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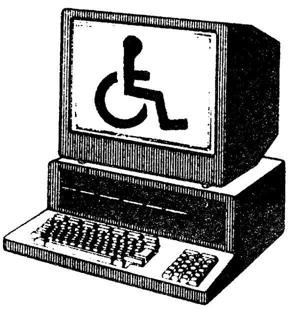

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ORIGINAL: ENGLISH

FINAL REPORT AND DOCUMENTS OF THE

INTERNATIONAL SYMPOSIUM ON COMPUTERS AND ELECTRONICS FOR THE SERVICE OF THE HANDICAPPED

Sponsors

- Electronics and Computers Research Centre (ECRC)/ Scientific Research Council
- War Handicapped Welfare Council (WHWC)
- Economic and Social Commission for Western Asia (ESCWA)
- UNESCO Regional Office for Science and Technology for the Arab States (ROSTAS)

May 1987

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ANNEXES

Introduction

1. The Symposium on Computers and Electronics for the Service of the Handicapped was held in Baghdad from 4 to 6 May 1987. The Symposium was co-sponsored by the Electronic and Computers Research Centre/Scientific Research Council, the War Handicapped Welfare Council, the Economic and Social Commission for Western Asia and the UNESCO Regional Office for Science and Technology in the Arab States.

2. The objective of the Symposium was to acquaint concerned experts and institutions in the Arab countries with various electronics and informatics innovations in rehabilitation techniques for the physically handicapped, and to enhance local capabilities to use these innovations.

3. The Symposium was held under the auspices of the Minister of Higher Education and Scientific Research of Iraq, Mr. Samir Mohammad Abdul Wahab.

4. The opening speeches stressed that the new philosophy of rehabilitation aims at reshaping life for the handicapped by retraining them to benefit to the maximum from their physical, mental and social capabilities unhindered by disability. The philosophy also aims at gaining in the society the recognition that a disabled person is a human being with all human needs, and is entitled to all human rights, hence the necessity to stress the importance of providing for the handicapped productive work opportunities to enhance their integration in the economic and social life of society.

5. The fast growing use of technology in various aspects related to the handicapped was pointed out. Diagnosis, physical and psychological treatment and therapy, etc., are relying more and more on technological advances. New applications are developed every day in the fields of education, training, rehabilitation, services and employment. Computer and electronics innovations are providing added capabilities of mobility and communication, thus enhancing the independence of the disabled and facilitating their integration in the daily life of society around them regardless of the nature and degree of disability.

6. Owing to the fast-moving nature of technological innovations, the need and importance of exchanging information and experience was stressed. In this respect, international co-operation was deemed essential; the United Nations Decade of Disabled Persons (1983-1992) was considered an excellent umbrella under which to channel international co-operation in this field.

7. The participation in the Symposium of experts from advanced centres contributed greatly to the Symposium's success. Up-to-date information circulated about innovations developed worldwide was assessed as being of extreme importance for participants and for various institutions concerned in the region. Special thanks were given to the French participants who came as part of the continuous support and contribution which the French Service des Industries de Communication et de Service, (SERICS), which has been contributing to ESCWA activities in the field of micro-electronics and informatics.

8. The fruitful co-operation among the co-sponsoring agencies was deeply appreciated and was assessed as very essential to the success of the Symposium. The agencies were called upon to continue their co-operation in the implementation of relevant recommendations.

9. (a) About 150 experts attended the Symposium, including speakers from Algeria, France, Iraq, Ireland, Kuwait, Saudi Arabia, the United Kingdom and the United States of America. The list of participants is contained in the report of the Symposium in Arabic (See annex III).

(b) Fifteen papers were presented covering various innovations in the computers and electronics applications for the benefit of the handicapped, education, training, services and employment, stressing mostly added capabilities in mobility and communication. The list of documents is contained in annex I.

10. In the closing session, the participants deliberated on various proposed recommendations, adopting a few action-oriented ones that can be implemented within the foreseeable future. The Symposium recommendations follow.

Conclusions and recommendations

11. Taking into consideration the up-to-date information presented during the Symposium about various innovations in the fields of rehabilitation, education, training and employment of disabled persons, and the added capabilities and job opportunities provided, particularly by computers and electronics applications, the participants considered informatics a very suitable and adaptable technology offering real possibilities to reintegrate the handicapped in the economic and social life of society. The following recommendations were adopted to enhance the diffusion of computers and electronics applications for the benefit of disabled persons in the Arab region:

(a) Further informative and training activities are necessary. It was recommended that such activities should be organized in various Arab countries on a regular basis, to inform concerned institutions and decision makers of innovations developed, and to help to prepare an environment to adapt these innovations to meet pressing needs in the region.

(b) Computers and electronics applications offer special advantages in rehabilitation efforts. It was recommended that full advantage should be taken of these applications, which offer easy adaptability, added capabilities, relative independence and real employment opportunities in productive jobs, thus allowing for realistic possibilities to reintegrate the handicapped in the economic and social life of society.

(c) To enhance the success and effectiveness of future activities, it was recommended that serious efforts should be exerted to secure the active participation of handicapped persons and concerned decision makers from the region.

(d) It was pointed out that computer-aided learning was very effective in that it could be adapted to the special needs of the handicapped. In this respect, it was recommended the introduction of computers in special schools and centres, should be given special importance.

(e) Noting that a large number of disabilities require only minor modifications, if any, on available computer equipment, and that a large percentage of handicapped persons can be easily trained in various jobs related to computers, the following measures were recommended:

(i) Organization of special training programmes in various computer tasks for the handicapped, particularly for those that can use available equipment with minor or no modifications;

(ii) Calling on governments to provide computer equipment to the handicapped at subsidized prices;

(iii) Encouraging employers to employ trained handicapped persons in areas suitable to their real capabilities and that are not affected by their disabilities.

(f) Serious co-ordination and co-operation is necessary among Arab institutions concerned with the handicapped, and between these institutions and research centres undertaking efforts to adapt technological innovations to the benefit of the handicapped in the region. In this respect, it was recommended that regular meetings should be held among these institutions and centres and that timely and accurate information should be circulated about their efforts and activities, to secure co-ordination and avoid redundancies and waste of scarce available resources.

(g) More accurate and up-to-date information is needed about the nature of disabilities and about rehabilitation efforts in the region. It was recommended that greater efforts should be made to collect and circulate relevant statistics about the handicapped in various Arab countries.

(h) With reference to the draft project proposal prepared by ESCWA concerning the handicapped, the following measures were recommended:

(i) A pilot regional rehabilitation centre should be established equipped with more suitable innovations in the fields of rehabilitation, services and training of the handicapped. Such a centre would have direct access to similar centres in more advanced countries, and would provide up-to-date information, experience and training opportunities, about innovations in these fields to institutions concerned in the region.

(ii) The centre should be equipped with technical workshops and should have access to production facilities, so as to adapt innovations suitable to the needs of the handicapped in the region, particularly since many relevant equipment parts available in the market and/or produced in the region may require minor or no modifications.

(iii) A feasibility study should be undertaken on the establishment of a suitable rehabilitation industry, such as aritificial arms or limbs, as a step towards the development of a rehabilitation industrial base.

(i) The terminology and symbols used in Arabic Braille including the mathematical terminology should be critically reviewed, so as to take into consideration the progress made in the field and to prepare the ground for regional co-ordination and standardization.

10. To keep up-to-date with innovations in the field, Arab experts and institutions concerned in the region should participate in various seminars, exhibitions and similar activities organized worldwide. Regional and international institutions concerned must assist in this respect, circulating timely information on such activities and providing fellowships to Arab participants whenever possible.

(j) The co-operation among the institutions co-sponsoring the Symposium was much appreciated and contributed greatly to the success of the Symposium. It was recommended that this co-operation should be continued in the implementation of the relevant recommendations. It was also recommended that contacts with concerned institutions in the region should be maintained and that these institutions should be invited to participate more actively in future events.

Annex I

LIST OF DOCUMENTS

E/ESCWA/ID/87/WG.2/2	Hansi Qasem, Abdulhadi Al-Otaibi, et al. Computer Application for the Training of Deaf Children in Kuwait, Kuwait Institute for the Scientific Research, Kuwait.
E/ESCWA/ID/WG.2/3	عبد الرحمن سالم الخلف، وزارة المعارف،المملكة العربية السعودية برايل العربى ومشكلات الحاسبات الآلية.
E/ESCWA/ID/87/WG.2/4	D.C. Chitore, S.F. Rahmatallah, K.S. Albakry, An Electronic Controller for Artificial leg Prosthesis, University of Technology, Baghdad, Iraq.
E/ESCWA/ID/87/WG.2/5	F. Ajina and K. Ajina Microprocessor based trained speech recognizer for the handicapped, Electronics and Computers Research Centre, Iraq
E/ESCWA/ID/87/WG.2/6	M. Mulla Huwaish, A.A. Ibrahim The use of myoelectric prosthesis for the upper limb, Muath Ibn Al Jumoh Military Orthopaedic workshop, Iraq.
E/ESCWA/ID/87/WG.2/7	Tohru Ifukube A Design of Blind Mobility Aided Modelled After Echo Location of Bat, Hokkaido University, Japan
E/ESCWA/ID/87/WG.2/9	محمد طاهر ميلودى ، مشروع نسخ اللغة العربية لابجدية براى آليا ، المعهد الوطنى للتكوين فى الاعلام الآلي، الجزائر.
E/ESCWA/ID/87/WG.2/10	Linah H. Al-Banna, and S. Al-Banna Some Computer Associated Technologies for the Handicapped in the U.S.A., LOGOS General Systems, U.S.A.
E/ESCWA/ID/87/WG.2/11	William Leard The Changing Workplace: The Educator's View, Maryland Rehabilitation Centre, U.S.A.
E/ESCWA/ID/87/WG.2/12	G. Busby Computer and Electronics for the Service of the Handicapped: An Overview from the U.K., British Computer Society, U.K.

E/ESCWA/ID/87/WG.2/13	Bob Allen Current and Future Trends in Computer Technology for the Physically Disabled, Central Remedial Clinic, Dublin, Ireland.
E/ESCWA/ID/87/WG.2/14	G. Busby Aspects of Mobility for the Disabled, British Computer Society, U.K.
E/ESCWA/ID/87/WG.2/15	Philippe Balin Visiobraille: The Blacklight, Air France, Paris, France Dr. Pierre Courbin Informatics for the Handicapped in France: Benefits and limitation, National Technical Centre for the Studies and Research on the Handicapped, France.

Background Papers

Blind user Access to a Wang V.S-100 System, Jack Morgan, Wang Laboratories, Massachusettes, U.S.A.

Visiobraille, Description of a Workstation for the Blind, Zygote, France.

A Note on Information Technology and the Handicapped, S. Arora, Centre for Social Development and Humanitarian Affairs, United Nations, Vienna.

New Information Technology in Special Education, A study prepared for UNESCO by Jorgen Hansen, Denmark.

