MULTIGRACE: A MULTIMEDIA LEARNING AND TEACHING ENVIRONMENT FOR GRAPHIC INTERPERSONAL COMMUNICATION SYSTEMS

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ABSTRACT

This paper describes the design and development of MULTIGRACE, a flexible and open multimedia environment facilitating enhanced learning of signs of graphic communication systems by individuals with communication limitations. MULTIGRACE supports the symbol instructor and the learner by the use of digitised images, graphics, animation and video. The functions of the system include multiple modes and styles of learning as well as simple tests for on-going assessment. A mode for transition to another graphic communication system or natural language is also provided. MULTIGRACE has already been applied to Blissymbolics.

INTRODUCTION

For the last two decades, there has been a growing interest in providing more and more communication options to both adults and children alike, bearing a wide range of communication limitations. New symbol systems, communication aids, input devices and interaction techniques have been developed and applied. Icons and other forms of graphics play a significant role in the daily communication process for many disabled people [1]. Nowadays, a large number of people are dependent on communication aids with non-orthographic writing systems (such as BLISSYMBOLS, REBUS, PIC, PCS, Sigsys etc.) because they are unable to speak and have difficulties in reading and writing [2].

The user of Augmentative and Alternative Communication (AAC) who communicates primarily through graphic signs, such as pictures or any other graphic representation system, uses either an iconic or a symbolic system. A symbol is a representation of an object or a concept by convention, and its meaning is assigned by its interpreters. A symbol may be an icon if it represents its object by resemblance. The interprentant of a symbol must be learned because: a) the relationship between the representament and the object or concept lack an "evident" referent, b) meanings are shaped in social contexts and c) meanings are jointly constructed on the basis of the assigned intent and interpretation of previous objects or concepts. Introducing symbols to the learner is by no means an easy task. Symbol teaching should be related to meaningful everyday experiences of the learner, who in turn needs a varied experience with a symbol in order to make it part of his/her vocabulary. The need for an effective way of teaching an AAC system becomes imperative. Images have been widely accepted as one of the best means of expression that can not only achieve excitement, but also attract, focus and captivate attention.

MULTIGRACE

Nowadays, the computer support of human interaction with multimedia information is rapidly evolving. An analogy exists between multimedia technology and early learning, as young children learn through their senses, which is a multisensory learning process. Multimedia technology, exposes the learner to multiple content and contexts as well as stimulates a variety of cognitive processes by promoting his/her active involvement, thus enhancing learning [3].

The developed multimedia environment of MULTIGRACE, does not only enhance and support the learning of signs of graphic communication systems, but also allows an individual or a team of symbol instructors for a specific graphic communication system, while developing courses, to focus on content specification and other high level tasks.

DEVELOPMENT FRAMEWORK

General requirements of such an open environment must allow to: a) adapt to the learner's mental level (use different teaching modes or levels according to the various user needs), b) incorporate new graphic signs either drawn by the symbol instructor or digitised using a scanner and c) choose a different graphic communication system to be taught. Another requirement for the environment as a multimedia application, is the one to enable the simultaneous usage of at least two of the following representation media: still images, computer animation, live video signal, sound and text.

For the analysis, design and development of MULTIGRACE, the approach of rapid prototyping was utilised with IBM's Audio Visual Connection (AVC) multimedia-authoring tool. The main objective was to develop a system that would fulfil the basic requirements and functions of the designed environment. This prototype would be used for presentation and evaluation purposes in order to identify possible errors of the initial design.

A number of phases were encountered during development and included: a) educational and learning design [4](definition of needs, objectives and content, development of user/learner profiles, adoption of pedagogical strategies, general screen and user interface design, definition of functions supported, dialogue needs), b) evaluation of the proposed model, c) definition of specifications d) design and implementation.

The design and development of MULTIGRACE, satisfies the general requirements and specifications. The user's interaction with the computer is based on WIMP techniques. All functions may be performed by selecting icons, buttons, or "hot-spot" areas on screen. An attempt was made for proper choice of style, metaphors and aesthetics for visual elements. Depending on the user profile, apart from using the keyboard, several additional pointing devices must be supported enabling direct or indirect mode of user interaction. The environment justifies its multimedia character by being able to incorporate simultaneously at least two of the following: a) still images (supported functions: interchange between colour and grey scale, edge extraction, slide-show of multiple images), b) text in the user's native language, of various sizes, with spelling (mainly to display the sign's meaning), c) sound effects and speech, d) motion video, which means the system must be able to control a VCR or a Laser Disk player (supported functions: play, stop, freeze frame, frame advance), e) animation (supported functions: play, stop, freeze frame, frame advance), f) art drawing to be used when teaching groups of signs (supported functions: definition and recognition of hot-spots), g) The graphic sign being taught in three different sizes, with or without "overlays" [5] (used to gradually associate the sign with a corresponding image), with or without colours (if any), with or without explicit indication of its meaning (in the form of written text in the user's native natural language).

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A built-in test facility is also incorporated for assessing the learner's understanding of a graphic sign. A drawing tool (AVC's painting module) can be used by the experienced teacher for drawing new graphic signs and defining hot-spots.

Minimum hardware and software requirements call for a 80386DX based IBM PC compatible, with 4MB of RAM, colour VDU, 100MB hard disk, high resolution 256 colour-capable graphics adapter (SVGA graphics), MS-DOS ver. 4.0 or IBM OS2 ver. 1.3.

FUNCTIONAL DESCRIPTION OF MULTIGRACE FOR LEARNING

The primary objective for the symbol instructor/speech therapist is to select stimuli (pictures, drawings, video, animation) easily recognisable by the user and teach him to associate them with the referred symbol. Selection of symbols is performed from a symbol dictionary which incorporates a classification scheme based on grammar, geometric or alternative standardised set of rules. Secondary objectives include training to recognise, memorise and produce individual or/and combinations of symbols and possible variants. In the main teaching mode, the images, videos and animation (along with supported functions upon them) that relate to the selected sign can be viewed. Moreover, the built-in testing facility may be invoked. Two more teaching modes are available. One for teaching groups of signs that in some way relate to each other, and another where a connection can be made with another communication system either augmentative or conventional (natural language). The user may browse through the screens, change the symbol being taught, and eventually exit.

MULTIGRACE supports teaching of the four aspects of symbols: lexical structure (what the symbols are), syntactic structure (how they relate to each other), semantics or meaning structure (how they relate to what they represent) and pragmatics (how they relate to the users). The developed multimedia environment can be used for teaching elements of almost any graphic communication system, as long as the proper associations are made and the required databases are built among the system's graphic signs and their corresponding images, video clips, animation etc. It is user friendly (catering for the various user needs) and quite versatile and rich as far as its educational content is concerned. MULTIGRACE has been already applied for the case of the Blissymbolics graphic communication system.

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