings are attached to them.
- Narrative analysis – An approach that views the data as a story and looks for chronology, stories within the data, sequences, as well as narrative and temporal themes.

Content analysis will be used to analyse the data gathered for this study Table 2.9 provides a summary of the content analysis process that will be adopted in this study.

Table 2.9: A summary of the content analysis process as summarised from Zhang and Wildemuth (2009:3).

1. Prepare the data	<p>Before analysis can start, the data needs to be transformed into written text. When transcribing interviews, the following questions need to be answered (Schilling, 2006:30):</p> <ul style="list-style-type: none"> • Should all the questions of the interviewer or only the main questions from the interview be transcribed? • Should the verbalisations be transcribed literally or only in a summary?
---------------------	---

	<ul style="list-style-type: none"> Should observations during the interview (e.g. audible behaviours) be transcribed?
2. Define the unit of analysis	<p>The unit of analysis is the fundamental unit of text that will be classified during the content analysis process.</p> <p>In qualitative content analysis, individual themes are used as the unit of analysis instead of words, sentences, or paragraphs.</p>
3. Develop categories and a coding scheme	<p>These can be derived from the data, theories or previous related studies.</p>
4. Test your coding on a sample of text	<p>The best way to test the consistency and clarity of category definitions is to code a sample of your data.</p>
5. Code all the text	<p>Once sufficient consistency is achieved, the coding rules can be applied to the remainder of the prepared text.</p>
6. Assess your coding consistency	<p>Once the entire data set has been coded, it is important to recheck the consistency of the coding. This is because human coders are more likely to make errors as the coding progresses due to fatigue.</p>
7. Draw conclusions from the coded data	<p>Sense is made of the identified themes and their properties. During this stage, inferences will be made and meaning will be reconstructed from the derived data.</p>
8. Report your method and findings	<p>Report on your decisions, coding practices, and methods of establishing trustworthiness.</p> <p>Present findings of patterns, themes or categories important to social reality.</p>

Hsieh and Shannon (2005:1279) discuss three different approaches of content analysis: conventional, directed and summative.

The conventional approach to content analysis is generally incorporated into studies which aim to describe a phenomenon (Hsieh & Shannon, 2005:1279). This approach is well suited to studies in which existing research literature or theory is limited (Hsieh & Shannon, 2005:1279). In the conventional approach to content analysis, researchers avoid the use of predetermined categories and rather allow categories to flow from the data instead (Kondracki & Wellman, 2002:224). The researcher approaches coding by making notes of the first thoughts, impressions and initial analysis. In doing so, labels for codes begin to emerge that reflect one key thought (Hsieh & Shannon, 2005:1279). These form part of the initial coding scheme. The

identified codes are then grouped into categories based on how they are linked or related (Hsieh & Shannon, 2005:1279).

The directed approach to content analysis is used when there is existing theory or research surrounding a phenomenon (Hsieh & Shannon, 2005:1281). This existing theory or research is either incomplete or in need of further description (Hsieh & Shannon, 2005:1281). Therefore, the goal of the directed approach to content analysis is to either validate or conceptually extend a theoretical framework or theory description (Hsieh & Shannon, 2005:1281). In the directed approach, researchers make use of existing theories or prior research to identify key concepts or variables which can form initial coding categories (Potter & Levine-Donnerstein, 1999:258). Open-ended questions followed by targeted questions about the predetermined categories can be used when the data is collected primarily through interviews description (Hsieh & Shannon, 2005:1281). Two coding strategies can be implemented in the directed approach to qualitative content analysis. In the first strategy, the researcher reads the transcript and highlights all text that appears to be related to a specific phenomenon. The researcher then codes all the passages highlighted in the first step using the predetermined codes. Any highlighted text that could not be categorised using the predetermined codes will then be given a new code description (Hsieh & Shannon, 2005:1282). In the second strategy, the researcher immediately begins coding using the predetermined codes. All text that could not be categorised into codes are identified and analysed to determine whether they represent a new category or sub-category of an existing code description (Hsieh & Shannon, 2005:1282). When using this strategy, comparisons of code frequencies can be used to meaningfully compare the data.

The summative approach to content analysis begins by identifying and quantifying certain words or content within the text with the ultimate goal of understanding their contextual use (Hsieh & Shannon, 2005:1279). The analysis for the appearance of specific words or content within a piece of text is called manifest content analysis. This analysis is quantitative as it counts the frequency of particular words or content (Kondracki & Wellman, 2002:226). Summative content analysis is viewed as qualitative content analysis as it furthers the aforementioned process by including

latent content analysis which is the process of discovering the underlying meanings of the specific words or content (Cantazaro, 1988:437; Hsieh & Shannon, 2005:1283). Data analysis in the summative approach to qualitative content analysis commences with searches for the occurrences of identified words or content (Hsieh & Shannon, 2005:1285). The frequency of words or content is used to identify patterns in the data and contextualise the codes accordingly (Morgan, 1993:112). This allows for the context to be interpreted according to the words or content with which it is associated (Hsieh & Shannon, 2005:1285).

Table 2.10 contrasts the key coding differences between the conventional, direct and summative approaches to content analysis as given by Hsieh and Shannon (2005:1286).

Table 2.10: Key coding differences between conventional, direct and summative approaches (Hsieh & Shannon, 2005:1286).

Type of content analysis	Study starts with	Timing of defining codes or keywords	Source of codes or keywords
Conventional content analysis	Observation	Codes are defined during data analysis	Codes are derived from data
Directed content analysis	Theory	Codes are defined before and during data analysis	Codes are derived from theory or relevant research findings
Summative content analysis	Keywords	Keywords are identified before and during data analysis	Keywords are derived from interest of researchers or review of literature

The transcripts stemming from the interviews and focus groups will be analysed and coded. It is necessary to perform textual analysis on the transcriptions of the focus groups and interviews in order to elicit meaning from them. According to Myers and Avison (1997:241), there are three different modes of textual analysis – narrative and metaphor, semiotics, and hermeneutics. In the narrative and metaphor mode, much like the literary definition of the terms, understanding takes place through the relating of a story and comparison with a different object (Myers & Avison, 1997:241). The identification of patterns in situations or text leads to understanding in the semiotic

mode of textual analysis (Myers & Avison, 1997:241). Finally, in hermeneutics, understanding is gained through the interpretation of text. The hermeneutic circle of gaining understanding refers to the dividing of text into multiple parts, gaining more understanding of the whole by examining the parts, applying that which is learnt to the whole text, examining more of the parts, applying that which is learnt to the whole text. The aforementioned process (hermeneutic circle) is repeated until the entire text is completely analysed.

Coding consists of meticulous reading through transcribed data, and dividing that data into significant units (Maree, 2007:105). In essence, within the coding process, the data is marked with symbols, unique identifying names or descriptive words that assist the researcher in segmenting the transcript into sections of unique data units. Data, previous related studies, and theories are used to derive categories and coding schemes that will be applied to the qualitative data (Zhang & Wildemuth, 2009:310). Once these have been derived, the data is then categorised into each of the predefined categories. Table 2.11 provides an example of coded data using the coding method illustrated by Maree (2007:106). It is imperative to ensure that themes and categories do not overlap as this may interfere with the credibility of the coding. Once the data is categorised, assumptions and inferences may be made by reconstructing the meaning of words and phrases as categorised in the coding process. Coding enables the researcher to promptly gather all data that has been associated with a general topic so that they can be compared or contrasted as needed.

Table 2.11: Example of a coded transcript using the coding method illustrated by Maree (2007:106).

Reflective Notes	<i>Interviewer: What is the prevailing emotion amongst high school teachers with regard to their profession?</i>	Code
Note sense of discouragement and overwhelming responsibility	<i>Participant 1: High school teachers <u>feel pressured</u> to achieve a high pass rate despite the <u>challenges</u> they face in terms of <u>discipline in</u></i>	Teachers feel pressured/stressed Teachers have a challenging work environment

	<u>the classroom and discipline amongst learners in general.</u>	Discipline amongst learners have a deep impact on high school teachers
--	--	--

Within a qualitative research study, it is important to ensure that the analysis, findings and conclusions are trustworthy. Maree (2007:113) summarises important aspects that contribute toward ensuring the reliability of a qualitative research study:

- Use more than one data source: Instead of conducting one focus group, rather conduct a focus group and two individual interviews. Comparing whether the key aspects of each of the sources leads to the same conclusion will result in an additional sense of assurance for the researcher.
- Verify raw data: It is easy to misinterpret information. Once the interviews and focus groups have been completed, submit your transcriptions and notes/memos to the participants in order to ensure that you have collected the correct data.
- Maintain a record of decisions you have taken regarding your research: It is important to keep a log of your research decisions as this will make it easier for other people to follow your logic throughout the study. This may prove especially useful in assisting others to understand how you came to certain conclusions.
- More than one coder: Acquiring another coder to code the transcripts you are working on may help to validate the categories you find, as well as reveal categories that you may have missed.
- Allow stakeholders to comment on your work: Submit your transcripts, analysis, interpretation, or findings to stakeholders or others who may have an interest in your research. For example, submit your analysis to the interview participants in order to validate whether you have correctly captured what they tried to express.
- Validate and verify your findings: Submit a draft report to participants and ask them to provide feedback.
- Control for bias: Engage with others throughout your studies by allowing them to read your work. By doing so, you will receive an objective opinion and can recalibrate your focus accordingly.
- Avoid generalisation: The aim of a qualitative research is to provide understanding via an individual's perspective or group of individuals'

perspectives. As such, do not try to enforce your findings upon the greater population.

- Choose your quotes carefully: It is imperative that a researcher does not merely include quotes that substantiate his claim. A researcher should never impose his own interpretation of the text.
- Maintain confidentiality and anonymity: When conducting interviews and focus groups, some participants may express views that are contrary to the general population. The exposure of these views may carry negative consequences for the participant, and it is therefore very important to protect a participant's identity.
- Be honest about the limitations of your study. Understanding these limitations may assist readers in understanding how you reached your conclusions.

2.4.6 Interpretive methods used in this study

In this *Diagnosing* phase of this study, semi-structured focus groups will be used to interact with a historical consultant from the Robben Island Museum and ex-political prisoners who were incarcerated in the general cells in Robben Island Prison. A semi-structured interview will be conducted with an ex-political prisoner who was incarcerated in the single cells in Robben Island Prison. The aforementioned meetings will be conducted in this manner because the ex-political prisoner to be interviewed was a maximum-security prisoner on Robben Island, whereas the other ex-political prisoners who will take part in the focus group were detained in the general section. The accounts of the ex-political prisoners from the general section and the account of the ex-political prisoner from the maximum-security section may differ slightly and will therefore be dealt with separately. Directed content analysis will be used to analyse the data gathered in this phase. The information gathered from the coding of these interviews and focus groups will be used to identify the core elements of prison-life on Robben Island. These core elements will then be incorporated into the storyline of the digital graphic novel.