Annex II

AGENDA

Monday 4 May, at ESCWA Headquarters, Airport Road

09:00 - 10:00	Registration
10:00 - 11:00	Opening Session
	- The Holy Kour'an
	- His Excellency, The Minister of Higher Education and Scientific Research, Mr. Samir Mohamad Abdul Wahab
	- ESCWA Executive Secretary, Mr. M.S. Al-Nabulsi
	- UNESCO Representative
	- Chairman, War Handicapped Welfare Council, Dr. Raji AL-Tikriti
	- ESCWA Industry Division, Mr. K. Jabbar
	- Chairman, Organizing Committee, Mr. Munther Al-Tikriti
11:00 - 11:30	Recess
11:30 - 13:00	Work-Session I*
	- Pierre Courbin: "French experience in developing computer and electronics applications for the handicapped"
	- Philippe Balin: "Demonstration of the visio-braille"
	- Miloudi Mohamed Tahar: Transcription due Braille Arabe

Tuesday 5 May, at Ibn Al-Haytham Hall, National Research Council, Jadriah

09:00 - 10:30	Work-Session II*
	- Fares K. Ajina *et al*: "Microprocessor based speaker trained speech recognizer for the handicapped"
	- Sana'a Al-Bakri *et al*: "An electronic controller for artificial leg prosthesis".
	- Ayad A. Ibrahim *et al*: "The use of myoelectric prosthesis for the upper limb amputation".
10:30 - 11:00	Recess

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* Paper presentation restricted to 20 min. followed by 10 min. discussion.

11:00 - 12:30   Work Session III*

- R.H. Allen : "Current and future trends in computer technology for the physically disabled with particular reference to the assessment and prescription of appropriate systems".
- Geoffry Busby: "Computer and electronics applications for the handicapped in Britain".
- Mrs. Lina El-Banna: "Computer and electronics applications for the handicapped in the USA".

12:30 - 13:30   Special Workshop I

Prof. Bill Leard: "The experience of Maryland Rehabilitation Centre".

13:30   Video films on various computer and electronics applications at the service of the handicapped.

Wednesday 6 May: at Ibn Al-Haytham Hall, National Research Council, Jadriah

09:00 - 11:00   Work-Session IV*

Tohru Ifukube: "A design of blind mobility aid modelled after echo locations of bat."

Hani Qasem: "Computer applications for the training of deaf children in Kuwait.

11:00 - 11:30   Recess

11:30 - 12:30   Special Workshop II

Geoffry Busby: "The experience of the British Computer Society's Specialist Group for the Disabled".

12:30 - 13:00   Closing Session, Recommendations

13:00   Video films

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* Paper presentation restricted to 20 min. followed by LO min. discussion.

Annex III

التقريـــــــــر الختامـــــــــي

توطئــــــــة

١ــ عقدت ندوة "الحاسبات والالكترونيات في خدمة المعوقين" في بغداد ، في الفترة ٤ــ٦ آيار/مايو ١٩٨٧ ، وشـارك في تنظيم الندوة وتمويلها كل من : اللجنة الاقتصادية والاجتماعية لغربي آسيا (الاسكوا) و مركز البحوث الالكترونيات والحاسبات ــ مجلس البحث العلمي في العراق ، وهيئة رعاية معوقي الحرب في العراق ، ومنظمة الامم المتحدة للتربية والعلـم والثقافة (اليونسكو) ــ المكتب الاقليمي للدول العربية

٢ــ كان الهدف من الندوة هو تعريف المعنين من الخبراء والمؤسسات في الوطن العربي بالمستجدات في تطبيقات الالكترونيات والحاسبات، لاعادة تأهيل المعوقين وتحفيز القدرات المحلية على استخدام هـــذه المستجدات .

٣ــ افتتحت الندوة برعاية السيد وزير التعليم العالي والبحث العلمي في العراق ، الاستاذ ســمير محمد عبد الوهاب، حيث تكلم في جلسة الافتتاح مندوب السيد الوزير ، ونائب الامين العام التنفيذي للاسكوا وممثل اليونسكو ، ورئيس هيئة رعاية معوقي الحرب، ورئيس شعبة الصناعة في الاسكوا ، ورئيس اللجنة التحضيرية مدير مركز بحوث الالكترونيات والحاسبات. وقد ركزت كلمات الافتتاح على ان فلسفة التأهيل الحديثة تعني اعادة البناء والحيوية للمصاب ، واستعادة الشخص المعوق لاقصى ما تسمح به قدراته من النواحي الجسدية والعقليـــة والاجتماعية ، كما تعني تقبل المعوق كانسان له كرامته وحقوقه واحتياجاته ، وبالتالي اهمية توفير فرص العمــل المثمر والمنتج للمعوقين وادماجهم في الحياة الاقتصادية والاجتماعية للمجتمــع.

٤ــ واشارت كلمات الافتتاح الى النمو المضطرد في استخدام التكنولوجيا في مختلف المجالات المتعلقــة بالمعوقين، الى جانب المعالجة الطبية والنفسية، بما في ذلك التعليم، التدريب، والتأهيل ، والخدمـــات، والاستخدامات كما اشارت بشكل خاص الى التطور الهائل في تطبيقات الحاسبات والالكترونيات في مختلف هــذه المجالات، وما توفره مستجدات هذه التطبيقات من قدرات مضافة للمعاق في الحركة والتواصل مع الآخرين ممـا يزيد الى درجة كبيرة في استقلاليته ويسهل اندماجه الكامل في الحياة اليومية للمجتمع مهما كانت نوعية اعاقتـــه ودرجتهـــا .

٥ــ وقد اشارت كلمات الافتتاح ايضا الى اهمية تبادل المعرفة والخبرة حول مختلف مســـــتجدات التكنولوجيا المتعلقة بالمعوقين ، على الصعيد الاقليمي والدولي، لتسارع التطور في هذه المستجدات، كمـا اشارت الى ضرورة التعاون الوثيق بين مختلف المؤسسات الدولية المعنية بالامر ، خاصة ضمن برنامج الامـــم

المتحدة في العقد الدولي للمعوقين ١٩٨٣ـ١٩٩٢٠ واشادت كلمات الافتتاح في هذا المجال بالمشاركة البناءة لمختلف الخبراء الذين جاءوا من خارج العراق وتقدموا بأبحاثهم وبعرض تجاربهم، وكانت هنالك لفته خاصة لمشاركة ادارة المعلوماتية والالكترونيات الفرنسية (SERICS)، بخبيرين متخصصين٠ وكان هنالك تقدير عال لروح التعاون الوثيق بين المنظمات التي شاركت في اعداد الندوة وعملت على انجاحها٠

٦ـ شارك في الندوة حوالي ١٥٠ خبيرا، بينهم مشاركون من الجزائر والكويت والمملكة العربية السعودية وفرنسا وبريطانيا وايرلندا والولايات المتحدةالامريكية، وترد قائمة المشاركين في الندوة في الحلقات ٠ وقدم في الندوة حوالي ١٥ بحثا شملت مختلف المستجدات في تطبيقات الحاسبات المتعلقة بالمعوقين في مجالات التربية والتدريب والخدمات والتشغيل، وبشكل خاص القدرات المضافة في الحركة والتواصل ، وترد قائمة الابحاث التي قدمت ضمن الملحقات٠

٧ـ ناقشت الجلسة الختامية للندوة مقترحات للتوصيات، واقرت المناسب منها٠ وقد صيغت التوصيات المقرة بشكل عملي يتيح للمؤسسات المعنية السعي لتنفيذها في فترة زمنية منظورة كما هو وارد ادناه٠

التوصيـــــات

بعد ان اطلع المشاركون في الندوة على المستجدات في تقنيات تأهيل المعوقين وتدريبهم وخدمتهم وعملهم. وبعد استعراض خاص لتطبيقات الحاسبات والالكترونيات في هذه المجالات، وما توفره هذه التقنيات الاحدث من قدرات مضافة للمعوقين ومن فرص حقيقية لادماجهم في الحياة اليومية للمجتمع، اوصت الندوة بما يلي:

١ ـ العمل على اقامة المزيد من الانشطة الاعلامية والتدريبية حول مستجدات تقنيات تأهيل المعوقين وتدريبهم وخدمتهم واستخدامهم،وذلك بشكل دوري ، وفي مختلف الاقطار العربية ، من اجل اطلاع المسؤولين والعاملين في هذه المجالات على التطور المتسارع لهذه المستجدات، ومن اجل المساهمة في تهيئة الظروف الانسب للاستفادة من هذه المستجدات في المنطقة العربية.

٢ ـ التأكيد على اهمية تطبيقات الحاسبات والالكترونيات في مواجهة احتياجات العوق ، لملاءمة هذه التقنيات الاحد ث لظروف المعوقين ، ولما توفره من قدرات مضافة متزايدة في مواجهة المصاعب التي تنتج عن مختلف انواع العوق ودرجاته ، مما يسمح للمعوقين بمزيد من الاستقلالية عن الاخرين،ويوفر لهم فرصا حقيقية للعمل المثمر والمنتج.

٣ ـ الدعوة لاشراك المعوقين،والمسؤولين عن برامج المعوقين ، وأصحاب القرار ، بشكل مباشر في الانشطة المماثلة التي ستقام فيالمستقبل وتهيئة الظروف المناسبة لذلك.

٤ ـ الدعوة للاسراع في ادخال الحاسبات وتطبيقاتها في مراكز المعوقين ومدارسهم، وبشكل خاص الدعوة للاستفادة من تطبيقات الحاسبات في تعليم المعوقين .

٥ـ بالاشارة الى انالعديد من حالات العوق لا تتطلب تعديلات جذرية على الحاسبات المتوفرة في الاسواق ، والى ان العديد من المعوقين بامكانهم استخدام الاجهزة المتوفرة دون اي تعديل فيها ، الدعوة الى :

ا) اقامة دورات تدريب على الحاسبات للمعوقين القادرين على استخدام الاجهزة المتوفرة ،

ب) تشجيع الحكومات على توفير هذه الاجهزة للمعوقين بأسعار تجعلها بمتناول اعداد كبيرة منهـــــم،

ج) تشجيع ارباب العمل على استخدام المعوقين المتدربين في المجالات التي تتناسب مع قدراتهم الفعليةوالتي لا تتأثر بظروف الاعاقة.

٦ ـ السعي للمزيد من التعاون بين مختلف المؤسسات العربية التي تهتم بشؤون المعوقين ، وبينها وبين مراكز البحث التي تعمل على تطويع مستجدات التكنولوجيا لصالح المعوقين في البلاد العربية ، والعمـــل

على نشر اخبار هذه المؤسسات وانشطتها ، تعميما للفائدة وتجنبا للتكرار وهدر الامكانات الضئيلة المتوفرة في هذه المجالات.

