Perceptive Visual Training Programme: An Experiment within the CANS Project

Nelson Pacheco da Rocha[(1)], Leonor Moniz Pereira[(2)], Ernesto Afonso[(1)], Elisabete Saragoça[(2)]

[(1)] Departamento de Electrónica e Telecomunicações da Universidade de Aveiro / INESC

[(2)] Faculdade de Motricidade Humana da Universidade Técnica de Lisboa

Resumo **- O artigo reflecte a participação portuguesa no Projecto CANS (Citizen Access Network and Services) do programa Europeu Telematics que teve por objectivo demonstrar o uso das novas tecnologias na melhoria dos contactos entre os cidadãos e os seus provedores de serviços. No artigo serão apresentados o serviço remoto desenvolvido para a Experiêcia Portuguesa, o equipamento projectado e implementado, e os resultados da avaliação efectuada.**

Abstract **- The paper reflects the Portuguese participation in CANS (Citizen Access Network and Services) Project of the European Telematics Programme which main goal was to demonstrate the usage of new technologies for improvement of contacts between the citizens and their service providers. In the paper we present the remote service developed for the Portuguese Experiment, the equipment that has been designed and implemented, and the results of the evaluation that has been performed.**

I. INTRODUCTION

The CANS (Citizen Access Network and Services), a project within the Telematics European Programme, set out to investigate, implement and demonstrate the usage of Telematics technologies for improvement of contacts between citizens and their service providers [1]. The general problem confronted by CANS contained a diverse range of social scenarios, a mix of types of geographical and physical locations, and also an extremely disparate set of user groups. The sites have been selected to allow contrasts and complementarity such that the general problem could be addressed in the round, while allowing very real and concrete experiments in Telematics solutions at the local level. By bringing together a set of different but well related studies, the CANS project offered a wide and general view of the solution space for improvement of citizen access networks.

Two of the CANS sites were located in large cities, and involve City authorities who feel that service provision to citizens must be improved, and may benefit from the use of Telematics solutions (sites in London and Frankfurt) [1]. There we saw local authorities with extremely large and complex infrastructures, administering a wide range of social groups including migrant labour (mobile), ethnic groups (static but growing), and minorities who have come from deprived circumstances (eg. poor and rural), or who have disabilities, which affect communication (eg. deaf). In each case, the mix of cultures, languages, social groupings, and support needs places a heavy burden on the local authorities and other service providers. They try to deal with difficulties generated by poor language skills, poor contact with the home location, information systems, which are outdated and do not cater for ethnic diversity. They also identify the resulting reduction of "utility" in information systems and the problems of integration of a large number of service agencies all struggling with a common problem set, but from different directions.

Another two sites were located in remote and rural settings where the service agencies are either centralised in a single City (Kortrijk, Belgium), or are distributed among a small set of towns within a large geographical area (North West Ireland - centred around Sligo). In North West Ireland, there is a small population (200 thousand) spread over a region of some 3000 square miles. Nearly 80% of people are dependent on state benefits, and they have the lowest average income in the whole of Ireland. In comparison, the town of Kortrijk in West Flanders has a population of 76 thousand people, but also administers a set of seven villages, and countless hamlets and small farms, covering a large area.

CANS also included two sites which provided "virtual support networks" at a National level. These are the IvD (Instituut voor Doven), who administer a large deaf population spread throughout the Netherlands, and FENACERCI (the Portuguese co-operative federation of resources centres) that provides nation-wide coverage of support for disabled people in Portugal. In both cases there is a history of struggling to improve the general access to services and public authority information by their respective client groups. In the Netherlands there was a special interest in the problems of adult deaf people and the needs of the elderly deaf person, while in Portugal there was an emphasis on provision of improved support and education for children and youngsters with visual disabilities.

In addition, CANS also included a remote town in Finland (Joensuu) where a new suburb (Marjala) has been developed with a view to making Telematics part of the core infrastructure. Here, the original concepts of inter-connectivity have provided a multi-service channel to connect service agencies and the extension of this to the citizen level have been investigated - especially in the context of older citizens.

