WRITTEN SIGN LANGUAGE:
A PROJECT

A man is dead and his corpse has disappeared
under the ground. His relatives have all become dust.
Only writing preserves his memory.
Egyptian scribe, 2000 B.C.

1. MOTIVATION

Deaf or hearing impaired people -non hearing, for short-, rather than using oral expression, usually prefer to communicate by means of sign language, because they have never acquired or have lost the capacity to articulate phonetic language correctly.
Sign language consists in a large variety of movements of the hands and the arms accompanied by some beats or strokes, usually associated with different face expressions, in order to transmit to the interlocutor all kinds of information. Almost in every country or even in every region there exists some variety of sign language used by the non hearing.

At first sight it might seem that the best way to talk to someone with hearing limitations is the use of writing. This could be true if only this person had been trained in reading and writing before his or her hearing loss. In the opposite case, the difficulties that arise for the impaired person in relation to written language are only comparable to the ones he or she has with orally spoken words. This comes out because in the absence of the capacity to recognize sounds, the possibility to understand the meaning of their graphic representation is very weak. The lack of the referent makes it almost impossible to give any fixed association to the symbol. Thus, a phonetic alphabet in most cases becomes a barrier rather than an aid for hearing impaired people.

We have arrived at the conclusion that sign language is the natural language for the majority of the non hearing. This means that most certainly they elaborate their thoughts and ideas in relation to or conditioned by their knowledge of this language. On the other hand, this conclusion comes about from a fact that arises from experience: deeply deaf people, even after rehabilitation, very scarcely try to use written language to communicate among them or with normal hearing persons. The reason is that they are not naturally Spanish nor English nor French speaking: they are sign language speaking. We could name them **sign-talking**.

The most worrying conclusion from all this is that the non hearing sign-talking people do not posses a form of written expression of their own that may offer the possibility of keeping their memory or the ability to communicate with someone who is not in the immediate vicinity. For normally hearing

persons who might be interested in learning to communicate with the non hearing, sign language is a difficult subject to study because they have to remember every new sign with no easy means of permanent recording, and there are thousands of them. There exist forms of dactylology, that is, representations of the letters by means of hand signs, but these are no more than transcriptions of phonetic alphabets, which brings us back to the beginning.

In consequence, being practically illiterate, hearing impaired persons become culturally diminished and most probably their ability to form abstract thoughts is less powerful than for literate persons. Besides, a language that has no written form, and belongs to a community inserted in the fast moving modern life, can be subjected to so many changes that there is no means of establishing definite “spelling” forms, conventional grammar rules and other aspects of the preservation of the language.

Let us keep in mind that human development has been divided in prehistory and history, the appearance of writing being the turning point. This means that almost every great achievement of civilization springs out of the ability of writing, in the same manner that articulated language itself is the utmost characteristic of human condition. Symbolic representation, whether in spoken or in more permanent written form, is the basis for establishing human society. Improvement of the capacity to represent and handle natural and social forces, and to communicate their consequences in an organized fashion, is a major step into welfare. Science could not have been developed without a written support.

The disadvantages faced by those who have no access to the benefits of written language while they take part of the life of the civilization, put them in a position liable to discrimination. A way out from this situation can be proposed, which is the objective of the present project.

There are antecedents to this initiative, like Sign Writing, but there are some drawbacks related to this computer program. In the first place, Sign Writing is completely dedicated and tied to the computer, so that it is not a daily use written language. Secondly, Sign Writing does not overcome the difficulty inherent to finding the meaning of some sign that one does not know beforehand. Thirdly, Sign Writing is more intended as a teaching tool in order to present all the features contained in the signs, but is not designed as a fluent communication vehicle.

2. THE WRITING OF SIGNS

One of the most venerable forms of written expressions of a language is Chinese ideographic writing, which in spite of its inherent difficulties has survived for thousands of years. In this form of

representation, there is no symbol for each sound. Instead, every word has its own character which is drawn by means of brush strokes. Characters are ideographic representations of concepts, so that for the elaboration of books, for instance, typographic cages in Chinese must have thousands of different kinds of them. In primitive times, most of these ideographs emerged as simplified images of the objects they intended to represent, although consequent evolution introduced variations that make modern ones almost impossible to recognize in comparison to their ancestors.