٧ ــ دعوة المؤسسات المهتمة بشؤون المعوقين في البلاد العربية ، لمتابعة تطور اوضاع المعوقين وجمع مختلف المعلومات المتعلقة بهم ونشرها بشكل دوري منتظم، وذلك حتى تتركز الجهود في مواجهة حالات العوق الأكثر الحاحا، وحتى تكون المعالجة مرتبطة بالظروف الموضوعية للمعوقين في المنطقة.

٨ ــ بالاشارة الى مشروع اعدته الاسكوا حول المعوقين ، الدعوة الى:

ا) اقامة مركز تأهيل نموذجي اقليمي عربي، تتوفر فيه مختلف مستجدات تقنيات التأهيل ، خاصة تلك التي تستفيد من الحاسبات والالكترونيات، ويكون على اتصال مستمر مع مراكز مماثلة في البلاد الأكثر تقدما في هذا المجال ، من اجل توفير المعلومات والخبرة وفرص التدريب على هذه المستجدات للعاملين في ميدان التأهيل في الاقطار العربية.

ب) توفير الورش الفنية لهذا المركز، وتسهيل صلته مع مراكز الانتاج، ليتسنى للعاملين فيه تطويع المناسب من مستجدات تقنيات التأهيل لصالح المعوقين في المنطقة العربية ، وحتى تقوم مراكز الانتاج العربية بانتاج الاجهزة المطلوبة خاصة وان كثيرا من هذه الاجهزة قد لا يتطلب سوى تعديلات بسيطة على ما هو متوفر في الاسواق وما ينتج في الاقطار العربية.

ج ــ اعداد دراسة جدوى لاقامة وتطوير صناعة تأهيل مناسبة في المنطقة العربية ، تستفيد من مجهودات المركز المقترح، ومن الممكن البدء بانتاج الاطراف الصناعية مثلا انطلاقا الى صناعات اكثر تقدما فيما بعد.

٩ ــ اعادة النظر بالاختصارات والمصطلحات المستعملة في لغة برايل العربية، بما في ذلك المصطلحات في الرياضيات، أخذا بعين الاعتبار للمستجدات، وسعيا من اجل التنسيق بين مختلف الاقطار العربية في هذا المجال.

١٠ ــ تشجيع الخبراء العرب على المشاركة في مختلف الندوات والاجتماعات والمعارض التي تنظم على الصعيد العالمي حول مستجدات التقنيات المتعلقة بالمعوقين ، ودعوة المنظمات الاقليمية والدولية لمساعدة المؤسسات العربية في هذا المجال ، بتوفير المعلومات عن هذه الانشطة في الوقت المناسب، وبتوفير الزمالات والامكانات للمشاركة فيها قدر المستطاع.

١١ ـ الاشادة بالتعاون المثمر والبناء بين المنظمات التي شاركت في تنظيم الندوة وعملت على انجاحها ، ودعوة هذه المنظمات للاستمرار في التعاون فيما بينها لتنفيذ هذه التوصيات، ودعوتها كذلك للاتصال المستمر والبناء بمختلف المؤسسات العربية العاملة في ميدان تأهيل المعوقين وتعليمهم وتدريبهم وتشغيلهم، واشراكها بشكل فاعل في مختلف الانشطة التي تقام في المستقبل .

المشاركون من الجمهورية العراقية

الاسم	الجهة
رعد حمدان ظاهر	معهد التكنولوجيا
طالب محمد جواد عباس	وزارة الدفاع ـ قسم الحاسبة
هيثم عبداللطيف العاني	وزارة الدفاع
عبد الحمزة عبد الحسين عبد الكريم	مديرية الفنية ـ الحاسبة الالكترونية
عدنان عبد الامير	المركز القومي للحاسبات الالكترونية
مظفر الجراح	المركز القومي للحاسبات الالكترونية
حامد محمد علي	كلية الهندسة
محمد صاحب سلطان	ديوان رئاسة الجمهورية
سوسن بعد الرزاق جواد	وزارة النقل والمواصلات ـ قسم الحاسبة
اسيل محمد السراج	وزارة النقل والمواصلات ـ قسم الحاسبة
جوني عمانوئيل بابا جان	وزارة النقل والمواصلات ـ قسم الحاسبة
بان يوسف التكريتي	وزارة النقل والمواصلات ـ قسم الحاسبة
صادق عبد الرزاق	مديرية الامن العامة
عبد السلام لبيب عبد اللطيف	مديرية الامن العامة
سمير قاسم امين	مدير الحاسبة ـ الامور الطبية
محمود خضر جبر	حاسبة الامور الطبية
شيرين عبد الحكيم	وزارة الصناعة والمعادن/المؤسسة العامة للصناعات الهندسية
يسار محمد بهجت الاثري	= = =
شيان واضح محمد	= = =
حسين حميد شاهين	مديرية الحاسبات المايكروية
نجم مثنى محمد نجيب	جامعة البكر
لباب عبدالله الخالدي	وزارة النفط
ابراهيم طه	معاون مدير الامور الطبية
اعئدة ابراهيم مهدي	وزارة الشباب ـ دائرة الرعاية العلمية
ثائر مجيد توفيق	مدير الرعاية العلمية/الرصافة
سحر رشدي احمد	رئيس اختصاصيين الحاسبة/المؤسسة العامة للكهرباء

المشاركون من الجمهورية العراقية

الاسم	الجهة
قيس عبدالكريم عبد الرحمن	المؤسسة العامة للعمل والتدريب المهني
لقاء عطا مهدي	وزارة النقل والمواصلات/المؤسسة العامة للسكك الحديد
رضا ماجد محمد	جامعة البكر
علاء حسين محمد صالح	مديرية نظم الحاسبات الالكترونية/مديريرية التأهيل في وزارة الدفاع
نزار يعقوب يوسف	وزارة النقل والمواصلات/المؤسسة العامة للسكك الحديد
د. مهند عبد الغني عبد الكريم	طبيب
خالد عبد الرزاق الحران	ضابط
سمير رشاد حسن	مديرية التجنيد العامة
احسان محمد حسن	= = =
طارق احمد الزوبعي	ادارة المراتب ـ وزارة الدفاع
حارث عبود عباس	منظمة الامم المتحدة للاطفال (اليونسيف)
حامد خليل جاسم	قسم الحاسبة الالكترونية ـ التجنيد العامة
ايمان عبد الوهاب	وزارة الدفاع ـ مديرية الاشغال العسكرية
صبيح سليم محمد ثابت	وزارة النفط
سلم مجيد الشماع	معاون مدير الامور الطبية
خمائل حسين صادق	جامعة البكر
جوان مصطفى عزيز	وزارة الدفاع، جامعة البكر
عامر صديق مصطفى	= = = =
نبيل ابراهيم عبد الباقي	آمرية الانضباطية العسكرية
سمير حمودي الشيخلي	دائرة رعاية المعوقين وزارة العمل والشؤون الاجتماعية
سهام رشاد عبدالله	= = =
د. عبد الباقي محمد رؤوف	طبيب اختصاصي في جراحة التجميل والتقويم
د. هاشم خليل العاني	مدير معهد العلاج الطبيعي

المشاركون من الجمهورية العراقية

الاسم	الجهة
كوكب نجم عبد الله	وزارة التخطيط/الجهاز المركزي للاحصاء
د. وائل الشهابي	رئيس المجلس الاستشاري للتأهيل الطبيعي/وزارة الصحة
منى احمد كمونة	الاتحاد العام لنساء العراق/المركز العام
نضال ياس هاشم	الاتحاد العام لنساء العراق/المركز العام
نواف عدوان	مدير عام اتحاد الاذاعات العربية
د. جمال حبوش	مديرية الامور الطبيعية
غانم عواد عبد الله	مديرية الحركات العسكرية
عبد الاله الديوهجي	وزارة الصناعة -مركز الحاسبات والمعلومات
نبيل ايليا نجار	حاسبة المؤسسة العامة للكهرباء
يوسف شوكت شكوري	" " " "
ابتسام نجم عبد الله	" " " "
ساجدة عبد الزهرة	المؤسسة العامة للمشاريع النفطية/دائرة الحاسبة الالكترونية
سوسن عبد الكريم	" " " " " " "
قيس الشكرجي	وزارة الصناعة
نزار القريشي	وزارة الصناعة
فداء صفاء محمد علي	معهد التكنولوجيا
لؤي محمد رشيد	" "

المشاركون من الجمهورية العراقية

الاسم	الجهة
غزوان حامد المختار	مهندس اهلي
اعتماد رشيد الصالحي	وزارة العمل والشؤون الاجتماعية
الهام خليل جواد	الاتحاد العام لنساء العراق
نوفل عبد الستار	نادي وسام المجد الرياضي
احمد غائب مجيد	وزارة الدفاع /مديرية التموين والنقل
نوفل محمد علي	= = = =
صلاح بشير محمد	مديرية الحوانيت والنوادي
عقيد ركن حسن علي سليم	مديرية الحركات العسكرية
جعفر صادق عبد الهادي	امانة العاصمة
شناء علي جعفر	وزارة الاسكان والتعمير /مركز الحاسبة الالكترونية
جمال عبد الهادي مهدي	= = = = =
جمال سلمان مجيد	معمل قصر مرك
فارس حكمت عبد الكريم	جامعة بغداد /مركز الحاسبة الالكترونية
نادين سليمان قصير	المركز القومي للحاسبات الالكترونية
سعد محمد عبد العزيز	شركة الصناعات الالكترونية
سهام نجم	= = =
رفعت ابراهيم	= = =
حميد مجيد نقاشة	خبير = =
محمود حمزة	الكلية الفنية العسكرية
سناء فيصل رحمة الله	الجامعة التكنولوجية
قيس سعيد	= =
صائب مصلح خليل	= =
سمير مال الله	الكلية الفنية العسكرية
علاء احمد خضير	= = =
دريد محمد احمد الشيخلي	ضابط
وارد نجم عبدالله	مديرية الفنية

المشاركون من الجمهورية العراقية

الاسم	الجهة
خليفة عبود سالم	وزارة التجارة/مؤسسة الستيراد المواد العلمية
عبد الكريم رجب	مجلس البحث العلمي
هند قندلا	المركز القومي للحاسبات الالكترونية
صباح مزيد الدبوس	كلية الدفاع الوطني
مجيد محسن السوداني	مديرية ادارة الضباط
عبد الكريم عبد الرزاق حمودي	" " "
الرائد المهندس اسامة خالد حسن	" " "
عبد الوهاب فاضل	رئيس شعبة التخطيط والمتابعة
اياد اسعد البراهيم	معمل معاذ بن الجموح للاطراف الصناعية
ساجدة عبد الرزاق	وزارة النقل والمواصلات/المؤسسة العامة للسكك الحديد
نوفل شاكر محمود	" " " " " " "
امير حسين عوني	مسؤول شعبة الصيانة الذاتية
قحطان عبد القادر محمد العزاوي	مديرية نظم الحاسبة الالكترونية/وزارة الدفاع مديرية العلمي والفني
سلمان حسين عوني	دائرة رعاية المعوقين/وزارة العمل والشؤون الاجتماعية
د. عبد الودود زكي	مستشفى الرشيد العسكري
توفيق عبد الحسين	وزارة العمل والشؤون الاجتماعية /المؤسسة العامة للرعاية الاجتماعية /الاشراف التربوي