II. USER NEEDS IN PORTUGAL

The Portuguese site aimed to develop Telematics applications to support professionals and families living in geographically and socially isolated areas, which have children and/or youngsters with visual impairment (with or without other additional handicaps). This is particularly important because Portugal is a country where there is a lack of qualified professionals, a marked asymmetry between regions in general, and between some rural and urban areas concerning access and distribution of health, education and social support services and resources.

According to the Portuguese Education Ministry, in 1995 there were 729 students with low vision in regular schools. Since children and youngsters with visual impairment and other disabilities are a small population, only a few number of professional are working to provide special support in areas like visual training. They are spread all over the country and sometimes need to travel extensively to a student, losing a lot of time. As a result, no specialist support is given to a number of students with low vision, their families and teachers.

Teaching methods are today more visually oriented, so create new problems for the educational integration of visually impaired students. Playing and participating in recreational activities requires use of visual information, and this increases isolation of such children and youngsters in the school community. According to Brucefors [2] if we increased the abilities of the visual impaired person we increased his/her social adjustment.

As we can conclude the majority of the authors consider that it is essential to develop a visual stimulation programme. This opinion is espoused by Barraga [3] who observes that the efficiency of visual functioning (the ability to use vision to perform a desired task [4]), can be improved if visually impaired people are the subject of a perceptive visual training programme. The same author observes that the development of the visual system in people with visual impairment rarely happens in an automatic or spontaneous way.

The term "Low Vision" substitutes terms like subnormal vision, partial vision, residual vision and near blindness. In general we are speaking of people with a visual acuity between light perception and 0.3 and/or those who have a small visual field. An important definition of low vision is given by Corn [4, 5], who suggests a person with low vision is the one who still has a severe visual handicap after correction, but through the utilisation of optical or non-optical aids and/or technical changes, or changes in the environment can improve his visual function.

The aetiology of the visual impairment may also cause other disabilities, which can retard physical and motor development, such as brain damage, sever mental retardation and cerebral palsy, and the aetiology of mental retardation may cause visual impairment.

The main goals of the Portuguese site were to improve the access and quality of services for multi-impaired (ie. visual impaired with additional disabilities) children and youngster, as well as to empower and strengthen professionals and families, and support the intervention, and competence to deal with the daily problems.

Parents and teachers of children and youngsters with visual impairment and additional handicaps need to know how to help them to move; how to play; which are the best toys, materials and games; how to teach them to dress, to eat, to use the toilet; know the best way to stimulate them to walk, to communicate, etc. Therefore, it is important to parents and to teachers to know how to stimulate and help these children and youngsters not only to maximise the development and their potential, but also to maximise their adjustment and social integration.

III. SERVICES

The main service of the Portuguese site was to provide, at distance, a functional visual training for children and youngsters with visual impairments or/and with multi-impairments. The Perceptive Visual Training Programme that we have developed is an adaptation for a multimedia system based on the "Programme for Development the Efficiency of Visual Functioning" of Barraga and Morris [3] and on the "Look and Think" of Chapman's Programme. Some of the objectives of this programme are concerned with the abilities to identify icons and objects, discrimination of objects and symbols and recognition of objects represented in 2D.

Three learning phases were identified for the multi-impaired users:

- The firsts related whit the turn on and off the equipment and with the understanding the user interface.
- The second one dedicated to the understanding of how they can select, mark and move certain objects.
- The third one for the visual stimulation.

During the first two phases the children and youngsters had someone nearby helping them. In the final part of the second phase they were able to receive alone the visual training.

Simple tasks were provided using adapted games: a client from one resource centre can play a game with a college, which is in other resource centre or with the service provider. These activities also provided the possibility to the users to communicate amongst themselves.

