ACTION RESEARCH OR DESIGN SCIENCE RESEARCH AS METHODOLOGY FOR THE DEVELOPMENT OF A HISTORICAL DIGITAL GRAPHICAL NOVEL? A CRITICAL SYSTEMS PERSPECTIVE

Diane-Lee Pretorius
North-West University, Vanderbijlpark, South Africa, 22458603@nwu.ac.za

Roelien Goede
North-West University, Vanderbijlpark, South Africa, roelien.goede@nwu.ac.za

JT Terblanche
North-West University, Vanderbijlpark, South Africa, jt.terblanche@nwu.ac.za

ABSTRACT

The legacy of Nelson Mandela is part of the lives of most South Africans. His story inspires South Africans and people around the globe to forgive and work hard to achieve freedom from oppression and poverty. For this reason, we need to keep his story alive and teach young people about the sacrifices he made to achieve his goals. Funded by an international consortium, a project called Mandela27 was launched to educate people around the world on the life of Nelson Mandela. Part of the project involved the development of a digital graphical novel depicting life in the prison where he served a 27 year sentence.

This paper investigates action research and design science as design methodologies for the development of the digital graphical novel. The development of the digital graphic novel was commissioned to the Serious Games Institute of South Africa (SGI-SA) based at the North-West University. A serious game is a computer game that aims not only to provide entertainment but also to provide an educational experience to the user.

The SGI-SA often uses design science research as research methodology when developing games. Design science research (DSR) is a methodology used mostly by engineers to develop artefacts. DSR aims to provide scientific rigour in the process of designing, developing, and evaluating artefacts. Its epistemological stance is that knowledge is created through the making of an artefact and evaluating the success thereof. Many different approaches are documented but most often the following cyclic phases are proposed: Awareness of the problem, suggestion of possible solutions, development, evaluation of artefact, and conclusion.

Since these phases are comparable with typical AR phases (diagnosis, action planning, action taking, and specifying learning) the developers of the digital graphic novel had to reflect carefully on AR and DSR to select an appropriate methodology for the project. Both these methodologies use existing theory to guide the development process. Critical systems thinking promotes holistic thinking, pluralistic problem solving, emancipation, and reflection. This paper provides a reflection on the design of the digital graphical novel from an AR and DSR methodological perspective within the framework of critical systems thinking.

INTRODUCTION

Artefacts are often part of information system (IS) research projects. With the new prominence of design science research in IS, the researcher is tempted to automatically select DSR as research methodology when an artefact is part of the research design. This paper reflects on research methodology chosen for the development of a specific artefact, namely a digital graphic novel depicting the life of the historic icon Nelson Mandela in the political prison on Robin Island in South Africa. We categorise this artefact as a historical graphical novel. Two research methodologies namely design science research (DSR) and action research (AR) are compared and reflected upon in terms of applicability for the design of the historical digital graphic novel in question.

DSR is a prominent research methodology to design and evaluate an artefact (Gregor & Hevner, 2013). Knowledge is created through reflection on the design and evaluation process which are guided by prescriptive theories. AR is a cyclic research methodology focusing of participative change (Baskerville, 1999). When performed form a critical social theory perspective, existing theories guide intervention aimed at emancipation of oppressed parties in the problem environment (Harvey, 1990). Knowledge is created through reflection on learning that took place as part of the intervention.

The aim of this paper is to give a critical systems perspective on the selection of an appropriate methodology (DSR or AR) for the development of the historical digital graphic novel. A critical systems thinking perspective implies reflection on the underlying assumptions of the methodologies in question as well as their ability to address the problem holistically (Ulrich, 1983). Jackson (1991) also includes methodological pluralism and emancipation in critical systems thinking.

The paper starts with a discussion of the problem environment followed by a short literature review of theoretical concepts involved in the project. It then proposes a DSR research plan as well as an AR research plan for the development of the artefact. These research plans are then reflected upon from the perspectives of critical systems thinking. The selection of an appropriate research methodology is then substantiated.

BACKGROUND TO PROBLEM ENVIRONMENT

Nelson Mandela is one of the most well-known freedom fighters of our time. With his 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 a divided South Africa is a memory fresh in their minds. However, the majority of younger generations within South Africa cannot really relate to this social phenomenon, 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.

The Mandela27 Project was embarked on to recount the various social events that took place both in South Africa and Europe during the 27 years of Mandela’s incarceration. As part of the

outputs of the Mandela27 project a serious game that depicts the prison life of an individual incarcerated during the time of the Apartheid regime was created. The purpose of the serious game was to give a fair portrayal of the experiences by those within the walls of Robben Island Prison. The game is divided into two distinct sections – namely, digital graphic novel sections and interactive gameplay sections. The digital graphic novel sections serve to convey key aspects of prison life on Robben Island in a narrative format that the player can later use to solve problems in the interactive gameplay sections. This study will focus on the digital graphic novel sections and not on the serious game as a whole.

