World-Wide-Web Supporting for the Learning of Non-Orthographic Languages

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The production of educational software is moving from the paradigm of courseware devised by or for the individual teacher to the development of educational resources that can be shared and accessed from a wide variety of teaching sites. This paper describes the design and the implementation of a novel integrated open system for the effective supporting, through the World-Wide-Web (WWW), of multiple non-orthographic languages' learning. The teacher can access educational material and rich multimedia representations of meanings and formulate student specific courseware according to individual needs. After a user requirement analysis, the architecture of the systems is presented along with implementation issues. The system fulfills the crucial need to prepare, organize and up-date the training material on time, free of those constrains brought by location or operation platform and with an efficient economic way for the teacher of non-orthographic languages for an efficient, learner centered, education. The system allows an individual or a team of teachers to focus on content specification and other high level tasks, while developing courses.

Keywords: **Internet - Web Education, Language Education, Global Education, Non-orthographic Languages**

1 Introduction

The rapid development of Information and Communication Technologies (ICT) in the last years, specifically the Internet and hypermedia, has provided the possibility for developing innovative approaches for the learning community [Ewing et all, 1999]. ICT lead people to a totally different way of acquiring knowledge and collaboration for both teachers and learners [Gilliver et all, 1998].

Furthermore, the production of educational software is moving from a focus on courseware produced by the individual teacher to the development of educational resources that can be shared and accessed from a wide variety of teaching sites.

Unlike most pupils, those with moderate to severe speech or intellectual and/or physical impairment approach literacy not as speakers, but as individuals who process and use non- orthographic languages prior to and along with print. Such non-orthographic languages are graphic sets and systems for augmentative and alternative communication. The majority of the non-orthographic languages are sets of line drawings, each with its own distinct and fixed meaning. Other graphic representational systems, such as traditional orthography, represent integrated, rule based, symbolic systems, wherein a fixed set of elements can be recombined to produce an almost unlimited range of novel meanings. Words and sentences in normal text are written in an orthography whose graphemic units are members of the alphabet of a natural language. A user of well-established non-orthographic language combines a number of graphic symbols to

formulate a sentence [von Tetzchner & Martinsen, 1992]. For the effective communication with other people, this sentence can be translated to common orthography or synthetic speech through a suitable communicator device or an application of a personal computer.

The characteristics (abilities, skills, requirements and preferences) of an individual student, user of non-orthographic language, may vary significantly. In principle, each student may require a system specifically tailored to his/her particular needs. One major issue, with respect to user requirements, is the provision of effective user access to the vocabulary. The teacher or the facilitator usually selects a vocabulary to meet the end-user needs according to his/ her communication skills and language abilities. Once selected, the vocabulary can be organized in an appropriate layout and, subsequently, up-dated or modified, according to the specific end-user requirements and preferences. The need to prepare, organize and up-date the training material on time and with an efficient economic way is crucial for the teacher of non-orthographic languages. Learner centered education [Norman and Spohrer, 1996] is a must for students of non-orthographic languages.

Teachers are the most important factors for the successful and prompt implementation of new information and communication technologies into the field of education of non-orthographic languages. But teachers need efficient and easily accessible support. At the moment the most promising way of supporting teachers is focused on the WWW [Astreitner et al, 1998], [Metaxaki et al, 1988] through appropriate teacher support systems facilitating access to sources of information, such as data bases, electronic dictionaries and on-line context-sensitive learning aids [Kraus, 1995].

In this work we present the design and the implementation of an integrated open system for the effective supporting, through the World-Wide-Web (WWW), of multiple non-orthographic languages' learning. The teacher can access educational material and rich multimedia representations of meanings and device student specific courseware according to individual needs. After a user requirement analysis, the architecture of the systems is presented along with implementation issues.

2 Motivation

The application of non-orthographic languages and visuo-graphic symbols to a broad spectrum of language-learning children with speech and language impairments has been widely accepted for the last two decades [McNaughton & Lindsay, 1995] [Stephenson and Linfoot, 1996]. Such systems are often known as Alternative and Augmentative communication (AAC) systems and include both graphic symbol sets and graphic symbol systems. A set of symbols includes a limited number of graphics that is closed in nature, but it does not have clearly defined rules for expansion. A system is a set of symbols specifically designed to work together to allow for maximum communication. Symbol systems include rules or a logic for the development of symbols not already represented in the system. These rules may be internal to the system or may be part of the language coded by the symbol system. Such distinct organizational forms (set, system) are not found in spoken languages. Visuo-graphic symbols can not be construed as a natural language, given that they are never passed on from parent to child in an informal way (i.e. via simple exposure). Rather, they have been created by developers and introduced by individuals like teachers or felicitators.