As we mentioned before, it is important to parents and to teachers to know how to contribute to functional vision

stimulation of their low vision children and youngsters not only for maximise their visual potentialities but also to maximise their adjustment and social integration. Therefore, the Perceptive Visual Training Programme also included a complementary service developed to:

- Advice and help parents and teachers in every kind of questions linked to the Perceptive Visual Training Programme and visual stimulation, such optical aids, materials/games, exercises, etc.
- Advice and help for families and teachers concerning how to deal with theirs children's and pupil's problems.
- Supervision of the intervention made by local professionals.
- Team work and collaboration of several professionals and specialists (regular teacher, specialised teacher and doctor can exchange information about the student and define the intervention programme, evaluate their visual capacities, etc.).

Furthermore, since the target group of the London and

Control functions	VI(*)	MI(**)
On & off switches on opposite sides of other information and in the front part of the equipment (easy to turn on/off)	E	E
Logical and easy to understand layout of controls	I	E
Easy to identify each one of the controls	E	E
Easy to find the different controls	E	E

(*) Visual Impaired children and youngsters

(**) Visual Impaired children and youngsters with additional disabilities (multi-impairement)

Table 1 - Control functions

Display	VI(*)	MI(**)
Image with high definition allowing the identification of persons and photos	E	E
Control of colour contrast	E	E
Low level of glare	E	E
High background contrast	E	E
Control of brightness	E	E
21 inch screen	E	E
Cursor with about 1.5 to 2.0 cm	E	E
Coloured cursor (with the possibility to change the colour)	E	E

(*) Visual Impaired children and youngsters

(**) Visual Impaired children and youngsters with additional disabilities (multi-impairement)

Table 2 - Display

Keyboard(*)	VI(**)	MI(***)
Good figure/ground key contrast	E	E
Split the keyboard in two parts providing left and right recognition and orientation	I	E
Use large keys with enough space between them (dimensions' 1x1 cm with a distance of 0.5 cm between them)	E	E
Key-edges avoiding finger slipping	I	E
Important keys should be provided with tactile distinct marking	E	E
Not too sensitive keys so that it is possible to receive tactile information without using a command	E	E
Different size/shapes of controls to facilitate their location and identification	E	E
Keyboard only with the necessary keys to perform the procedures	I	E

(*) Whenever possible the usage of the keyboard should be avoid, because multi-impaired children and youngsters are not probably used to it.

(**) Visual Impaired children and youngsters

(***) Visual Impaired children and youngsters with additional disabilities (multi-impairement)

Table 3 - Keyboard

Netherlands sites were also disabled users, several transnational "experts meeting" were organised as a space where several experts could change information (usefulness and benefits of technology, work methodology, etc.).

IV. TERMINAL EQUIPMENT

For the design and development of the terminal equipment it was considered a set of user and service requirements.

A. User Requirements

Concerning general user requirements, it was considered important that the equipment must be economical and need a low frequency of technical assistance. Must be robust, attractive and have an interface similar to other familiar systems and include the possibility to adapt and incorporate additional input/output devices.

The system must not impose great mental workload nor a great linguistic competence. The dialogue must be easy to understand, without any technical sophistication, and offer the possibility of working slowly, of making mistakes and correcting them.

The information must be displayed in a way that the target group could perceive. User guidance must be available as well as simple usage or memory aids. Information related to the state of equipment (eg. ringing, engaged, etc.) must be provided. Furthermore, the system must provide to the service provider guidance concerning information about the users.

Several specific requirements have also been considered (see tables 1 to 5) related to the control functions, display, input devices and audio system, and classified as:

- Essential (E), which means indispensable to a good system and to the service;
- Important (I), which means not indispensable but desirable.

