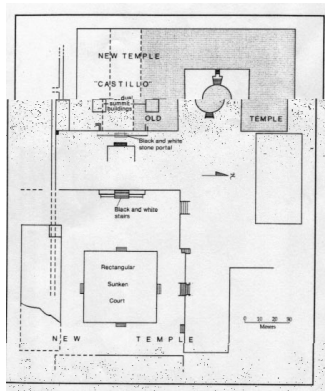


# Reconstructing Chavín de Huántar (Peru): Designing an Educational Tool for Art Historians

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## Abstract

*This paper discusses the process of reconstructing a unique and remote site such as Chavín de Huántar in Peru, focusing on the choices made in designing the user interface and the difficulty of translating archaeological/anthropological information into a visual and information-rich tool for the teaching of art history. Peru contains hundreds of sites that can be easily ignored due to the lack of visual resources that can help evaluate a site and culture. This paper explains why it is difficult to evaluate Chavín de Huántar and how a virtual reconstruction was done in order to provide a useful and user-friendly resource for art historians and their students in order to help appreciate the importance of this site and rescue it from being forgotten. The project is compared to an existing reconstruction done by Stanford University using Zoom by Live Picture and contrasted with the technology used for this reconstruction (VRML, HTML, JavaScript and Metastream), which delivers a richer visual guide and more immersive experience. The paper discusses plans to create a fully immersive reconstruction of Chavín de Huántar using CAVE(tm) technology, Iris Performer and OpenWorlds and the issues concerning the maintenance of two tools for teaching: one that is more portable and one that is more immersive. (<http://www.evl.uic.edu/gotsis/huacas>)*



**Figure 1a. Map of the Chavin de Huantar temples and courts**

## 1. Introduction

Chavín de Huántar is located at an elevation of 3,150 m at the eastern base of the Cordillera Blanca in Peru and it is a ceremonial center that flourished and disintegrated between 900-200 B.C. The Chavin-style sphere of influence was widespread in several areas of Peru and it has been said that some of its cultural centers “rivaled the classical Greek polis

in size and beauty.” [1] Chavín de Huántar is a temple complex with circular and rectangular plazas and series of tunnels built over different periods of construction time. Unfortunately the structure is badly damaged from the passing of time and numerous landslides and many of the artifacts that belong to the temple, including sculptures depicting central deities such as the Lanzon [Figure 1c], were not found *in situ* [Figure 2a]. Much of the information related to this Chavin temple is fragmented even though there is quite enough data. From an art historian perspective, interpreting the available data is challenging because it is presented from an anthropological or archaeological point of view. The advantage is that because of the accuracy of the anthropological data and numerous maps [Figure 1a] and sketches, a reconstruction of the site is possible. Such reconstruction is much needed as a teaching tool because without the help of even a pseudo-immersive environment such as VRML, it is difficult to understand why this temple had so many followers and what the role of atmosphere was in the spread of the cult. Unfortunately again, all existing pictures of various areas of the site were taken for documentation only, in a very dry and straightforward style that has resulted in a very misleading representation of size of the site and its details. For example, around the walls of the Old Temple, there are wedged in a series of sculpted heads whose size varies from 70-90cm tall and some weighing more than half a ton, but when appearing in a photograph in a college textbook, they do not seem to be larger than a door knob. Because virtual environments can be designed true to size, a virtual reconstruction of Chavín de Huántar would be the only way to go in order to rescue its reputation for monumental masonry, stone sculptures and intimidating architectural details.

## 2. Related studies

The Stanford Chavin Project [2] that was led by John Rick in the summers of 1995 and 1996 involved the production of accurate maps using theodolite surveying technology and also included among the projects the creation of a web site that used panorama stitching technology with the Zoom Viewer Plugin from Live Picture to give a “virtual tour” of the site. The ability to rotate 360° around some key locations of the site along with detailed descriptions of each location are incredibly effective in making an impression. The panorama stitching technique is very useful for a quick overview but has very limited interactivity, poor depth perception and no method of conveying size and atmosphere. The objective of this project, which was intended to orient visitors and students to the site and give a better overview than fragmented pictures to support the research data, was met successfully.