Graphic symbols are the printed symbols other than words used for communication by some individuals. The simplest and most transparent symbol in a Graphic Representational System (GRS) is a photograph, which looks exactly like the object it represents. At the other extreme are GRSs that use symbols that are opaque; the relationship to the referent is not obvious and, in fact, may be arbitrary. Many other GRSs incorporate symbols that fall somewhere on this continuum of iconicity. Dozens of commercially available GRSs have been invented and are currently in use in different parts of the world.

Picture Communication Symbols (PCS) [Johnson, 1985] is one of the most known and used set of symbols. Blissymbols is an artificial well-established system developed by Charles Bliss [Bliss, 1965] as a universal language system. As an example, the representation of the meaning "ambulance" in the non-orthographic language BLISS is given in Fig. 1. It includes grammar and syntax and it has been used in more that 35 countries the last twenty years. An international organization, named Blissymbolics Communication Institute, has the responsibility for the standardization and dissemination of the system [McNauton, 1985]. BLISCII has been proposed as a standardized code for Blissymbols [Tronconi, 1990].

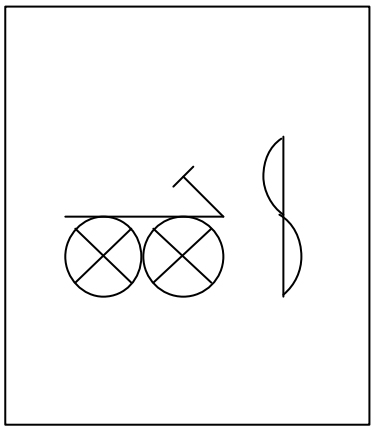

Fig. 1: Representation of the meaning "ambulance" in the non-orthographic language BLISS.

Other GRSs are PIC (Picture Ideogram Communication) [Maharaj 1980], REBUS [Kiernal et al, 1982], SIGSYM [Cregan, 1982], MAKATON [Kiernal et al, 1982]. For a detailed description of the different types of graphic symbols and their features see [Fuller et al, 1992].

The role of lexical linguistic information in the framework of AAC systems has been already described elsewhere [Antona et al, 1999]. The relationship between language knowledge and the use of GRSs has been explored early [Rankin et al, 1994].

3 User requirements

Symbol refers to a representation of a referent or a meaning. Iconicity, referred to the visual relationship of a symbol to its referent, plays an important role for teaching the meaning of a symbol. There are two types of iconicity: translucency and transparency. Translucency is the degree to which individuals perceive a relationship between a symbol and its referent when the referent is known. Transparency is the degree to which

the meaning of a symbol can be readily guessed in the absence of the referent.

Symbol communication serves as a native language for a non-speech child. It has an extremely important role in forming child's language concept which can be later successfully used to read, write and communicate through and suitable aid, with the language of the normal population. Students need a lot of training to become even partially literate. Classical methods of teaching the to read and write require intensive one to one interaction between a student and a teacher since the student needs immediate feedback. This make the task ideally suited to be computerized.

It is important to emphasize that symbol use is highly culturally bound, and caution is needed about assumptions that can be made regarding iconicity across cultural and linguistic communities.

The system must allow an individual or a team of teachers to focus on content specification and other high level tasks, while developing courses.

Nowadays the usage of interactive multimedia is widely adopted and accepted for a number of software applications. Moreover their diversity, flexibility and ease of encompassing many different learning styles have made them the most favorable among developers of learning applications. However, there is no way of guaranteeing a priori that learning will take place as a result of using them. In addition various debates take place whether and what they may have to offer particularly in the fields of education and training. Hence why evaluation is needed and has to be identified as an inseparable part of the development process of software application. The generic methodology and the instrument for evaluating interactive multimedia [Kouroupetroglou, 1995] has been used in the software development presented in this paper.

The development of educational resources that can be shared and accessed from a wide variety of teaching sites has a number of implications: a) different resources must be capable of being seamlessly integrated into a specific teaching package and b) resources must be sufficient generic to be interested to those outside the development team.

Adaptation cost, language barriers, cultural differences of educational material are very important elements of distribution of educational material. Making learning resources more accessible and flexible are major rationales for world-wide learning [Collins et all, 1996]. The need for more efficiency in learning leads to access the educational information by the teacher. Key factors in this process are:

- production cost of educational material,
- cost of delivery,
- on-time availability and delivery,
- availability of training material as independent of time and place as possible,
- multilingual support,
- reusability.

