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User Interfaces for a Virtual Learning Environment: Two Study Cases

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Abstract: A recent powerful idea in the design of Web-based learning environments is the usage of *virtual places*. The employment of interface metaphors is one of the approaches enabling inexperienced users to feel comfortable in such *virtual* environments. We have designed a Virtual Environment for Distance Education and Training (VEDET), which provides basic virtual spaces, resources, and services. In this paper we discuss the user interface of two Web-based distance learning courses *Business on the Internet* and *Business English*, developed on the basis of VEDET. A web-based learning environment has been implemented to support the delivery of these courses. Two examples of interface metaphors have been developed and adopted, each presenting a coherent image of the environment.

KEYWORDS: Distance Learning, Human Computer Interface, Business/Commerce, Internet, Languages

1. Introduction

The power of the new communication and information technology influences human life and economy so deeply that it makes all of us learners both as individuals and members of (real or virtual) learning communities and learning organisations in a learning society. Looking back at the history of communication and information technology we can clearly see how the main attention of researchers and technologists has gradually moved from hardware to software, then to the human-computer interface, and most recently to social issues related to global communication and collaboration. Computer mediated communication leads to the establishment of *virtual communities* formed on the basis of topics of mutual interest, collaborative work, business, or other joint activities. These communities cross national and cultural barriers and demand the re-conceptualisation of social life, including education and business.

One of the approaches allowing inexperienced users to make effective use of computers is an emphasis on *interface metaphors*. Metaphors help users to understand a new system interface by invoking their prior knowledge. This understanding is important since it allows the users to interpret and predict the behavior of the system.

The essence of interface metaphors is that objects (activities) are transformed into pictorial representations, which the user can easily identify and understand. This basic understanding gives the user an idea as to how to use the system. The interface has to be designed in such a way that the activities that the user could do in the physical world could be done on the electronic versions. One of the main design problems with the *metaphor as model* approach is how to incorporate additional functionality, which is not part of the interface metaphor but which enables the computer to be more powerful than non-electronic equivalents (Preece, 1994).

This paper discusses the interface metaphors developed for two World-Wide Web (WWW) based distance learning courses *Business on the Internet* and *Business English*. A WWW-based learning environment has been developed to support the delivery of the courses. Two examples of interface metaphors have been developed and adopted to present a coherent image of the environment.

The paper is organized in the following way. First, the general model underlying the environment is presented and the Virtual Environment for Distance Education and Training (VEDET) is discussed in brief. Then the two different examples of interface metaphors are described: the cases of *Business on the Internet* and *Business English* courses. Finally, some practical results as well as future plans are discussed.

2. General Educational Model

The success of both individuals and organisations in the global economic and intellectual competition depends on their skills to transform, quickly and at the right moment, available information into useful knowledge that can be used for taking important management decisions. Employers demand that their workers are able not only to memorise facts but rather to learn new methods, new programs, new professional skills. The search and filtering of huge amounts of information is not an easy task and the new developments in information and communication technology still do not support it efficiently.

For the purposes of the *Business on the Internet* and *Business English* courses a learner-centred educational model was chosen. The instruction is based on electronic libraries

and object-oriented multimedia resources rather than on printed materials. Students can study on their own using aesthetically formatted and interactive multimedia learning materials. They have to construct their own knowledge, to study individually according to their skills, interests, preferences and cognitive characteristics, to *learn how to learn*. Students can control their learning process, work in a team with other students, take part in discussions, and receive feedback on the effectiveness of their learning. The tutors are students' *classmates*, who help them find how to cover and traverse optimally the information-rich global information systems and how to find the most suitable learning materials. The achievements of the students are assessed on the basis of the final result (product), which can be presented, defended and published both locally and globally. Self assessment is encouraged. *Co-operative learning* and work dominate over *competitive learning*. The tutors can work with students individually as well as with small groups of students. The student can work in a dynamic and interactive multimedia learning environment where, aside from the tutor and the other students, s/he can communicate and work with his/her virtual friends all over the world.