In the *Evaluating* phase of the study, focus groups will also be conducted with groups of young people regarding the aesthetic appeal of the digital graphic novel that will be created. Directed content analysis will be used to analyse the data gathered in this

phase. The information gathered from the coding of these focus groups will assist in the design and improvement of the digital graphic novel.

Once the necessary information is attained, the design and creation of the digital graphic novel will take place. This process will be accomplished through the design science research method.

2.4.7 Design science research method

As indicated in Figure 2.2, design science research methods will be incorporated into the action planning and action taking phases of the study. Therefore, the design science research method will be discussed in detail.

According to Gregor and Hevner (2013:337), within the field of information systems (IS) design science research comprises the creation of a variety of socio-technical artefacts. They further state that design science research stems from “an important opportunity, challenging problem, or insightful vision for something innovative in the application environment” (Gregor & Hevner, 2013:343). In order to study the research topic under investigation, the researcher needs to identify what is known about the environment, as well as what existing knowledge can be drawn upon in order to further understand the environment. Knowledge that is known about an environment is called descriptive knowledge (Ω knowledge) and existing knowledge that is drawn upon in order to aid the research process is called prescriptive knowledge (Λ knowledge). Figure 2.6 shows the different forms of descriptive and prescriptive knowledge.

USEFUL KNOWLEDGE

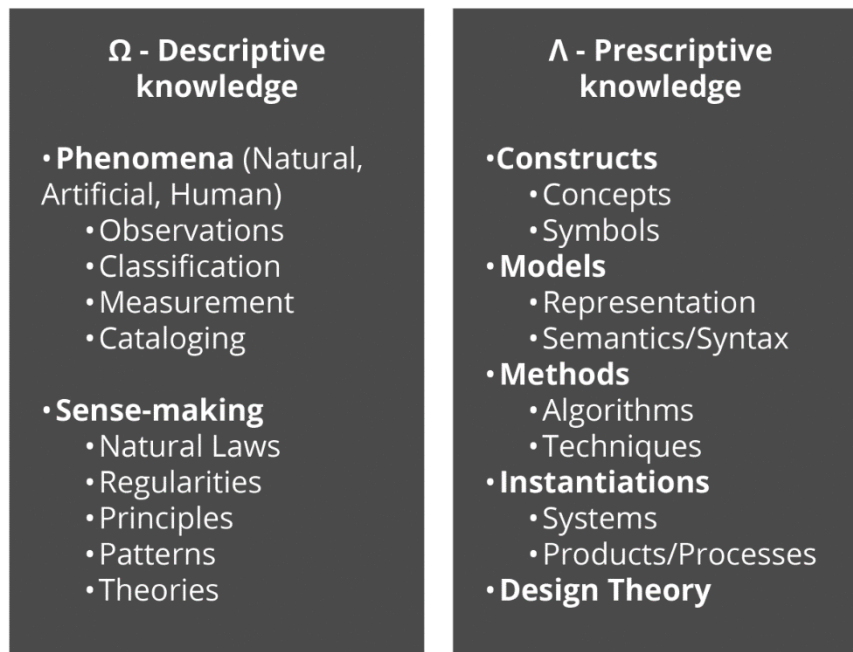


Figure 2.6: The design science research knowledge base (Gregor & Hevner, 2013:344).

The researcher makes use of the descriptive knowledge in order to inform the research process – for example, aiding in the development of accurate research questions. While doing this, prescriptive knowledge is also used in the form of examining other design methods or artefacts that have been developed to solve the research problem in the past. The combination of the two different types of knowledge serves to provide a benchmark against which the study may evaluate the innovativeness of the developed artefact and the knowledge arising from the research (Gregor & Hevner, 2013:343). Figure 2.7 illustrates the roles that both prescriptive and descriptive knowledge play in the design science research process.

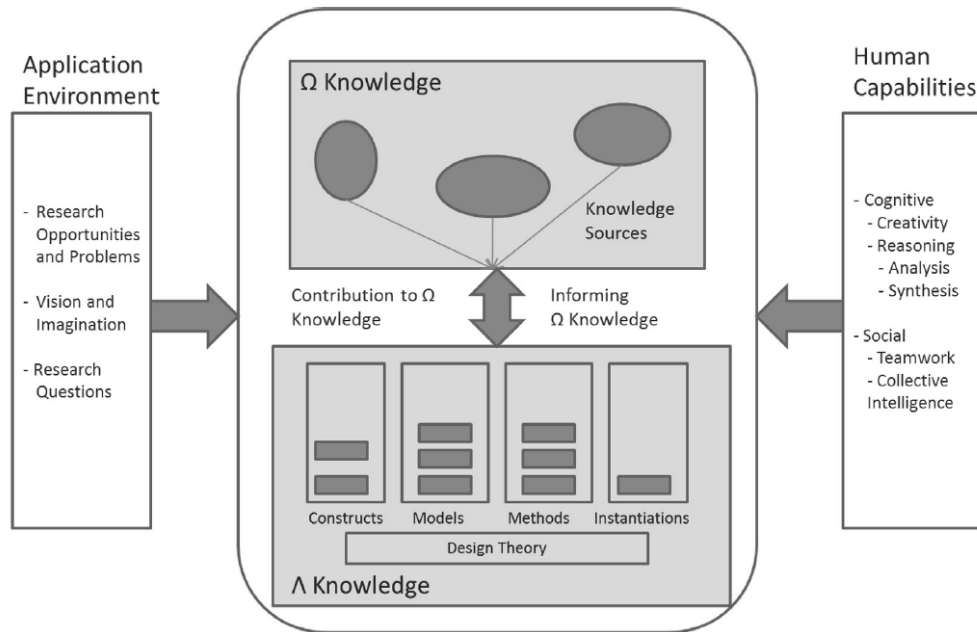


Figure 2.7: The roles of knowledge in design science research as illustrated by Gregor and Hevner (2013:344).

As the research process of a specific research topic continues, descriptive and prescriptive knowledge gathered from previous studies gradually evolve through the various design cycles (Gregor & Hevner, 2013:A5). Figure 2.8 illustrates the evolution of knowledge via design cycles.

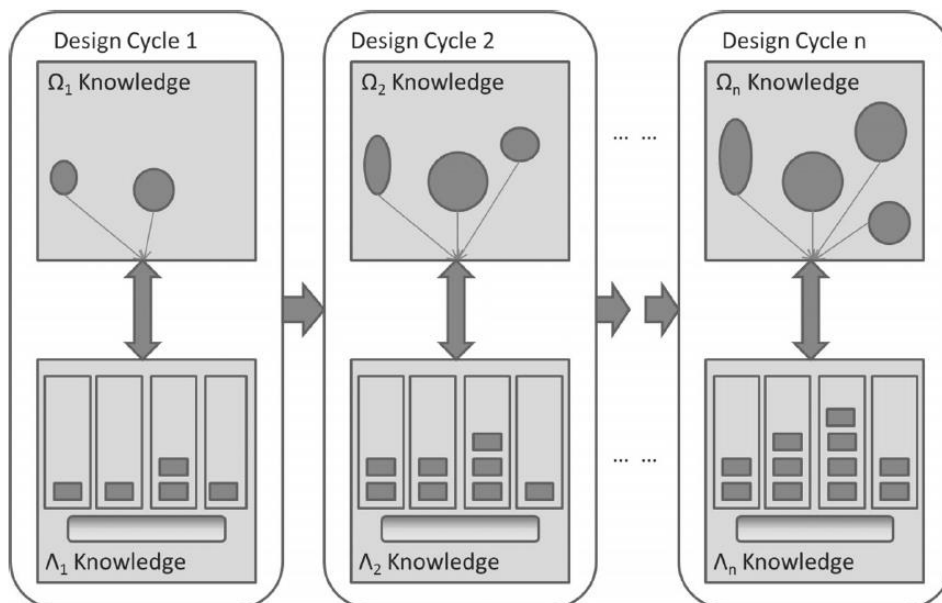


Figure 2.8: The evolution of knowledge in design science research as depicted by Gregor and Hevner (2013:A5).

Peppers *et al.* (2006:89) propose a process model of design science research that comprises six activities as illustrated in Figure 2.9.

1. Problem identification and motivation

In this activity, the researcher defines the particular research problem and substantiates the significance of the proposed solution. This helps to impel the researcher and readers to search for the solution and accept its results while also assisting the readers to understand the reasoning of the researcher in understanding the problem. To complete this activity, the researcher must know what the problem is and the value of the solution to the problem.

2. Objectives of a solution

The objectives of the solution should be rationally inferred from the problem statement. For this activity, the researcher will once again need to know what the problem is as well as what the current resolutions to the problem are and how efficient they are.

3. Design and development

The development of the artefact takes place within this activity. During this activity, the desired functionality of the artefact is determined along with its design and architecture. Once the aforementioned are established, the creation of the artefact can commence. In this activity, the researcher will need to be familiar with theory regarding the research problem that can be used in order to form a solution.

4. Demonstration

The researcher demonstrates how effectively the created artefact solves the research problem. To achieve this, a case study, simulation, experiment, etc. may be conducted.

5. Evaluation

The degree to which the created artefact solves the research problem is measured. This is achieved by comparing the objectives of the solution to the actual monitored results from the application of the artefact in the demonstration activity. There are many ways to conduct an evaluation, these include surveys, user feedback and satisfaction questionnaires. The results of the evaluation phase will determine whether it is necessary to

conduct another iteration of the design science research process in order to solve the identified research problem.

6. Communication

Once the artefact has been confirmed to solve the research problem, the researcher should communicate the findings. This is usually done by explaining the research problem and its significance, the artefact and its innovativeness and effectiveness, the objectivity of its design, as well as its usefulness to others.