The most relevant characteristic of written Chinese is that it can be used as a communication vehicle even among persons that use different spoken dialects. They might not understand each other by speaking, but certainly will communicate by writing!

Although Chinese writing consists of thousands of different ideographs, there is something of it that remains within small scale limits. Every single character is constructed using a few among about two hundred of basic strokes, called radicals. This does not mean that if you know the radicals then you can understand any ideograph. This corresponds only to knowing the letters used in a language, which does not bring you to the meaning of the language itself. The radicals are the basic elements on which Chinese writing stands. And this is enough for us.

If we examine the movements and beats from which sign language is made, it is possible to get to the idea that no more than of the order of one hundred different elements are necessary to produce almost any sign. This very favorable remark leads us to the possibility of giving to each of these elements a graphic representation -which we call grapheme- and to construct ideographs based on them. The purpose is not to imitate the real signs produced by the sign-talking in all their details, but to obtain for each one a representation that is close enough to provide appropriate recognition, that is admitted by the sign-talking community, and that belongs to a determinate significance which may not give place to confusion. The most desirable aspect is simplicity, in order to give to the sign-talking a flexible tool that may be used in every practical circumstance in which writing may be necessary.

Through this formulation it is possible to overcome another difficulty related to the creation of a dictionary to translate words into and from sign language. Currently, there exist glossaries and computer programs in Colombian Sign Language (CSL) and in American Sign Language (ASL) in which the sign corresponding to Spanish or to English words can be found under the form of one or several photographs that explain it. The reverse, instead, is not yet possible, because there exists no systematic classification of signs that, according to some order, may lead the search. In other words, if one knows a sign by its bodily features, at present there is no method that permits to obtain its meaning in English or Spanish or any other language by means of a dictionary. Such a

possibility appears as an immediate consequence by using the systematization that stems from the present project. Namely, once the graphic form of a sign is known, it will be feasible to find its equivalent in other languages. Once this aim of obtaining a methodic graphic representation is satisfied for Colombian Sign Language, it must be very easy to implement the same methodology for other sign languages.

3. THE PROJECT

3.1 The graphemes.

The first step consists in selecting the essential graphemes or radicals by using the knowledge of expert sign-talking people. This step is proceeding successfully until now. The final state of this phase will be determined by the advances achieved in subsequent stages from which results will be fed back in order to attain the greatest simplicity and completeness. This means that only the experience in creating more and more written signs will provide enough information about the correctness of the graphemes established for the first time. In a certain way, determination of graphemes and creation of signs must run parallel, although the first one should be completed in a shorter time.

3.2 The written signs or ideographs.

A Spanish-CSL dictionary will be constructed by creating the written signs of, say, the 2000 more usual words, counting on experts in sign language with the assistance of an artist. The acquired experience will give clues to the simplification of the originally proposed graphemes, and eventually will give rise to the appearance of new ones in order to create certain ideographs not considered before.

3.3 The computer editors

The use of computers as a construction tool is invaluable for this process. A preliminary version of the software needed to draw the graphemes -**Grapheme Editor-** has been implemented. This has been done with no need of knowing the final form they are going to have, since it is a generic drawing tool. The graphemes are given a name and a code and finally saved into a data base from where they can be retrieved in order to be changed or to be used for constructing the signs. The section programmed for construction of the ideographs on the basis of the graphemes is called **Ideograph Editor.** Three students of systems engineering at the Universidad Tecnológica de Pereira, under the author's direction, graduated in 2002 with a thesis that consisted partly in

elaborating this software. The characters created are saved into a data base for their subsequent use. The completion of his phase is a fundamental support for phases 3.1 and 3.2. The first version thus far created is a satisfactory exercise, but appropriate modifications must be made in order to have the software completely functional.

3.4 The radical-based search

In order to have complete access to the characters created through the use of the previously described software, another computer program, used to recover out of the data base any character from its radicals or graphemes, has been designed. On completion of this phase, it will be very easy to find an ideograph once the basic strokes that conform it are known. The search can also be directed by using the name of the ideograph in Spanish. This software is called the **Ideograph Searcher**, and it works as a CSL into Spanish dictionary.

