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The Virtual Tibetan Classroom: Displaying Complex Scripts in 3D Virtual Environments

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Abstract

An important part of the "Hopkins Tibetan Treasures Research Archive" <http://haa.ddbc.edu.tw> is the development of the Virtual Tibetan Classroom for use in the 3D virtual environments of Second Life and OpenSim. This paper describes specific tools developed to display the Tibetan language to students inside a 3D virtual environment. The project pursued two technical paradigms: Fixed-content Language Display and Real-time Input Language Display. The project also adopted generic designs for writing and displaying languages with complex and unique scripts (such as most Buddhist research languages: Sanskrit, Chinese, Japanese, etc.). Working from the templates created for the virtual Tibetan classroom, scholars of Sanskrit, Chinese, and so forth can readily design their own language locales. The paper concludes with an invitation to all Tibetan instructors and language students to use the existing installations in Second Life and on OSGrid, or to request their own copy.

Introduction

The Hopkins Tibetan Treasures Research Archive[1] has created a Virtual Tibetan Classroom (Fig. 1) for the study of Tibetan (and eventually other Buddhist canonical languages) in 3D virtual environments. Although the classroom contains numerous virtual objects for Tibetan language instruction, this paper describes particular 3D tools that exemplify methods of Tibetan script display. Although these applications are currently set to serve the needs of Tibetan students, they were designed to be localized to other Buddhist canonical languages, most of which use complex scripts. The virtual classroom can be visited and used for instruction in the Catocala region of Second Life or in OSGrid, part of the emerging OpenSim-powered Hypergrid. Alternatively, the entire virtual Tibetan-language classroom installation can be uploaded from the internet into any OpenSim installation.[2]

Traditional academic instruction in these languages is expensive both for student and institution, requiring specialized faculty and consuming campus and faculty

Fig. 1. A Virtual Tibetan Classroom in OSGrid

resources. As familiarity with virtual worlds increases, graduate departments may wish to diminish administrative and instructional costs by relocating language instruction to the virtual classroom. Since there is an emerging body of research which suggests that this can be done without sacrificing language acquisition,[3] it seems prudent for Buddhist studies to have established methods for displaying complex and unique languages inside 3D virtual reality platforms.

Tibetan language is an important part of many Buddhist studies curricula. The Tibetan language employs a complex script, meaning that consonants and vowels are not always in the same shape and ligature grid position. Complex scripts are inherently difficult to present on digital text display systems in general and to display in 3D virtual classrooms in particular. To make matters worse, Tibetan words are unsegmented and often conjoined together in lengthy polysyllabic strings. Strict morphological constraints makes even simple deployment of words problematic. Generally, a programmed parser is required to transliterate romanized Tibetan into the target font.

Unfortunately for digital Buddhist studies, the Tibetan script in its complexity is typical of the other languages used in researching and writing about Buddhism. Sanskrit employs a complex script and unsegmented words. Pali is usually represented in romanized characters but with diacritical marks above and below consonants and vowels. Chinese presents a unique set of problems: each word is a separate character, and standard romanizations of Chinese are ambiguous.

Although our project focused on implementing Tibetan in virtual classrooms, we decided whenever possible to create generic solutions for the display of all Buddhist canonical languages. The results are 3D virtual applications by which Tibetan can be spoken, written, and listened to and which can be adapted for virtual classroom solutions for Devanagari, Pali, and Chinese. In fact, our project's research outcomes are applicable to the teaching and display of numerous of the world's languages.

For our project technology we restricted our research and development to the virtual classrooms of Second Life and OpenSim, since these 3D Multi-User Virtual Environment plat-

forms are currently the most popular models for non-gaming virtual reality interactions. Both are programmed using Linden Scripting Language (LSL), and objects created in one place are can be recreated (with some exceptions) to the other.

Project Objectives

The Virtual Tibetan Classroom teamdeveloped methods for the display of Tibetan and other complex scripts and for the playback of recorded and streamed audio. Based on these methods, we designed numerous tools and applications to be used in a virtual Tibetan classroom:

- Tibetan Number Puzzle and Grammar Verse
- Tibetan Whiteboard
- Cube of Tibetan Consonants
- Wall of WylieWriters
- Preset WylieWriter Lessons (with and without audio)
- "Collected Topics" Set Analyzer
- Tibetan Tutorial Viewscreens
- Tibetan Machinima Tutorials

A primary function of all of these tools is to display the Tibetan script. Some of them must be loaded with graphics and audio, either by the author of the tool or by the instructor preparing new language lessons. With other tools it is possible to input Tibetan text in realtime. I refer to these two input paradigms as:

- Fixed-content Language Display
- Real-time Input Language Display

The next sections will describe these two paradigms and demonstrate how our Tibetan language applications employ either Fixed-content language display or Real-time Input language display methods. Although this paper will not discuss programming details or pedagogical theory, it should be said that Dharma Drum Buddhist College has generously devoted time and resources to setting up the external server used by the Whiteboard.