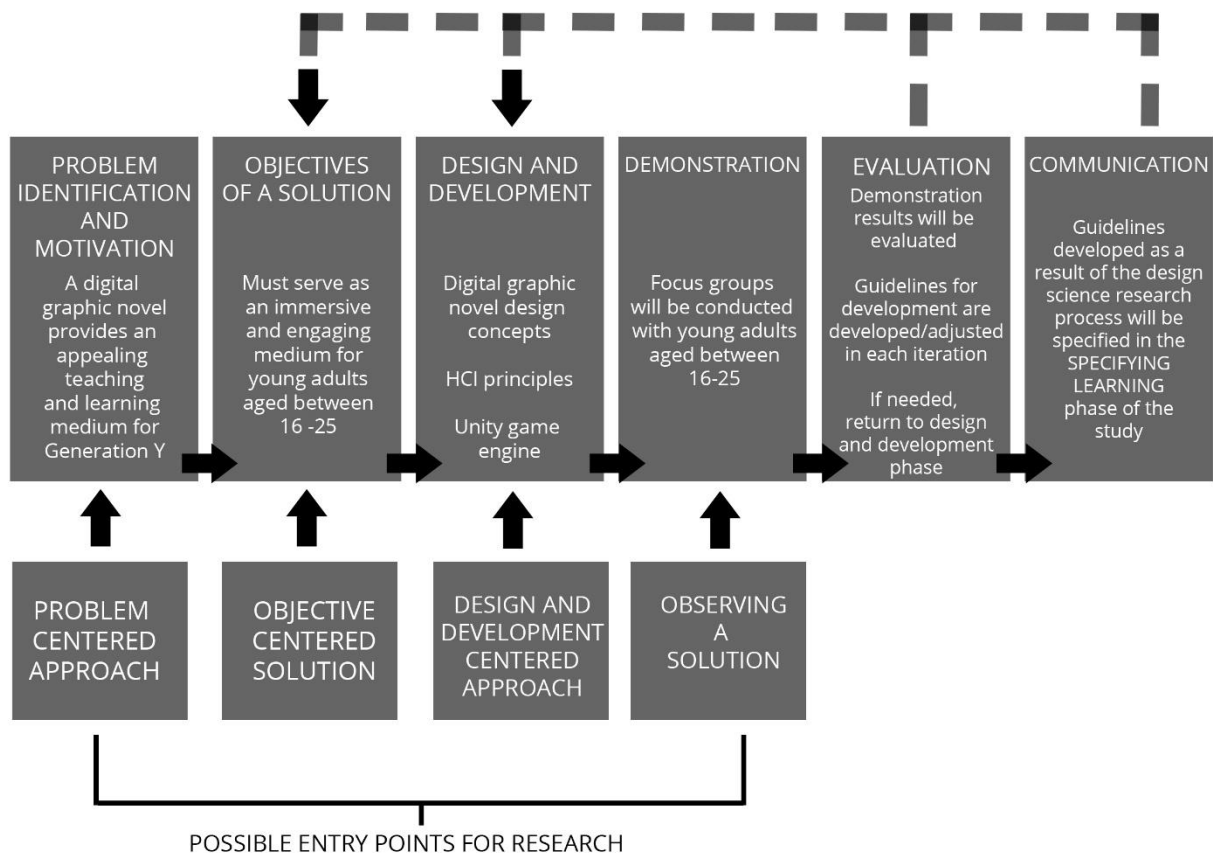


Figure 2.9: Adapted design science research process model (Peffers et al., 2006:93).

Venable (2006:17) composed an activity framework of design science research that illustrates the role of theory building in the design science research process as shown in Figure 2.10.

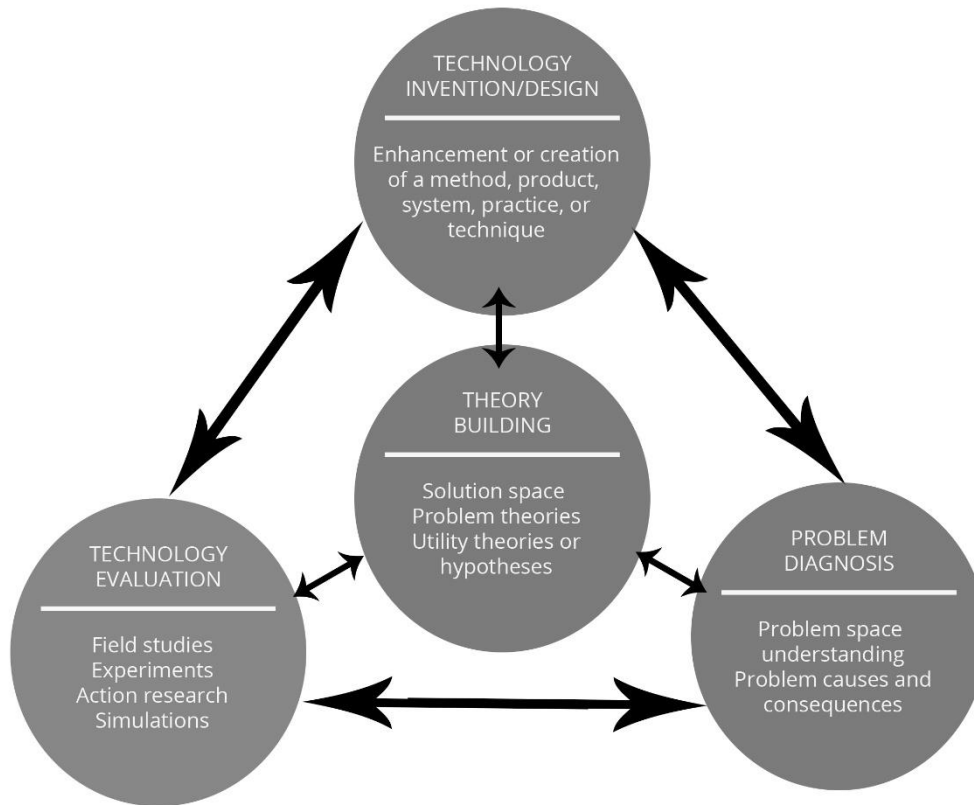


Figure 2.10: An activity framework for design science research (Venable, 2006:17).

According to Venable’s framework, theory building forms the central part of a design science research process with design science researchers engaging in theorising during every activity within the design science research process.

2.4.8 Design science research method used in this study

This study seeks to utilise theory generated during each activity in order to formulate guidelines for the development of a digital graphic novel used to portray emotional social phenomena.

The descriptive knowledge (Ω knowledge) that will inform the design and development of the digital graphic novel will be the guidelines for creating digital graphic novels (presented in Chapter 4). The prescriptive knowledge (Λ knowledge) that will be incorporated in the design and development of the digital graphic novel will be the guidelines isolated from the literature reviews of HCI principles (Chapter 5) and emotion (Chapter 6). The design science research method will be applied to this study within the *Action Planning* and *Action Taking* phases of the overall action research

cycle. The design science research method proposed by Peffers *et al.* (2006:89) will be used in this study. The aforementioned design science research method was discussed in section 2.5.5. A summary of how each phase will be performed is presented in Table 2.12.

Table 2.12: Implementation of design science research method adapted from Peffers et al. (2006:89).

<p>Problem identification and motivation</p>	<p>Short and Reeves (2009:417) believe that a graphic novel provides an appealing teaching and learning medium that caters to the high stimulation needs of generations that grew up surrounded by TV and the Internet, and who are now accustomed to receiving a great deal of both visual and verbal stimulation (Wolf, 1996:124).</p> <p>Part of the Mandela27 project is aimed at making young adults aware of the stories of the ex-political prisoners of Robben Island Prison. Therefore, in order to portray this emotional social phenomenon to young adults, a digital graphic novel will be created.</p>
<p>Objectives of a solution</p>	<p>The digital graphic novel must serve as an immersive and engaging medium through which young adults can learn about the experiences of ex-political prisoners of Robben Island Prison.</p>
<p>Design and development</p>	<p>Concepts isolated from a literature review of digital graphic novel design will be implemented in the design and development of the digital graphic novel.</p> <p>HCI principles will also be applied in the design and development of the digital graphic novel.</p> <p>Concepts isolated from a literature review of emotion and emotional social phenomena will be implemented in the design and development of the digital graphic novel.</p> <p>The artefact will be developed using the Unity game engine.</p>
<p>Demonstration</p>	<p>Focus groups will be held with young adults aged between 16-25.</p>

Evaluation	<p>The results of the demonstration will be evaluated and guidelines for the development of a digital graphic novel will be developed/adjusted at each iteration.</p> <p>The process will then recommence from the design and development phase with the newly established guidelines being applied.</p> <p>This evaluation phase will be combined with the evaluation phase in the action research section of this study.</p>
Communication	<p>The guidelines developed as a result of the design science research process will be specified in the <i>Specifying Learning</i> section of the entire study.</p>

2.5 Research plan for this study

This study is structured according to the action research processes proposed by Checkland and Holwell (1998:13) (Figure 2.1) and Baskerville (1999:14) as depicted in Figure 2.2. Figure 2.11 illustrates the manner in which both proposed action research processes are integrated into the study. The action research process as given by Baskerville (1999:14) will be adopted within the research process while the Checkland and Holwell (1998:13) action research process will be incorporated into the study as a whole. As illustrated in Figure 2.11, critical systems heuristics will form the framework of ideas that will guide the research methodologies applied in the study.