3.5 The paper dictionary

Although the use of the computer is mandatory for the preparation of the material concerning sign language writing, not every one can access a computer. A dictionary in both ways, **CSL-Spanish** and **Spanish-CSL**, will be written and published for the sign-talking population, which includes photographic representation of each sign in the Spanish into CLS section.

3.6 The text editor

The purpose of the sign writing is the production of texts. Having the computer as an aid, it becomes necessary to elaborate a **Text Editor** that helps the user to prepare computer based texts that can be managed in the same way that normal text editors do. This text editor uses the Ideograph Searcher and the two-way dictionary as its working tools. The user of this package does not normally have access to the Grapheme Editor or to the Ideograph Editor, because these are meant to be used by institutions that try to enrich and preserve the sign language.

3.7 The CD ROM

For the use of interested persons, and as a complement of the paper dictionary, a CD-ROM will be produced , which includes the text editor, the two-way dictionary, videos for the represented signs, and basic texts such as tales, poems, anthems and legislation .

4. PROJECTIONS

In the future, other projects can be undertaken, namely those that step forward into getting a better comprehension of the sign language. For instance, although there exist studies about the grammar of CLS, it has to be completed, standardized and presented in written form, both in Spanish and in Sign Language. On the other hand, intelligent computer programs that facilitate translation in both ways are excellent options for further development.

5. THE GROUP

5.1 The director

The director of this project is Jaime Hernández Gutiérrez, pysicist, graduated in 1970 from the Universidad Nacional de Colombia at Bogotá. Presently, physics teacher in the Universidad Tecnológica at Pereira since 1971.

5.2 The co-workers

6. THE BUDGET

For completion of the present project within a year, at least four persons under a part-time director should commit themselves in a full-time job. The author of the project offers himself as director on a voluntary basis, but the rest of the staff should be paid.

This labor is to be made in the installations of the Instituto de Audiología Integral de Pereira (Institute of Integral Audiology), a non-government organization which dedicates itself to attending the hearing handicapped from diagnosis to therapy, including rehabilitation and education (see Appendix for a further description).

Other expenses consist in office implements, magnetic media, photocopies of material, and acquisition of the software license (DELPHI) that serves as a basis for the elaboration of the required programs.

Qty.	Item	Cost (Colombian pesos)
2	Sign language experts	26 592 000.oo
1	Drawing artist	13 296 000.oo
1	Computer programmer	13 296 000.oo
1	DELPHI license	7 500 000.oo
	Office implements, and material	1 000 000.oo

Total	62 684 000.oo

6. BIBLIOGRAPHY

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Universidad Tecnológica de Pereira

APPENDIX 1

THE INSTITUTE OF INTEGRAL AUDIOLOGY

A.0. Introductory

For the past 25 years, the Institute of Integral Audiology located in Pereira Colombia, has successfully promoted and implemented many programs improving the quality of life for people who are hearing impaired. The programs have focused on all auditory impairments, their relationships to disorders of communication, and the establishment of a permanent link between hearing and non hearing cultures through a sign language school. Its success is due in large part to the hard work, commitment and innovative approach of the current program, resident audiologists and benefactors.

While facing the XXI century, the Institute of Integral Audiology calls for the support of people who can think in terms of children exposed to both, hearing impairment and extreme poverty.

A.1. History of the Institute and background

The idea of the Audiology Institute of Pereira started with the arrival to the city, early in 1978, of the first Phono-Audiology specialist in the central coffe region of Colombia, Ms. Bolivia Chica Rios. Together with the Antonia Santos School, and the cooperation of Ms. Lia Restrepo de Franco, they were able to incorporate hearing-impaired children to the regular school educational system. This early success prompted the creation of *Instituto de Audiología Integral- IdeA*- and the construction of the physical facilities was initiated.

In 1997, first steps were taken for the creation of the “sign school” for the hearing impaired. A pre-school section was opened for learning sign language and for hearing impaired children. Ever since, the Institute has continued its quest for improving and diversifying the programs for the purpose of giving stability and security to the objectives of the institution.

