A ‘Virtual Learning Space’ for Language Learning — Past, Present, Future

Abstract

In this paper we discuss the development and practical use of the Virtual Learning Space (VLS) tool, a multiuser, distance learning environment designed for developing language skills. Where did it come from, what do we have, how does it work, where are we going, and what are the limitations? The main emphases are the features and functions which this tool can provide for teaching. In this paper we also discuss the pedagogical and functional evaluation aspects and define to a level the success of the tool.

Keywords: distance learning, CALL, multi user, VRML, X3D, JAVA

1. INTRODUCTION

E-learning courses have become an increasingly integrated part of higher and further education. Supported by the fast development of computer hardware and the wider spread of broadband connections, they are an option available now for students wanting to study from home or for teachers to enrich their traditional teaching methods. Most of today’s e-learning systems are mainly designed for managing course materials, which are usually provided in text and document form.

This paper describes the Virtual Learning Space (VLS), an interactive, distance learning environment for language learning. The learner interacts in a rich 3D virtual environment with other users, teachers, and native speakers, all represented as avatars. In this environment students can access multimedia learning materials and communicate via chat or videophone with other users, allowing for rich interactions with both teachers and other students.

2. CALL IN OUR CONTEXT

The use of computers for language learning (CALL — Computer Assisted Language Learning) is a major area of commercial activity and a fertile field of academic research. There is now an increasing interest in constructivist paradigms and in the creation of online communities who are learning by performing ‘real’ tasks in virtual environments (for theoretical issues with specific relation to technology see [HTF*01] and [PPW02]).

There is also a strong and not unrelated interest in ‘students as partners’ (for some issues in HE learning and pedagogy see [Mag01]). At Manchester a highly developed Tandem model already exists for language learning [Loz04] and a new asymmetrical ability L-PAL partnership programme between FL (Foreign Language) learners and EFL (English as a Foreign Language) students is being widely adopted within the existing course and assessment specifications for a number of languages, including Japanese, Chinese, and Arabic. Also, in the context of the new University of Manchester (the Victoria University of Manchester and UMIST merged in 2004) we have a particular interest in overcoming internal distances with non-specialist learners from diverse parts of our widely spread campus being able to learn flexibly within space and timetabling constraints. This combines with our need to find partners and material for languages (in this case Japanese) where there may be cultural and linguistic ‘distance’ of a different order than with more commonly taught European languages, and with a limited local community of native-speakers to draw on. Given the further issue of an 8 or 9 hour time-zone difference between the UK and Japan we are truly engaging with ‘distance’ in all kinds of ways.

In line with a social and constructivist approach to language learning, these schemes seek to engage students in partnerships with other learners. The learners carry out meaningful tasks requiring communication in language but where the language element is in some sense subsidiary to the goal. For example, students may be set to discover how to cook a meal from each other’s country. All the linguistic and cultural learning that such a task involves is to some extent hidden like the plate beneath the steaming food that results — but should remain after the food has been consumed! Any VLE (Virtual Learning Environment) must seek to allow and facilitate such constructivist tasks. Since we are talking of learning for cred-
its toward a degree, it is essential that the VLE also supports the existing QA-ed structure with its teacher-led classroom time and requirements for assessment and monitoring.

3. History

Our work on teaching Japanese in a VLE began in 2000 with a partnership with the University of Nagoya, in Japan, using a tool called JEWELS (Japanese Education World-wide Electronic Learning System), an Active Worlds® environment. Active Worlds® is a commercial product, providing an easy way to set up virtual reality worlds like JEWELS, but access to that environment ceased with staff changes.

After reflection on that experience it was felt necessary to develop an in-house platform whose design would be wholly led by the pedagogic functions required. This design process has been previously reported in [LBBPK05].

4. Goals

For our pedagogic goals we require an environment where there are social as well as classroom spaces, so that chance meetings and interactions take place and a community has the opportunity to coalesce. Learners, tutors and visitors should be able to interact in both social and academic contexts. This is the ‘campus’ idea. We have therefore taken the physical reality of our campus and attempted to make this our metaphor with classrooms, blackboards, library, cafeteria, computer cluster and other things that mark everyday university life. On a campus people meet and chat. Our VLS seeks to provide these functionalities.

The Virtual Learning Space was designed as a learning tool where students can participate from everywhere, using their own computers with a broadband connection, from a computer cluster on campus, or even from abroad. Students should meet other students, their teachers, and others in the environment, talk with each other, view teaching materials, or take part in formal lessons or assignments. By creating suitable environments, where for example role playing becomes much more realistic than in a real classroom, we would be encouraging general interaction among users.