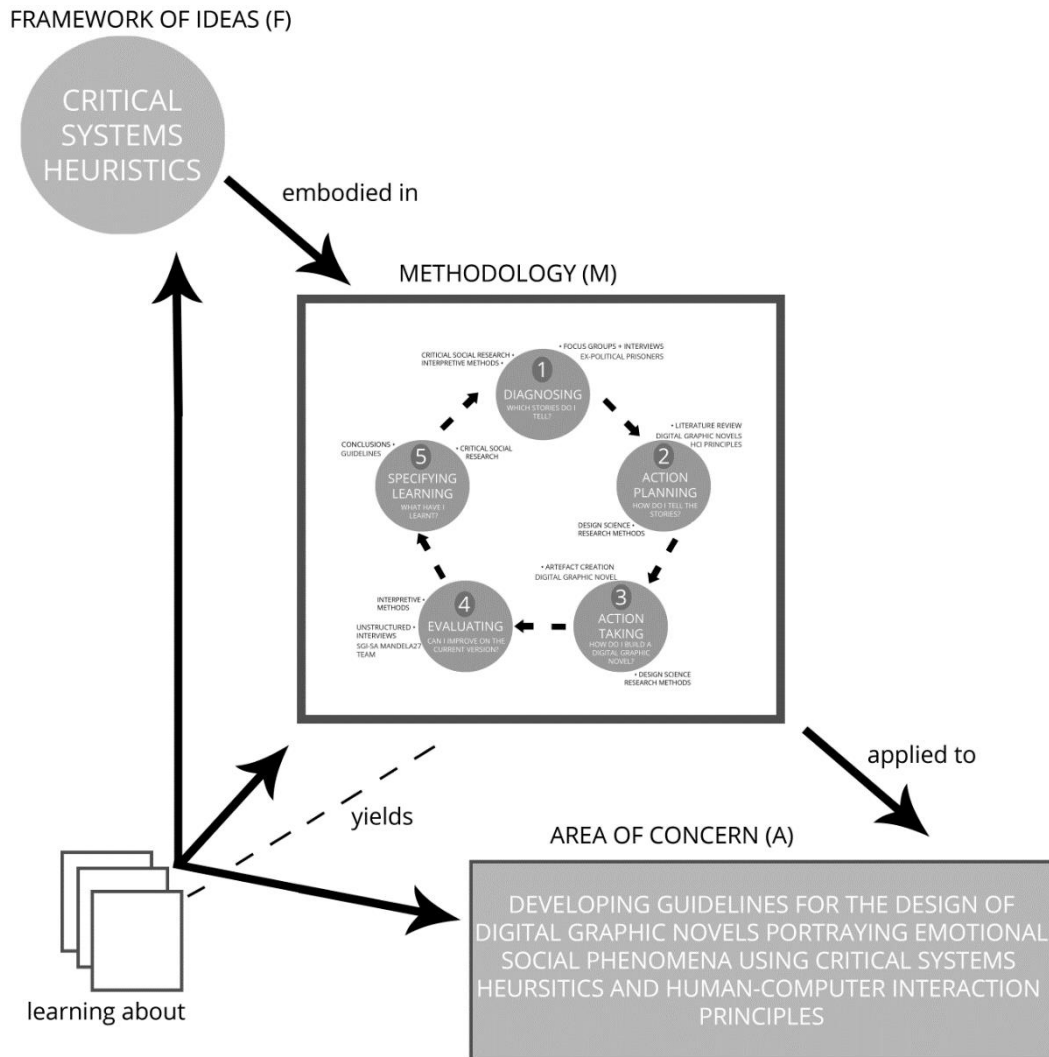


Figure 2.11: Integration of both proposed action research processes in this study.

Design science research and action research will guide the actions that are applied to the area of research – the use of digital graphic novels to portray emotional social phenomena. The research process will be conducted within the aforementioned area of research and will be comprised of the adapted (Figure 2.2) five phases of action research as given by Baskerville (1999:14).

2.6 Ethics adopted in this study

Ethics in research can be defined as applying moral principles ‘in planning, conducting, and reporting the results of research studies. The fundamental moral standards involved focus on what is right and what is wrong’ (McNabb, 2002:36) . In this study,

ethical considerations were taken with regard to both the people directly involved and the researcher.

The ethical considerations of those directly involved in the study were (Oates, 2006:55):

- The right not to participate – should an individual wish not to participate in the study, they will not be forced to. Their decision will be accepted and respected.
- The right to withdraw – if, at any time, an individual becomes uncomfortable, he or she will be allowed to decline to provide an answer or to discontinue his or her participation in the activity.
- The right to give informed consent – participants will only give their consent to participate once they have been made fully aware of both the nature of the research as well as what their involvement will be.
- The right to anonymity – individuals will be granted the right to have their identity and location protected due to the sensitive nature of the subject matter in the interviews and focus groups with ex-political prisoners.
- The right to confidentiality – the participants will be granted the right of having the information provided handled with the utmost of care and not made freely available to others not involved in the study.

The ethical considerations of the researcher in this study were (Oates, 2006:60):

- No unnecessary intrusion – the researcher will not intrude upon the activities of the participants or ask questions that may be seen as offensive.
- Integrity – the researcher will record the information accurately and fully. The information will be stored in a safe and secure location. The researcher will ensure that the information gathered will be used in a manner that will not cause harm.
- Plagiarism – the researcher will not pass off the work of another as her own. Full credit will be given to the author within the references.

2.7 Conclusion

Methodology enhancement will be used in this study. The overall paradigm and methodology of the study will be critical social research theory with techniques from different paradigms being incorporated within the various phases of the research study

structure (see Figure 2.2). A combination of the action research cycle and the design science research process will be implemented. Within the phases of the action research cycle, methods from varying paradigms will be used:

1. Diagnosing – Critical social research using interpretive methods
2. Action Planning – Design science research methods
3. Action Taking – Design science research methods
4. Evaluation – Interpretive methods
5. Specifying Learning – Critical social research

The research methodology has been covered first in order to assist the reader in understanding the structure of the study. The following chapter will focus on critical systems heuristics which is the framework of ideas that will be embodied within the research methodology of the study.

3 Chapter Three: Critical Systems Heuristics

3.1 Introduction

The main goal of this study is to formulate a set of guidelines to aid in the development of digital graphic novels that will be used to portray emotional social phenomena. Critical systems heuristics is used in the formulation of these guidelines. Critical social research, more specifically critical systems heuristics, is used in the *Diagnosing* and *Specifying Learning* stages of this study. In order to discuss critical systems heuristics, critical systems thinking needs to be discussed (Section 3.2). This chapter will start by defining the concept of systems in Section 3.2.1. Here we will discuss the definition of a system and its five components. This is followed by Section 3.2.2 which presents a discourse of systems thinking. Within the discourse, we will cover the adaptive whole (Section 3.2.2.1), the five principles of systems thinking (Section 3.2.2.2), hard systems vs. soft systems (Section 3.2.2.3), and the performance of a system (Section 3.2.2.4). A brief history of the origin of critical theory is then presented by discussing the Frankfurt school in Section 3.2.3. Section 3.2.4 then covers critical social theory which is followed a comparison of rational vs. polemical reasoning in Section 3.2.5. Critical systems heuristics is discussed in Section 3.3 where the concept of boundary judgements is explored in detail. Section 3.4 depicts the researcher's initial answers to the 12 boundary questions discussed in Section 3.3. Finally, the discussion of critical systems thinking ends with a summary of critical systems thinking in Section 3.5 and a conclusion presented in Section 3.6.

Section 3.3 presents the concept of critical systems heuristics and provides the 12 boundary questions as set forth by Ulrich (1987:279). Initial answers to Ulrich's 12 boundary questions are provided in Section 3.4. A summary of critical systems heuristics is then provided in Section 3.5 with the conclusion of the chapter being presented in Section 3.6.

3.2 Systems and systems thinking

In order to understand systems thinking, it is important to understand what is meant by the word 'system'. Ackoff (1971:661) defines a system as a set of interrelated elements. A system can also be defined as a set of components that are combined to

create a complex whole (Checkland, 1997:667). Each individual component of a system works together in order to accomplish a common goal (Churchman, 1968:29). Systems may also be concrete (the human body) or abstract (the education system) (Ackoff, 1971:661). According to Von Bertalanffy (1950:23), a system may be either open or closed. A closed system does not allow any material to enter or leave it. A system can be defined as an open system when it interacts with its environment by receiving an input and rendering an output – e.g. living organisms.

Maturana and Varela (1980:76) challenged Von Bertalanffy's (1950:23) perspective of an open system by placing emphasis on the closed system of interactions that take place within living entities instead of its component parts. The interactions within the system are self-producing in nature and ensure the independence of the system. These systems are called autopoietic and respond to environmental pressures based on their organisational structure and with the goal of maintaining their core organisational identity (Jackson, 2007:7). These state-maintaining systems:

- React in only one way to a certain internal or external events.
- React in different ways to different internal or external events.
- Produce the same internal or external state.

This type of system can also be categorised by the fact that it reacts only to change and that its reaction is governed by the event that brought about its change in state (Ackoff, 1971:665). Another term used to describe systems that use internal adjustments in order to retain their state is homeostatic (Ackoff, 1971:664). A homeostatic system is comprised of a static system that contains both a dynamic environment and dynamic elements (Ackoff, 1971:664).

For the purposes of this study, we will be viewing a system in terms of Churchman's components of a system. Churchman (1968:29) identifies five features that need to be considered when defining a system, these are:

- Objectives
- Environment
- Resources
- Components
- Management

Each of these features plays a key role in the defining of a system, and as such, will be discussed in further detail.

3.2.1 Objectives

The objectives of a system serve as the measure of performance of a system in terms of efficacy (the system does what it is supposed to do), efficiency (the use of resources is optimised), and effectiveness (achieves the higher goals) (Checkland & Scholes, 1999:39). In order to determine whether an objective is a real objective or a stated objective, the researcher must test whether the system will willingly forgo other goals in order to satisfy it (Churchman, 1968:31). Once the real objectives of a system are uncovered, the consequences of the system activities in relation to the objectives can be measured (Churchman, 1968:34).

3.2.2 Environment

The environment of a system is what lies outside the scope of the system and consists of people and things that are fixed or given constraints in terms of the system (Churchman, 1968:34) e.g. the weather and politics. The environment may play a part in determining the performance of a system by exerting external pressure on it (this is discussed further in Section 3.2.2.1). In order to determine whether an aspect is part of the system or the environment, two questions must be asked (Churchman, 1968:36):

- Is there anything that can be done to change it?
- Does it impact the objectives of the system?

If an aspect has an impact on the objectives of a system and nothing can be done to change it, then it is part of the environment.

3.2.3 Resources

Resources exist within a system and are used by the system in order to complete its activities (Churchman, 1968:37). Resources may be in the form of money, equipment, or time. Unlike the environment, resources are aspects that the system is able to alter for its own benefit. In general, the particular actions of a system are shaped by the amount of resources within the system (Churchman, 1968:39).

3.2.4 Components

The particular actions of a system are taken by the components which make up the system (Churchman, 1968:39). Components are identified by deconstructing the tasks that a system needs to perform. Identification of components provides a means to tell whether a system is functioning properly at a specific point in time and what steps need to be followed in order to maintain or increase performance (Churchman, 1968:42). The fundamental aim of component identification is to find components whose performances are directly related to the performance of the system as a whole – i.e. when the performance of a component increases, the performance of the system increases (Churchman, 1968:43).

3.2.5 Management

The management of a system pertains to the formation of strategies for the system (Churchman, 1968:44). These management strategies affect the following features of a system:

- The setting of overall objectives of the system.
- The determining of the environment.
- The allocation of resources.
- The identification and control of components.

Management is not only responsible for defining the plans of a system but also for ensuring that those plans are carried out (Churchman, 1968:45). Evaluation of plans needs to be conducted in the system management with the appropriate changes being made if needed. In order to achieve this, the management aspect of a system needs to obtain information that informs it when there is an error within the system and what can be done to rectify it (Churchman, 1968:46).

The system as a whole is viewed as possessing properties that make it greater than the sum of its parts; these are referred to as emergent properties (Checkland, 1997:667). Emergent properties have no significance in respect of the parts that form the system as a whole. To do systems thinking is to view a problem in terms of emerging properties and other systems properties such as objectives, environment, resources, components and management.