المشاركون من خارج العراق

الاسم	المؤسسة	بلد الاقامة والعمل
محمد ميلودي محمد الطاهر	المعهد الوطني للاعلاميات	الجزائر
هاني قاسم	معهد الكويت للابحاث العلمية	الكويت
عبد الرحمن سالم الخلف	مؤسسة النسور	المملكة العربية السعودية
عبد الرحمن احمد باعبدالله	وزارة المعارف	المملكة العربية السعودية
لينة هباب البنا	لوغو لنظم الحاسبات	الولايات المتحدة الامريكية
وليم ليرد	مركز التأهيل في ميريلاند	الولايات المتحدة الامريكية
روبرت الن	مركز التأهيل العيادي	ايرلندا
جيوفري بوسبي	جمعية الحاسبات البريطانية / المجموعة المتخصصة بالمعاقين	بريطانيا
بيار كوربان	اللجنة الوطنية للمعاقين	فرنسا
فيليب بالان	الخطوط الجوية الفرنسية	فرنسا

الهيئات المنظمة

مجلس البحث العلمي

الاسم	الجهة
محمد عماد نوري	مجلس البحث العلمي
تنادر حمود الشرع	" " "
شالان حسن عباس	" " "
عامرة سليم رحيم	" " "
الحارث عبد الحميد حسن	" " "
عبد الكريم عباس	" " "
امير حسين	" " "
طارق الخطيب	" " "
معتز شنايان	" " "
ليليان سركيس	" " "
منى غازي	" " "
لمى علي	" " "
منى موسى	" " "
نجاة علي عودة	" " "
وسن عبد الرحمن	" " "
آمنة عبد المطلب	" " "
ندى نوئيل بنيامين	" " "
نوال محمد	" " "

هيئة رعاية معوقي الحرب

علي كاظم مجيد

يحيى محمد خلف

حسن ابراهيم يعقوب

موفق علي عباس

عبير طالب السامرائي

خالد جبار علوان

عماد عبد الرحمن

شاكر ناجي محمود

بلال محمد سعيد

الاسكوا

كامل جبار

حسن الشريف

وفاء جسماني

برناديت كوي

سلوى محمد

اللجنة التحضيرية

منذر نعمان التكريتي

سهيل نجم العبيدي

حسن الشريف

تحسين القدسي

غسان تحسين ابراهيم

السيدة هيفاء عبد الرزاق

ANNEX IV. THE SYMPOSIUM DOCUMENTS

COMPUTER APPLICATION FOR THE TRAINING OF DEAF CHILDREN

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Abstract

IBM-France developed a PC-based voice training system for the training of deaf children. KISR adapted this system to the Kuwait Special Institute for the Handicapped (KISH). The adaptation process involved the Arabization of all software applications and the development of new ones. The adapted system was applied at KSIH and was evaluated for its usefulness and effectiveness as an aid for the training of deaf children.

Introduction

Developments in microprocessor and microcomputer system technologies have had a great impact on western societies. Many applications that were only feasible using super computing facilities are now running on small personal computers.

One recent application is the data processing and analysis of speech signals using personal computers. Such an application proved to be of some use for the training of hearing impaired and deaf children. It is known that those children cannot speak properly simply because they cannot hear their own voices, nor hear other people around them. This problem is particularly true for children who are born deaf. They face huge difficulties in understanding the people around them, learning their own language, and expressing themselves since they have never heard a human voice.

The IBM Scientific Center in France developed a system that visualizes the child's voice using a personal computer. Voice parameters such as intensity and pitch are extracted from the speech signal and displayed in color graphics and plots (Fig. 1). One can easily distinguish between voiced and unvoiced sounds by looking at the sketch of his voice. Another interesting application is the development of voice-controlled games. While having fun playing an amusement video game, the deaf child is receiving training on pitch control.

The system was applied to a number of institutes for the handicapped and was tested for its usefulness and effectiveness. It was found that some deaf children may benefit from it in a few ways, such as enabling them to control the intensity and the pitch of their voices. Also, they may distinguish between voiced and unvoiced sounds with some pronunciation assistance.

The Kuwait Institute for Scientific Research (KISR) conducted a joint project with the Kuwait Scientific Center (KSC) and Kuwait Special Institute for the Handicapped (KSIH). The project was funded by the Kuwait Foundation for the Advancement of Sciences (KFAS). The

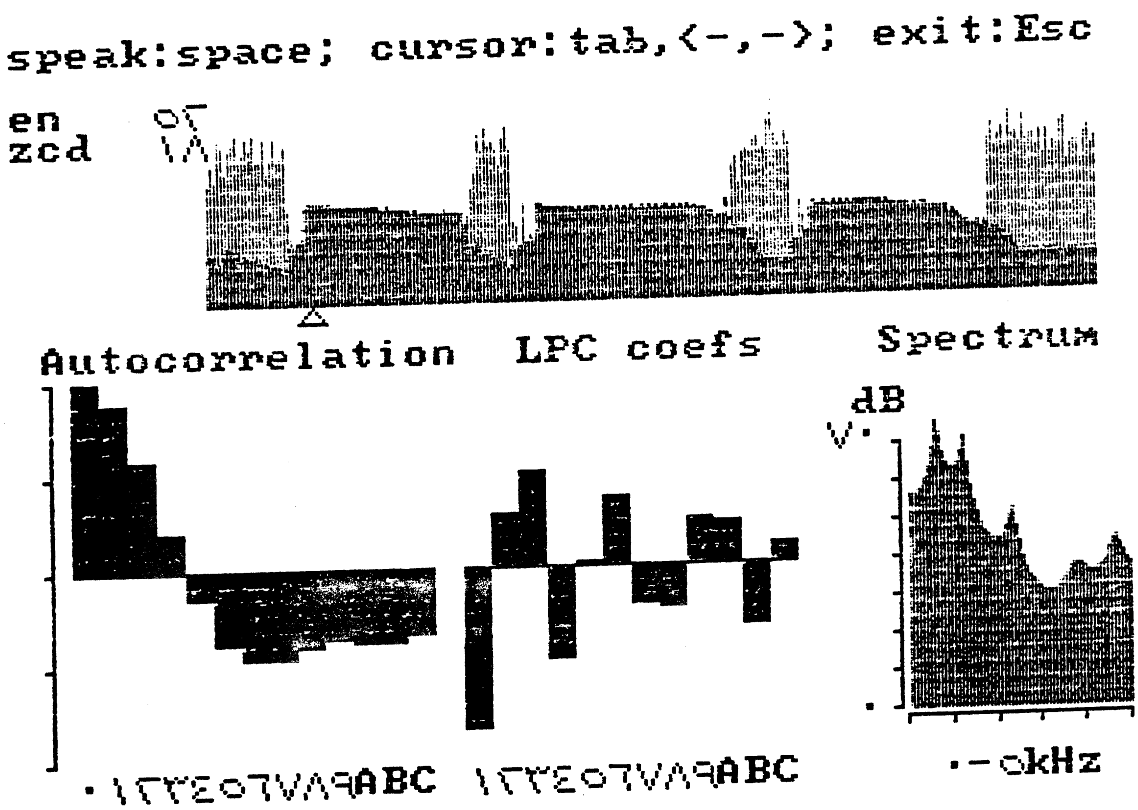


Fig. 1. Graphs and plots of speech parameters from the voice training system.

idea was to introduce the system to KSIH, adapt it to meet our local environment, and, finally, evaluate it for its usefulness as an aid to training hearing impaired children at the Kuwait Special Institutes.

System Description

The system is composed of an IBM personal computer with a voice training card. A microphone is attached to this card through a microphone preamplifier. The system extracts acoustic information from speech input, such as pitch and intensity, and displays them graphically on the monitor. Following is a brief description of the five major training programs originally supplied with the system.

* Amplitude Adjustment "Amplit"

  This program displays real-time scales of intensity (in decibels) and signal amplitude together with messages explaining how the potentiometer (amplifier) should be adjusted to obtain good speech input and avoid speech saturation of the analog-to-digital converter.

* Project Presentation

  A general presentation of the research project is offered by the program. It explains some basic facts about deafness, speech training via visual feedback, lip-reading difficulties, cued speech, and automatic assistance to lip-reading.

* Pitch and Intensity Graphs "Pitchint"

  This program is used during speech training sessions to display plots of pitch and intensity of the voice in real time. It can also merge the child's plots with those obtained from the teacher for comparison (Fig. 2).

* Pitch-Controlled Games "Pitgame"

  These games ask the user to guide a mobile object across the screen to reach targets while avoiding obstacles. A score is added when a target is reached, but taken away when an obstacle is hit. The mobile object can only move straight when the deaf child produces a sustained vowel through the microphone. To avoid the scattered obstacles, the child has to show some control of his voice pitch (Fig. 3).

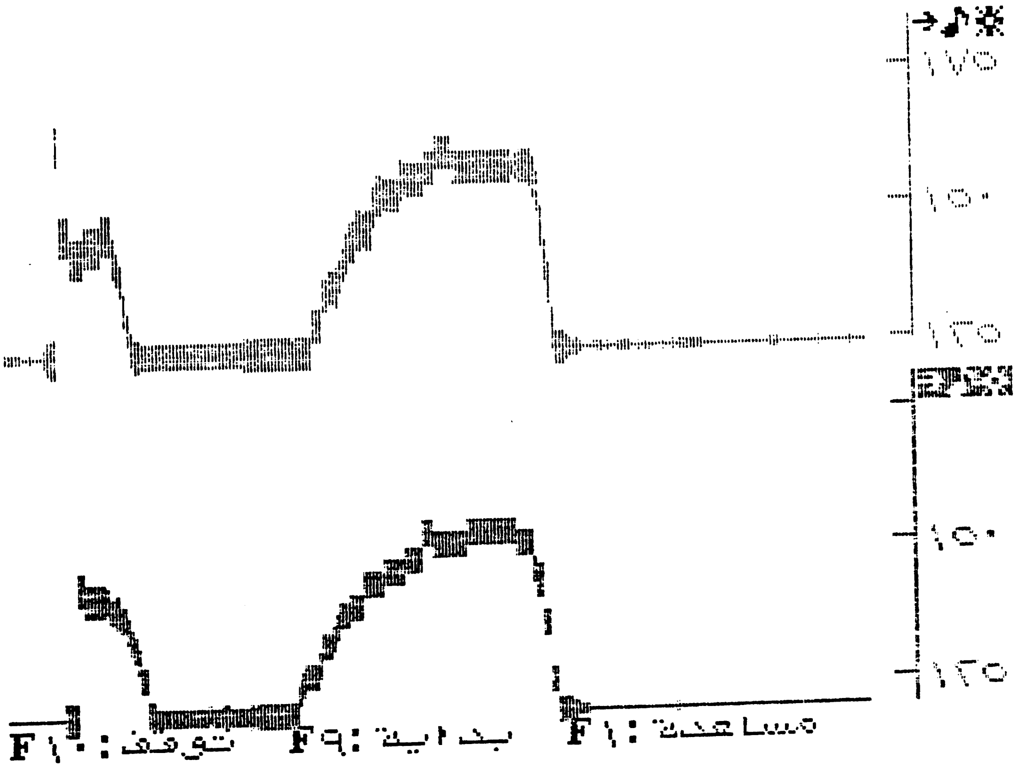


Fig. 2. Graphs and plots of speech pitch and intensity using the "Pitchint" application.