B. Service Requirements

The preliminary definition of the terminal equipment has been derived from the requirements of remote service planned for the Portuguese site:

- Service centre terminal versus client terminal - Two different workplaces should be linked by point-to-point ISDN connections. When two workplaces are connected, the all system works under a master slave relation: the control facilities (connection management, image selection and communication commands) are provided by the service centre terminal (service provider), which supervises the service centre and also presents the functions needed by the service centre staff to control the operation of the remote client equipment. This solution means that most of human-machine interactions are performed in service centre terminal and the client terminal presents a quite simple user interface.
- Videophony channel - Simultaneous visual and audio information should be provided for the communication between the service provider and the

Mouse/Joystick/Touch Screen	**VI**(*)	**MI**(**)
Should have an ergonomic design	I	I
Have only one Key (***)	E	E
Key with a contrasting colour	E	E
Touch Screen	I	E

(*) Visual Impaired children and youngsters
(**) Visual Impaired children and youngsters with additional disabilities (multi-impairement)
(***) Only to mouse

Table 4 - Alternative Input Devices

Audio System	**VI**(*)	**MI**(**)
Audio feedback output	E	E
Good sound quality	E	E
Background noise reduced	E	E
Easy volume control with simultaneous visual information	E	E
Optional use with hands free	E	E
Optional use with headphones	E	E
Optional use of microphone without wire	E	E

(*) Visual Impaired children and youngsters
(**) Visual Impaired children and youngsters with additional disabilities (multi-impairement)

Table 5 - Audio system

client in order to improve the service quality and the user acceptance. Because high quality video is not essential for the display of the participants the H.261 compression should be used. In terms of sound quality, it should conform to the CCITT standard for audio-conference (a bandwidth of 7 kHz), and it is essential that the latency between speak and final output and the echo should be minimal.

- Shared workspace - A shared workspace should be provided to allow the participants to view and manipulate a common set of objects. These objects may include images, graphics, text documents, etc. The shared workspace must offer adequate functionality to support the procedures concerning co-operative activities.
- Gesture support facilities - Support facilities that convey gesture are essential. As a minimum, telepointers should be provided. These serve several purposes: for example, they allow participants to mark certain details of the images displayed in the shared workspace, their movement can be used to attract attention indicating that the partner is active. Careful design of the facilities is essential. Either the pointers move continuously, such as a cursor, or they are markers that must be explicitly dragged. The marker must follow the screen cursor with minimum delay. It should also be possible to change the marker size, colour, orientation, and label.

C. Terminal Equipment Specification

In terms of hardware, the basic configuration of each terminal includes a codec and a personal computer with an ISDN network controller, a video camera, an hand-free audio unit, and input devices (a conceptual keyboard and one of the following: touch screen, easy-ball, mouse and joystick).

Since two types of codecs were used (Tandberg Model 15 and Vcon Armada Cruiser 100) there was the need to define two different configurations:

- Tandberg Model 15 - since the Tandberg Model 15 is an external device, this configuration has implied a video insertion card for the connection between the personal computer and the codec.
- Vcon ArmadaCruiser 100 - this is a PC add-on board that allows a much more integrated system. Furthermore, preliminary results show that this second configuration presents better image and audio quality when compared with the first configuration.

In terms of software, two applications have been considered: the Videophony and the shared WhiteBoard.

The Videophony is a window in the upper left corner of the screen showing the communication partner or the self-view of the user and that presents several commands (Connect /Disconnect, Zoom/In, Freeze/Unfreeze, Local and Remote):

- The Connect button can be used for the connection establishment. After a connection establishment, the name of the button is changed for Disconnect, which finishes the connection;
- The Zoom In/Zoom Out and Freeze/Unfreeze are also toggled buttons and they are, obviously, related with the zoom and freeze commands of the videophony image;
- The Local and Remote commands allow, respectively the selection of the cameras both of the remote and local sites, and enables the self-view.

The "projection" of a specific page in the WhiteBoard is a mental model that adheres to a download of information from the service centre to the client terminal. After the download of the information, both the service centre and client terminal have the WhiteBoard windows with the same information.

During the presentation of the information, both the service provider and the client, are allowed to perform the creation and manipulation of simple geometric objects and text, by pointing using the telepointer, which provides an easy way of focusing the attention of both users to a particular region or point in the screen. Within this facility any movement on any workplace is immediately reflected on the other system screen. During such presentation the participants, both the service provider and the client, are allowed to perform the following actions on the screen combined with spoken comments: draw with a virtual pencil, write with a virtual text, point with a virtual pointer, erase with a virtual erase and move with a virtual hand.