One of the first meetings for this project defined a ‘wish list’ of functions and visual components. The minimum goal was to create at least all the functions available in the Active Worlds® environment, which is a multiuser world with embedded video and audio clips and chat functionality. As visual background a virtual reality campus of the University of Manchester was chosen for our VLS to give users a recognizable environment. From the main street (Oxford Road) on the south campus of our university, the user should be able to enter different learning spaces containing objects to interact with.

5. The Present System

The system developed is a computer graphics and web based tool, accessible with a general purpose web browser. Every user is required to login using a unique user name and a password. After the login users enter a 3D space, a representation
of the University of Manchester campus, in which they can see avatar representations of other users in the environment. After they choose in which course they want to participate, they can talk to all users in this course, or privately just to an individual. A video phone functionality enables the users to communicate in a more direct audio-visual manner, adding an important aspect to the language learning. Users can explore the campus, or enter into a teaching area, where they can take part in a lesson or specific exercises, or view teaching material.

5.1. Features and their Use in Teaching and Learning Japanese

The use of the VLS reported here is a combination of teacher-centred small group, and tandem partnership modes within the context of a pre-existing course unit. Over the last year a series of learners of Japanese have been meeting with a tutor in small groups (2-6) or with a ‘partner’ in pairs. The partners have been Japanese native speakers whose English is at an advanced level. The learners of Japanese have all been students in a level 2 language course with 3 contact hours a week. The VLS time was extra and consisted of 10 x 90 minute sessions over a 10 week period.

The design of the tool was led by issues for learning and pedagogy and featured ‘walking through’ the environment as a team (tutors and designers) in order to ‘storyboard’ the learning experience and develop a list of necessary and desirable features and functions. In the same way as we designed it, we have laid out features and functions with the thinking that lies behind them and with some comment on activities and issues during our test period.

i) Login

The individual learners have to be known to the system. This enables the users to feel the environment is person-alisable and secure so that they have some confidence that inappropriate behaviour is likely to be limited. Each user is clearly labelled and can be addressed. There is also a need to distinguish categories of user permissions. The tutor-coded login can effect changes in the live environment for pedagogic purposes (see v below). The record of actions in the VLS is recoverable by administrators and tutors, and standard administrator rights to warn, discipline and bar can be applied if required. An interesting realisation was that as tutors it is possible to operate multiple, diverse identities using different avatars which allow for role-plays of a realism undreamed of in a face-to-face situation. As in chat rooms, the real ID and gender etc. of an avatar are assumed to be genuine, but we have used this uncertainty for pedagogic goals.

ii) Street, Classrooms, Library

There is a potential need to have multiple, parallel groups and private spaces where teaching and learning is restricted to specified (i.e. ability) groups. We therefore have a number of interiors to buildings with several rooms each and a library space where resources and materials (or links to them) can be housed for learners to browse or seek for specified items. Most material in the library consists of video-clips, pictures for pedagogy, i.e. Japanese shop signs for reading comprehensive exercises, or work-sheets accessed by links to a server (see Figure 8).

iii) Configurable avatars

It seems important to allow some self-expression and individuality, as this forms part of social and linguistic presentation. Having a degree of control over gender and colour-coordination of the avatar is a step towards allowing individual users to replicate their real-world behaviour (see interface in Figure 5).

iv) Gestures

Language use is not easily divorced from culturally specified paralinguistic features such as gestures. For example in the case of Japanese there is a need to bow in certain linguistic contexts. For example the very common phrase ‘yoroshiku o-negai shimasu’ and its variants can be said to require a bow and this behaviour can be observed even when people speak on the phone where there is no possibility of the gesture being seen (see Figure 9). This being the case it seemed that a minimum would be to have a bow as well as a hand-wave function.
v) Live change of objects (text and links) A tutor must be able to write quickly and easily on the blackboard — either to summarize or to provide materials e.g. a grammatical template for an exercise — or to show a picture. This may need to occur several times through a learning session. The tutor login has the ability (not given to learner logins) to control the live environment via a pull-down menu (see Figure 6) and to write onto the board by typing text or writing (see xi below) or to change the pictures on the walls as appropriate. When the tutor moves into a different part of the world, the pull-down and settings will be updated to allow changes to objects in the new environment.

vi) Overview of active users There is a need to see who is in the environment and so a whisper function (see vii below) shows all available users via a pull-down menu, even if they have not interacted via the main chat window.