The authors see the World-Wide Web (WWW) as one of the best mediums for implementing this model. The WWW could support teaching and learning in a number of ways:

- as a source for reading materials;
- as a corpus for self-exploration;
- as a medium for writing, publication and dissemination: publishing on the WWW allows writing for a real audience (classmates, the Internet community) rather than just for the teacher;
- as a forum for communication: students develop confidence in using English as a language of communication; they learn to organize and present ideas in a clear way; they have the opportunity to get in touch and communicate with other students all over the world.

Our efforts to incorporate the World-Wide Web into instruction are aimed at using it both as an information resource and as a basis for organizing long distance collaborative learning.

3. A Model for a Virtual Environment for Distance Learning via Internet

The idea of a *uniform interface* is the most important one for the success of the World-Wide Web nowadays. It is central also to the Intranet and Extranet concepts, unifying the

principles of presenting and using information, creating *institutional webs*, applying *learner modeling* and *intelligent Internet agents* technology in various types of organizations.

A recent powerful idea in the design of the Web-based learning environments is the availability of virtual places: auditoriums, workshop rooms, cafés, libraries etc., where students from different locations can meet, interact, and work together, as if they were face-to-face.

A prototype of a Virtual Environment for Distance Education and Training (VEDET) was developed at the Department of Information Technology, University of Sofia. VEDET contains four types of learning organizations: a virtual university, a virtual language learning center, a virtual school, and a virtual enterprise (Nikolov and Nikolova, 1996). It includes also a number of virtual services such as: a virtual library, a virtual post office, a virtual student house, a virtual exhibition and entertainment center, a virtual electronic publishing house, a virtual help desk, a distance education brokerage service, a virtual electronic document and software delivery service, a virtual course customization service, a virtual transportation service, a virtual liaison office, a virtual public arena.

The kernel of VEDET is the virtual university, which includes:

- an administration office, where students can register and discuss organisational issues with the university staff;
- a virtual lecture hall (auditorium), where a lecturer could deliver a lecture for a particular virtual learning community;
- virtual seminar rooms, where the virtual class can discuss issues related to subject matter topics;
- virtual workshop rooms, where collaborative work can take place;
- a virtual reading room, which contains all locally prepared learning materials.

The virtual university learning environment includes *branches* of most of VEDET services.

Similarly, the virtual language learning centre consists of an administration office, virtual classrooms, virtual reading rooms, a video centre, a phono lab, a student centre. It also includes branches of some of the VEDET virtual services. All the language courses currently offered are announced at the *information desk* of the administrative office. One can register for a course at the *registration desk* of the administrative office.

Each course takes place in a *language classroom*. The classroom is the central place for a language course: the place where the virtual teaching actually takes place.

The virtual library has an integrated catalogue of locally available electronic resources, as well as a gateway to other virtual libraries, such as GNA library (GNA, 1993).

The virtual post office provides electronic news services, multimedia e-mail and listserv services, electronic journal subscriptions and delivery, postcards construction and delivery, etc.

The virtual publishing house (Nikolov *et al.*, 1997) offers customised publishing of stand-alone and networked hypermedia materials, such as: electronic textbooks, videos and audio, teacher and student guides, questionnaires, presentations, catalogues, advertisements, etc. The customers order publishing services by providing resource materials - text, scripts, audio, images, logos, ideas for illustration and animation development, links to related Internet sites, instructional design requirements (Ducket *et al.*, 1995).

The virtual electronic document and software delivery service allows learning resources to be supplied at any time and to any place *locally* and *globally*. It supports the learning resources flow and workflow planned by the instructors and administrators.

The virtual electronic entertainment centre provides access to virtual museums, art galleries, exhibitions, concerts, movies, computer games, etc.

The virtual help desk provides support in specific activities.

The virtual public arena including a virtual café is a place for informal talks. The virtual café can have a number of different rooms for students, teachers, parents, employers, as well as cross-meeting places for discussing career opportunities between students, parents, and employers.

The virtual course customisation service deals with distance course customisation and adaptation to the needs of the local learning community, by taking into consideration the local educational and training traditions, language, culture, and even individual needs of a particular group of learners.

The virtual liaison office deals with the administration and co-ordination of international co-operation projects, student and staff *virtual mobility* schemes, etc.

