

Heritage and Learning: An Online Rock Art Education Tool

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1 Project Description

This heritage and learning project will provide users with a website that gives them access to databases containing information about rock art in South Africa. The project is a collaboration with the Archaeology Department of UCT, with a particular emphasis on rock art preservation, rock art education and learning through rock art. The systems built for the website will make use of resources in the databases to aid users in learning more about rock art, as well as allowing them to use rock art as a basis for learning about other topics of interest that are related to the content of the rock art images. It will be comprised of a home page that links to each of the systems developed and then the systems themselves. These systems will be interactive and innovative, consisting of an interface and implementation for Guided Tours, a 3D visualisation system displaying the heritage sites and information relating to them and a storytelling system that allows users to learn about culture and heritage through indigenous stories and dynamic image displays. The system will allow users to navigate the different rock art sites with a choice of going along a particular path or even learning about rock art through the Bushman stories. It is intended that the project be of use to any and all users that are interested in learning about rock art.

2 Problem Statement and Research Questions

A website will be created in order to solve the problem of providing a useful tool to display and query information about rock art as well as provide a means for learning about other topics related to the content of the rock art. The information will be accessed from a database that will be connected to an interactive website that allows users to navigate through the information they are querying.

The problem of rock art preservation is constantly being dealt with by organizations such as the Trust for African Rock Art (TARA) and the Clanwilliam Living Landscape Project (CLLP) in South Africa. While the sites containing rock art are generally documented well, the information is not generally accessible to the public. For this reason, the archaeology department feels the need for the creation of a tool that allows the public to interact with and learn about rock art and heritage sites.

This system is of key interest to the Archaeology Department as they have the information but no useful tool for displaying the information. This problem will be addressed by the design of an interactive website that provides a 3D visualization of the caves, a method for creating guided paths for the system as well as a story telling feature that relates Bushman stories in an interactive manner.

The following question is the overall research question that this project aims to address.

2.1 Is it possible to build a usable and useful E-Learning tool focused on rock art education?

This question is subdivided into the following research questions.

2.1.1 Is it possible to build a usable and useful 3D cave navigation system to encourage learning about rock art?

Determine the possibility and feasibility of developing a 3D visualisation system of a heritage site that displays archaeological information and materials. The system should be innovative and easy to navigate and it should allow for free, user-defined navigation as well as navigation of a fixed path.

2.1.2 Is it possible to build a usable and useful guided pathway system to promote learning and learning design?

Determine the possibility and feasibility of developing a system that will allow users to go on guided tours of the sites and information related to them, as well as allowing them to build their own tours.

2.1.3 Is it possible to build an engaging and dynamic storytelling environment to encourage learning about rock-art?

Determine the possibility and feasibility of developing an immersive storytelling environment where users can read indigenous stories, particularly those pertaining to the San people. The environment will incorporate a dynamic image visualisation to display images of related rock art.

3 Procedures and Methods

3.1 Tools and Languages

Various tools will be made use of in order to implement the systems. These include:

- WebGL - In order to create the 3D visualization of the cave to provide users with a real feel for the rock art site.
- HTML5 - Used in conjunction with WebGL, this markup language will be used to create the website.
- MySQL - Databases to store the information. This will be linked to the website.
- JQuery - Scripting language needed to provide integration with and navigation through the resources.

3.2 System Design: A prototype

An interactive website will be designed using the tools outlined above. A Web home page will allow the user to navigate to the various components that the site provides. These include the ability to navigate to and within the visualizations of the cave in order to view the rock art and other artefacts found within the site, the option to view Bushman stories with images that are accessed from the database as well the ability to navigate the site using guided paths. Aside from standard navigation links that will allow a user to move among any of the systems of the website, the components will also be connected as shown in Figure 1. Some of the stories in the story telling system will include taking the user on a guided tour of the website relating to a particular story. Some of the guided tours will incorporate navigation through the 3D visualization to areas that relate to the topic of the tour.

Data provided by the archaeology department will be used to develop the site visualization in WebGL using HTML5. Users will be able to interact with the rock art by clicking on the images and learning about a particular artwork through various pop-ups providing the user with the information needed. Users will be able to create a guided tour path by choosing a particular topic and then following the guided path with the option of branching off on to new paths and coming back to their branching-off point. This may depend on some form of path finding algorithm and A* implementation for finding a suitable path given the particular constraints provided by a user, such as a particular topic.

The storytelling feature will allow users to read through different Bushmen stories with relevant rock art images shown alongside. There will be two views, a simple view and a collage view. In the simple view, text from the story will be shown alongside a rock art image pertaining to the section of text being read. In the collage view, all of the rock art images pertaining to the story will be shown alongside the text and a light will illuminate the image pertaining to the current portion of text. Ambient sounds, such as the sound of grasshoppers or a fire crackling, will also be used to enhance the users' experience.