Although, quite a few computer systems have been designed to assist in the teaching of non-orthographic languages, they are usually not open, they do not offer reusability and they do not cover any language [Kouroupetroglou et al, 1993, 1994].

Becoming an alphabetic reader is not easy [Ehri, 1993]. The procedure of teaching a person to communicate via a non-orthographic language is much more complex, especially in the first learning stages [von Tetzchner and Martinsen, 1992], so that we have developed a step by step approach that follows a multi-professional approach, which is discussed elsewhere [Kouroupetroglou et al, 1990]. Recently researchers have begun to discuss the possible roles of graphic symbol systems in language acquisition and language development [Gerber& Kraat 1992].

4 System Description

The general architecture of the system is presented in Fig. 2. The design of the system has taken into account the general requirements described previously. The system constitutes a highly multilingual environment of orthographic and non-orthographic languages based on multimedia meaning representations.

The following functional parts can be recognized:

- a core database, where the elements of the meanings and their multimedia representations are stored,
- a multi-user application for editing the elements of the core database,
- a portable user-specific data base,
- an application for accessing the user database,
- active server pages for accessing the core database from the WWW.

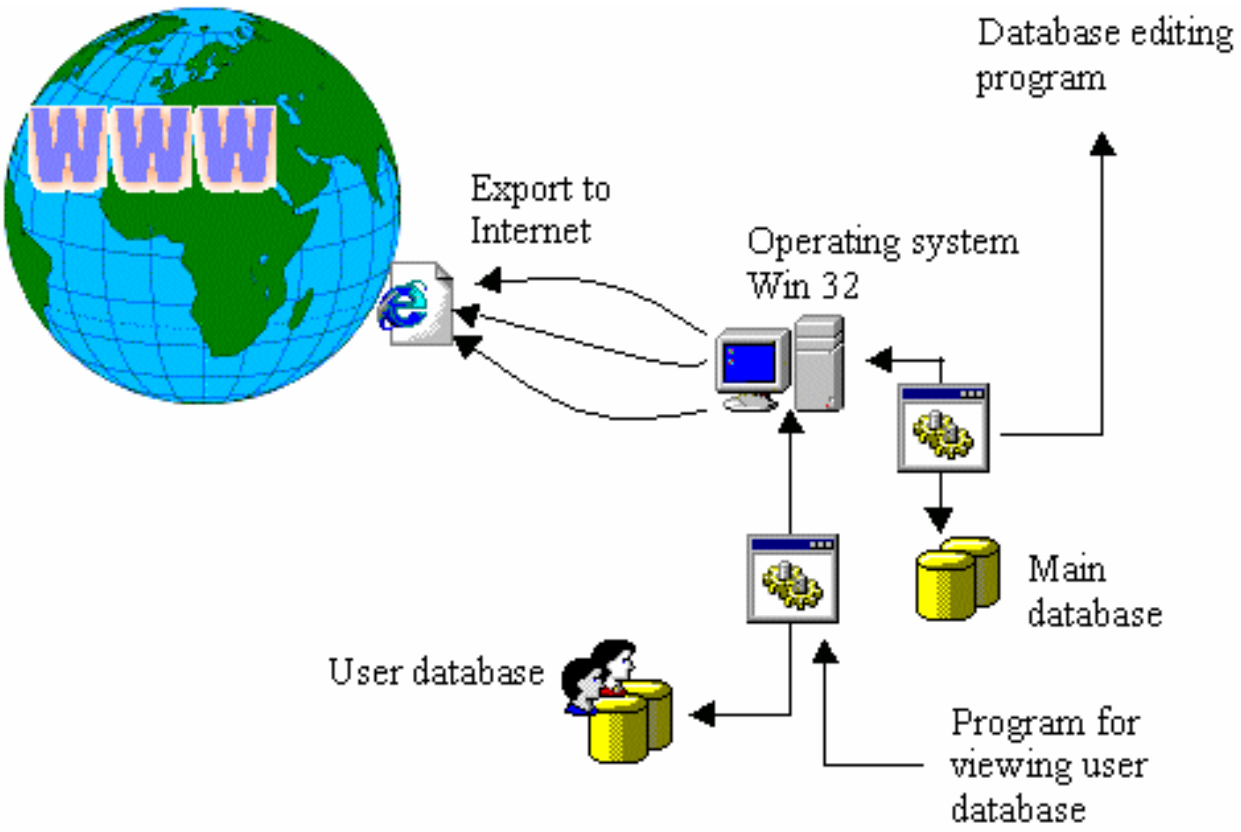

Fig.2: General architecture of the system.