3.2.6 Systems Thinking

Now that the definition and elements of a system have been discussed, we will have a detailed look at the term 'systems thinking'. Checkland (1981:75) defines the term 'systems thinking' as using the concept of a system in order to think about the world outside ourselves. It is therefore the objective of the systems thinker to describe the world outside himself (external world) using systems thinking. This means that the systems thinker views reality and the processes contained within it in terms of whole entities (systems) which he identifies and circumscribes (Checkland, 1981:83).

Checkland and Scholes (1999:25) further define systems thinking as setting "some constructed abstract wholes (often called 'systems models') against the perceived real world in order to learn about it". Checkland (1981:83) states that the systems thinker may also form reality into certain systems according to his own needs. In this study, the researcher has identified and circumscribed reality into certain systems due to her own need to further learn about it. In this section, we will look at some fundamental concepts within systems thinking.

3.2.7 The adaptive whole

Systems thinking is based upon the fundamental idea of the adaptive whole (Checkland, 1997:668). Checkland (1997:668) defines the idea of the adaptive whole as being the concept of a whole entity that exists within a specific environment that is subject to change and may subsequently cause trauma in the system – the adaptive whole adapts to the changes in the environment in order to ensure its survival. As mentioned in Section 3.2.1, a system which reacts to its environment in such a way that is self-producing and autonomous can be considered autopoietic. An autopoietic system only changes its structure with the goal of maintaining its core organisational identity (Jackson, 2007:7). The adaptive whole can therefore also be referred to as being autopoietic or homeostatic (see Section 3.2.1).

Checkland (1997:668) states that four primary concepts need to be present before a system can be described as an adaptive whole:

1. Emergent properties – the system contains properties that exist only when all its components are joined together.

2. Layered structure – the system contains sub-systems which themselves function as whole systems.
3. Communication processes – processes that enable the system to perceive changes in the environment.
4. Control processes – processes that aid the system in responding through means of a control action.

A fundamental aspect of systems thinking is the cognisant utilisation of systems concepts (such as the adaptive whole) in order to understand phenomena or to direct intervention that is aimed at bringing about improvement within an environment (Checkland, 1997:669).

3.2.8 Five principles of systems thinking

Gharajedaghi (1999:29) states that there are five principles that need to be comprehended in order to truly grasp a systems thinking mind-set. These five principles are:

- Openness
- Purposefulness
- Multidimensionality
- Emergent properties
- Counterintuitiveness

In the case of an open system, openness refers to the fact that a system can only be understood relative to its environment (Gharajedaghi, 1999:30). A system can be differentiated from its environment by observing the variables surrounding it. Variables that influence the system and can be controlled by it belong to the system. Variables that influence the system but cannot be controlled by it belong to the environment. A variable can be controlled by the system if the system can manipulate it for the benefit of the system. A variable is influenced if the system can only partially manipulate it – i.e. the system does not solely dictate the actions of the variable. ‘Influenced’ variables form part of what Gharajedaghi (1999:31) refers to as the ‘transactional environment’.

Purposefulness seeks to answer the ‘why’ question in a system (Gharajedaghi, 1999:33). In order to fully understand a system, one has to ask why certain things

operate the way they do. A purposeful system can yield the same results in different environments – e.g. human body temperature remains relatively constant at varying external temperatures. However, it is also capable of delivering varied results in the same or alternate environments – e.g. a runner with an injured foot will not train. These qualities are due to the fact that purposeful systems contain both state-maintaining and goal-seeking properties (Gharajedaghi, 1999:37).

Multidimensionality deals with the ability to observe complementary relationships between opposing properties of a system and to form viable whole system components from these impractical parts (Gharajedaghi, 1999:38). An example can be made of a runny nose. Although the properties of a runny nose are unpleasant, they are also intertwined with the body's attempt to rid itself of foreign substances. Thus, the 'opposite' properties of discomfort and health form a complementary relationship within this circumstance.

Emergent properties, as previously mentioned, are the properties of the whole that cannot be inferred from the individual properties of the parts (Gharajedaghi, 1999:44). Checkland (1981:3) notes that the concept of a 'system' comprises a set of elements which are connected together in order to form a whole, and this whole possesses properties that are unique to itself and are not merely properties of its individual elements. Emergent properties of a system are therefore greater than the sum of the properties of the individual components (Checkland, 1997:667). In essence the focus on the 'whole-system' within systems thinking can be attributed to the concept of emergence. We can conclude this by considering a statement made by Ackoff (1971:661), the "systems approach to problems focuses on systems taken as a whole, not on their parts taken separately". Ackoff (1971:661) states that certain properties of systems can only be properly considered when observed from a holistic point of view.

Counterintuitiveness refers to the outcomes of certain actions being opposite to their intended outcomes (Gharajedaghi, 1999:48). For example, dropping the required pass rate so that more learners progress to the next level may aid in the short-term statistics of learners who complete the curriculum, however, this inevitably leads to a significantly ignorant generation. Gharajedaghi (1999:49) states that the ramifications of the following statements need to be comprehended in order to understand counterintuitiveness:

- Time and space may separate cause and effect. An incident at a specific time and place may have a delayed effect that will take place in a different time and place.
- Circular relations may occur where cause and effect replace each other.
- Multiple effects may result from a single cause. As time passes, the order of importance may shift.
- Although certain variables originally yielded a specific effect, at a different time, different variables may be used to yield the same effect. This means that removing the original cause of the effect will not necessarily result in removing the odds of the effect taking place.

Each of the preceding principles aid in developing the other. For example, once a systems thinker masters the principle of purposefulness, it is easier to look for multidimensional relationships between components that work together in order for the system to achieve its ultimate goal. The five principles of systems thinking are a great aid in order to get into a 'systems thinking' mind set (Gharajedaghi, 1999).

3.2.9 Hard vs soft systems

Systems thinking can be categorised into two types – hard systems thinking and soft systems thinking. Hard systems thinking is applied to practical problems where an objective (or objectives) can be identified. A system is then constructed in order to achieve the pre-determined objective (Checkland, 1981:138). Hard systems thinkers believe that every practical problem can be represented by a current state and a desired state with multiple ways of progressing from the current state to the desired state. The hard systems thinker needs to define both the current and desired states and then attempt to find the best alternative to get from the former to the latter (Checkland, 1981:138). Suffice to say, within hard systems thinking, it is believed that the world consists of systems that can be manipulated to work efficiently (Checkland, 1997:669). Engineers make use of hard systems thinking due to the fact that in their field, they are presented with a problem which they need to solve through the creation of a reliable, efficient system (Checkland, 1981:146). Hard systems thinking has a tendency of neglecting the human aspect of systems in that it considers people as components that can be engineered rather than actors whose support needs to be acquired in order to implement a solution and attain the final goal (Jackson, 2007:62).

Unlike goal-driven hard systems thinking, soft systems thinking is a process of inquiry (Checkland, 1997:669). There are not pre-defined objectives or a structured problem statement. These unstructured problems are called soft problems (Checkland, 1981:146). Soft problems cannot be represented as an endeavour to achieve a pre-defined desired state in the most efficient way possible. In fact, the end states or purposes of the problem are problematic themselves Checkland (1981:316). Given the fact that, in soft systems, it is not evident that a system needs to be engineered, the analysis of the system should entail defining a range of systems that could contribute towards the improvement of the problem situation (Jackson, 2007:183). Each proposed system should voice a unique worldview (*Weltanschauung*). This means, that in soft systems, a number of different models are constructed to compare to the real world as opposed to merely the single model used in hard systems (Jackson, 2007:183). The models used in soft systems represent 'human activity systems'. Jackson (2007:183) defines a human activity system as "a model of a notional system containing the activities people need to undertake in order to pursue a particular purpose".

When selecting a name of a relevant system in soft systems, it is important to formulate an appropriate name. The chosen name of a system will serve as a 'root definition' as it represents the fundamental purpose of the modelled activity system (Checkland & Scholes, 1999:33). The fundamental purpose of a modelled activity system is always represented by a transformation process where a certain entity (input) is transformed into a new version of the same entity (output) (Checkland & Scholes, 1999:33). In order to formulate an appropriate root definition, the mnemonic CATWOE can be used (Checkland & Scholes, 1999:35):

- C** – Customers: the victims or beneficiaries of the transformation process.
- A** – Actors: those who would do the transformation process.
- T** – Transformation process: the conversion of input to output.
- W** – *Weltanschauung*: the worldview that makes the transformation process meaningful within context.
- O** – Owners: those who could stop the transformation process.
- E** – Environmental constraints: elements that exist outside the system taken as given.

Within soft systems, the focus of the researcher is to construct the richest picture possible in terms of the problem situation rather than trying to mould it into various systems models (Jackson, 2007:183). Checkland and Scholes (1999:45) advocate literally drawing rich pictures, as they believe that human interactions are made up of rich relationships and connections that are better represented graphically rather than in written form. Figure 3.1 is an example of a rich picture.

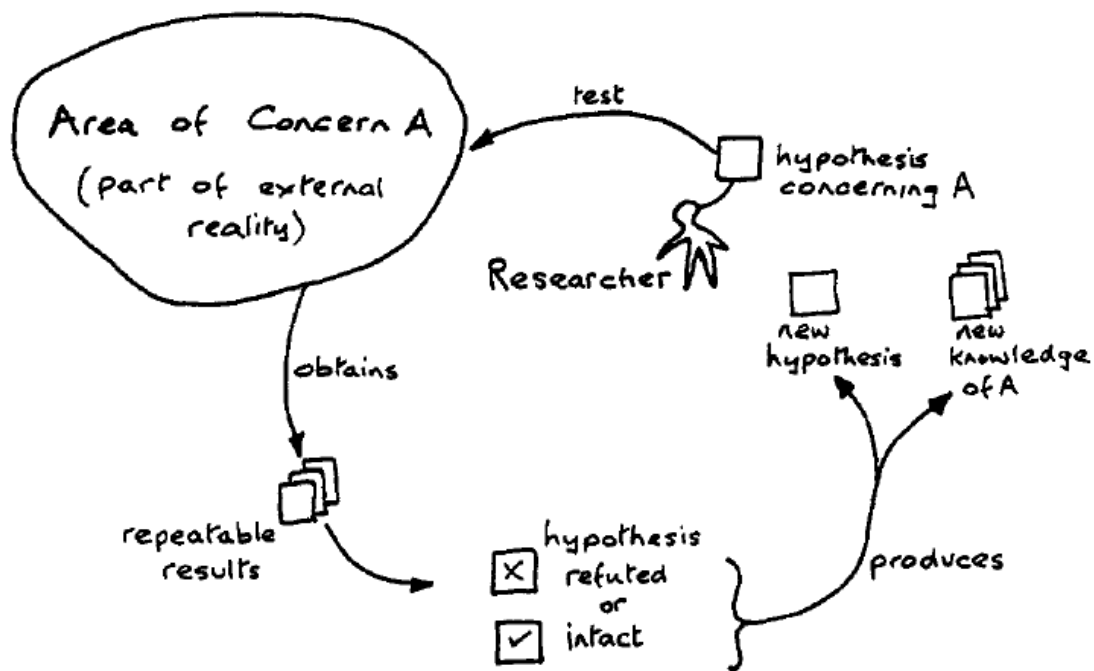


Figure 3.1: Example of a rich picture depicting the hypothesis testing research process of natural science (Checkland & Holwell, 1998:12)⁸.