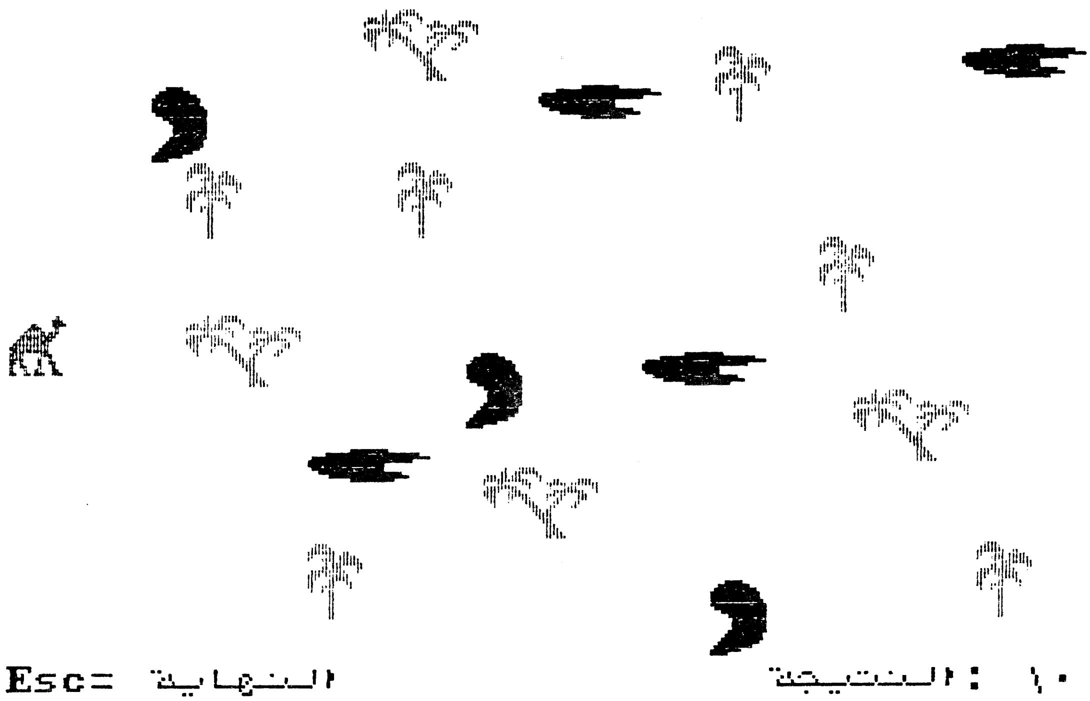


Fig. 3. Layout of the "Pitgame" application showing the moving object "camel" obstacles "trees" and targets "grass patches".

* Acoustical Parameters Display "Dispsent"

  This program can be used to acquire a short sentence (3.28 sec.) and display some of the acoustical parameters or signal waveforms.

* Language Selection

  The user may select a language through this program for example, English or French. Once a specific language is selected, all successive training programs will use that language. At an intermediate stage, the Arabic language was added to the list enabling the use of Arabic text in system operation.

When turned on, the system will present a menu so the user can select one of these listed applications. Within each application, a help file briefly explains the functions of all the keys involved. When the user exits from any application, the system automatically displays the main menu for the selection of another one.

System Adaptation and Application Developments

The adaptation process started with system Arabization which was important due to the fact that Arabic is the official language used at KSIH. Also, most of the teachers found it more comfortable when information related to the different software applications are displayed in Arabic. The project team followed a special scheme in Arabizing the software's English text. The scheme involved the use of the BASIC editor along with the IBM Arabic utility software and the Enhanced Graphic Adapter Card (EGA). Messages and information were written in Arabic through the BASIC editor and were stored in Basic files. Later on, these files were modified by a professional editor and stored in data files in a form that is acceptable and usable by the system's software application. The use of more than one editor was mainly due to the fact that there was no Arabic editor available at that time. All software applications were tested for their functioning and clarity. Copies of Arabic written software applications were given to the teachers and educators of KSIH. They were highly appreciated and fully accepted specially by the young students who found the training system to be self explanatory.

Another major task was the development of new software applications that meets KSIH requirement. After several meetings with KSIH directors and educators, a decision was made to develop a new voice controlled game (Fig. 4). The game was developed using the same voice pitch parameters, but has different style in character mobilization than the original supplied voice control games. It serves the same purpose of controlling the pitch of the deaf child voice through the movement of an object. The pitch information of the child's voice is obtained through a microphone by the IBM supplied speech analyzing board. These information are processed by a special software program that leads to the movement of a car (object) on the T. V. Screen. To drive this car through a predesigned road, the child has to show some control of his voice modulation. The developed voice control game was named "Road Game".

System Application and Evaluation

A pilot training program was carried out at KSIH on selected groups of students of different ages, sex, and levels of deafness. The aim of the program was to explore the effectiveness of the deaf children training system in Kuwait's environment. The training experiment was executed in two phases.

Phase 1. First Training Experiment (Feb. - May 1986)

Training Program and Execution. A group of six boys and one of six girls were selected. Each member group was subdivided into three subgroups, each representing an educational stage in the KSIH lower grades. Each subgroup had two students of the same age and the same education standards but different levels of deafness (one student profoundly deaf and the other hearing impaired). The subgroup ages were 8, 10 and 12 years. Each subgroup was attended by the same teacher, who was also the class teacher throughout the training period. None of the teachers had previous experience in computers (except one teacher for a subgroup of 12 year old boys).

The training period lasted for approximately two and half months during which each subgroup was exposed to the system for one hour and twenty minutes for one day each week. This means that, for the duration of the training program, each subgroup used the system for 14 hours.

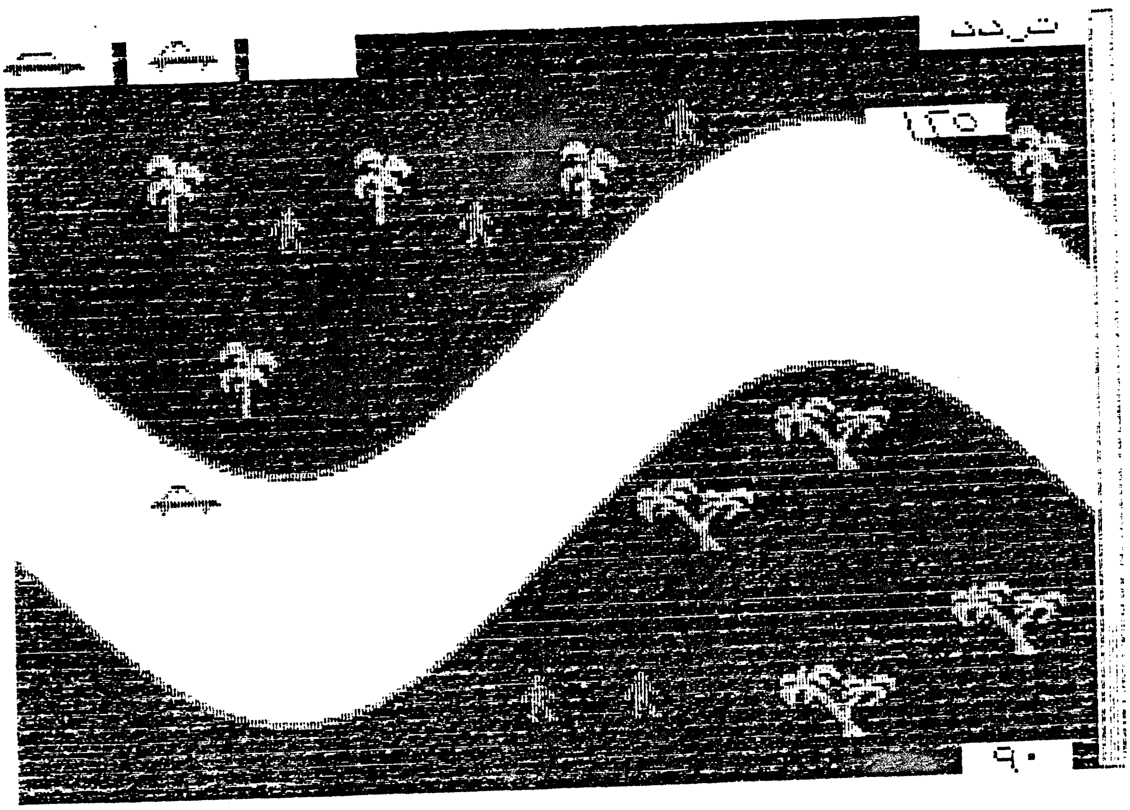


Fig. 4. The "Road Game": A voice controlled game developed by KISR.

The training concentrated on voice pitch and intensity control and on recognizing the difference between sustained voiced and voiceless Arabic sounds.

Training Results and Evaluation. At the end of the training period, staff from KSIH, KISR and KSC met to review the results of the training and to assess the usefulness of the system and its impact on the selected students and their teachers.

The following criteria were established for evaluating the training results:

* Sufficiency of teacher training and their understanding of the system's capabilities as a teaching aid.
* Sufficiency of student exposure time.
* Suitability of the system's application programs to meet the goals of alleviating some deaf children training problems.
* Differences between students exposed to the system and those who were not.
* Differences between boys and girls in terms of the impact of the system.
* Aspects of the system that were most attractive to both students and teachers.
* Teacher's points of view about using the system as a teaching aid.
* Teacher's suggestions for further system enhancements.

All teachers felt that the training they received was insufficient, particularly in areas where the system could be used as a tool for helping the pronunciation of deaf children and that one system is not enough for all students. Nevertheless, they all gained a reasonable understanding about using the system as a training tool for control over a deaf child's voice pitch and intensity and for differentiating between sustained voice and voiceless Arabic sounds.

It was overwhelmingly agreed that the pitch-controlled games helped boys and girls with pitch irregularity problems gain control over the pitch of their voices in a reasonably short time. Control over voice energy was also successful. Some students could even recognize the difference between voice and voiceless sounds. There was a marked

difference between students exposed and those not exposed to the system. Those exposed to the system demonstrated better ability in controlling the pitch and loudness of their voices than those who were not. There was no difference between boys and girls as far as the impact of the system on them is concerned.