## 3. The ‘Huacas’ project prototype

### 3.1. Overview

A search for other digital reconstructions of archaeological sites in Peru proved unfruitful; therefore my own personal interest in Pre-Colombian Art History led me to initiate the ‘Huacas’ Project. This project involves the virtual reconstruction of archaeological sites in Peru and Bolivia, starting with Chavín de Huántar because of its fundamental role. A ‘*huaca*’ is the Quechua word for sacred place or landscape. The ‘Huacas’ project a portable learning tool therefore web-based with plans for expansion to a more immersive medium such as the CAVE™. This tool is a system of virtual site explorations, paired with high-quality information and includes bibliographical references. The interface adapts to the individual’s reasons for exploration, whether they are at the student, professor or enthusiast level by offering several levels of information and navigation.

### 3.2. The reconstruction

The initial process of reconstruction involved the collection of archaeological data, maps, descriptions and photographs. This process was painstaking because the archaeological maps in textbooks are not always accurate and the drawings of sites are mostly or only top views. Therefore, information about dimensions have to be extracted from textbook descriptions and paired with pictures in perspective view in order to get as close as possible to the dimensions of the site. During this process, all photographs are inspected for the possibility of being used for texture maps. If they are deemed suitable, they are scanned and enhanced. Several texture maps have been created from drawings of sculpture figures. These are scanned, traced, recolored, embossed and applied a stone texture overlay. This technique proves to be very successful for any non-flat objects from which pictures are useless for texture extraction. An example of the result of this process can be seen at the tunnels of the Old Temple of Chavín de Huántar [Figures 1b and 1c] for the Lanzon sculpture.

Another important aspect of the reconstruction is to try to create the proper atmosphere in order to immerse the visitor into the site. Chavín de Huántar was an important religious center in the highlands with several thousands of followers who respected the temple. The temple must have looked most mysterious and majestic during wet and foggy season so there was an attempt to recreate this atmosphere in the reconstruction. It is known that there are various holes in the roof of the Old Temple, which possibly served for the pouring of libations into the temple. Most interestingly, the temple must have roared in its entirety when it rained because of the sound of the rain coming into those holes and down to the temple. This effect reproduced offers the visitor an understanding of why Chavín de Huántar was so well respected. The Lanzon tunnel was lighted simulating torch lighting and the Lanzon itself does not become illuminated until the visitor runs into it. The visitor gets the feeling of ‘sneaking around’ in places only priests of the temple would have access to because of this effect.

The areas reconstructed so far are: the Old Temple with its circular sunken court [Figure 2b], the Lanzon tunnel [Figure 1c], the New Temple rectangular courts [Figure 2c] and the Black and White Portal of the New Temple [Figure 3]. Various Chavin culture objects such as *cupisnique* style pottery and large sculptures, which were not found in situ, are also being reconstructed and placed in possible areas where they might have been.