The core database handles:

- a set of language independent meanings,
- a set of orthographic and non-orthographic languages,
- sets of text representations of the meanings for each orthographic language,
- a description of each meaning in each orthographic language,
- sets of graphic representations of the meanings for each non-orthographic language,
- one or more pictures relevant to each meaning,
- one or more videos or animations for each meaning
- three sets of oral representations of the meanings in each orthographic language (spoken representation with male, female and childish voice),
- the onomatopoetic representation for each meaning.

The system is open and expandable to add new meanings as well as new orthographic or non-orthographic languages along with their multimedia representations.

The portable user database in reality is a subset of the core database devised according to the needs of a specific student by the teacher. It includes only one pair of orthographic and non-orthographic language and a subset of meanings from the core database, along with their representations (Fig.3). The user database can be ported to the personal computer of a specific teacher or student. Furthermore, the system incorporates a tool for the semantic grouping of the meanings for each user.

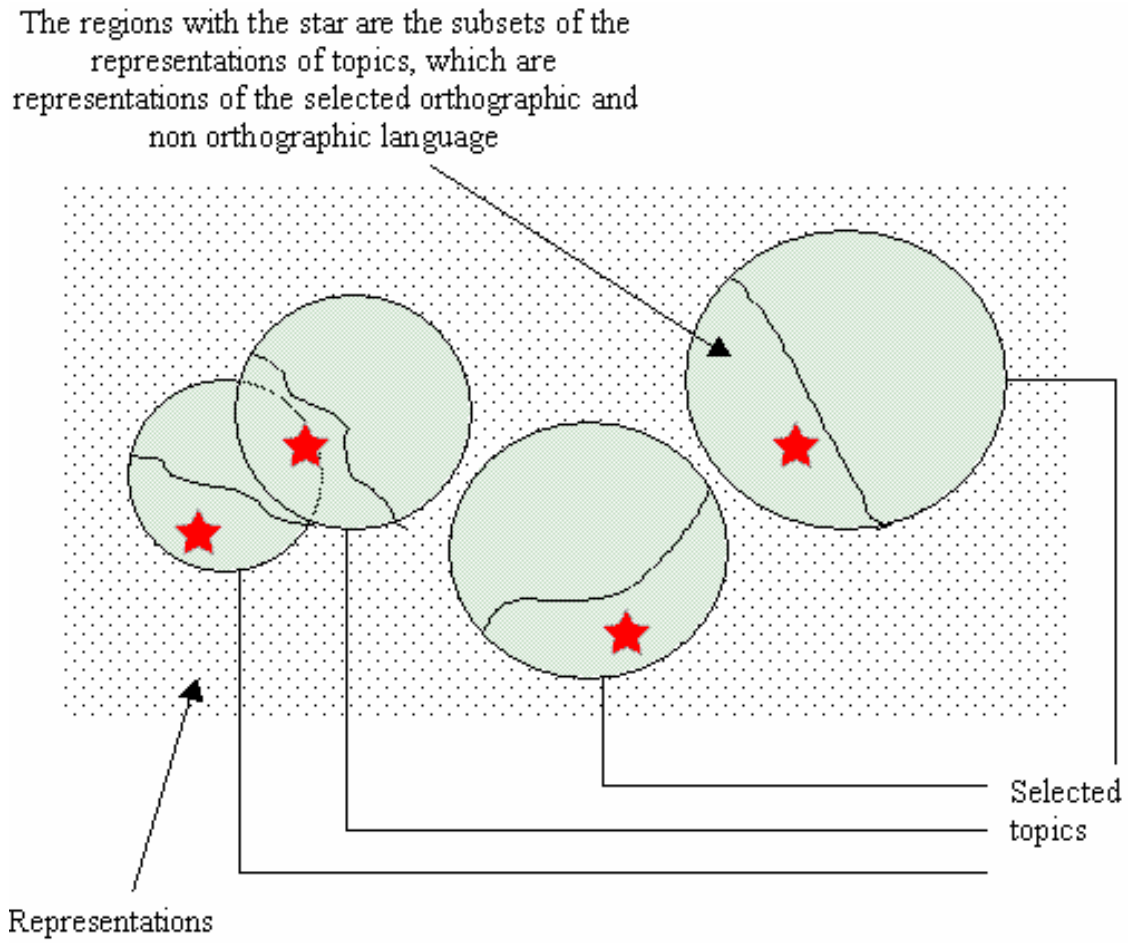

Fig. 3: Theoretical draft of the user database.