The IdeA is duly accredited in Colombia through Licensed and Certified Hearing Instrument Specialists, who, for over 25 years, have dedicated their sevices, efforts and commitment to improving the quality of life for people who are hearing impaired, and specifically to a segment of the population who has correctible hearing problems.

The children come to the Institute in different ways. Some are referred by the Health Centers in the area, others are from the local school system, and many by word to mouth of the general population. The Institute is not affiliated in any form to the private industry, and does not receive subsidies from the local government or private organizations. Besides, it is unique in its kind, inasmuch as no other institution in the central coffe region of Colombia can provide the complete

services of integral rehabilitation which ranges from early diagnosis to special education, including hearing aids adaptation. The Institute facilitates access to basic hearing screening to over 30,000 people a year, ensuring sustainable health and educational services to those that can not afford a basic Otoacoustic Emissions Test. In the near future, and thanks to some projects in progress that appeal to the generosity of donors, the Institute will be able to expand its services to remote areas with a mobile support unit. Services in rural areas are expected to increase from 3,000 to 10,000 patients in a year. A combined population of 6 million people will greatly benefit from the modern hearing testing services to be offered by the IdeA.

The Mission of the Institute:
“The Institute of Integraal Audiology is a certified non-profit non-government organization, that promotes hearing health and awareness upon risk factors which may cause hearing losses, making available integral rehabilitation in a prompt and reliable manner. Likewise, the Institute offers formal and non-formal education to hearing and non-hearing students at large”.

The vision of the Institute:
“To become a center of integral hearing services in the city of Pereira that may create the establishment of a permanent link between hearing and non-hearing cultures, in order to weave between them a collective feeling of respect for human diversity”.

A.2 Existing services and capabilities

. The central focus of the Institute of Audiology is to offer services related to all auditory impairments and their relationship to disorders of communication. The main responsibility of the two resident audiologists at the Institute is to identify, evaluate and habilitate/rehabilitate individuals with either peripheral or central auditory impairments and strive to prevent such impairments.
. The Institutte provides information on hearing, hearing loss and disability, prevention of hearing loss and rehabilitation to personnel from business and industry. The Institute operates as an independent entity that provides services to hospitals, clinics, private practitioners, schools and other settings where audiological services are relevant.
. The Institute conducts over 17,000 clinical testing procedures a year, of which 3,000 are administred in rural areas. At the present time, the Institute is carrying out hearing tests and screening for more than 30 different institutions to include private organizations and industrial firms, generating revenue for its self-supporting objectives.
. The Institute, through the Learning Sign Language School, offers formal education to boys and girls, among which there is a number of hearing impaired children, all communicating by means

of sign language. Presently, there are 219 children attending classes in courses ranging from pre-school up to 8th grade. The school is projected to offer services up to the middle vocational school level. Students pay for these services in accordance with the income of the family involved. Fees for services rendered range from USD$2.00 to USD$10.00 per month depending on the family income.

. The Institute offers through the Sign Language School extra curriculum activities to include theater and music programs. Under these specialized programs, boys and girls are developed into skillful artists and musicians. The formation of an in-house orchestra, which counts with about two dozens of children from 6 to 18 years old, the first of its kind in the country, is a result of extensive and careful work of the Institute staff and programs in place.

. The Institute has established a unity of integral services, which does not require a formal education curriculum. This program is offered to boys and girls whose disability does not permit them to receive a formal education. Presently, there are 90 children enrolled in this program. These children receive vocational rehabilitation for the purpose of preparing them in different trades and manual arts that eventually will open the doors to the labor market..

. The Institute is working to ensure that hearing impaired people have the opportunity to learn and develop skills, engage in productive work, choose where to live and participate in community life. People with disabilities want to be employed, educated and participating citizens living in the community. Those who are deprived of hearing aqlso receive therapy in phono-audiology, speech therapy, psychology, social services and nutrition.

. The Institute financially supports boys and girls participating in a variety of hearing prevention and formal educational programs. It is cooperating with the complete rehabilitation and educational effort of 309 children, boys and girls, who are presently registered with the Institute for hearing loss services.

. In the area of Colombia where the Institute is located, there is not a single entity or institution that may be able to carry out clinical audiometric testing. The work of the Institute not only covers a large population in the local community, but also coverage has been extended to rural towns and surrounding provinces to include Risaralda, Quindío , the northern part of El Valle and parts of Chocó. However, existing services are limited and results are marginal at best.