A digital graphical novel was chosen because research discusses the benefits of using graphic novels to communicate with 'Generation Y' (Short & Reeves, 2009) – which can be seen as the younger generations of South-Africa born into a free and democratic country. Research could be found pertaining to the fact that educators should consider graphic novels dealing with social issues as an alternative medium in the classroom and integrate them into lessons (Schwarz, 2007).

A graphic novel can be seen as a comic narrative with a serious literary concept for a target audience and usually depicts a complete story instead of periodical content found in comic strips (Murray, 2014). From *Superman – Earth One* (Straczynski et al., 2010) to *Maus: A Survivor's Tale* (Spiegelman, 1986), graphic novels embrace a variety of themes including superheroes, fantasy, civil war, and even family dynamics. This study will explore digital graphic novels which are electronic versions of graphic novels but contain components that deem the content interactive, for example sound in the form of a narration.

As mentioned earlier this paper provides a reflection on the design of the digital graphical novel from an AR and DSR methodological perspective within the framework of critical systems thinking. In order to create a shared understanding on the key concepts of this study the next sections reflect on design science research, action research and critical systems thinking.

DESIGN SCIENCE RESEARCH

The aim of this section is to provide an introductory understanding of DSR in IS. The discussions starts with a description of DSR in terms of meta-physical assumptions, this is followed with a description of the role of knowledge in DSR as well as the typical DSR research process. The discussion concludes with a list of guidelines for good scholarly DSR research.

The nature of DSR

Vaishnavi and Kuechler (2004) state that the epistemological assumption of DSR 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 which 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.

DSR is currently receiving high scholarly attention in the field of information Systems (IS). An important journal in the IS field, Management Information Systems Quarterly, recently published guidelines (Gregor & Hevner, 2013) for the use of DSR in IS. According to Gregor and Hevner (2013:337), within the field of IS, DSR comprises the creation of a variety of socio-technical artefacts. They further state that DSR stems from "an important opportunity, challenging problem, or insightful vision for something innovative in the application environment" (Gregor & Hevner, 2013:343).

The role of existing knowledge in DSR

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). 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). 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).

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 addressed within this study by reflecting on the design process of a digital graphic novel that portrays social phenomena. The digital graphic novel addresses 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.

The Process of Design Science Research

Figure 1 provides a research process model for Design Science Research by Peffers *et al.* (2006:93). This DSR process model iterates through the following phases namely 1) problem identification and motivation, 2) objectives of a solution, 3) design and development, 4) demonstration, 5) evaluation and 6) communication.

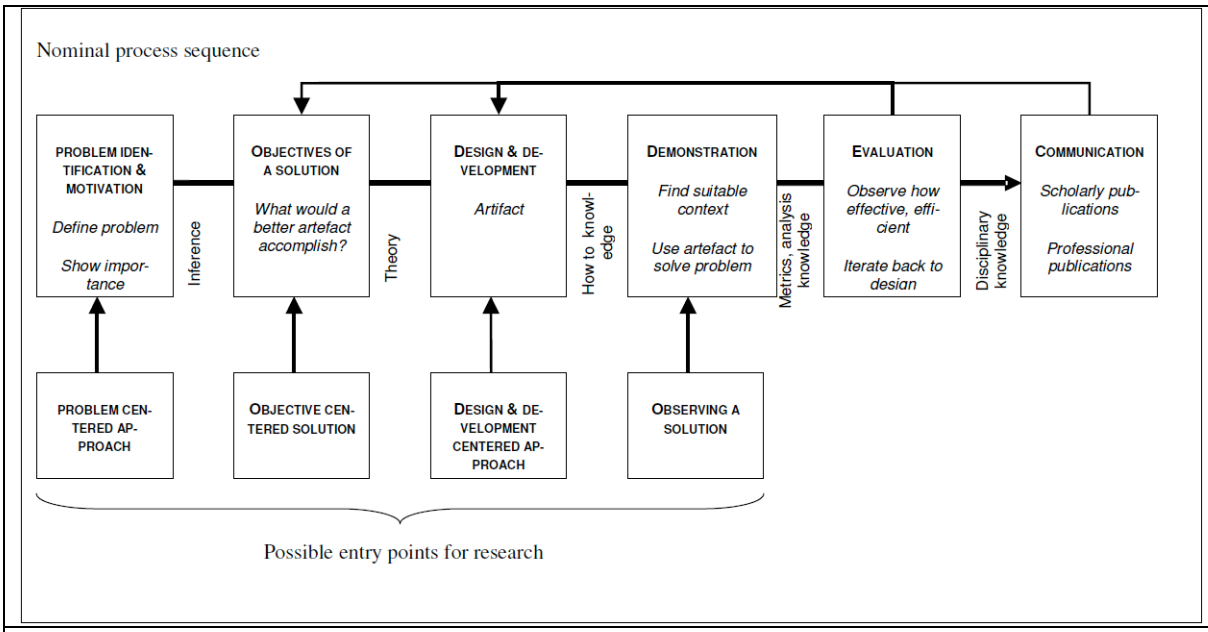

Figure 1. Design Science Research process model (Peffers et al., 2006:93)

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.