The distance education brokerage service plays the role of a market place for educational services and products. Any educational institution can do global marketing research for its own products there and order and *purchase* educational products and services.

The virtual transportation service provides fast *shuttle-bus* transportation service between the virtual places of VEDET and a *space-shuttle line* between different virtual environments.

VEDET provides only basic virtual spaces, resources, and services. The users could reconstruct VEDET virtual space by adding new customised facilities, spaces, and services according to the particular instruction requirements. For instance, for the purposes of a session of electronic commerce a new virtual workshop room could be created and *equipped* with a business Web pages development toolkit, software and electronic conference tools appropriate for collaborative projects in marketing on the Internet, etc. (Farraro *et al.*, 1995; Favorin, 1995; Guzdial *et al.*, 1995)

VEDET offers a comprehensive interface metaphor to be used both for human-computer interface and instructional design purposes. The two distance courses described in this paper can be seen as examples of the power and flexibility of the proposed approach. This approach also enables the process of restructuring traditional education and training by complementing them with virtual components.

4. Main Design Principles

4.1. Business on the Internet course

The *Business on the Internet* course could be regarded as a case study for instructional design principles for on-line courses as well as a technological framework for distance course implementation (Stefanov *et al.*, 1997). The main technological platform for course delivery is the WWW integrated with other Internet services such as E-mail, computer conferencing, WWW interface to data bases, etc.

In the proposed approach, cooperation takes a key role. The participants work within a learning community where the emphasis is on:

- providing a wide choice over content and direction of learning;
- managing by participants of their own learning and cooperation with others through processes of negotiation and discussion;

- providing a critical perspective on learning and other academic issues with a strong relationship to participants' professional practice;
- Participants and tutors taking collective responsibility for the design and evaluation of the program with constant reviewing and modification of the design, procedures and ways of working.

Some important aspects of the proposed design are: openness in the educational process; forming a learning community; self-managed learning; supportive learning environment; collaborative assessment of learning; assessment and evaluation of the on-going learning process, etc.

Main design decisions

The above mentioned design principles led to the idea of developing a *template* - a WWW-based tool, consisting of a set of WWW pages, with uniform design metaphors and consistent layout. The template represents a virtual learning environment including the following virtual components: Wall Tray (including introduction, course philosophy, and course organisation), Students' Help desk, Teachers' Help desk (assisting teachers to apply in a flexible way the chosen instructional design), Virtual Library, Café. The template consists of two main parts:

- *introductory part* - helping the students with overall course orientation;
- *study part* - promoting the real learning according to the chosen model.

All Web template pages have been designed with strong consistency in mind, so the users (teachers and students) can easily navigate and become oriented as to what part they are using/exploring, for what purpose, what to do next, how and where to go next, etc.

Both the introductory part and the study part of the template include various units, all linked together and having common purpose and functionality. The units are designed so as to be easily modifiable and have a standard interface. They are also self-contained, manageable sections that can stand alone and are often interchangeable.

The main units in the introductory part, when filled in with appropriate information, will constitute the course home page, introduction to the course, course outline, course micro-planning, evaluation and statistics, simple demo version of the course, students' and teachers' authorisation. They all have a common frame structure.

The main units in the study part, when filled in with the necessary information, will constitute the basic course learning units, each one containing sub-units, corresponding to different learning activities.

The pilot *Business on the Internet* course is accordingly structured in two parts: introductory part and study part. The study part (see Figure 1) includes six basic units containing the following sub-parts: a lecture, guest lecturers, tests, questions, case studies, an essay, a resource bank, discussions. A large unit could be further divided into sub-units each with its own objectives, activities and tests. The learning objectives are short, clearly defined, measurable goals that students could achieve.