vii) Chat with whisper functions The interactions in the VLS have mostly been in text (although see below under x), but user feedback has consistently shown the use of ‘oral’ reference to text-chat mode (i.e. the use of ‘said’ for ‘wrote/typed’), and so it would seem that a strong if unconscious sense of this ‘really’ being ‘chat’ is well developed in some users. We have been experimenting with having learners meet an unknown person and ask them about themselves — a useful device where an inventive volunteer can be ‘forever new’ to the same group of learners! — We have also been taking or sending learners to a classroom space via a linguistic exercise such as giving directions in the target language. Learners meet with a known tutor and are instructed and/or explicitly asked to produce certain language. When multiple interactions are occurring or when someone wishes to monitor or audit a conversation it is useful to be able to ‘whisper’ to an individual and not have this text visible to third parties. This function has been used to monitor language or task activity in a similar way to a traditional language lab teacher action of overhearing a designated pair or individual in order to give corrective feedback. Whisper and ‘public’ chat are distinguished typographically on screen as the whispers appear as italics, but they retain the same colour-coding scheme which helps to make multi-user chat sessions easy to navigate.

viii) Chat log The saving of a log of chat for later analysis of communicative successes and failures as well as linguistic accuracy was a key pedagogic requirement, and has proved invaluable in teaching discourse strategies such as turn-taking, interrupting and back-channel responses. Japanese is a language where discourse features and back-channel responses are very explicitly marked and ‘chat’ generated by and with native-speakers has helped show this to learners.

ix) Video telephony Audio is a key part of language learning and of particular importance in languages such as Japanese, where oral and aural competence usually moves severely out of phase with script competence [NN03]. To know a language means to speak it, and the best way to learn this is to practise with an advanced or native speaker. Video telephony helps in this respect; it enables communication even with remote partners. For language learners it is also of particular importance to see the lip movements and facial expressions of the partner to distinguish words and meanings. When the partner is not present and the learner wants to leave a message an answer phone facility can record it. All video phone conversations are also recorded for possible later analysis or marking.

x) Video, Pictures and Slide-show The teaching of Japanese at Manchester often makes use of photos of signs and other texts that are rarely or never seen outside of Japan. The ability to set up a slide-show or randomised photos adds to the visual attraction of the tool, but is also performs a valuable pedagogic role.

xi) Embedded objects — links The complexity of Japanese script means that even upper level students can be completely unable to decipher graphical representations of familiar language. With this in mind it was essential to have access to a fast online dictionary that will appear in a separate window and into which text from the chat window can be pasted and quickly searched for pronunciation and/or meaning. Experience has shown that while tutors become adept at limiting their use of characters and grammatical structures according to the learner’s ability, it is much more tricky to control language use when volunteer partners are involved, and quick access to references or tutors is essential in a way that seems likely to differ substantially from languages written in alphabetic scripts.

xii) Interactive Blackboard The blackboard allows the tutor to type text and also to write with the mouse or a graphics tablet. This was of particular use in presenting Chinese characters (‘kanji’ in Japanese) as they can be shown with their correct stroke order and appear ‘as if by magic’ in front of the learner on the blackboard. The learner can also write on the board if the tutor ‘unlocks’ it and this function was used to test students’ ability to write certain characters correctly.

5.2. Technologies

One goal of this project was to create a learning tool free of license fees; therefore technologies were chosen because of their license conditions, common availability and interoperability with each other. It was supposed to be a web based tool accessible via a common web browser with access control over a web login. Therefore an Apache Tomcat server with a user database was used.

Instead of creating an imaginary environment for our learning space we decided to use a VRML model of the University of Manchester campus. There are a number of VRML plugins for web browsers freely available and VRML can have animations using embedded scripts and external access via the External Authoring Interface (EAI) to Java applets on the
web page [HW96]. The java applets are also used for communication with the remote server, to exchange information about user activities, like logins and logoffs, chat messages, updates of avatar positions and avatar actions.

Java Script and JSP tags on the web page provide additional information. In this way the user’s screen resolution can be obtained and the size of the components on the page can be adjusted so that an optimal view of all parts is assured. Also the user name is passed on into the applets and the VRML world.

Creating a tool for Japanese distance learning makes it necessary to be able to use two byte fonts in all parts of the system. Microsoft operating systems provide Input Method Editors (IME) for a wide range of languages. That makes it possible to write Japanese characters on a standard keyboard. In this way users can use all programs supporting Unicode characters for their language and the Java language supports the Unicode character set in most of its components. The application contains two applets: one is used primarily for the chat functionality; the other for user interaction with the VRML world and the video phone functionality.

The VRML standard supports UTF-8 fonts, but two byte fonts cannot be displayed in all VRML plugins. For this project we used the the Cortona plugin from Parallel Graphics.