The connection between the service provider and the client terminal is provided by ISDN and each terminal uses two basic accesses (2 x 128 Kbit/s). One basic access is used for the video communication, while the second basic access is allocated to transmit data and audio signals.

V. DEMONSTRATOR SITE IN PORTUGAL

Five different Institutions were involved in the Portuguese site (Figure 1): Faculdade de Motricidade Humana - FMH, Centro Educacional para o Cidadão Deficiente - CECD and Cercisimbra from the FENACERCI, Instituto António Feliciano Castilho - IAFC and Hospital Gama Pinto. Those Institutions are located in Lisbon and rural areas of the Tagus Valley.

FMH acted as a Service Centre providing the Perceptive Visual Training Programme, and IAFC acted as an Information Centre. The Ophthalmologic Institute of the Hospital Gama Pinto provided the assessment of visual impairment. The final users were multi-impaired children and youngsters with mental or visual impairment from Cersizimbra, CECD, IAFC and Hospital Gama Pinto.

User participation was split into two phases. The first one, the Mini Trial, took place from January until March 1997 and it consisted in an early verification of the equipment accessibility and the impact of the services. The second phase, the Experiment, took place during the

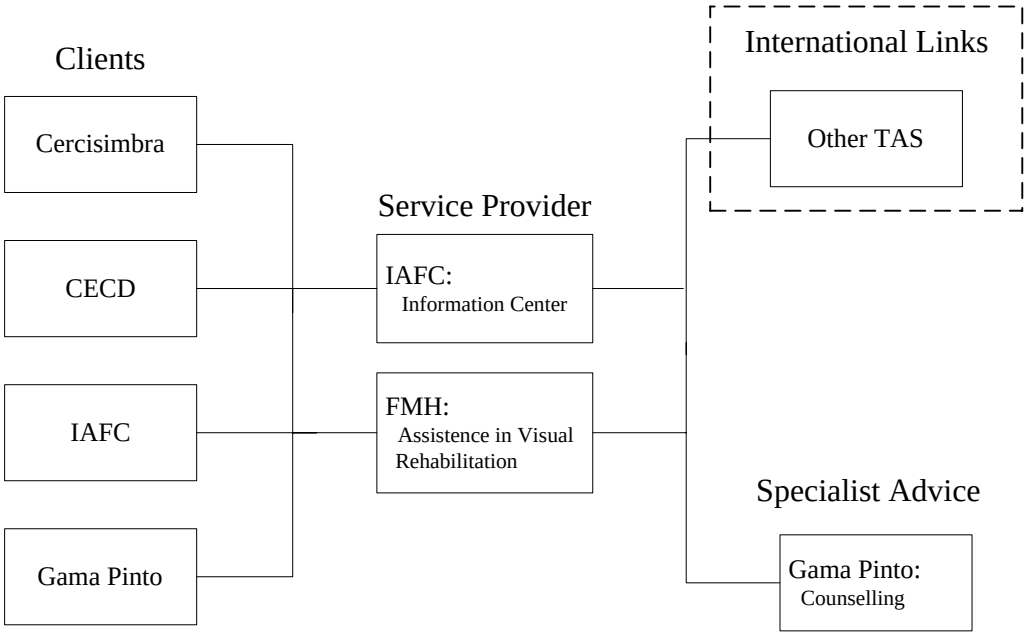

Figure 1 – Portuguese Site

year of 1998 to evaluate the Perceptive Visual Training Programme.

D. Mini Trial

The early verification consisted [6] of two parts: service aims and introduction to the professionals participating in the project, and equipment introduction to allow the clients and staff to learn how to use the terminal equipment and to evaluate the accessibility of the same equipment.