The learning activities are important parts of the lessons and they actually promote learning and move students towards the course objectives. Each specific student target group is offered selected readings. The lecture notes are available on-line at the beginning of the course and can be refined during the course. Each student is assigned the task of constructing Web pages on a specific theme and their hypermedia reports could be published on a Web page. This allows both students and tutors to enrich the learning environment. The students also have at their disposal examination study hints with hypertext links to important materials. Private correspondence among the students, tutors and experts is encouraged. *Guest lecturers* are *hired* simply by including hyperlinks to their materials on the Web or by scheduling on-line or asynchronous presentations by them. The students can present their reports online or publish them on a Web page. Online discussion groups are formed dynamically and some students are assigned to lead off discussion. Special conferences are opened and the students are invited to discuss specific problems, case studies or proposals. Quizzes and tests included in each unit allow students to measure their own progress and mastery of the course components. A number of small projects linked to form a larger project are given to all students. The students can learn at their own pace. They also have the opportunity for free exploration using the resource banks attached to each unit as well as the course library. Web course materials and online interactive sessions are stored for further use in classes.

4.2. Business English course

Traditional approaches to foreign language instruction are usually entirely teacher directed, closely following a chosen textbook. In contrast, most of the emerging WWW LEFL (Learning English as a Foreign Language) sites offer resources or activities which

the learners can freely explore, use or take part in (see for example Mike Vallance's Business Meetings on <<http://www.stir.ac.uk/epd/higdox/Vallance/Diss/FP1.htm>>). Though the principle of *learners taking all the responsibility for their own learning* is recently strongly advocated, the Business English course authors believe that, for a course which is to be credited, the human teacher should have the overall control of the instructional process. Accordingly, the main postulate was *while keeping the tutor's leading role, to move towards more efficient learner centred instruction*. The latter resulted in setting basic course design principles focussing on: constructivist learning, real-life problem solving simulation, meaningful communication and co-operative learning and work, creative language practice, interactiveness, and Web-based self directed learning.

Main design decisions

In order to implement these design principles, a WWW-based learning environment was developed to support the delivery of the *Business English* course. The purpose of this learning environment is twofold: on the one hand to embed the main course content (with references to relevant web sites) and on the other, to serve as a medium enabling learner centred activities and supporting the overall course organisation; in other words, to serve as a *virtual place* where the Business English instruction will take place.

The course material is divided into learning units, each built around one main topic. All units have identical structure and consist of pre-reading activities, reading, post-reading activities and assignments. The pre-reading activities range from expressing an opinion on a given issue or completing a self-analysis questionnaire to taking decisions on a controversial problem. The aim is to provoke some brainstorming and thus lead students into the topic. Each reading section includes: basic text, complementary texts and references. The texts included in the reading sections provide only brief information on the topic. In order to expand their knowledge in this area, students will have to do a lot of self-studying in the local or virtual libraries. The post-reading activities are divided into three groups:

- comprehension* - directly related to the text for reading: true and false exercises, filling in tables, taking notes;
- language focused tasks* - gap-filling, phrasal verbs;
- follow-up activities* - field studies, team building, role-play, SWAT analysis;

□ *surf-the-net* - exploring a site with a specific task in mind.

Assignments include writing a memorandum, a CV, a covering letter, a business letter, guidelines on how to work in a multinational team, an article to a magazine on corporate culture and others.

The virtual teaching takes place in the *Business English classroom*. On the *walls* of the classroom poster information is presented: course description and course syllabus. The course syllabus is presented in a table providing hypertext links to the actual learning material and activities. One of the walls is equipped with a *message board* and another with a *shelf* containing books that are going to be used frequently (including an English Grammar book, Merriam-Webster's WWWebster Dictionary and Encyclopedia Britannica). The message board is a board for administrative messages from the instructor, spotlight information, notes and instructions for the week, etc. It is important for the students to check the *message board* regularly because the tutor announces the tasks for the week there. All the old messages can also be viewed. The classroom *corners* are designed for self-study activities. *Gateways* lead to the Post Office, Conference Centre, Library, Student Centre, and the Café. The interface of the *Business English* course is given in Figure 2.

5. Discussion

VEDET is based on a strong integration of virtual learning institutions and services. The *human computer interaction model* of the two WWW-based courses interrelates with their instructional design strategy. Learners, instructors and administrators from different locations *inhabit* the virtual learning environment and can meet, interact, learn and work together, as if face-to-face. VEDET is interactive, flexible, open, distributed, accessible from a distance, asynchronous, filtered, and contains Web *road-maps* and course archives.