All scripts developed for the tools in the Virtual Tibetan Classroom are freely available to the public under the same Public Domain license as the Hopkins Tibetan Treasures Multimedia Archive. It is our hope that they can be used as templates in mapping to other language locales.

Fixed-content Language Display Tools

Fixed-content Language Display tools must be pre-loaded with every glyph and sound that the tool will use in the execution of its program. They are stored within the 3D tool as graphic or audio files. The tool is thenceforth self-contained and does not require a supporting server elsewhere on the internet for processing or content. The benefits of Fixed-content Language Display tools are speed of display and independence from internet-enabled external servers. The limitations of Fixed-content Language Display tools are (1) a lack of flexibility due to predetermined content and (2) a limited amount of graphical and audio storage per application. Lack of flexibility can be countered by instructors creating and loading new instructional content. We developed four types of Fixed-content Language Display tools. Some of these are described below.

The Cube of Tibetan Consonants

The Cube of Tibetan Consonants is an example of a Fixed-content Language Display tool with audio. The Cube (Fig. 2) contains thirty graphics and thirty audio files, enabling self-learning through display and pronounciation of each of the Tibetan consonants. The controlling program provides a full classroom unit, allowing the user to step through the consonants sequentially or to play a specific consonant over and over. A quiz module is included so that students can track their progress learning the Tibetan consonants.

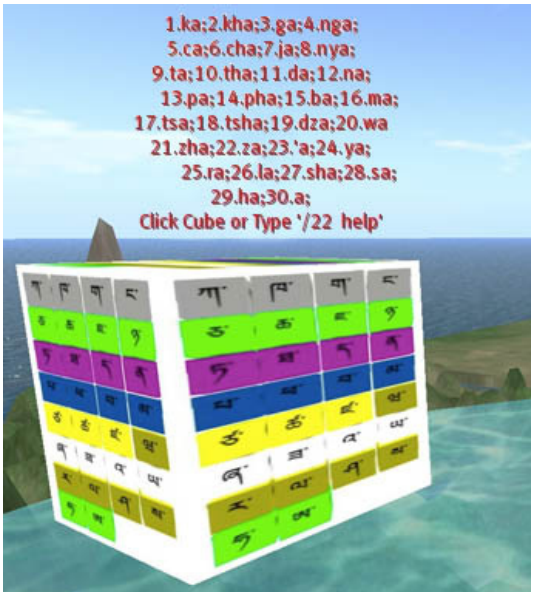

Fig. 2. Cube of Tibetan Consonants

The Wall of WylieWriters

The Wall of Wyliewriters was designed to be an array of display panels each consisting of three panes. Each panel can display all possible possible glyphs. The Wall of Wylie-writers here (Fig. 3) consists of an array of forty-four three-paned panels. The panels can be written to individually at the time of classroom instruction or can be preprogrammed to display customized Tibetan lessons on command. The array can be extended beyond forty-four panels if required. We developed an automatic panel generator for this purpose.

Fig. 3. Wall of WylieWriters

The WylieWriter with Server-side Audio

Server-side instructional audio greatly extends the capacity of the WylieWriter by enabling uploaded audio to stream into the Virtual Tibetan Classroom in response to a programmed media request. In this way, Tibetan language recordings can be incorporated into preprogrammed WylieWriter lessons (Fig. 4). Machinima tutorials (see below) and other video elements can also be employed to enhance language acquisition.

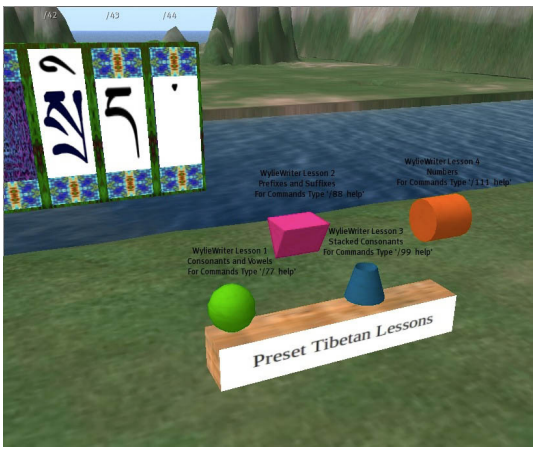

Fig. 4. Lesson Presets

Machinima Video Tutorials

Machinima Video Tutorials are a generic solution expanding the limitations of virtual classroom language instruction by bringing easily produced and externally-stored audio and video into the classroom. Our team recorded Machinima tutorial videos inside Second Life and uploaded them to Youtube and other internet sites where they can be viewed with a normal web browser. Within Second Life and OpenSim these videos can be screened on designated media players. Machinima tutorials greatly extend the resources of instructors since virtually any language lesson played out in a 3D virtual environment can be recorded from the desktop, edited, and placed on an internet server.