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.

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 surrounding the research problem that can be used in order to form a solution.

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.

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 is it necessary to conduct another iteration of the Design Science Research process in order to solve the identified research problem.

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.

Guidelines for scholarly design science research

The seven guidelines for design science in information systems research are incorporated into the study in order to guide the design process of the digital graphic novel. Table 1 summarises the design science research guidelines.

Table 1: Guidelines for design-science research in information systems (quoted from Hevner et al., 2004)

GUIDELINE	DESCRIPTION
Guideline 1: Design as an artefact	Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.
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 artefact 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 artefact, 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 artefact.
Guideline 6: Design as a Search Process	The search for an effective artefact 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.

The aforementioned guidelines can be used as guiding principles when using the DSR process model to create an artefact, and in this case a digital graphic novel. The success of a DSR project can be measured when each of the questions in the checklist created by Hevner and Chatterjee (2010) can be positively and efficiently answered (Table 2).

Table 2: The DSR checklist to evaluate the success of a project (quoted from Hevner & Chatterjee, 2010)

NR	QUESTION
1	What is the research question (design requirements)?
2	What is the artefact? How is the artefact represented?
3	What design processes (search heuristics) will be used to build the artefact?
4	How are the artefact and the design processes grounded by the knowledge base? What, if any, theories support the artefact design and the design process?
5	What evaluations are performed during the internal design cycles? What design improvements are identified during each design cycle?
6	How is the artefact introduced into the application environment and how is it field-tested? What metrics are used to demonstrate artefact utility and improvement over previous artefacts?
7	What new knowledge is added to the knowledge base and in what form (e.g., peer-reviewed literature, meta-artefacts, new theory, a new method)?
8	Has the research question been satisfactorily addressed?

This paper later provides the application of DSR methods in the design of a digital graphic novel. The next section reflects on action research.

ACTION RESEARCH

The discussion of AR follows the same course to that of DSR starting with the nature of AR, The role of knowledge of AR, the AR process and concluding with guidelines for good scholarly AR.

The nature of Action Research

Action research developed from the work of Lewin at the Tavistock institute as reported by Rapoport (1970). Lewin conceptualised social change as a three-stage method: dismantling former structures (unfreezing) changing the structures (changing) and locking them back to the permanent structure (freezing). This implies a stable state prior and after the intervention or change phase (Greenwood & Levin, 1998:17). Lewin (1948) argued that one could only understand the inner structure of a social system by trying to change it. Although Susman and Evered's (1978) paper did increase the acceptance of action research in the IS scholarly community it was only after the publication of the tutorial of Baskerville in 1999 in the acclaimed journal, *MISQ,* that AR became a mainstream research methodology in the field of IS.

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

1. 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.

2. 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:

    a. Highly interpretive assumptions are made about the observation.

    b. The researcher intervenes within the problem environment.

3. 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.

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

According to Baskerville and Wood-Harper (1996) 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 organization 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.

It is worth noting that Baskerville (1999) does not refer to the ontological and epistemological assumptions of AR. Qualitative research can be done from a positivistic, interpretive, or critical social perspective. According to Myers (1997) action research can be positivistic (Clark, 1972), interpretive (Elden & Chisholm, 1993), or critical (Carr & Kemmis, 1986).

In our application of AR we adopt a critical social theory perspective. Critical social research is underpinned by a critical–dialectical perspective, which attempts to dig beneath the surface of historically specific, oppressive, social structures (Harvey, 1990). Critical social theorists see knowledge as being structured by existing sets of social relations that are oppressive. This can be class, gender or race oppression. "Knowledge is critique… It is a dynamic process not a static entity…It is the process of moving towards the understanding of the world and of the knowledge which structures our perceptions of the world" (Harvey, 1990).

The role of existing knowledge in AR

Over the years AR has been criticised that it appears to be similar to professional consultation and does not provide a scholarly contribution. Baskerville and Pries-Heje (1999:4) highlight the theory generation process of action research, as well of the shortcomings thereof. They argue that at the beginning of the research, researchers draw upon existing theory as foundations upon which to plan and take action. This theoretical framework is reinforced, withdrawn or modified

to reflect the realities of action-taking according to the outcomes of each cycle. It is this evolution of theory that constitutes the scientific contribution of action research. Baskerville and Pries-Heje (1999:4) states that little attention is given to the exact processes by which such theories are cyclically developed during the course of action research.

It is in this regard that we find the FMA model refined by Checkland and Holwell (1998) extremely useful. The argue that any AR research project can be expressed in terms of the framework of understanding (F) that guides the cyclic development of a methodology (M) while applying it to an area of understanding (A) as depicted on figure 2. The researcher can make a scholarly contribution by reflecting on F, M, and A respectively as indicated as "yields learning about" on the figure.