The *Business English* and *Business on the Internet* learning environments developed on the basis of VEDET support *learner centred instruction* focusing on new roles for the learner, different from the traditional ones, namely greater motivation, responsibility, accountability, self-control, ability to work on their own and to collaborate. The emphasis is on communication between the instructor and the students. This is supported in various ways: by e-mail, class list server, local bulletin board system, group discussions via asynchronous computer conferencing, etc.

VEDET can be used either for delivery of distance learning courses or as an aid to class infrastructure allowing some functions to be carried out through web pages and web-based activities. We believe that in either case it will extend and enrich the delivered courses. The environment supports the six categories for tele-learning as a part of a face-to-face course (Collis, 1996):

- making the course materials more organized and accessible to students;
- improving the effectiveness of the lesson presentation session;
- improving communication between the instructor and the students;
- improving discussion among the students;
- improving the range and quality of resources available to the students and shifting the responsibility to the student for the selection of appropriate resources;
- improving the range and quality of learning activities available to the students, particularly in terms of collaborative learning.

The implementation of the courses was a successful beginning of the interface metaphor's validation. Now the courses have entered their experimental phase. Five instructors - four university lecturers from Sofia University (three from the Department of Information Technology and one from the Faculty of Economics and Business Administration) and one from the American University, Blagoevgrad - are using the VEDET based courses. More than 25 students are participating, some of them at a real distance. Special evaluation forms have been prepared for the students and for the tutors. Among the main goals are to test how computers can assist communication between the students and the instructor, how to make students co-operate by sharing information and how selected sites on the Web can be used to expand students' knowledge of a particular subject.

The very first impressions of this process could be summarized as follows:

- Both the instructors and the students take part vigorously in the courses which indicates that the work on/in the courses is motivating and pleasant for them. Since the students have had some previous experience in using the Internet and the WWW as a course environment, obviously they do like the courses, not just the use of the new technology.
- Only one of the instructors had some initial problems in using the environment. For a broader use, however, VEDET courses should be accompanied with appropriate user documentation.

- The main problems for the instructors is their lack of experience in using interactive tools in a networked environment. This indicates that some demonstrations should be prepared to serve as examples for instructors of how to include more interaction in their lessons.
- The instructors and the students like the better communication within the course compared to their (conventional) classroom practice.
- The interactive exercises (automatic checking) are of great help to the instructors and allow the students to see their results immediately. The experience shows that they are among the favorite activities of the students.
- The pilot versions of the courses were developed with very little special maintenance, which indicates that it is easy enough to use VEDET for a real course implementation.

The implementation of the two courses was a good experience for the authors of the paper. It helped to identify some key problems and suggested directions for further development and improvement of VEDET.

Future plans and improvements

The technological, communication and information infrastructure, especially the electronic catalogues and Internet resources collected, will be used to create a community of practice which will continue to grow after the project is completed.

One of the main directions for further development of VEDET includes adoption of the paradigm to accommodate individual learning styles. The environment should enable the learner to identify himself within one of the four basic learning styles proposed by Honey and Mumford (1992) and then to choose the appropriate content structure, learning activities and method of navigation suitable for that learning style.

Another interesting idea is related to a broader use of different types of multimedia information (audio, live video, synchronous videoconferencing, etc.). This feature could be used also in so-called “simulated distance education” thus eliminating the technology barriers.

An important line of future improvements of VEDET is connected with database registration and accounting features, enabling more sophisticated ways of achieving collaboration and group support activities.

Our future plans are also aimed at including *intelligence* in the VEDET environment. One of the key features strongly related to the intelligence of the interface is user

modeling. This concept involves automatic construction of a model of user's current knowledge, skills, and behavior, so that the system can use it to adapt its own behavior to that particular user's individual characteristics.