In summary, the fundamental difference between hard systems thinking and soft systems thinking lies in the fact that hard systems thinkers are of the opinion that they can understand the real world in terms of a system as a whole and can engineer that system in order to achieve their desired objectives. Soft systems thinkers, however, are of the opinion that they cannot understand the real world as a whole system, but can rather discover a method in which the limitations of their individual perspectives can be recognised and integrated within their decision making process (Checkland & Scholes, 1999:A10). To suffice, the hard systems thinker views the world as systemic,

⁸ Checkland intended for his 'rich pictures' to be displayed as is. Therefore, they have not been altered to fit into the format of the other images in this dissertation.

while the soft systems thinker views the process of inquiry as systemic (Checkland & Scholes, 1999:A11). Figure 3.2 is a graphical representation of the distinction between the two systems thinking stances.

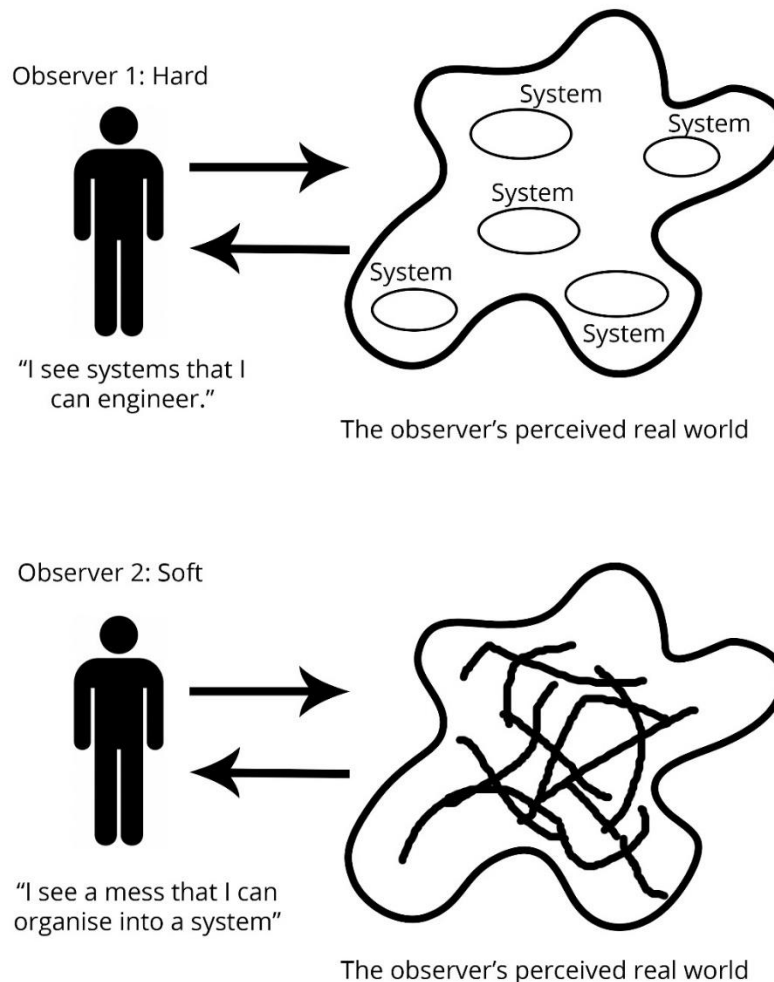


Figure 3.2: Hard vs soft systems perspectives adapted from Checkland and Scholes (1999:A11).

3.2.10 Performance of a system

Soft systems methodology provides criteria against which the transformation of input into output can be judged (Checkland & Scholes, 1999:288). The three E's (discussed in Section 3.2.1.1) can be expanded to include two more E's – namely ethicality and elegance (Checkland & Scholes, 1999:288). The 5 E's used to determine the performance of a system can then be defined as:

- Efficacy – Does the means of transformation of input to output work? In other words, is the input entity of the system successfully transformed into a new output entity?
- Efficiency – Is the minimal amount of resources necessary for the transformation used?
- Effectiveness – Does the transformation process aid in the acquisition of longer-term goals which are related to the owner's expectations?
- Ethicality – Is the transformation of the input entity into the output entity a moral process?
- Elegance – Is the transformation process aesthetically pleasing?

By determining the answers to the aforementioned questions, the soft systems thinker is able to measure the performance of the identified system and make the necessary adjustments in order to achieve optimal performance of a system as whole.

3.2.11 Frankfurt school

Before critical social theory is discussed, a brief history of critical theory will be covered. This brief history will cover the origins of critical theory and highlight a few key members of the field and their contributions towards the methodology.

In the period between the two world wars, the founders of the Frankfurt School endeavoured to attain a unity of both theory and practice and theory and empirical research (Calhoun, 1995:13). It was the ambition of the founders of the Frankfurt School to achieve both aforementioned unisons while maintaining a historically grounded awareness of the political, cultural, and social problems of the age (Horkheimer, 1972:230).

The founders of the Frankfurt School included Theodor Adorno, Leo Lowenthal, Franz Neumann, Herbert Marcuse, Friedrich Pollock, Erich Fromm and the leader of the group, Mark Horkheimer (Calhoun, 1995:14). The members of the Frankfurt group aspired to differentiate critical theory from traditional theory. They noted that traditional theory failed to observe how categories in the consciousness of people were moulded and how these categories affected their outlook and what they believed to be possible (Horkheimer, 1972:230).

However, it was not one of the founding members of the Frankfurt School who made the biggest impact in the field of critical theory, but rather, a protégé of Theodor Adorno, Jürgen Habermas (Calhoun, 1995:29). Habermas developed a whole new approach to critical theory around the 1960s (Gutting, 2005:13). In his approach, Habermas agrees with the founders of the Frankfurt school. He maintains that modern deployments of reason inhibit human freedom and undermine values by limiting the scope of rationality to the means and ends of reasoning as found in empirical science, instead of including other forms of reason such as the understanding of hermeneutics (Gutting, 2005:13). According to Habermas, the ultimate purpose of philosophy is to provide a foundation for human values and restore freedom through an all-encompassing description of rationality (Gutting, 2005:14). Habermas (2005:310) states that “the only knowledge that can truly orient action is knowledge that frees itself from ideas”. Habermas’ approach is based on the assumption that – in principle – all differences can be resolved by means of rational discourse (Calhoun, 1995:33).

Although they made a significant contribution to the field, one cannot limit the field of critical theory solely to the members of the Frankfurt school. There were many other theorists who had no ties with the Frankfurt school and yet managed to make significant contributions to the field of critical social theory (Calhoun, 1995:34).

3.3 Critical Social Theory

Calhoun (1995:35) suggests that critical social theory should not be seen as merely a ‘school’, but rather a body of work which both produces and demands critique in four different areas:

1. A theorist engages critically with his environment with the understanding that the current state of affairs does not provide a representation of all possibilities and offers the positive implications of social action.
2. The theorist’s own cognitive processes depend on the critical account of the cultural and historical conditions in both personal and social terms.
3. The theorist constantly conducts a critical re-examination of his understanding in terms of categories and conceptual frameworks, including how those frameworks were formed.

4. The theorist takes a critical look at other social explanations in order to identify their pros and cons, and establishes reasons for areas in which they fall short and misunderstandings they contain. Once done, the theorist reveals how their insights can be incorporated in a more solid foundation.

Calhoun (1995:35) also notes that all the aforementioned areas of critique contain a need for historical analysis and understanding. In the first point, the world is 'denaturalised' by viewing the world as a result of some human actions among varying possibilities. In order for a theorist to engage critically with his environment, the environment needs to be explained in terms of its important features which will allow practical action to take place among other activities perceived as being normal within the environment (Calhoun, 1995:35). In the second point, the theorist is required to provide accomplishments, social formation and historical background that contributed toward his theoretical outlook (Calhoun, 1995:35). In the third point, the theorist is required to perform a historical analysis with which he views the manner in which certain notions tend to take on particular significance that is embedded within his view of the world in both experience and practice (Calhoun, 1995:36). Finally, in the fourth point, the theorist is required to critically examine past philosophies, not as references of insight, but rather as historical compositions that are different from his own (Calhoun, 1995:36).

3.3.1 Rational vs. polemical reasoning

Werner Ulrich, the founder of critical heuristics, maintains that polemic reasoning, rather than rational reasoning, is needed in dealing with social situations which contain both involved and affected parties (Ulrich, 1987:277). Rational reasoning is based on deductive logic and the empirical verification or contradiction of facts by the involved party (Ulrich, 1987:277). Polemic reasoning seeks to understand the meaning behind the viewpoints of both the involved and affected parties in regard to what they believe to be 'right' in a given situation (Ulrich, 1987:277).

Ulrich (1987:277) maintains that the problem with rational reasoning is that the founding philosophers, such as Habermas, developed 'ideal' models of rational discourse that are impractical. These 'ideal' models are based on the premise that all participants within a discourse are willing and able to make coherent arguments and

then rely only on the force of the superior argument to decide the outcome (Ulrich, 1987:277).

Finally, Ulrich (1987:277) states that his main concern with the 'ideal' models of rational reasoning is that they do not take account of justification break-offs. In other words, every argument that is formulated begins and ends with some form of judgements, and the justification of these judgements need to remain up for debate – this is not provided for in rational reasoning (Ulrich, 1991:104).

3.4 Critical Systems Heuristics

According to Ulrich (2002:72) critical systems thinking can be defined by three commitments – critique, emancipation and pluralism.