The features of the system that attracted both teachers and students were the pitch-controlled games and the renewed interest and hope the computerized facilities generated in them to face their problems. The renewed interest, the pitch-controlled games, and the personal qualities of the teachers helped two students aged 14 years remarkably well; they managed to control the pitch of their voices in just over three lessons.

Majority of the teachers believed that the system can be a useful teaching aid. Two of them on the other hand, had the feeling that it can only serve as an entertainment piece of equipment. In general, they suggested to further improve the application of the system in order to help them resolve some of the pronunciation difficulties encountered by deaf Arab children. Examples of these are:

* Lack of ability to differentiate between short and long vowels when they appear after consonants.
* Lack of ability to recognize Arabic consonant poses.
* Lack of ability to correctly pronounce the Arabic prefix "AL" in different contexts.

This has led to a second phase of this application experiment.

Phase 2. Second Training Experiment (Sept. - Dec. 1986)

Training Program and Execution. After several preliminary meetings of members from KISR, KSIH and KSC, a plan was prepared for the second phase of this training program. Since positive results were obtained, the voice-activated game applications were used and reapplied through all of the training period, i.e., from October till the end of December, 1986. The "Road Game", a voice-activated game developed by KISR, was used for the first time in the training experiment. Also, in this phase of the experiment, more emphasis was put on training KSIH teachers to understand and use "Pitchint" (a voice-training program). It was not

till mid-November, that a detailed training program was developed for the application of this voice-training exercise.

"Pitchint" is an application program that combines two user's (child/teacher) voices in a comparative form (Fig. 2). Its primary target is the display of the voiced/unvoiced sections of the users speech. The deaf child can train his voice by a continual effort to produce voice patterns similar to the ones produced by his teacher.

The group from KISR selected a set of words and letters that best demonstrate program capabilities. This list was given to five teachers (Three female and two male) for application. For a total of 12 training sessions (40 minutes each), the teachers applied the "Pitchint" program to their students. Each classroom contained seven students on the average. Classes were selected from the first, fourth, sixth and seventh grades, that is, students between the ages of seven and thirteen years.

Training Results and Evaluation.

The Voice-Activated Game "Pitgame". The selected group of deaf children showed more and more interest in voice-activated game applications. Some teachers had difficulty convincing the children to switch to another training application within the voice-training system. Some children showed a remarkable mastering of the game, and have competed with each other, writing down the score, which sometimes reached full mark. Small children, between seven and eight years, showed more interest in the voice-activated games than in any other application. Since they did poorly in the "Pitchint" application, one teacher suggested that the training sessions of the young children (first and second grades) be limited to the voice-activated games only. Their poor performance was mainly due to their young ages and lack of experience. As for the newly developed "Road Game", the children liked its idea but could not score well on it. They seem to lose most chances of winning at the starting point.

The Voice Pitch Training Application, "Pitchint". An application of the "Pitchint" program was demonstrated during the second phase of the training of deaf children. The list of words, prepared by KISR and KSC,

showed the capabilities of this program. Three major voice training exercises were used. The first was the distinction between the short stressed letters and the long ones, for example (بِ) and (بي). The second was the short and long stresses at the end of the words, such as (لْ) and (لّ). The third was the distinction between words that have the same mouth and lip movement but different pitch levels, for example, (حدّ) and (حتّ).

The program was applied to all students in the training experiment. Upper grade students appreciated the "Pitchint" program more than the young ones. Traditionally, bright students showed better mastering and controlling of the program. They need fewer trials to match their voice pattern with that produced by the teacher. The children made a remarkable effort to match their voice patterns with those of their teachers and classmates. This effort to succeed was one of the positive results of the "Pitchint" application. The winning feeling that the child gains from the visual feedback makes him apply more effort to produce a matched pattern. Mr. Awadh Abdul-Kareem (seventh grade boy's teacher) stated that one of his students managed to pronounce the letter (جـ) for the first time after several exercises with the program.

Children suffering from complete deafness had less success (sometimes none) in getting a matched pattern than those who have some hearing. An exception to this was those who mastered some skill in lip reading although completely deaf. The third training application, the distinction between words with similar lip movement but different pitches, was considered very difficult. It was very hard, even for the brightest child, to produce different patterns for words with similar lip output. Also, the effect of the training session does not last long if it is not backed up by a continual process of recap exercises. It is only through repetition and reapplication that children can master the production of matched patterns. Children from all over the school who are having difficulties in pronouncing some of the Arabic letters were picked and given extra sessions using the training system and the assistance of their better performing classmates.

In general, the teachers felt positive and encouraged by the application of the "Pitchint" program. They understood and demonstrated some of the system's educational concepts and applications. The idea of the system being only an entertainment device has totally disappeared.

Although they have different opinions on how to apply it, who should use it, and at what grade level, the teachers totally agree that the system is a useful aid in the teaching of deaf children.

Conclusion

The voice-training system can be visualized as a tool that aids in the training of deaf children. When evaluated under this category, it can be considered as an advanced and effective piece of equipment. Its unique and new style of voice training makes it interesting and fun to work with. Although it cannot teach a child how to pronounce a word, it can certainly show him some of its sound characteristics; a feature that will give him some sense of that spoken word and provide him with some feedback for his pronunciation trials. Being PC-based, it can always be modified and provided with new training applications. This makes the training system superior to any other dedicated speech-analyzing device.

"برايل العربي ومشكلات الحاسبات الآلية"

بحث مقدم من :

وزارة المعارف بالمملكة العربية السعودية

عبدالرحمن السالم الخلف

مقدمـــــة :

الحمد لله رب العالمين ، والصلاة والسلام على أشرف الانبياء والمرسليـن أما بعد :ـ

فيسرنا أن تشترك وزارة المعارف بالمملكة العربية السعودية فـي هذه الندوة التى ينظمها المجلس الوطنى للابحاث فى العراق بالتعـاون مع اللجنة الاقتصادية والاجتماعية لغربى آسيا بالتنسيق مع منظمة اليونسكـو والخاصة بموضوع بحث تطبيقات الحاسبات الآلية التى تم تطويرها على مستـوى العالم لخدمة المعاقين فى مجالات التعليم والثقافة والتشغيل شاكريـن ومقدرين باسم وزارة المعارف بالمملكة العربية السعودية هذه الهيئـات وعلى رأسها المجلس الوطنى للابحاث فى العـراق لتبنى مثل هذه الندوة المتطورة فى فكرتها والسامية فى هدفها والمتخصصة فى بحثها ٠

ولعل ما سوف نطرحه من افكار وآراء حول جانب من جوانـب هذه الندوة يعطى تصورا عما يعانيه الكفيف العربى من مشكلات تعـوق تقدمه العلمى والثقافـى ، وتحد من الاستفادة من هذه الاجهزة المتطورة ، ونحن على ثقة بأن يضع المشتركون فى هذه الندوة حلولا جذريـة ، ويخرجـون بتوصيات محددة حول هذه القضايا التى سوف نثيرها فى هذا البحث ٠

ونحن من خلال تجربتنا الخاصة باستخدام الحاسبات الآلية فى مجال النسخ بالخط البارز قد لمسنا وعانينا من هذه المشكلات الكثير ، وقد قامت وزارة المعارف من خلال احساسها بالمشكلة التى تقابل المكفوفين السعوديـن وغيرهم فى مجال التربية والتعليم والثقافة ٠ قامت ببرمجة عدد من الحاسبـات الآلية بالتعاون مع بعض المؤسسات السعودية مثل الرائد (٥) المبرمج باللغـة العربية بالخط البارز ليشكل وحدة كاملة مكونة من الحاسب الآلى " فيرسـا "

المصمم لخدمة ست لغات حية يمكن ترجمتها الى اللغة العربية بالخط البارز عن طريق الرائد (٥) وتقوم الطابعة " ٨٢٠ " بدورها بترجمة هذه المعلومات الى الحروف العادية بلغات مختلفة من بينها اللغة العربية لتكون وسيلة ربط بين المبصر والكفيف من جهة والكفيف والمبصر من جهة اخرى ، كما ان الوزارة ساهمت فى تعريب الحاسب الآلى Speach plus

ويوجد لدى وزارة المعارف حاسبات آلية تقوم بطبع المقررات والكتب الثقافية مثل الحاسب الآلى " بوما ... E.S.V " وهو جهاز متطور يتكون من عدة وحدات لنسخ وسحب وتصحيح الكتابة بالخط البارز .

ولعل من أبرز الاسباب التى دفعت الوزارة لطرح هذه المشكلات ومناقشتها من قبل المتخصصين هو ذلك المشروع الذى سيقدم خدماته فى القريب العاجل باذن الله ، وهو مشروع المكتبة الناطقة المركزية للمكفوفين بالرياض ، والذى سوف تغطى خدمته جانبين :

*** الجانب الاول : خاص بالكلمة المسموعة واقسامه هى : —

٠١ قسم خاص بالتسجيل الالكترونى .
٠٢ = = بالكتب والمراجع والمصادر .
٠٣ = = بالاستماع يسع حوالى ٥٠٠ كفيف فى وقت واحد .
٠٤ = = بالانتاج والتجهيز للكتب الصوتية .
٠٥ = = بالاستعارة الخارجية ، وخطط له ليخدم خمسة آلاف كفيف مشترك داخل المملكة وخارجها .

**** الجانب الثانى : يخدم الكلمة الملموسة :

ويشتمل على الاجهزة والحاسبات الناسخة فى مجال الخط البارز لنسخ الصحف والنشرات الدورية بالاضافة الى الكتب الثقافية ، وقد بلغت تكلفة هذا المشروع حوالى ثلاثين مليون ريال سعودى .

ونظام هذه المكتبة الناطقة يسير على غرار الانظمة المتطورة المطبقة على المستوى العالمى فى هذا المجال . ومن هنا نطرح بعض المشكلات الفنية والتربوية والتى فرضت نفسها على بساط البحث أمام الهيئات الاقليمية والعربية والدولية ، وقد تتطلب هذه المشكلات تفهما اكثر وادراكا لجوانبها المختلفة ، وعمقا فى حلها ، ولا أنكر أن هذه المشكلات كانت تطرح فى كثير من الاجتماعات والندوات العربية ، غير أن النقاش فيها يقل والحماس يخمد حينما تناقش هذه القضايا من خلال وجهة نظر ادارية بحتة أو حينما تناقش على حياء وخجل باعتبار أن الذين يتولون نقاشها غير مؤهلين من الناحية التخصصية لهذا النقاش لعدم وجود الكوادر المتخصصة القادرة على استيعاب هذه المشكلات ووضع الحلول المناسبة لها ، والمشكلات التى سوف أتعرض لها بالتفصيل فيما بعد قد برزت بشكل فعال منذ اكثر من خمس سنوات حينما بدأ التطور التقنى يتدخل فى العملية التعليمية للمكفوفين .

أهـداف البحـث : ـــ

يهدف هذا البحث الى اعادة النظر فى المصطلحات والرموز الرياضية والاختصارات العربية حيث انها قد طبقت فى العالم العربى منذ اكثر من ثلاثين عاما قبل ان تظهر هذه الثورة التقنية فى مجال الحاسبات الآلية والاجهزة الالكترونية الناسخة بالخط البارز .