Video telephony is a Java Web Start application which is launched from an applet. It uses multicast UDP to stream both audio and video data; with Java Media Framework providing the technology and codecs. Multicast makes it feasible to call several people in a conference call without increasing the outbound traffic from the client PC. Audio and video streams produced are compatible with the Access Grid system (http://www.accessgrid.org) so we were able to use the Arena Access Grid recorder from the Memetic project [Row05].

5.3. Client — Server

The project is a web based multiuser environment and requires the use of two independent servers: a web server to provide the internet pages and a data server to handle the multiuser parts.

Access control is embedded into the Tomcat web server, as all web pages are placed in a protected area which requires a valid login and password to access them. Any teacher is able to add or remove users from the user database by using the web server administration tool.

The screen size of the 3D world depends on the screen resolution on the client PC, to allow as much as possible of the graphics to be visible. The loaded applets contact the project server, registering the newly logged in user with the user name and group (from the user database on the web server) and requesting all updates from the environment. The server provides one main function that of accepting events with different identification and sending these events to all clients. It saves the last event with the same ID, i.e. the position of each user has a unique ID and only the last position is saved on the server. After a user has logged off, all events connected with this user will be deleted [Fon01]. Exceptions to this are changes made to the world by users with the group ‘Teacher’. Another function of this server is archiving the chat log, which is not accessible by students, and only teachers can use it afterwards for evaluation purposes.

The project server receives all events from all the users and posts all changes to all users. Some of the events occur relatively rarely but they should be handled with some priority. On the other hand events like the change of the position and orientation of the avatars may happen several times per second. To make sure that the project server does not get swamped with incoming events and so handle the more important ones with some delay, two instances of the project server are running on the server hardware. One instance handles all the chat messages where the user expects interactivity, the other handles all the interactions with the 3D world.

5.4. Video telephony

After the first year of development the VLS was used for teaching of an advanced Japanese course. Even though the students found the chat functionality of the tool useful and relatively easy to handle, the biggest problem was mastering the IME, chat could not fully replace verbal communication. For language learners it is also extremely helpful to see the lip movements of the conversation partner. In the second phase of this project video telephony was added.

Any user can select a person or everyone ‘online’ from a list of possible callees and attempt to make a call. If a person receives a call, he or she can decide either to accept the call or not and if it is accepted video communication is established. During the video call any partner can decide to invite another person to this call by selecting the name from the list and adding it to the call. If nobody answers a call or the call was rejected, the caller can chose to leave a message on the callees answer phone(s). The next time the person logs in he or she is informed that there are new messages.

For pedagogic reasons all calls are recorded, but only the teacher or an administrator has access to these recordings.
5.5. User Interface

A major factor for the usability and acceptance by the students is the user interface. It has to be easy to use, intuitive, understandable and clearly arranged, and all functions must be easily accessible.

The user interface consists of three main panels; see Figure 3. The central part is the 3D world in which the user moves through the campus of the university and sees other users, and in which actions are displayed. The 3D world is displayed in a Cortona plugin with the standard user interface switched off and the motion mode set to ‘walk’.

On the left hand site is a Java applet through which all interactions with the world are handled. There are two groups of users, ‘Students’ and ‘Teachers’. Users belonging to the ‘Teachers’ group have additional options to change the world; see Figures 5 & 6. From this applet the video phone application is also accessible. During calls a phone is shown with the video streams and a control for the audio volume visible. Quitting a call and adding other callees is done using this applet.

Underneath the 3D world is a second applet handling sessions (originally developed by UMA, Austria). Initially after the application is loaded, users can choose which course they want to participate in. This enables several parallel sessions to be run that won’t interfere with each other. After a course is decided; the user interface changes; see Figure 7. The user interface provides information about the current course and displays a list of other users. In the centre of the applet is the chat area with a text field for the chat messages and two lines to post messages. The user has the choice between posting a message to everyone present, or choosing a specific individual from the combo box (whisper). At any time the user has the option to leave the current course by pressing the ‘disconnect’ button, which then displays the global choice of courses again.

6. Evaluation

6.1. Educational Tool

Bearing in mind the multiple requirements of our pedagogy, it is remarkable that the VLS has been able to deliver virtually everything we wanted. The VLS has been successfully used for both teacher-led and partnership (Tandem, L-PAL) models of learning as well as for access to resources for independent learning. The testing process has not indicated any need to
alter the teaching, learning and assessment structures we already have in place. Testing suggested a need for adjustments for ‘best fit’ with the functionalities available (i.e. in the area of keyboard skills, order of introduction for script/s and explicit dictionary skills teaching), and suggests possibilities for enhancing partnerships, role-plays and self-access elements (among others) which are already present in our teaching and learning programmes. We can and will use the VLS as it is, and also plan to roll it out to other courses during the next academic year.