3.3 Evaluation

The various components of the website will be tested by users as follows.

- *3D Cave Visualization:* The users will navigate through the cave while completing a set of predefined tasks that allow them to interact with the various features the visualization provides.

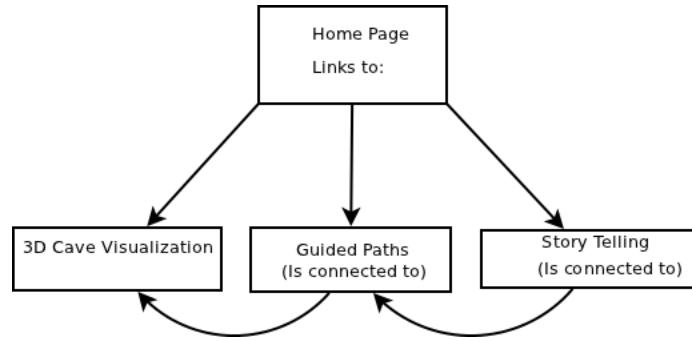


Figure 1: System design diagram

- *Guided Paths:* Users will be tasked with the creation of a guided path as well as the navigation of a predefined guided path.
- *Story Telling:* The users will read a Bushman story as well as provide feedback on the features of this component and how the dynamic image visualisation affected their immersion in the story.

For the high fidelity prototype, the aforementioned tests will be carried out by 20 users. Of the 20 users, we will require that 10 be users with experience in navigating 3D systems and/or guided paths. The other 10 users will have had no experience with any system similar to this one. Experience can be used as an independent variable, which will be useful in our evaluation of the usability of the system based on user experience.

The evaluation will require users to navigate the system alone with no help from one another or the evaluators. This will be done to test the design features of the system. Thereafter, the users will fill out an evaluation form describing any issues they had with the system in terms of design features and what they thought various components were meant to do. We will use this information to create our final system. A full evaluation of this final system will then be conducted as outlined above.

4 Ethical, Professional and Legal Issues

In order to conduct any user testing, an application for ethical clearance will need to be made. This application will be done fairly early on in the implementation phase of the system so as to stay on track with our time framework (See Appendix A).

Participants for user testing will be randomly recruited from a pool of students with the only requirement being that they are registered students at the university. They will be solicited by means of verbal request. The anonymity of students will be assured throughout the procedure such that no individual outside of the experiment will be able to deduce the identity of the participants. No names will be recorded in written or spoken form. Each participant will be provided with a detailed paragraph at the onset of the study which stipulates the procedure and nature of the evaluation for the express purpose of the participant making an informed decision with regard to consent. This document will be signed and dated by the participant before engaging in the evaluation. At any point during the evaluation, participants may choose to opt out and their input data will be disregarded. No obvious risks to participants are anticipated. This study does not employ deception either through the withholding of information from, or the presentation of misinformation to, participation.

Furthermore, there are legal implications with the work in terms of maintaining the privacy of the location of the physical sites. Some of the sites have been vandalized while others are too old for the general public to wander in at their own leisure. For the sake of preservation, the locations need to remain private. That is, sensitive data (such as geographical location of a site) must not be exposed.

5 Related Work

A lot of research has been done with regard to 3D visualizations of information spaces (Borner et al., 2000), (Shiaw et al., 2004), (Güven & Feiner, 2006). This research details the development of 3D visualization techniques that display information over 3D models and allow the user to navigate large information spaces. A similar technique can be used to display information on the inside of the cave model that it is related to.

With regards to digital storytelling, one paper that is of particular interest is ‘Digital Storytelling in Africa’ (Ladeira et al., 2010). The paper details an implementation of a virtual reality storytelling environment and provides useful ideas for implementation in our system.

Much has been done in terms of guided paths systems. A closely-related work on guided paths has been the Walden’s Paths project of the late 90’s (Furuta et al., 1997). A team of computer scientists implemented a website that allows users to traverse a system following certain predefined paths. Dynamic path creation was not implemented in the early prototype.

6 Anticipated Outcomes

6.1 System

The system will be an interactive website that allows users to navigate through the 3D visualizations of rock art sites, view the rock art images and associated information overlaid on the model and facilitate learning about the heritage associated with the art. The website will include a unique story telling feature that incorporates the rock art images into the experience dynamically. This feature will help users to learn more about the culture and practices related to the artwork. Finally, the website will allow users to create and follow paths through the rest of the system and information in order to facilitate learning about specific topics.

6.2 Expected Impact

The project is expected to result in a Web-based system that facilitates public access to archaeological resources in a manner that promotes education pertaining to rock art. This system will be interactive and easy for users to navigate and access. It will provide a means for archaeologists to share their knowledge and findings with the people who it pertains to and who view it as part of their heritage.