ومن أبرز الاسباب التى دعت الى طرح مثل هذا البحث وجود رموز جديدة خاصة بمادتى الرياضيات المعاصرة والعلوم المطورة ، وظهرت الحاجة الى هذه الرموز بعد تطبيق منهجى هاتين المادتين فى المملكة العربية السعودية منذ اكثر من ثلاث سنوات مضت ، بعد ان اصبحت الرموز والمصطلحات القديمة غير قادرة على الوفاء بمتطلبات العملية التعليمية لهاتين المادتين ، علاوة على كونها رموزا اقليمية غير مرتبطة بالرموز العالمية التى برمجت على أساسها الحاسبات الآلية ، الامر الذى يتطلب تعريب هذه الرموز للاستفادة منها عند توفر هذه الاجهزة لدى اى جهة عربية .

ووزارة المعارف بالمملكة العربية السعودية ممثلة فى الامانة العامة لبرامج التعليم الخاص لم تألو جهدا فى سبيل دراسة هذه المشكلات مع الجهات المعنية داخل المملكة وخارجها . وقد قدمت بحوثا فى جميع الندوات والمؤتمرات التى عقدت فى عمان بالمملكة الاردنية الهاشمية عام " ١٣٩٧ هـ - ١٩٧٧م " ومؤتمر الشارقة المنعقد تحت اشراف لجنة الشرق الاوسط لشئون المكفوفين عام "١٤٠٢ هـ - ١٩٨٢ م " . وآخر جهد بذلته فى هذا السبيل هى ندوة نظمها وتبناها مكتب التربية العربى لدول الخليج العام الماضى ١٤٠٦ هـ - ١٩٨٦ م وقدمت الوزارة بحثا بهذا الخصوص درس من قبل المختصين فى بعض الجامعات السعودية ومكتب التربية العربى ووزارة المعارف ، وتوصل الى حلول سريعة تتمثل فى اقتباس بعض الرموز والمصطلحات من :

الشفرة الانجليزية / British Conde

والشفرة الامريكية / Nemith Conde

وقد أخضعنا هذه الرموز والمصطلحات لقواعد اللغة العربية .

ونـرفق فى نـهاية هذا البحث جدولا يمثل الرموز والمصطلحات الرياضية التى تم تعريبها فى المرحلة الابتدائية ، وتزيد على ستين رمزا فـى مجال النسخ بالخط البارز ، ونعتقد أن هذه الرموز غير مأخوذ بهـا فى ميادين تعليم المكفوفين العربية ، واضطررنا الى الاخذ بها للأسباب سالفة الذكـر .

وطلبت هذه الرموز من قبل بعض الاتحادات العربية للمكفوفين لدراسة مدى الاستفادة منها فى مجال العلوم المطورة والرياضيات المعاصرة ، كما أن معهد الخليج العربى بالبحرين قد طبق معظم هذه الرموز . ومن هنا ندعو الى اعادة النظر فى الرموز العربية القديمة ودراسة عدم ملاءمتها للمرحلة الراهنة ، وننادى بتشكيل لجنة من الجامعة العربية والهيئات المختصة فى العالم العربى لدراستها والتوصل الى انجع الحلول لها ، ونحن على استعداد للتعاون والمساهمة فى حل وعرض ما تمخضت عنه تجربتنا من آراء وحلول لتكون مؤشرا يستفاد منه عند دراسة هذه المشاكل التربويـة .

كما أننا زودنا المنظمة العربية للعلوم والثقافة بملاحظاتنا حول الرموز والاختصارات العربية باعتبارها الجهة التى أقرت هـذه الرموز عام ١٩٥١ م .

وقمنا بتزويد منظمة اليونسكو بناء على طلبها بآرائنا حول هذه الرموز والاختصارات .

كما زودنا اللجنة المشكلة لوضع رموز عالمية موحدة للمكفوفين بطريقة برايل بآرائنا ومقترحاتنا حول هذا الموضوع ، ولا نزال فى انتظار حل هذه المشكلة .

" رمـوز برايل ومشكلة الحاسبات الآلية "

ان الحديث عن رموز برايل يتطلب منا أن نقسم هذه الرموز الى قسمين :-

الاول / رموز تتعلق بمصطلحات وعلامات رياضية سبق الاشارة اليها وسيأتى لها ذكر فى موضع لاحق .

الثانى / رموز تتعلق بحروف برايل وهى تنقسم الى قسمين :

أ) برايل كحروف وكلمات غير مختصرة .

ب) برايل كاختصارات لكلمات معينة تبلغ حوالى مائة وخمسين كلمة وليست لدينا أية مشكلة عندما نكتبها بشكل غير مختصر وانما تبرز المشكلة بشكل واضح حينما نكتبها بشكل مختصر خصوصا بعد ظهور الحاسبات الآلية الناسخة بالخط البارز ، فهذه الحاسبات صممت لتستخدم اصلا فى اللغات الاجنبية ذات الحروف اللاتينية ، ولم تضع فى اعتبارها طبيعة اللغة العربية واختصاراتها بالخط البارز .

كما ان الهيئات العربية لم تعط برايل العربى ما يستحقه من عناية واهتمام فى خضم هذه الثورة التقنية الجامحة ، حيث ان الاختصارات العربية قد وضعت منذ اكثر منذ ثلاثين عاما حينما كانت الوسيلة المعتمد عليها فى كتابة الخط النافر هى لوحة برايل وقلمها المعدنى ، وآلة بيركنز .

أما اليوم فقد تغير الوضع تماما وتدخلت الحاسبات الآلية فى العملية التعليمية للمكفوفين ، وأصبحت القواعد التى تحفظ فى الرؤوس والمنظمة للكتابة بالخط النافر العربى أصبحت هذه القواعد تخزن فى عقول الكترونية غير قابلة للنقاش أو تدخل العقل فى تفسيرها ، وانما تعتمد هذه

الحاسبات على قواعد ثابتة غير قابلة للتحريف أو التبديل من قبل الانسان .

فالاختصارات العربية القديمة تختصر (فى) على اساس انها حرف و " حول " على اساس انها ظرف و " نفس " على اساس انها اسم . اما الكمبيوتر فهو يختصر هذه الكلمات على اساس انها حروف سواء وجدها مستقلة او متصلة بكلمة مثل " فياقوم " و " يحول " و " يفوق " و"بنفسج" فهو يختصر هذه الحروف اذا برمجت له بناء على الاختصارات العربية ، ولم يفرق بين كونها اسماء او حروف او افعال . الامر الذى يترتب عليه تحويل لغتنا العربية الى رموز . وعلى القارئ الكفيف ان يبحث عن معانيها اذا كانت لديه القدرة على فهم معانيها .

أما اذا لم تكن لديه القدرة فسوف يقرأ رموزا لا يعرف لها معنى ولا يدرك لها مدلولا ، مما يدعونا الى اعادة النظر فى اختصاراتنا العربية على ضوء التطور التقنى الذى ظهر فى مجال الحاسبات الآلية . وأورد هنا بعض القواعد التى اعتمد عليها فى برمجة كمبيوتر الرائد (٥) وهو جهاز يمثل صندوق مبرمج للحروف العربية النافرة اجتهد فى برمجته العربية مؤسسات سعودية بالتعاون مع عدد من المكفوفين المبتعثين من قبل وزارة المعارف السعودية لتحضير الدراسات العليا بالولايات المتحدة الامريكية .

وهذا الجهاز واحد من الاجهزة المكملة للحاسب الآلى " فيرسابرايل" والقواعد التى سوف اذكرها والمتعلقة بنظام الحاسبات الآلية توضح الفرق الشاسع بين القواعد المعتمد عليها فى مجال انظمة الحاسبات الآلية ، والقواعد القديمة المعمول عليها عندما تريد الكتابة لاختصارات بسيطة او مركبة . وأورد هنا بعض هذه القواعد لمجرد المقارنة فقط .

١. ورد فى برمجة الرائد (٥) ان البرمجة وضعت الرمز (٥) (٣ – ٦) علامات رفع القوة للاس ، وكان من الضرورى تعديله الى الترتيب الحالى لتلافى التطابق بينه وبين علامة التجزئة .

٠٢ الرمز " = " ورفع القوة والنسبة المئوية " ٪ " يمكن طباعتها دون الحاجة الى علامة التحويل الى ارقام او اتصالها بأرقام ، اما بقيـــة العلامــات فنظرا لتشابهها بعلامات تستخدم فى الحروف وعلامات التشكيـل فانها لا بد ان تكون متصلة بأرقام او ان تسبق بعلامات التحويل الـــى ارقــام .

٠٣ حالة التحويل الى ارقام تلغى حسب الاصول المتبعة فى طريقة برايل وتلغى كذلك باستخدام اشارة التحكم " ٤ " .

٠٤ ان رمزى " ٢ – ٥ – ٦ " " ٣ – ٤ – ٥ – ٦ " $ و " ٦ " " ٣ – ٤ – ٥ – ٦ " # يدخلان الترجمة الى حالة الارقــام نظــرا لاحتوائهما على علامة التحويل الى الارقام" ٣– ٤ – ٥ – ٦ " .

لذلك اذا اريد كتابة شئ غير الارقام والعلامات الرياضيـــة بعدها مباشرة فلا بد من الغاء حالة الارقام باستخدام علامـــة التحويل الى الحرف " ٥ – ٦ " .

وكيف للحاسبات الآلية أن تفـــرق عند تخزين المعلومات بين القواعد الآتية المستخدمة فى مجال الاختصارات قديما .

٠١ ان كلمة " مع " ، " من " ، " ست " ، " فى " ، " عن " يمكن ان تختصر فى اول الكلمة وفى وسطها ولا يمكن ان تختصر فى آخر الكلمة خشيـــة أن تتشابه بعلامات اخرى .

٠٢ الكلمات المكونة من حرفين مثل كلمة " كل " اذا اتصلت بحرف جر او حـرف عطف او " ال " التعريف او ضمير ، فانها تكتب بدون اختصار .

واما المكونة من ثلاثة او اربعة احرف اذا اتصلت بشئ مما ذكر فانهـــا تختصر ولكن بشرط ان توضع النقطتان " ٣ – ٦ " قبل الحرف الدال على هـــذه الكلمة مثل " صارت " فكيف يمكن تبسيط مثل هذه القاعدة لتكون ثابتـــة لدى ادخال المعلومات للكمبيوتر .

٣. لا يجوز اختصار كلمة " قبل " بالتاء المربوطة فى كلمتى " قبلة " "وتقبل" ولا يجوز اختصار كلمة " اذا " بألف همزه فى كلمة " اذاعة " ولا اختصار " لم " فى كلمة " علم " او " لمعان " ولا الهاء النازلة فى كلمة " هو ذا " اذ يؤدى الاختصار الى الخلط فى المعنى ، وهذه القاعدة هى الاخرى تحتاج الى بحث وتبسيط عندما يراد برمجة الكمبيوتر اذ انه لا يفرق فى المعلومات الدخلة له بين ما اذا كانت هى الكلمة المراد اختصارها ام ان المراد غيرها .