6.2. System

The task was to create a prototype of a highly interactive computer graphics environment, and a distance learning tool to teach the Japanese language using components free of license fees. The tool created is in active use. During development and in the test period a number of issues were discovered.

The application is fairly resource hungry; it is recommended to use a reasonably fast PC with at least 256 MB RAM and a fast internet connection (at least broadband). Considering the development speed in computer hardware this is not a major problem, and already all PC cluster computers at the University of Manchester fulfill this requirement.

Latency in using the tool is also an evaluation issue and occurs in several places. There is the latency between moving the avatar in the local world and seeing this movement in everyone else’s world. It is largely dependent on the number of simultaneous users and the amount of movements these users do at the same time. Evaluations after the first development phase have shown, that if only one user is moving the movement is usually visible for other users after about two seconds. If a number of users move at the same time a backlog of unprocessed movements builds up which can cause unacceptable delays of many seconds. This issue was addressed in restricting the number of events a user sends every second. The second kind of latency occurs when posting chat messages. Chat messages do not cause major delays, mainly because it is unlikely that there are many messages being submitted at the same time, with average delays being around two seconds. Another problem is connected with writing chat, since the rendering of the VRML scene takes a major part of the processor, a delay can occur between typing the letters and their appearance on screen; this delay was also reduced by limiting the percentage of the processor Cortona can use for its renderer. An evaluation of the multi-user capabilities can only be truly accomplished when a group of users use the system at the same time. Some changes have been applied to the design, and so there will be a new evaluation conducted later during this academic year.

The last point to consider at is how easy it is to enlarge or change the world. Although it is quite easy to construct a new 3D world using authoring tools, to embed it in the environment some knowledge and understanding of VRML is necessary, but no changes are necessary in the Java part of the application. All complex objects already present in the world can be encapsulated in external prototypes to make redeployment easy.

Figure 8: Retrieving some work from the library

Figure 9: Being polite

7. EXTENDING THE PROTOTYPE

The period reported on above was one where teaching and learning were supplementary to the programme of the participants. This was partly because using the tool on university computer clusters required testing the system extensively and, as
we had suspected, required modifications and trouble-shooting which would have wrecked a programme of study that relied on it entirely. Our research has given us a rugged tool that can be used across the university, and it has given us knowledge of its strengths and weaknesses. We can use this experience to design a new, blended-learning programme employing a combination of traditional classroom face-to-face teaching and a VLS partnership with a target-language learner of English which is also fully integrated into the assessment structure and meets the quality assurance standards for this kind of unit. With sufficient use there will come the opportunity to investigate what kinds of learning are taking place and their efficacy.

In terms of functionality the next stage is to move towards having the VLS login names connected to the central logins assigned by the university system, and thus move towards one of the strategic goals of integrating systems across the university. The 3D graphics have enormous potential for future pedagogy and it is hoped that we can explore possibilities such as constructing a Japanese house for a walk-through tour of the architectural features, or making a museum of popular culture where users can walk around exhibits and obtain information from supplied information and creative juxtapositions and events. It may be possible and useful to create a ‘shop’ featuring products, pricing and signage where, for example, role plays could take place. Many of these elements can already be brought in by web links, but to have them within a 3D environment would greatly enhance their attractiveness and potential usage.

The tool was always designed to be generic, and Japanese teaching was one of many possible applications for it. The next stage of our programme of development will be incorporating spaces for Italian, German, and EFL. We hope to create some sort of community by having many users and courses in dedicated spaces, but making all users pass through the same public space. To facilitate this we need larger numbers of regular users, and we propose to make a café space where chat can occur without reference to the classroom.

8. Conclusion

The Virtual Learning Space is one example of what virtual reality can do for teaching. With the fast development in computer technology and in the spread of fast internet connections it is possible to bring graphical and multimedia applications to learners anywhere in the world. This tool is in active use and is undergoing further developments; already it provides a large number of features to make learning more interesting and interactive with an easily extendable space. Especially language teaching has been shown to profit from these new possibilities, bringing native speakers and learners together in a virtual world, teaching not only the language but the culture behind it. Its success remains to be seen, but the prospect of a browser mounted environment where visitors can enter public spaces and interact with students and staff that replicates the real Manchester experience and its interaction with the vibrant city around it has great potential.

References