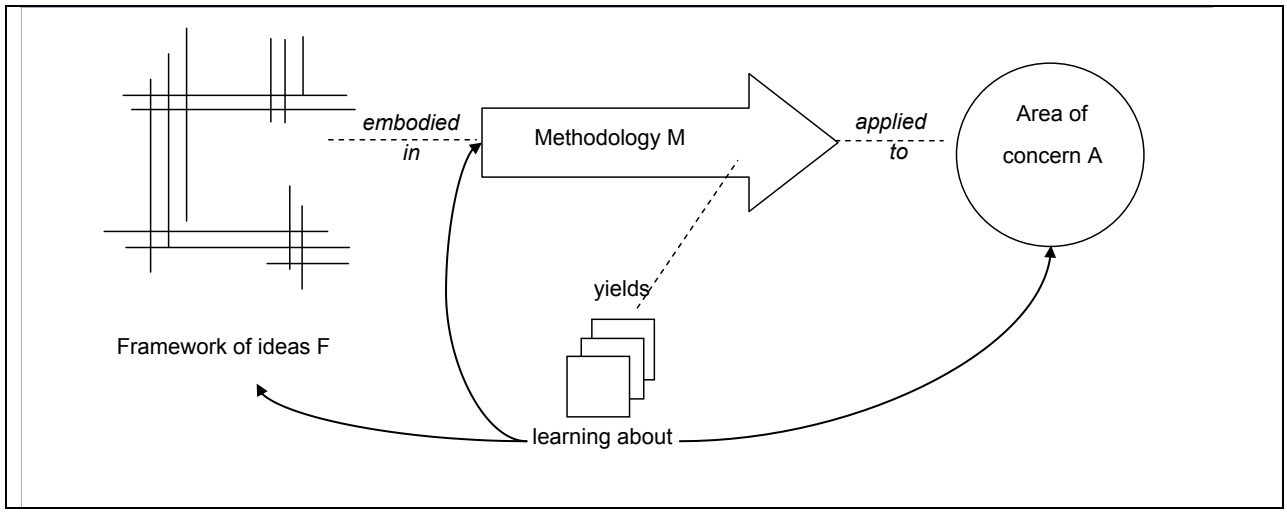

Figure 2: The FMA model of Checkland and Holwell (1998)

The process of Action research

From a critical social theory perspective the process of AR is a cyclic process aimed at intervention and emancipation through participative change. Blum (1955:1) defines action research as a simple two stage process:

1. 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.

2. Therapeutic Stage – Change experiments are conducted in this stage by introducing changes and studying their results.

The five phases of action research are diagnosing, action planning, action taking, evaluation, and specifying learning (Baskerville, 1999:14) (Figure 3):

1. Diagnosing – identification of the primary problems are the underlying cause for the organization's desire for change.

2. 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.

3. Action Taking – implementation of the planned action takes place here with researchers and practitioners collaborating in the active intervention into the client organization by causing certain changes to be made.

4. Evaluating – outcomes from the action taking phase are evaluated by the researchers and practitioners.

5. Specifying Learning – knowledge gained in this phase is provided to others.

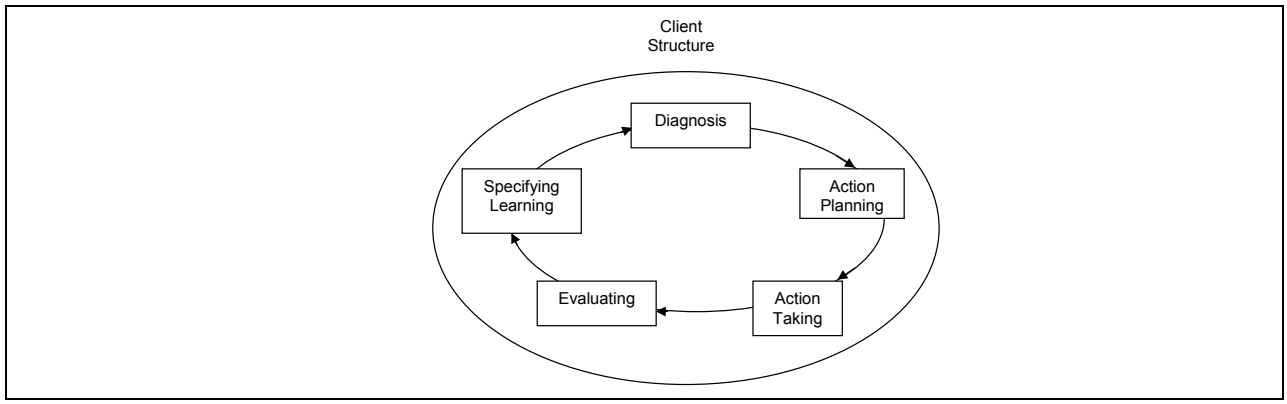

Figure 3. Five iterative phases of action research (Baskerville, 1999)

The cycle continues until the stated problem is resolved. From a critical social theory perspective the project will only be completed once the desired emancipation was achieved.

Guidelines for scholarly action research

Since AR is often done from different ideological perspectives we are interested in finding guidelines for AR from a critical social theory perspective. From information systems education research we find the recent principles for CST research in information systems of Myers and Klein (2011) most helpful. They identify three main elements of CST research namely insight, critique and transformation. The explanation of these elements is quoted in Table 3.