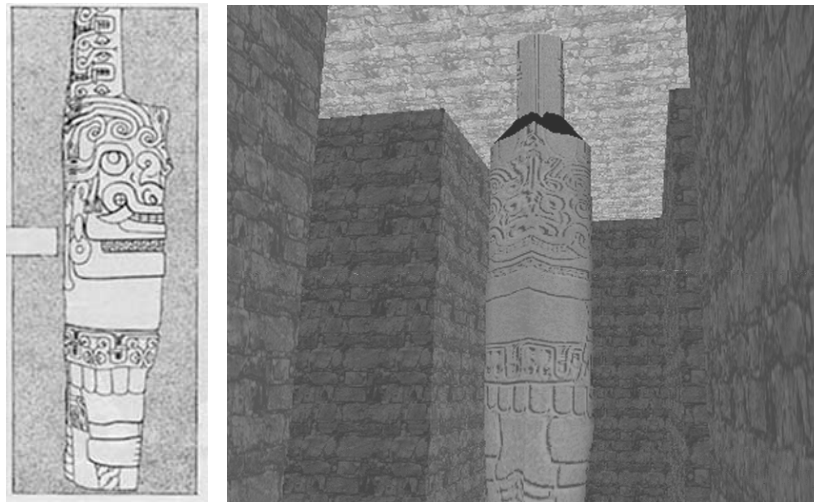
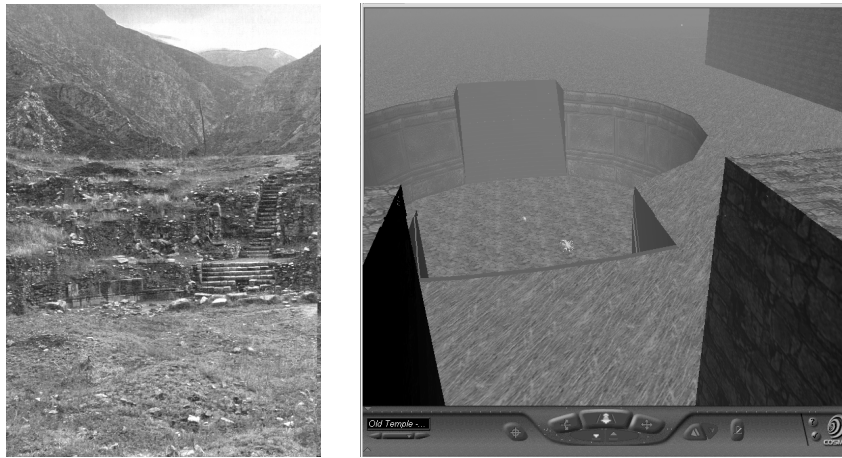


Figure 1b. Left. Lanzon sculpture hand-drawing

Figure 1c. Right. Lanzon sculpture  
in tunnels reconstructed

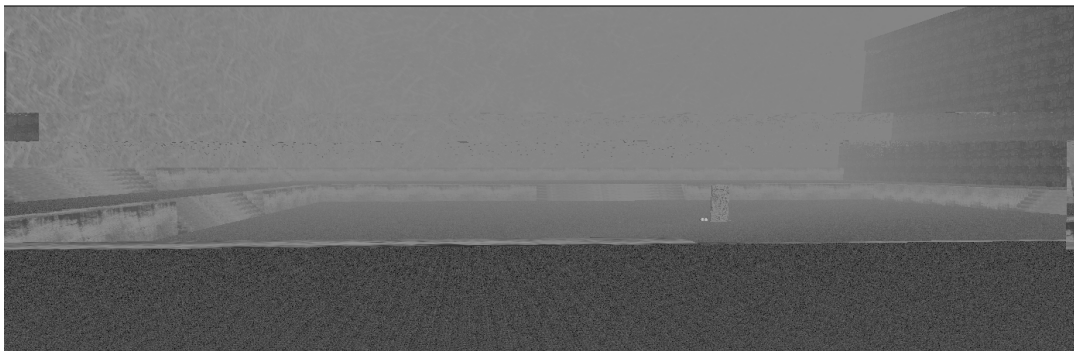


**Figure 2a. Left. Old Temple in its present state**

**Figure 2b. Right. Reconstruction of the circular court, view from half-way on stairs of Old Temple**

### **3.3. Technical requirements and notes**

The reconstruction was done using VRML97 with the Cosmoworlds editor. Modeling of certain objects was done using Alias Wavefront Maya 2.0. The VRML world was integrated into a frames layout created with HTML and JavaScript. The visitor is required to have a machine with at least a Pentium 233 MHz processor, 64MB of RAM, 4MB of Video RAM, Internet Explorer or Netscape 4 and higher (Java/JavaScript enabled), a VRML plugin and



**Figure 2c. Left. State of the Old Temple this decade**

SVGA resolution with millions of colors. The user can access the project via Internet over modem or network, or on CD-ROM. The project is optimized for the slowest type of data transfer and it also has been tested on Mac with similar specifications successfully. So far, the Mac VRML plugins are problematic because they seem to miss exit events of proximity sensors and therefore throw off some special effects and sounds. This prototype has not been tested yet on SGI machines. The prototype runs very slow on machines with 4MB or Video RAM but the performance is dramatically increased on machines with 8MB Video Cards. It runs equally well with software and hardware acceleration. Color, contrast and brightness

vary from platform to platform and VRML plugin but the variations do not seem to affect the overall quality of the reconstruction.