APPENDIX 2

CURRICULUM VITAE

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TITLE

Physicist. Universidad Nacional de Colombia. 1970

FIELDS OF INTEREST

Physics, Special Relativity, Graphic Computation

PROFESSIONAL EXPERIENCE

Titular Professor, Universidad Tecnológica de Pereira. Since 1971

PUBLICATIONS

Books

-Hernández, J., Vargas, J. G. y Hernández, J. D.Fundamentos de la Programación. Curso práctico de programación de computadoras, libro1. Editorial Cekit, Pereira, 1998.
- Hernández, J., Vargas, J. G. y Hernández, J. D. Programación Visual. Curso práctico de programación de computadoras, libro2. Editorial Cekit, Pereira 1998.
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Papers

- "Un algoritmo para dibujar objetos tridimensionales". Memorias del III Encuentro Nacional de Informática Universitaria, ASCUN. Barranquilla, 1986.
- "SOCRATES, Sistema Operativo Creador a Través de Estructuras". En colaboración con Gilberto Vargas C. Memorias del V Encuentro Nacional de Informática Universitaria, ASCUN. Popayán 1988.
- "La relatividad especial hecha fácil". Scientia et Technica, Universidad Tecnológica de Pereira, No. 2 , 1995.
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- "Los eventos: fundamento metodológico para la física". Scientia et Technica, Universidad Tecnológica de Pereira, No 5, 1997.

CURRICULUM VITAE

Last names: Ramírez Martínez Names: María Victoria
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TITLE

B.S. Electrical and Electronics Engineering. Fontys University. Rachelsmolen 1 (Eindhoven, The Netherlands), 2000.

PROFESSIONAL EXPERIENCE

1994 National Institute of Culture and Tourism. Organiser committee of "First Congress of Caribbean and Latin American Culture". Barranquilla, July 1994, Colombia.

1995 Institute for Democratic Participation Colparticipar. Setting up the library's database. (Bogotá, Colombia)

1996 Universidad Distrital Francisco José de Caldas. Assistant of Electrical Circuits Laboratory. Bogotá.

1997 Universidad Distrital Francisco José de Caldas. New students tutor in mathematics and physics. Bogotá

1998 TU-Delft, training in microcontroller applications and its work environment, by using a telephone line to restart a computer from a remote station.

2000 TNO Industrial Technology (Nederlandse onganisatie voor Toegepast Natuurwetenschappelijk Onderzoek) (Netherlands Organisation for Applied Scientific Research) Traineeship period of 100 working days as a requisite of the study curriculum of Fontys University. Eindhoven, The Netherlands.

Project:
Based on DECT (Digital Enhanced Cordless Telecommunication System) development of a new profile to be applied in a hearing aid system. The main task of the project was to create a new profile by programming in C language the baseband controller PCD50953 (8051 family) produced by Philips. The results are condensed in the confidential report: "Development of a new profile in DECT" of June 26 of 2001 TNO Industrial Technology, PPO, ESO.

Other tasks:
Support in CAD design using the Very Best program.

Writing the manual of a DECT test board for future projects.

2001 ECCT (European Communications Consultancy Team). This company tests communication products that fulfil the required specifications of the international standards in areas such as acoustics, telephone line interfaces, radio frequency and EMC (Electromagnetic compatibility). Eindhoven, The Netherlands

Tasks:
Radio Frequency Test fixtures (software and hardware) for Blue Tooth products. Specially involved with RF equipment (RF Universal Analyser)

2002 Philips Natlab Transceivers Group. Graduation project to get the bachelors degree of Electrical and Electronics Engineering. Eindhoven, The Netherlands.

Project:
The development of a mathematical model based on the transfer function of CDRs (Clock Data Recovery). Skills in two software environments are required: Matlab and AHDL (Analogue Hardware Design Language). Exploring different blocks that compose the CDR such as phase/frequency detector, charge pump, VCO (Voltage Controlled Oscillator) in order to obtain a non linear model at behavioural level and observe second order effects. The explored CDRs are designed for optical communications at data rate of 10 Gbps.