The user interface for accessing the system through the WWW is presented in Fig.4. In the specific example the following selection have been made: Orthographic language: English, Non-orthographic language: BLISS, Meaning: airplane, Representation: text description.

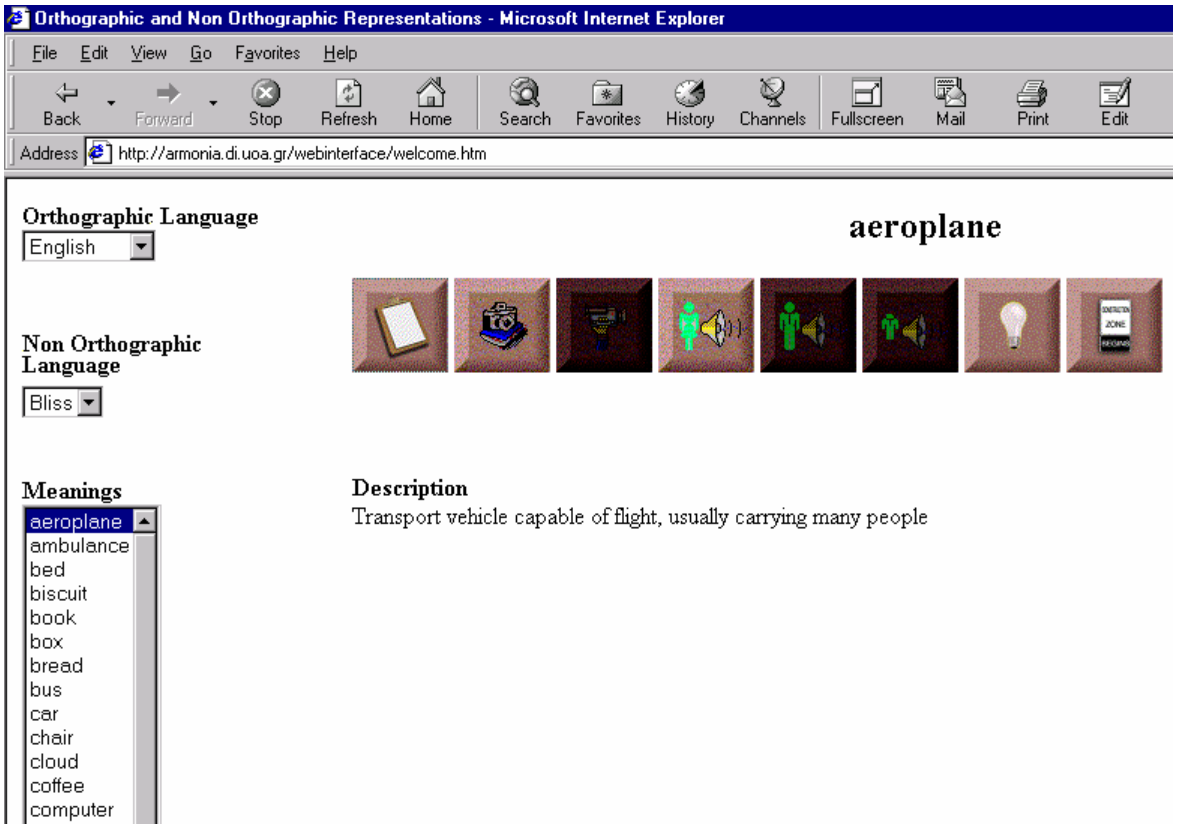

Fig.4: WWW access of the system. Buttons for meaning representations (from left to right): Description, Pictures, Video, Female speech, Male speech, Childish speech, Onomatopoetic, Non-orthographic representation. The button Description has been selected.

5 Implementation issues

The systems has been designed and developed for the MS-Windows 32 platform. A server side approach with Active Server Pages in VBScript has been used for WWW accessing mainly for it offers independency of the application from the user browser. The web server has been implemented using Microsoft Internet Information Server 4.0. WWW pages were designed and developed with Home Site 4.0 and MS Front Page 98 along with MS Visual InterDev 6.0. The core database has been designed using ErWin Ver. 2.6 CASE tool and has been implemented in the MS Access 97 RDBMS.

6 Conclusion

With the advanced of ICT, learning work in the future can become radically different from what it is today for the non-orthographic languages. With the use of the system developed in this work teachers will have an integrated WWW based system to cover various basic requirements free of those constrains brought by location and operation platform. Our next step is to evaluate its usage in a real world environment.

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