Table 3: Elements of Critical Social Theory research (quoted from Myers & Klein, 2011)

ELEMENT	DESCRIPTION
Insight	This element is concerned with interpretation and gaining insight. Insight can be gained in various ways, e.g., using critical hermeneutics and the archaeology of knowledge, or the concepts of social reproduction via the mechanisms associated with symbolic capital.
Critique	This element is concerned with critique, the genealogy of knowledge, and the social practices of control and reproduction. This element goes beyond interpretation to focus the researcher on the power structures that lie behind accepted interpretations.
Transformation	This element is concerned with suggesting improvements to the conditions of human existence, existing social arrangements, and social theories. Theories are not the primary driver for changes, but potentially fallible lenses through which we see the world. The ultimate arbiters of the desirability of changes are those affected by them.

Myers and Klein (2011) went on to develop these elements into principles for CST research. We list and summarize these principles in Table 4.

Table 4: Principles of Critical Social Theory in Information Systems Research (quoted from Myers & Klein, 2011)

PRINCIPLE	SUMMARY OF MEANING
Element: Critique	
1. The principle of using core concepts from critical social theorists	Research methods must be guided by work of scholars in the field of CST such as Habermas.
2. The principle of taking a value position	Researchers must articulate their value position such as equality or democracy.
3. The principle of revealing and challenging prevailing beliefs and social practices	The work of CST scholars can be used to highlight shortcomings of current thinking.
Element: Transformation	
4. The principle of individual emancipation	Intervention should guide self-reflection and self-transformation in order to fulfil individual potential.
5. The principle of improvements in society	Transformation of more than the individual is possible and therefor the society may be improved.
6. The principle of improvements in social theories	Application of theory may lead to the improvement of these theories.

We use these guidelines to reflect on our research plan for the historical graphical novel discussed later in the paper.

RESEARCH DESIGN FOR THE DIGITAL GRAPHIC NOVEL USING PURE DSR

The aim of this section is to provide a research design for a DSR project to develop the historical digital graphic novel for the Mandela27 project.

The primary objective of the research project for DSR is:

To develop a digital graphic novel according to design principles appropriate for the content. The content of the digital graphic novel should inform younger generations of the historical context of the life in the political prison of Robin Island as experienced by political prisoners in the era of Nelson Mandela

In a DSR research project, 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). In the context of this study the descriptive knowledge (Ω knowledge) of the study is the information that is gathered from ex-political prisoners. The prescriptive knowledge (Λ knowledge) that will be incorporated in the design and creation of the digital graphic novel will be human-computer interaction (HCI) principles. HCI principles are design rules for artefacts to adhere to in order to ensure successful interaction with the user (Dix et al., 2004).

Application of the DSR research process

The design science research cycle depicted in Figure 1 is used to structure the project. Each of the phases is discussed briefly.

Problem identification and motivation

The aim of this phase is determine what the problem is. In context of this study, the problem is that the majority of younger generations within South Africa cannot really relate to the social phenomenon of Nelson Mandela that fought for equal rights, 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.

In order to achieve this, a solution is suggested in the form of a digital graphic novel that informs younger generations of the historical context of the life in the political prison of Robin Island as experienced by political prisoners in the era of Nelson Mandela.

The digital graphic novel should be designed according to principles of human-computer interaction to ensure that the artefact is accepted by its target users.

Objectives of a solution

In this phase objectives are established to address the design problem. In context of this study, the objectives are:

- To research the digital graphic novel genre
- To investigate the desired content for the novel

- To study human-computer interaction (HCI) principles
- To determine how HCI principles can aid in the design of a digital graphic novel
- To evaluate HCI principles for their appropriateness in the design of a digital graphic novel
- To determine which HCI principles can be applied in the design of a digital graphic novel that informs younger generations of the historical context of the life in the political prison of Robin Island as experienced by political prisoners in the era of Nelson Mandela.

Design and development

In this phase, the objective is to create a digital graphic novel for the portrayal of the experiences of the ex-prisoners of Robben Island while being conscious of the design principles investigated in the previous phase.

Demonstration

In this phase, a prototype of the digital graphic novel is presented as a case study pertaining to the social phenomenon of Apartheid.

Evaluation

In order to determine the extent to which the designed artefact meets the requirements of the objectives of the study, focus groups are held with generation Y individuals. The target age group for the Mandela27 digital graphic novel are individuals ranging from 16-25 years of age who fall within 'Generation Y'. 'Generation Y' refers to individuals born between 1982 and 2003 – a generation 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).

As the digital graphic novel is designed for this target group, it is appropriate to conduct focus groups with individuals from Generation Y in order to ensure that they are pleased with the design.

The digital graphic novel is redesigned according to the feedback obtained during these focus groups.

Communication

In this phase, the digital graphic novel is deemed successful to be integrated into the serious game for the Mandela27 project. Design guidelines for digital graphic novels that portray social phenomena may be suggested in literature.