6.3 Success Factors

Usability tests will be conducted to determine the response from users. A positive outcome will require users to find that the cave visualisations are easy to navigate, intuitive and exciting; that the storytelling system creates an environment that is immersive and has an intuitive interface for creating their own stories; and that the guided paths system provides easy to follow paths and allows users to accurately record paths for others to follow.

7 Project Plan

7.1 Risks

Risk: Late Resource Acquisition

Various resources are required for this project, including data files of 3D cave models, information pertaining to rock art images and translated indigenous stories in written format. A delay in obtaining these resources would delay the creation of certain parts of the system, as well as delay the testing of the system.

Impact: High

Likelihood: Medium

Mitigation: Each group member will be in charge of ensuring that they obtain the necessary resources for their section. The providers of the resources will be contacted and follow ups will be made until the data is received. If needs be, dummy data will be used until the actual data is available.

Risk: Data Loss

Data loss, particularly that of source code, would be a major setback for the project.

Impact: High

Likelihood: Medium

Mitigation: An online version control system will be used to manage source code. Additionally, daily backups of all data will be made to an external device.

Risk: Integration Between Sections

Although each group member's part of the project is reasonably disjoint, there is some integration between parts. The guided tour feature will connect into the 3D cave visualisation, while the story telling feature will connect into the guided tour feature. Delays could thus occur if one section is waiting for the other section to be completed.

Impact: Medium

Likelihood: Medium

Mitigation: Each member's section has been made as disjoint as possible. Each member will first create their part using stubs. The integration between parts will then be added once all the parts have been completed.

Risk: Ethical Clearance Denied

Ethical clearance will need to be acquired to perform user testing. If this clearance is denied, there will be no way of performing these tests and thus the evaluation of the system will be compromised.

Impact: High

Likelihood: Low

Mitigation: This risk will be mitigated by applying for ethical clearance as early as possible. If clearance is denied, a new form of evaluation will need to be found to still effectively test the system.

Risk: Group Member Issues

There is a possibility that one or more members of the group may withdraw from the honours program due to financial, medical or academic reasons. One or more group members may also fail to complete their section or to produce working software.

Impact: High

Likelihood: Low

Mitigation: The various sections of the project have been made as disjoint as possible. Furthermore, weekly meetings of the group will take place to ensure that all group members are working consistently and that everyone is aware of what the other group members are working on.

7.2 Timeline

Design and implementation of the website will be done as part of an iterative process. An initial study will be conducted and presented to determine if the project is feasible. Using information gained from the study, design and implementation of an initial prototype will begin. This prototype will be evaluated using the method described above and a final prototype will be built incorporating changes. The final prototype will then be evaluated to determine the impact and success of the project.

The plan for the design and implementation as well as the other sections of the project which need to be completed can be summarized in a Gantt chart, which is included as an appendix. The chart shows the list of tasks that need to be completed, as well as the amount of time that has been allocated for completing each task.

7.3 Resources Required

- Laser Scans of the cave - Data will be provided by the archaeology department for the creation of the 3D cave models that will be used in the system.
- Database - Data about different rock art sites in the Western Cape that will be provided by the archaeology department.
- Bushmen stories - Translated versions of the Bushmen stories that will be used for the storytelling section of the project. These will be provided by the Computer Science department.

7.4 Deliverables

There are various deliverables that will need to be completed throughout the project, including a poster, a website and various written documents. At the end of the project a full working system will have been completed, specifically an interactive website that will allow a user to navigate a 3D cave visualisation, go on a guided tour, and experience a digital form of storytelling. Furthermore, the system will have undergone comprehensive testing and a full report detailing the project implementation and its success factors will have been completed.

7.5 Milestones

Milestone	Date
Proposal	21 May
Presentation	24 May
Revised proposal finalized	11 June
Web presence	12 June
Initial feasibility demonstration	25 July
Background chapter	29 July
Design chapter	29 August
First implementation and write-up	19 September
Final prototype and write-up	28 September
Implementation and testing chapters	3 October
Outline of complete report	10 October
Final complete draft of report	24 October
Project report final hand-in	31 October
Poster	3 November
Web page	7 November
Project demonstrations	8 November
Reflection paper	11 November
Open Evening	14 November
Final project presentations	19 November
Project to external examiner	23 November

7.6 Work Allocation

The work has been divided among the group members so that each has a share in implementing a tool that will be used on the overall website. Each member will have a part in designing and creating the home page with each member also focusing on particular features, as outlined below.

- Kaitlyn Crawford will build the 3D visualization of the caves and information.
- Marco Lawrence will develop the Guided Paths system.
- Joanne Marston will produce the Story Telling interface and implementation.

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Appendices

A Gantt Chart