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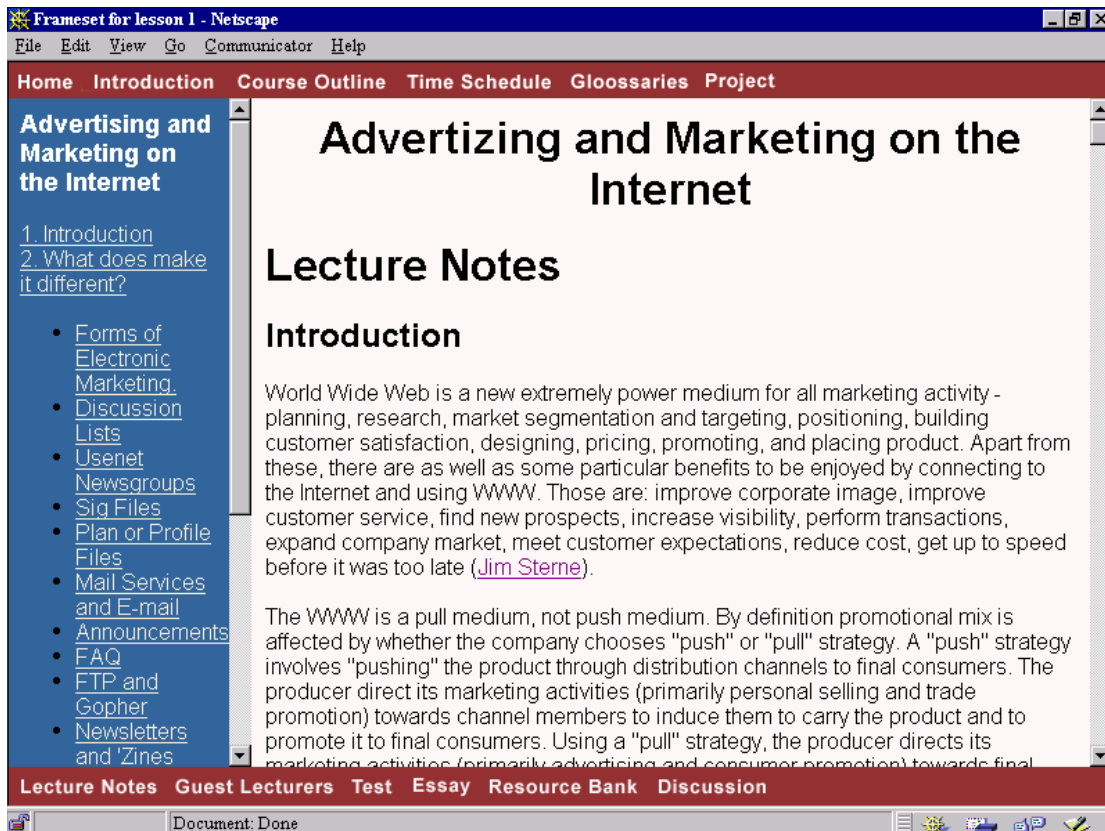


Figure 1. The Interface of the Business on the Internet Course

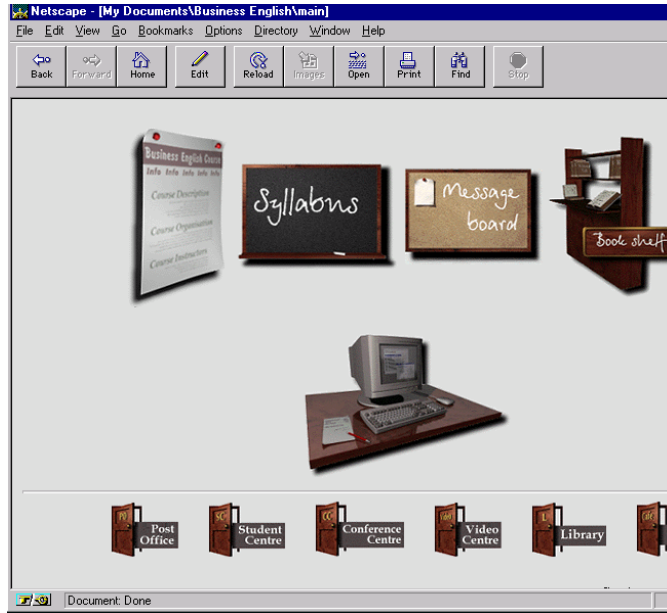


Figure 2. The Interface of the Business English Course