The equipment accessibility was evaluate at five different levels with the participation of 25 clients and 16 professionals: *(1)* call management (verify if the call procedures were or were not the most indicated for the population using the terminal equipment); *(2)* input devices (identify the most accessible input devices for the clients); *(3)* interface (verify if the functions of ToolBox were easy to identify and select; if the WhiteBoard allowed the necessary contact for the accomplishment of the tasks between the service provider and the client and if the telepointers had the necessary characteristics for the accomplishment of the tasks); *(4)* network (verify the number of failed attempts and the number of calls interruptions) and *(5)* clients (verify the motivation/interest of the clients).

After the evaluation of the equipment accessibility' we concluded that:

- The call management procedures were accessible to the users;
- The touch-screen, the easy-ball, and even the mouse were input devices suitable for the target group.
- The dimensions of the ToolBox icons should be increased and some of them should be replaced with others in order to facilitate the association of the symbol with the respective action.
- The sound quality of free-hands audio unit should be improved for a better communication between the clients and the service provider and between the professionals.

To solve those problems detected in the verification phase, the software applications were improved for the Experiment.

E. Experiment

During the Experiment [7] the evaluation methods used were performance observational studies (checklists were developed by FMH for this propose); interviews (to the clients during or after the sessions, and to the professionals), and questionnaires to evaluate the contents of Perceptive Visual Training Programme and to evaluate its potentialities.

The assessment purposes and the best way for its registration have been analysed and discussed within the project team along with the technicians that supervise the experience at the Institutions.

The Perceptive Visual Training Programme evaluation occurred since December of 1997 until May of 1998 once a week at distance. Since April of 1998 until September 1998 most of the clients had two Perceptive Visual Training Programme lessons a week, one at distance. The 21 multi-impaired users involved had in average 7 remote sessions, each one with 30 minutes.

The 7 professionals from the Institutions that participate in Experiment had an intensive training programme in order to implement themselves the Perceptive Visual Training Programme to their students. The teachers learned how to use the contents of the Perceptive Visual Training Programme and how to create new tasks. It was also an aim to give those professionals the opportunity to familiarise themselves with Telematics applications. The professionals' training starts in February and end in June and they had 30 hours of training.

The assistance to the Perceptive Visual Training Programme occurred according to our expectations. The contents more frequently worked were scanning, identification, discrimination, matching, perception of patterns and the relation between the all and the part.

In all the clients the number of tasks for sessions was increased 100%: they start with 3 our 4 tasks and finished the Perceptive Visual Training Programme with 7 our 9 tasks. That means that their attention and performance also increased and, consequently, the task comprehension and performance.

The clients talked with their Institution' staff about the distance sessions. Most of them invited the distance service provider to visit their Institution and said that they wanted to have more remote lessons and make more tasks.

The multi-impaired children and youngsters became totally autonomous, not only in what concern the procedures to establish a remote connection but also in what concern the use of the ToolBox of the WhiteBoard.

The professionals involved in the evaluation considered that the programme had a good organisation and an easy usage, the contents were appropriate to the target group and the tasks were attractive. The professionals suggested other contents that can be developed at distance, namely: write, read, arithmetic, security and daily life activities.

All the Institution professionals considered the activities of the CANS project a good complement to their work and considered important and necessary to maintain the distance education. Furthermore, they considered that the possibility to exchange information and knowledge with other professionals, even professionals from other countries, was very interesting. The videophony-based system provides the possibility of those contacts and to get/exchange information "on time".

The Institutions that participate in the Experiment had included the remote sessions in theirs schedules and fixed one day every month for meetings or workshops for the professionals that were, directly or indirectly, linked to Experiment. The Institutions adopted the CANS activities in the internal organisation without any difficulties or problems. Some of them are evaluating the possibility of maintaining the distance education/rehabilitation programme.

VI. CONCLUSION

According to what was exposed above, we conclude that the Perceptive Visual Training Programme had a good structure and, in general, all the results were positives. Furthermore, it has been proven that the design of the terminal equipment was suitable for the target population group.

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