Adherence to DSR guidelines

As part of our reflection on the applicability of DSR as research methodology for this problem, we reflect on our application of the guidelines for design science research studies (Hevner et al., 2004) presented earlier. The reflection is provided in Table 5.

Table 5: Reflection on the guidelines for design science research in information systems (Hevner et al., 2004)

Guideline	Description
Guideline 1: Design as an Artefact	A digital graphic novel portraying social phenomena will be 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 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 for developing digital graphic novels about social phenomena through the use human-computer interaction principles are determined.
Guideline 5: Research Rigor	Design evaluation methods are used in the construction and evaluation of the artefact.
Guideline 6: Design as a Search Process	The search for an effective artefact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	The findings of the research study will be communicated in the form of design guidelines for digital graphic novels that portray social phenomenon.

Scholarly contribution of the DSR project

Reflection on the scholarly contributions of any DSR project is part of the DSR research cycle as the *communication phase*. After an artefact has been successfully designed and developed, the researcher can communicate design processes followed. The DSR project is seen as a success if the communication of the project addresses the eight questions in the DSR checklist (Table 2).

In context of this study, question 8 asks whether the research question has been satisfactorily addressed. This question is successfully addressed when the target users accept the design of the digital graphic novel that portrays social phenomena.

RESEARCH DESIGN FOR THE DIGITAL GRAPHIC NOVEL USING PURE ACTION RESEARCH

The aim of this section is to give a research design for an AR project to develop the historical digital graphic novel for the Mandela27 project.

The primary objective of the research project for the AR project from a critical social theory perspective is:

To develop a digital graphic novel that informs younger generations of the historical context of the life in the political prison of Robin Island as experienced by political prisoners in the era of Nelson Mandela

From a critical social perspective emancipation is directed at the prisoners' rights to a fair representation of their story and directed at the young peoples' right to a comprehensive depiction in a format they will find entertaining and educational.

In terms of the framework of understanding (F) of the FMA framework discussed previously, Human-Computer Interaction (HCI) theory used to guide the graphical design and Critical Social Heuristics will guide the diagnosis phases of the AR cycle. The historical digital graphic novel to be developed is viewed as the methodology (M) to be refined after each cycle. The Area of application (A) is the education of young people using the novel as education to learn from the ex-political prisoners about their experiences on the island.

Application of the AR research process

The action research cycle depicted in Figure 3 will be used to structure the project. Each of the phases will be discussed briefly.

Diagnosing

The aim of the diagnosis is to understand the core elements that the ex-political prisoners found important to relay in their stories about the social phenomenon that they experienced. Interpretive research methods aim to understand a phenomenon from the perspective of the participants (Klein & Myers, 1999) and will be used to collect data. Focus groups will be used consisting of ex-political prisoners. The research team has access to these ex-prisoners as many of them are work as tourist guides on the island which today is a major tourist attraction in Cape Town, South Africa.

A second aspects of the diagnosis is to understand the needs of the audience of the novel in terms of learning activity. This process was part of the larger Mandela27 project and a serious game environment was selected. As indicated in the section on the background of the problem, a graphical novel was chosen to support the interactive game to be developed.

The result of the diagnosis phase is a narrative that is representative of the experiences of the political prisoners.

Action Planning

The aim of the *action planning phase* is to plan and design the layout of a digital graphic novel that portrays social phenomenon. Existing theories will guide the process. These include principles for HCI and design principles of graphical novels. Very few articles could be found on digital graphical novels but the researchers are convinced that literature on traditional graphical novels will be helpful in guiding the design process.

Action Taking

The *action taking phase* consist of the actual development of a digital graphic novel that portrays this historical content. Software development methodology such as agile methods (Scrum or XP) can be used to guide this process.

Evaluation

The aim of the *evaluation phase* are twofold. Firstly, the novel must be shown to the ex-prisoners or a representative of them to verify that the content portrayed in the novel is accurate and very

importantly that they experience some sense of emancipation that their story is being told. This evaluation will be done by means of an interpretive interview with a representative of the ex-prisoners who is the curator of the island museum.

Secondly, we have to investigate the success of the digital graphic novel that portrays the historical content among the youth. The novel will only be successful if the young people achieve understanding of the content. This evaluation will be done by means of an interpretive focus group.

Specifying Learning

The aim of the *specify learning phase* is to reflect on the AR iteration in terms of emancipation and knowledge creation. We reflect in terms of the FMA framework presented earlier.

When reflection on the area of application, A, the result of the evaluation phase will give an indication of content and presentation changes required in the novel to better achieve its purpose. The realisation of emancipation is the main purpose of the novel and therefor the main condition for success and completion of the project.

When reflecting on the methodology, M, or in this case on the newly developed artefact, it has been stated that very few articles have been written on the design of digital graphical novels. This project then serves as a demonstration of the application of the HCI and graphical novel principles in a case study. Contribution can take the form of a reflection and extension of the principles used.