### 3.4. Interface design

The goals for the interface of the project were to minimize travel and depth and to give the user feedback and flexibility. Simple text links are used for navigation and high contrast color for legibility. The most complicated part of the interface is the VRML window, which varies in complexity depending on the plugin in use. The layout of the application is a system of frames within one window, which hold at a minimum the VRML viewer and the feedback window. Controls for pop-up floating windows of help and external navigation are available at all times. There are three different styles of navigation: *'full immersion'* (Opens a new window with the VRML world so that the user can resize to preferred size. Pop-ups active.), *'50/50 immersion'* (VRML world occupies half the user's screen but cannot be resized. User can navigate and follow the links in the feedback frame. Pop-ups active. Navigation tips active. 50/50 assumes a 1024/768 screen resolution) [Figure 3], and *'guided'* (VRML world occupies half your screen but cannot be resized. Navigation is disabled. User follows instructions in feedback frame. Pop-ups active). These variable schemes are designed to adapt to all user levels by letting them choose between more VR, more information, less or more freedom. In general, the information in the feedback window is updated through the activation of proximity sensors while the user navigates the VRML window. Therefore, no matter where the user is, they can get general information about the site. Detailed information on objects is available in the form of pop up windows when the user clicks on a hot object. [Figure 4]. All pop up windows include a *'close'* and *'print'* button so the user can have instructions handy or pull bibliographical references quickly. The final version of the prototype will include pop-up windows with cultural artifacts in which they can be explored individually using a VRML or Metastream plugin. This will help the user navigate around the object and look at it from up-close without having to be restricted by the scene surroundings and collision detection. A spondylus shell left floating in various areas is used as an indication of a portal to another location, except



Figure 3. 50/50 Immersion navigation layout with view of the New Temple Black and White Portal

for the first one the user encounters in the circular court of the Old Temple, which pops-up a window with information about the spondylus shell. The spiny oyster seems like an awkward choice but it is a key cultural reference and art historians trained in Pre-Columbian cultures recognize it immediately.



**Figure 4. Old Temple, within circular court with pop-up window about the Spondylus shell**

#### **4. Conclusions and future plans**

The prototype of the 'Huacas' project is at an early stage but already it can be used as learning and teaching tool. For the Chavín de Huántar section, there are several more things to be added such as pop-up windows, information and sound effects but it was important to design the interface together with the reconstruction for this phase, in order to test it effectively at an early stage. This of course is just the beginning. Plans for this project include the reconstruction of major archaeological sites and objects from Peru and Bolivia, which are badly damaged or are inaccessible and some others that are more popular. Such reconstruction project would not be complete without a full scale VR deployment plan, therefore testing has started on transferring the existing VRML sites to a CAVE™ or ImmersaDesk™ environment using OpenWorlds. So far, OpenWorlds has not quite worked well with the VRML code that is optimized for the web and has caused several crashes of an SGI Onyx2 system. This may simply be a texture issue in which case the maintenance of two versions of texture maps, one for VRML and one for the SGI need to be produced at all times. Transferring the textual information to the visitor of the CAVE™ or ImmersaDesk™ environment may prove difficult but could be done as a narrative the visitor chooses to listen to through a control panel. These are only initial thoughts and have not been tested. The

maintenance of two educational products, one highly portable and one highly immersive is still highly problematic. One hopes that the technology arriving in the next two years will allow for the creation of one environment with multiple options.

## **5. References**

- [1] Burger, L. Richard, Chavin and the Origins of Andean Civilization. Thames and Hudson, London, 1995, p.220.
- [2] Rick, John. The Stanford Chavin Project. [http://www.stanford.edu/~johnrick/chavin\\_wrap/chavin/](http://www.stanford.edu/~johnrick/chavin_wrap/chavin/), Stanford University, 1997.