Within the commitment of critique, critical systems thinking undertakes the continuous endeavour of attempting to uncover hidden assumptions nestled within the seemingly unbiased opinions of different schools of thought. It achieves this by “questioning the methods, practice, theory, normative content and rationality of all schools of thought” (Schechter, 1991:213). The commitment of critical systems thinking to emancipation is focused on the full development of a person as an individual. This is achieved through the equal and free participation of the individual with other individuals in a community (Schechter, 1991:213). The commitment to emancipation also assists in the identifying of unequal power relations and boundary judgements (see Section 3.3), which are in turn incorporated within the further understanding of the identified problem area as a system (Schechter, 1991:214). Finally, the commitment to pluralism maintains that not one single approach to systems thinking is the best, and that therefore, there is no single school of thought that is able to cater to the needs of the entire spectrum of problem situations (Schechter, 1991:214). The commitment to pluralism is in fact a commitment that seeks to integrate the different approaches to systems thinking in a broad framework of interaction (Schechter, 1991:214).

There are two schools of critical systems thinking. One school is that of Hull University's Flood and Jackson (1991) while the other is that of Ulrich (1987) and critical systems heuristics. This study focuses on critical systems thinking as per Ulrich.

Critical systems heuristics was conceived by Werner Ulrich (1987:277) in order to assist involved and affected parties in dealing with justification break-offs in terms of their a priori judgements. Ulrich (1987:277) calls these judgements 'boundary judgements' because they define the boundaries of the reference system against which a person validates his arguments (Ulrich, 2002:72). Boundary judgements determine the 'facts' and 'values' of a person and as such, have a vital role in determining the meaning behind and merits of an argument (Ulrich, 2005:2). Ulrich (2005:2) states that in order to achieve productive communication, it is vital to clarify, both with ourselves and other involved parties, which reference system is assumed in a particular discussion.

Critical systems heuristics can be viewed as the first systematic attempt to provide a philosophical foundation and a practical framework for critical systems thinking (Ulrich, 2002:72). Ulrich (2002:73) defines critical systems heuristics as 'a critical methodology for identifying and debating boundary judgements'. To achieve this end, critical systems heuristics requires 3 requisites to be essential (Ulrich, 1987:277):

1. To impart a clear understanding of the meaning, inevitability, and critical significance of justification break-offs.
2. To provide a conceptual framework that can be used by involved and affected parties in order to justify break-offs and boundary judgements.
3. To offer a tool for convincing argumentation to all parties.

Critical systems heuristics supports boundary critique or the 'systematic effort of handling boundary judgements critically' (Ulrich, 2005:3). Boundary critique can either be applied in terms of dealing with one's own boundary judgements (reflective practice) or with the boundary judgements of others who are not self-reflective (emancipatory practice) (Ulrich, 2005:3). The systematic process of boundary critique contains the following responsibilities (Ulrich, 2005:4):

1. The need to identify what determines the condition of a specific claim by distinguishing the underlying boundary judgements.
2. The need to examine the underlying boundary judgements and their implications in terms of practical and ethical considerations.

3. The need to obtain alternatives for determining which reference system conditions a claim by providing alternative answers to boundary questions.
4. The need to acquire mutual understanding between all stakeholders in terms of the difference between each of their reference systems.
5. In the event that some stakeholders either take their boundary judgements for granted or attempt to force them upon others, the need to challenge their claims may arise.

There is no technique that can provide a means of deciding exactly which boundary judgement is right or wrong; each answer will depend heavily upon the interests, views and value assumptions of an individual (Ulrich, 2002:72). As a result of this, it is vital to use a critical approach in order to reflect and debate the differing assumptions of individuals (Ulrich, 2002:72).

As mentioned in the responsibilities of boundary critique, it is necessary to examine underlying boundary judgements and how they affect both the facts and values of an individual (Ulrich, 2005:6). Critical systems heuristics provides for this by making use of the 'eternal triangle' (Ulrich, 2000:6). When a problem definition or solution or any other claim with practical intent is raised, the relevance of selected facts are differentiated from others. The values and facts that are considered are directly related to the reference system used. When the facts, values or reference system changes, the remaining two are also changed. This makes up the 'eternal triangle'. In critical systems heuristics, the process of thinking about a situation through the 'eternal triangle' is called systemic triangulation. The eternal triangle is graphically represented in Figure 3.3.

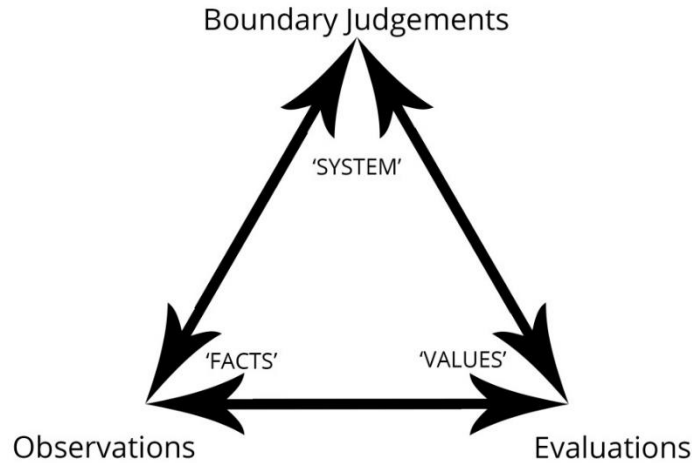


Figure 3.3: The 'eternal triangle' of boundary judgements, facts, and values (Ulrich, 2000:6).

A boundary category is a form of boundary judgement that determines the normative and empirical selectivity of a claim (Ulrich, 2005:7). In order for a boundary category to prove useful, it is necessary to both empirical (facts) and normative (values) content (Ulrich, 2005:7). Normative selectivity statements suggest which facts should be considered as relevant and which facts should not, while empirical selectivity states which facts are actually present in the selected system (Ulrich, 2005:7). Cross-tabulating the different forms of selectivity against the facts and values of a system provides four perspectives that are needed in examining selectivity (Ulrich, 2005:8).

Table 3.1: Four perspectives for examining selectivity (Ulrich, 2005:8).

Perspective	Empirical selectivity (‘is’ mode)	Normative selectivity (‘ought’ mode)
‘Facts’	Actual mapping: What facts are considered relevant and which ones are left out?	Ideal mapping: What facts ‘ought’ to be considered relevant and which ones should be left out?
‘Values’	Actual mapping: What values are considered relevant and which ones are left out?	Ideal mapping: What values ‘ought’ to be considered relevant and which ones should be left out?

By looking at Table 3.1, it is evident that in order to account for empirical selectivity, the assumptions of the facts and values that are present need to be considered. Similarly, in accounting for normative selectivity, the assumptions of the facts and values that ought to be present is considered (Ulrich, 2005:8).

Ulrich (2005:9) further defines four boundary issues that are vital to reflective practice in situations that involve intervention, problem solving or decision making. The boundary issues play a crucial role, because if they are not considered, the meaning and validity of a claim cannot be recognised (Ulrich, 2005:9). The four boundary issues are (Ulrich, 2005:9):

- Basis of motivation – Where does the sense of purposefulness and value come from?
- Basis of power – Who is in control of what is going on and what is needed for success?
- Basis of knowledge – What experience and expertise support the claim?
- Basis of legitimacy – Where does the legitimacy lie?

Critical systems heuristics claim that the answers to the four boundary issues determine the ‘anatomy of purposefulness’ of a claim and are therefore necessary to determine in order to perform reflective practice in most situations (Ulrich, 2005:9). If the four boundary issues are not taken into consideration, the meaning of a claim can

never be fully understood and its validity or basis for action cannot be determined (Ulrich, 2005:9). Ulrich (2005:9) further states that the meaning of a claim is linked to the manner in which it modifies our viewpoint on certain issues, on what we believe, and on the actions that we determine to be both ethical and rational.

Ulrich (2005:9) assigns three categories to each of the basic boundary issues:

- Stakeholders – the people who are involved or affected in a particular situation.
- Concern – the concern of the stakeholder.
- Difficulty – the difficulties that arise with regard to the identified concerns of the stakeholder.

Ulrich (2000:256) devised a table of boundary categories that links each of the boundary issues to each of the three categories of boundary issues. The table of boundary categories is shown in Figure 3.4.

Boundary categories		Boundary issues		
1. Client 2. Purpose 3. Measure of improvement	}	Sources of motivation	}	Those involved Those affected
4. Decision-maker 5. Resources 6. Decision environment	}	Sources of power	}	
7. Professional 8. Expertise 9. Guarantee	}	Sources of knowledge	}	
10. Witness 11. Emancipation 12. World View	}	Sources of legitimation	}	

The reference system (system of concern) that determines what observations ("facts") and evaluations ("values") are considered relevant when it comes to assessing the merits or defects of a proposition.

Figure 3.4: Table of boundary categories (Ulrich, 2000:256).

Another way to represent and use the boundary categories is by transforming them into a checklist of 12 critical boundary questions. These critical boundary questions can be used in three ways (Ulrich, 2002:72):

- To systematically identify boundary judgements.
- To evaluate alternative reference systems that can be used to define a problem situation or to assess a potential solution proposal.
- To compellingly challenge any claims that depend on hidden boundary judgements or take them for granted.

By providing a means of challenging claims based on hidden boundary judgements, critical systems heuristics offers an emancipatory application of systems thinking. This is due to the fact that both those affected and those involved in a certain situation are given a level of critical competence which enables them to take part in polemical reasoning regardless of their levels of expertise or knowledge (Ulrich, 2002:72). The 12 boundary questions are listed in Table 3.2.

Table 3.2: Checklist of 12 boundary questions (Ulrich, 1987:279).

Boundary Questions
Sources of Motivation
<i>Who ought to be the client (beneficiary) of the system S to be designed or improved?</i>
<i>What ought to be the purpose of S, i.e., what goal states ought S be able to achieve to serve the client?</i>
<i>What ought to be S's measure of success (or improvement)?</i>
Sources of Control
<i>Who ought to be the decision taker, that is, have the power to change S's measure of improvement?</i>
<i>What components (resources and constraints) of S ought to be controlled by the decision taker?</i>
<i>What resources and conditions ought to be part of S's environment, i.e., should not be controlled by S's decision taker?</i>
Sources of Expertise
<i>Who ought to be involved as designer of S?</i>
<i>What kind of expertise ought to flow into the design of S, i.e., who ought to be considered an expert and what should be his role?</i>
<i>Who ought to be the guarantor of S, i.e., where ought the designer seek the guarantee that his design will be implemented and will prove successful, judged by S's measure of success (or improvement)?</i>
Sources of Legitimation

Boundary Questions
<i>Who ought to belong to the witnesses representing the concerns of the citizens that will or might be affected by the design of S? That is to say, who among the affected ought to get involved?</i>
<i>To what degree and in what way ought the affected be given the chance of emancipation from the premises and promises of the involved?</i>
<i>Upon what world-views of either the involved or the affected ought S's design be based?</i>

The 12 boundary questions will be applied throughout this study in order to determine the underlying boundary judgements of the both those involved and affected by the study.