In terms of the framework of understanding, F, the usefulness of CSH can be reflected upon. Ulrich (1983) developed CSH for governmental planning problems and we are using it for a digital graphical novel that is essentially part of a computer game. The focus of using CSH was on understanding the emancipation required by the ex-prisoners and making sure our process included a witness for them. We used the guarantor idea of CSH to guide our selection of media and theoretical framework. This guarantor idea made us aware that we reflect on the success of our chosen framework before embarking on the development of the novel. A contribution can be made to the body of scholarly knowledge on the applications of CSH.

Adherence to AR guidelines

As part of our reflection on the applicability of AR as research methodology for this problem, we reflect on our application of the principles for critical social research studies (Myers & Klein 2011) presented earlier. The reflection is provided in Table 6.

Table 6: Reflection on the principles for critical social research in information systems of Myers and Klein (2011)

	Principle	Application in this study
1	The principle of using core concepts from critical social theorists.	We are using critical social heuristics of Ulrich (1983) to guide our understanding required for the content of the novel.
2	The principle of taking a value position.	Our stance is that a digital graphical novel is a viable medium for education in this problem environment. We also take the stance that the ex-political prisoners will provide information that we can use to create content that portrays life in the prison.
3	The principle of revealing and challenging prevailing beliefs and social practices.	We studied HCI principles and principles for graphic novels which we applied and in our evaluation and reflection we are able challenge these principles. We are also providing a fresh medium of education of the specific content.
4	The principle of individual emancipation.	Our aim is to emancipate the ex-political prisoners by having their story told. We are also trying to emancipate the youth by providing them with reliable content in a desirable format.
5	The principle of improvements in society.	As a South African society we need to deal with our past to grow in future as a free and peaceful nation at ease with our troubled past. We believe that this novel has a role to play in this process.
6	The principle of improvements in social theories	In reflection on our work we will peruse the applicability of critical social heuristics for use in the diagnosis of problems of this nature.

Scholarly contribution of the action research process project

Reflection on the scholarly contributions of any AR project is part of the AR research cycle namely the *specify learning phase*. We provided a reflection in the discussion of the phases in terms of the FMA framework.

As stated earlier the AR project will be successful when we have designed and developed a digital graphic novel that achieves the stated emancipatory purposes.

A CRITICAL SYSTEMS THINKING REFLECTION ON DSR AND AR FOR HISTORICAL DIGITAL GRAPHIC NOVELS

The aim of this section is to support the main objective of a critical systems thinking reflection on a DSR and AR research design for the design of a historical digital graphic novel. We start our reflection with a brief discussion of critical systems thinking to provide a shared understanding of the ideas.

Critical systems thinking

We understand critical systems thinking from its position in systems thinking. Systems thinking is about understanding the world in terms of systems (Checkland and Holwell, 1998). A system can be viewed as a set of interrelated parts working together to achieve an objective (Checkland and Holwell, 1998). The whole systems has characteristics that cannot be found in any of the parts, called emergent properties. In his seminal work C. West Churchman (1968) describes systems in terms of the following characteristics:

- Total systems objectives – the true objective of this system that will not be sacrificed and of which the success is measurable.
- Environment of the system – factors that influences the system but cannot be controlled by the system.
- The resources of the system- everything the system requires to achieve the overall objective.
- The components of the system – these are smaller parts sometimes called "missions" that are managed as subsystems to achieve their goals in support of the overall objective.
- The management of the system - The management of a system has to deal with the generation of plans for the system. This includes the setting of the overall goals for the system, defining environment, the utilisation of resources, and the division of the system into components (Churchman, 1968).

Checkland (1981) discussed various strands of systems thinking. It is important not to view them as categories or inferior or superior classes. Hard systems thinkers view systems as structures in reality organising phenomena, while soft systems thinkers uses systems to make sense of a messy environment. Critical system thinkers assume that there are conflict and power struggles in reality and systems thinking is seen as a method for highlighting the underlying oppressive structures in reality.

Our understanding of critical systems thinking is according to the list of critical system characteristics given by Jackson (1991). Jackson (2001) gives the following guidelines for the development of such systems methodologies:

1. *"Systems methodologies are structured ways of thinking, related to different theoretical rationales, focused on improving some real-world problem situations.*
2. *Systems methodologies use systems ideas (system, boundary, emergence, hierarchy, communication, control, etc.) during the course of intervention and frequently employ systems methods, models, tools, and techniques, which also draw upon systems ideas.*
3. *The claim to have used a systems methodology according to a particular rationale must be justified according to given guidelines.*
4. *Since each generic type of methodology can be used in different ways in different situations and interpreted differently by different users, each should exhibit conscious thought about how to adapt to the particular circumstances.*
5. *Each use of a systems methodology should yield research findings as well as changing the real-world problem situation. These research findings may relate to the theoretical*

rationale underlying the methodology, to the methodology itself, to the methods, model, tools and techniques employed, to the system to use each methodology, or to all of these."