Real-time Input Language Display

Real-time Input Language Display tools do not need to be pre-programmed. Instead, the language-learning content is input ad hoc by teachers and students and displayed in the target script in dependence upon external computer support. The great benefit of a Real-time Input Language Display tool is unlimited flexibility for displaying unforeseen content required in classroom situations. The primary limitation of such Real-time Input Language Display tools is their dependence on external servers. Inputing UTF-8 encoded Unicode strings is also a type of Real-time Input Language Display.

The Tibetan Whiteboard

The Tibetan Whiteboard accepts Wylie transliteration at the keyboard and displays Tibetan script. The Wylie string arrives at the server to be processed by a PHP program. The string is passed to the server's LaTeX text-processing system which renders the Wylie string into Tibetan script in a graphic format. The graphic file is then sent back to the Tibetan Whiteboard for display (Fig. 5). This process takes a few seconds. The string can be up to 256 characters in length. It can also include roman characters and diacritical marks. Mathmatical formulae can also be displayed on the Tibetan Whiteboard.

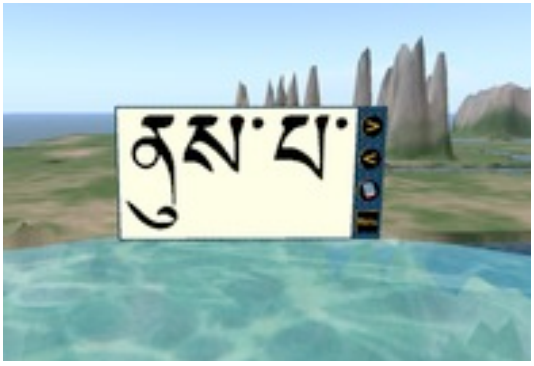

Fig. 5. The Tibetan Whiteboard

UTF-8 Character Encoding

UTF-8 Character Encoding support exists for languages defined by Unicode. User-input text in Second Life and OpenSim is displayed either through one of the communications channels (Fig. 6) or in floating text above a programmed object. Such text is originally typed in at the viewer command

Fig. 6. UTF-8 Encoded Tibetan

line or programmed in a script placed in an object. Since Tibetan is supported by Unicode, it can be displayed in the virtual classroom if the user has the ability to input UTF-8 strings. Our project used the Linux program 'Scim' for this purpose.

Conclusion

The tools and technologies of the Virtual Tibetan Classroom demonstrate that fully interactive Tibetan language classes are now possible in the 3D virtual environments of Second Life and throughout the OpenSim-powered Hypergrid. With access to our free and open source software, educators may now decide to develop new language tools and explore novel language locales.

Currently, language education in 3D virtual environments is just beginning to be explored by the language-teaching community. My experience has been that students with the necessary computers and skills benefit greatly from the unique sense of classroom presence created by a 3D virtual environment, in comparison with 2D distance-education platforms. Students without the proper equipment and skills require competent orientation before they begin work in a 3D classroom.

Those interested in teaching and studying Tibetan in a 3D virtual environment are welcome to use the two existing Virtual Tibetan classroom installations or they may request their own copy.

Contact information:

- The Virtual Tibetan Classroom in Second Life: Catocala Region.
- The Virtual Tibetan Classroom on the Hypergrid: Wamlabs Region, OSGrid.
- Visit <http://haa.ddbc.edu.tw/opensim.php> for an OAR file including the entire Virtual Tibetan Classroom for loading into any OpenSim installation.

Notes

1. <http://haa.ddbc.edu.tw>. Funded by the Taiwan National Science Council at Dharma Drum Buddhist College.
2. <http://haa.ddbc.edu.tw/opensim.php>.
3. There are many sources of information available about the impact of distance education. See for instance the University of Idaho's "Distance Education at a Glance, Guide 9, October 1995": <http://www.uiweb.uidaho.edu/eo/dist9.html>. For information about educational best practices in virtual environments, see the Virtual Worlds Best Practices in Education 2010 Conference website: <http://www.vwbpe.org>.