3.5 Initial answers to the 12 boundary questions

The initial answers to the 12 boundary questions represent the researcher's perspective of the study as a whole. By identifying the boundary judgements held by the researcher, the study can be conducted in a fair and unbiased manner. Table 3.3 displays the researcher's initial answers to the 12 boundary questions.

Table 3.3: Initial answers to the checklist of 12 boundary questions as given by Ulrich (1987:279).

Boundary question and answers	Research Phase
Sources of Motivation	
<i>Who ought to be the client (beneficiary) of the system S to be designed or improved?</i>	
Ex-political prisoners of Robben Island Prison.	Diagnosis Action Planning
Young adults between the ages of 16 – 25 years of age.	Action planning Evaluation
<i>What ought to be the purpose of S, i.e., what goal states ought S be able to achieve so as to serve the client?</i>	
The fair portrayal of the experiences of the ex-political-prisoners in Robben Island Prison.	Diagnosis Action Planning
An exciting medium through which to learn about emotional social phenomena.	Action Planning Action Taking

Boundary question and answers	Research Phase
The formulation of design guidelines for the development of digital graphic novels that portray emotional social phenomena.	Specifying Learning
<i>What ought to be S's measure of success (or improvement)?</i>	
The degree to which the portrayal of the experiences of the ex-political-prisoners are fairly related.	Diagnosis
The level of satisfaction of the readers.	Evaluating
The appropriate application of CSH and HCI principles in the development of a digital graphic novel so as to both correctly portray emotional social phenomena and to provide an engaging medium through which readers can learn about emotional social phenomena.	Action Planning Action Taking
Sources of Control	
<i>Who ought to be the decision taker, that is, have the power to change S's measure of improvement?</i>	
A representative of ex-political-prisoners.	Diagnosis
The representative of the Mandela27 project team.	Evaluation
The researcher.	All Phases
<i>What components (resources and constraints) of S ought to be controlled by the decision taker?</i>	
The recommendations for the content for the storyline of the digital graphic novel.	Diagnosis
The overall look-and-feel of the digital graphic novel, the content of the storyline as well as the implementation of the design.	Evaluation
The design of the digital graphic novel as a whole. This includes the co-ordination of the programming, artwork, sound recordings, project management and storyline.	All Phases

Boundary question and answers	Research Phase
<i>What resources and conditions ought to be part of S's environment, i.e., should not be controlled by S's decision taker?</i>	
The time period being addressed in the storyline.	Diagnosis
The accounts given by the ex-political-prisoners.	Diagnosis
The Mandela27 project deadlines.	Action Planning
Sources of Expertise	
<i>Who ought to be involved as designer of S?</i>	
The researcher will be involved by incorporating the ideas of the clients.	Action Planning Action Taking Evaluation
<i>What kind of expertise ought to flow into the design of S, i.e., who ought to be considered an expert and what should be his role?</i>	
Storyboarding – The researcher	Diagnosis
Programming – Programmer (SGI-SA ⁹)	Action Taking
HCI principles – HCI Scholar and researcher	Action Planning
Artwork – Art student (VUT ¹⁰)	Action Taking
Historical Consultant (RIM ¹¹)	Diagnosis
Project Co-ordination and Management – the researcher	All Phases
<i>Who ought to be the guarantor of S, i.e., where ought the designer seek the guarantee that his design will be implemented and will prove successful, judged by S's measure of success (or improvement)?</i>	
In terms of critical systems heuristics, the means and not only the ends provide the guarantee for the inclusion of all affected parties.	
The guarantee that the design will be implemented and distributed will be offered by the Mandela27 project team.	Action Taking
On the correct use of CSH to accurately relay the experiences of the ex-political-prisoners.	Diagnosis

⁹ SGI-SA – Serious Games Institute – South Africa

¹⁰ VUT – Vaal University of Technology

¹¹ RIM – Robben Island Museum

Boundary question and answers	Research Phase
The appropriate application of HCI principles in order to provide an engaging medium through which users can learn about emotional social phenomena.	Action Planning Action Taking Evaluation
The social relevance of the subject matter.	Diagnosis
The renewed popularity of comic books (medium).	Action Planning
Sources of Legitimation	
<i>Who ought to belong to the witnesses representing the concerns of the citizens that will or might be affected by the design of S? That is to say, who among the affected ought to get involved?</i>	
The historical consultant representing the ex-political prisoners who served time in Robben Island Prison during the specified time period.	Diagnosis
Representative of ex-political prisoners incarcerated in the general cells.	Diagnosis
Representative of ex-political prisoners incarcerated in the maximum security section.	Diagnosis
The readers at whom the digital graphic novel is aimed (individuals between the ages of 16 and 25).	Evaluation
<i>To what degree and in what way ought the affected be given the chance of emancipation from the premises and promises of the involved?</i>	
The ex-political-prisoners will have their stories accurately portrayed through the storyline of the digital graphic novel.	Diagnosis Action Planning
The users will receive an engaging medium that provides a larger enjoyment factor than the use of mere textbooks or the plain printed word.	Action Planning Action Taking Evaluation

Boundary question and answers	Research Phase
<i>Upon what world-views of either the involved or the affected ought S's design be based?</i>	
The Mandela27 project will tell ex-political-prisoners' stories to the world.	All phases
Youth want to learn about historical events in an engaging way.	
Digital graphic novels may be used in the education of young people regarding emotional social phenomena.	

3.6 Reflection of Critical Systems Heuristics applied to this study

The researcher chose to approach the selected problem area for this dissertation in terms of systems thinking. Upon further inspection, it becomes evident that the selected problem area cannot be observed as a definite system, but rather the process of inquiry into the selected problem area can be viewed as systemic. As a result, soft systems thinking will be applied to the study. By applying soft systems thinking, the researcher is able to view the problem area in terms of the limitations of the perspectives of all individuals who are involved and affected within the scope of the study and subsequently incorporate their opinions into the decision making process. In order to achieve a fair representation of the opinions and concerns of both the involved and affected parties, critical systems heuristics will be applied in the *Diagnosing* phase of the study in order to determine the boundary judgements of the researcher before the study is conducted. The focus groups and interviews held with the ex-political prisoners of Robben Island Museum will then also be observed in terms of critical systems heuristics so as to isolate core values that they deem necessary to be included within the proposed digital graphic novel.

3.7 Conclusion

Systems thinking will be used to observe the selected problem area of this study. The soft systems approach, and more particularly, critical systems heuristics will serve as the framework of ideas that will be embodied within the research methodology of the study. Figure 3.5 is a graphical representation of the role of critical systems heuristics

within this study. Critical systems heuristics will serve as the framework of ideas that will guide each phase of the action research cycle adopted in this study.

Digital graphic novels will be discussed in the following chapter.

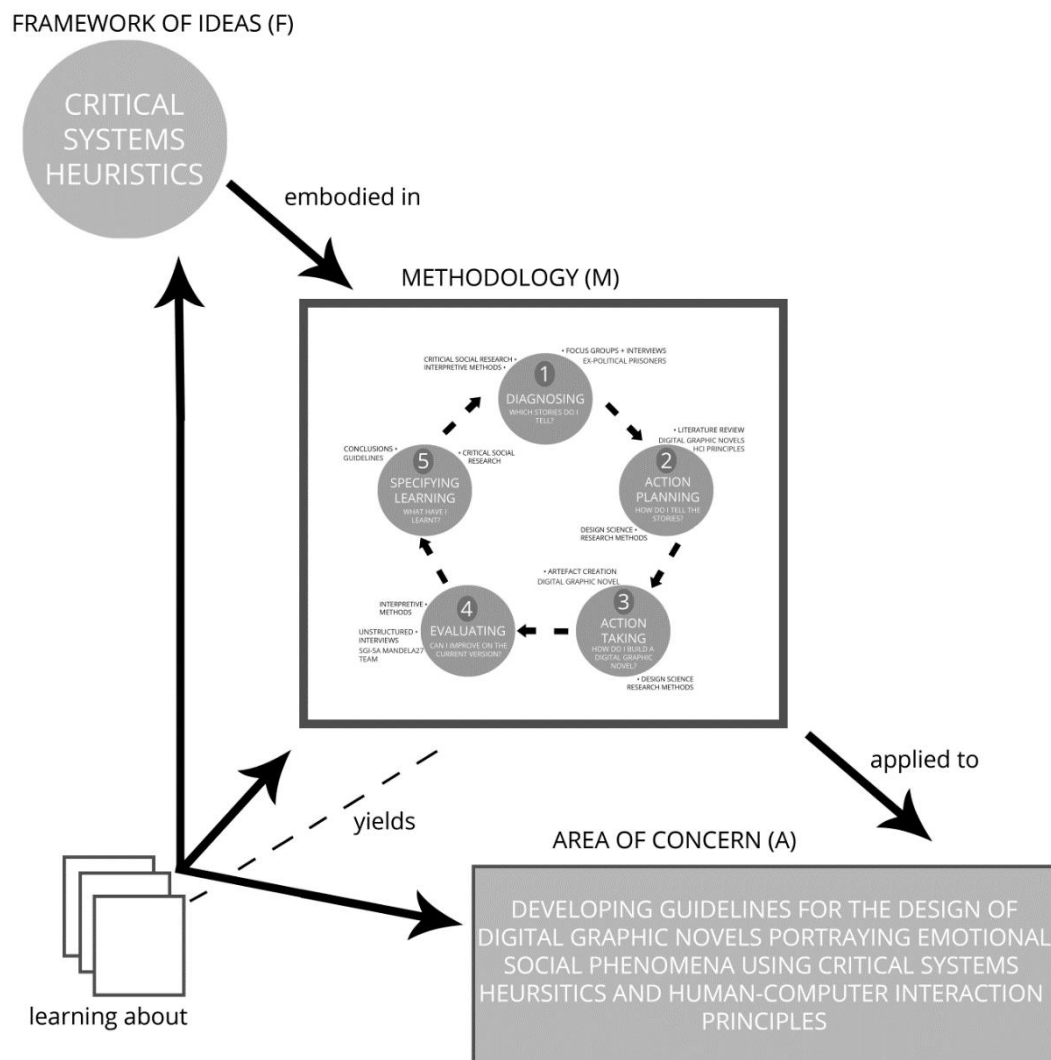


Figure 3.5: Adaptation of elements relevant to any piece of research (Checkland & Holwell, 1998:13).