From our perspective Ulrich (1983) adoption of the Kantian view of a system is helpful. Kant expressed the idea that individuals view reality in terms of their frame of reference shaped by their previous practical experiences and their theoretical knowledge. He refers to this as a conditioned reality. A phenomenon can be better understood if more than one conditioned reality is used, every individual conditioned reality enrich the understanding of the phenomena under investigation. Ulrich (1983) refers to the system as the sum of the conditioned realities. Thus, to use a systems approach means that one strives to understand different perspectives or conditioned realities. The aim of the systems facilitator is to reflect on the assumptions made by the different stakeholders resulting from their conditioned realities.

A critical systems thinking reflection of the DSR approach for the historical digital graphical novel

Key to our critical systems reflection on the DSR approach is the ontological assumption of DSR expressed by Vaishnavi and Kuechler (2004) where they believe in a single, underlying physical reality which remains constant and serves to limit the amount of different world-states.

It must be noted that various authors in the field of DSR in IS explicitly state ontological views. Some authors refer to work of Herbert Simon (1996) on technic philosophy. From this perspective the realistic view expressed by Vaishnavi and Kuechler (2004) seems representative of other scholars.

A basic assumption in the DSR process is that an artefact is developed in accordance with stated objectives or requirements. From the realistic perspective of DSR scholars, this might not be problematic, but it is problematic from a critical systems perspective. Kant argues that the only thing we know is that we do not know. The Kantian systems ideas supported in this paper highlights our inability to create specifications for a solution. The specification of the artefact is used as a measurement of success of the artefact. From a critical systems perspective emancipation is the real measure of success.

The process of DSR and especially the role of knowledge could suggest that DSR is appropriate for critical systems thinkers. However when DSR is used from a critical systems perspective a critical social theory stance will be taken on the ontological assumptions of DSR. The aim of the artefact will then be to emancipate the identified oppressed parties.

Furthermore, the assumptions made by the prescriptive theories used must be investigated. Guarantees should seek to responsibly apply chosen methods. It is our conviction that the DSR research approach is suitable for the *action taking* phase when an action research project is initiated aiming to develop an artefact used for emancipatory purposes such as the one discussed in this paper.

A critical systems thinking reflection of the AR approach for the historical digital graphical novel

When reflecting on the AR approach applied from a critical social theory perspective one encounters a theoretical difficulty. Critical social theory and critical systems thinking are both based on the same ontological assumptions. One should therefor find similarities in the tools for reflection (critical systems thinking) and the method reflected upon (AR from a critical social perspective). A further complication in our specific reflection is the fact that we used CSH of Ulrich (1983) as guiding theory in the *diagnosis phase* of the AR project.

From this stated subjective perspective we want to highlight aspects of our proposed AR project:

- AR need not be done from a critical social theory perspective and the advantages listed further of the AR project is mainly a result of our critical social theory stance we adopted.

- Myers and Klein (2011) promotes the use of the work of a critical thinker as guiding theory. We chose CSH. CSH provides a structured method to focus on required emancipation. It also provides a strong emphasis on responsible selection of expertise in terms of the guarantees of success of specific expertise. This is not inherent part of AR, but we made it part of the formal structure of our AR research project.

- Success of any AR project is pragmatic in nature. It is assumed that the project is only completed once the desired emancipation took place. In our project this might be problematic as the stories of the different ex-prisoners are accommodated and not everyone might agree with the resulting content of the novel. The same argument can be applied to the emancipation of the youth. Not all young people experience the format of a graphical novel as a good medium for education. In this regard the environment of the system (the requirements of the Mandela27 project) had an influence on the design.

- The typical AR process gives little guidance on the methodology used in action taking. In our case this entailed the creation of a software artefact. CSH gave us structure in terms of reflection on the expertise required to develop the novel. Once again our success of AR can be linked to our choice of guiding theory. One might argue that as AR promotes the use of the guiding theory the advantages of CSH may be then inherent to AR.

- The typical AR description gives very little guidance to the selection of an appropriate guiding theory. As such this is a major shortcoming encountered of AR. One has to say that the lack of guidance results from the broad interdisciplinary applications of AR. Pluralistic use of methodologies are inherent to critical systems thinking and total systems intervention (TSI) developed by Flood and Jackson (1991) provide guidance for the selection of methodologies.

CONCLUSION

The aim of this paper is to give a critical systems perspective on the selection of an appropriate methodology (DSR or AR) for the development of the historical digital graphic novel. We provided discussions on DSR and AR and we demonstrated how the historical digital novel can be developed using DSR and AR respectively.

In the previous section we reflected on the research plans from a critical systems thinking perspective, stating our dilemma that we used critical systems thinking in the AR research plan. From the reflection it became clear that both AR and DSR are research methodologies rather than approaches based on metaphysical ontological and epistemological assumptions. More work is required in the DSR scholarly community to position DSR ontologically.

The project described in paper is derived from an ongoing Master (MSc) study entitled "Guidelines to design digital graphic novels portraying emotional social phenomena using critical systems heuristics and HCI principles". In this study we have combined AR from a critical social theory perspective while incorporating DSR in the action taking phase.

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