٤. لا يجوز اختصار كلمة " ال " فى " الوان " لانها الف همزه ولا كلمة " ها " فى " مأرب " ولا " آن " فى كلمة " لسان " وكلمة " انتهى " اذ ان الالف هنا بدون همزه ، وهذه القاعدة تحتاج الى برمجة ايضا .

٥. لا يحسن استعمال الرمز " ٤ – ٦ " ، (٤ – ٥) ، (٤ – ٥ – ٦) فى الكلمات الآتية :

" تعاون ، عربية ، لون ، بركات ، مجتمعات "

فعند ادخال المعلومات لا يفرق فى البرمجة بين " لا يحسن ويجب " اذ ان القاعدة يجب ان تكون ثابتة وغير قابلة للاحتمال ، فاما تختصر واما لا تختصر ، وكما اشرت سابقا فانه يغلب على القواعد القديمة طابع العصر الذى وضعت فيه ، وهو طابع الاستنتاج والاعتماد على العقل فى استخلاص و الوصول الى قواعد برايل .

أما فى هذا العصر فلا مجال للاجتهادات العقلية اذ ان البرمجة والانظمة ثابتة وغير قابلة لتدخل العقل الانسانى . وهناك مشكلة يحسن طرحها فى هذا الحديث وهى ان ادخال المعلومات من الكتابة السوداء الى الحروف النافرة يتم غالبا من قبل شخص مبصر لا يعرف الحروف البارزة وانما يعتمد على معرفته للحروف العادية فقط ويترك للكمبيوتر التصرف فى تحويل هذه المعلومات ، فهناك تقع المشكلة ويقع الخلط والارتباك اذ ان هناك حروف عادية لا يوجد لها مقابل فى الحروف النافرة وذلك مثل الهمزة تحت الحرف (إن) .

وبعض العلامات التى تنطق ولا تكتب ويوجد لها علامات فى الكتابة السوداء تجعل القارئ المبصر يدرك الفرق بينها وبين الحروف الاخرى ، غير انه لا يوجد لها مقابل فى الخط النافر واجد من المناسب هنا أن اذكر ان الحاسبات الآلية ضمنت لدى البرمجة رموزا مستقاة من الرموز البريطانية او الامريكية ، ويمكن ان لا يكون لها مقابل فى الرموز العربية وقد وضعت هذه الرموز لتربط الحاسبات الآلية بنظام الكمبيوتر العالمى لسهولة الحصول على المعلومات ، فاذا أردنا ان نستفيد من هذه الاجهزة بشكل جيد وسليم فعلينا ان نوجد حلا لمثل هذه المشاكل ، وعلينا ان ندرك طبيعة المشاكل التى يجب ان نتغلب عليها .

لقد تغيرت الاختصارات الانجليزية عشرات المرات منذ ان وضعت ، والذى يعرف اللغة الانجليزية يعلم ان هناك اختصارات قديمة فى برايل الانجليزى اصبحت مهجورة وحل محلها اختصارات جديدة تتمشى مع طبيعة التطور التقنى . كما ان هناك مؤسسات امريكية خاصة بالمكفوفين تصدر نشرات دورية تضمنها كل جديد فى مجال الطباعة بالحروف النافرة ، اما برايل العربى فلا يزال يقف عند نقطة واحدة ويندب حظه عندما يرى ان اللغات الحية مثل الانجليزية والفرنسية والالمانية والروسية تمده بجميع متطلبات الحياة التى يجب ان يزود بها الشخص الكفيف فى هذا العصر .

ولا تزال الاختصارات العربية التى وضعت من قبل الجامعة العربية عام ١٩٥١م . هى الاختصارات المعمول بها فى عالمنا العربى ، وعلى الرغم من الاصوات التى ارتفعت من قبل المكفوفين مطالبة الهيئات الاقليمية والعربية باعادة النظر فى هذه الاختصارات على ضوء المتغيرات الثقافية والحضارية فى هذا المجال الا انها لم تحظ بالاهتمام الكافى حتى الآن .

" تجربة تطبيق الرياضيات المعاصرة فى معاهد المكفوفين بالمملكة العربية السعودية "

من المعلوم أن الطالب الكفيف لا يختلف فى قدراته العقلية عن الطالب المبصر، ولذلك فهو يدرس المنهج الذى يدرسه زميله المبصر فى مراحل التعليم العام ، بناء على ما لديه من قدرة وبناء على الهدف التربوى القاضى بدمجه فى المجتمع ، واذابة الفروق بينه وبين الطالب المبصر ، وربطه بالمفاهيم المشتركة وصهره فى بوتقة المشاعر والاحداث العامة لهذا المجتمع .

وقد قام التعليم العام بتطبيق منهج العلوم المطورة والرياضيات المعاصرة منذ عام ١٣٩٩ هـ ١٩٧٩ م . وحينما تأكد التعليم الخاص بوزارة المعارف بالمملكة العربية السعودية من نجاح التجربة على مستوى التعليم العام والاستمرار فى تطبيقها فى المراحل التعليمية المختلفة ، صمم على تطبيقها فى معاهد النور الخاصة بالمكفوفين .

وبالفعل طبقت هذه التجربة فى احد معاهد النور للمكفوفين على سبيل اختبار قدرات الطالب المعاق بصريا ، ومدى استيعابه لهذه المفاهيم . وقد نجحت التجربة وعقدت ندوة لدراسة نتائجها وانتهت هذه اللجنة المشكلة من العاملين على مستوى التخطيط ، والعاملين فى الميدان الى تعميم هذه التجربة على جميع معاهد المكفوفين فى المملكة العربية السعودية على ان تتبع الخطوات التالية :

١) تشكيل لجان خاصة لدراسة هذه المناهج وتكييفها وتعديلها لتتلاءم مع طبيعة العملية التعليمية الخاصة بالطالب الكفيف ، واضعة فى اعتبارها الوسيلة المتوفرة فى الميدان . المتمثلة فى المدرس والمنهج والاجهزة ، وقد استمرت هذه اللجان فى دراستها اكثر من عامين ، انتهت بعدها الى تعديل منهج هذه المواد فى المرحلة الابتدائية والمقررات وتكييفه ليتلاءم مع ظروف الطالب الكفيف . كما أوصت بتوفير بعض الاجهزة المتطورة القادرة على اخراج الكتاب بشكل فنى جيد لا يختلف عن اخراج تلك الكتب المتوفرة فى يد الطالب المبصر وبالفعل تم توفير هذه الاجهزة ومن اهمها جهاز " الديجرام ماشين "

وهو جهاز يعمل عن طريق الاشعاع الآلى والرسم اليدوى ، ولديه القدرة فى ابراز جميع الرسوم والاشكال والبيانات الهندسية ليلمسها ويدركها الطالب الكفيف بيده .

وقد احضرت فى هذه الندوة بعض النموذج والرسومات الخاصة بعمل هذا الجهاز .

ثم قام تعليم المكفوفين بعقد دورات تدريبية وندوات يهدف من ورائها الى تزويد مدرس الطالب الكفيف بجميع متطلبات العملية التعليمية كما يطرح ويناقش الآراء مع جميع العاملين فى الميدان حول المشكلات التربوية التى تعترض سبيل تطبيق هذه المناهج مع بداية كل عام دراسى ونتيجة لهذه الدراسات والبحوث والاجتماعات اتفق على ان يقوم التعليم الخاص بترجمة الشفرة البريطانية ويعممها على المعاهد لسد العجز فيما لا يتوفر من رموز عربية بارزة .

واجد المجال مناسبا هنا لذكر بعض الحقائق التاريخية حول الشفرة البريطانية لتكون مؤشرا يستفاد منه عند دراسة وضع رموز جديدة عربية .

١. من الناحية الفلسفية ، يرى الامريكيون ضرورة مطابقة الكود الجديد لرموز الكود المستخدم فى الكتابة السوداء بهدف مساعدة الناسخ عند كتابته لهذه الرموز ، بينما يرى البريطانيون ضرورة ان يكون الكود الجديد موجزا ويسهل القراءة بالنسبة للمتعلم الكفيف على الا يعوق ذلك عمل الناسخ فى المطابع .

٢. فى عام ١٨٦٦ اسس " روبربلير " و " وليم تيلر " مدرسة " وستر" للمكفوفين وقد سميت لوحة تعليم الحساب باسم " وليم تيلر " حيث انه احد الرواد فى مجال تعليم الرياضيات للمكفوفين وقد حلت لوحة المكعبات الفرنسية فى الوقت الحاضر محل لوحة تيلر فى بعض البلدان، ومن بينها المملكة العربية السعودية وهى تشتمل على عدة مميزات لا تتوفر فى لوحة تيلر .

٠٣ ومع نهاية القرن التاسع عشر اخذت الحاجة تزداد لتمثيل المصطلحات الرياضية كتابة ، فقام " هيوج تايلور " بعمل كود سمى باسمه واستخدم فى نسخ كتب الرياضيات ، وتعد محاولته الاولى من نوعها لعمل كود رياضيات، وقد قام الكود اليابانى على اساسها .

٠٤ فى عام ١٩٢٩ م شكل للمؤتمر الدولى للمكفوفين المنعقد فى " فيينا" لجنة لدراسة الوضع وتقرير ما تراه من توصيات ، وقد اشترك المعهد الملكى البريطانى فى هذا المؤتمر ، اما هذه اللجنة الفرعية فقد نجحت نجاحا جزئيا فقط بسبب الخصومة القائمة بين ممثلى كل من فرنسا والمانيا حول تمثيل الرموز الرياضية .

٠٥ فى عام ١٩٣٧ م اجرت المدرسة الالمانية للمكفوفين فى " ماربورج " تعديلا للكود وترجمه المعهد البريطانى عام ١٩٤١ م ولكنه لم يلق الاستحسان ، بل اثبت ان سنوات طويلة ستمضى قبل ان نصل الى كود رياضيات يفى بكل المتطلبات ويجتاز العقبات التى تعترضه .

٠٦ تمكن المعهد الملكى البريطانى فى " لندن " والمعهد الملكى للمكفوفين فى " ادنبره " بعد ذلك من التوصل الى كود مبسط وحديث وقد طبع الجزء الاول منه وهو يشتمل على موضوعات الحساب ومبادىء الجبر والهندسة وحساب المثلثات ، وظهر الجزء الثانى منه فيما بين سنتى ١٩٤٩ – ١٩٥٥م محتويا على الجبر كدراسة متقدمة والفروع المختلفة لعلم الهندسة . وقد شارك فى ذلك البروفسير " و . ج . بيكلى " وهو احد المتخصصين البارزين فى علم الرياضيات وقد كف بصره آنذاك .

٠٧ فى عام ١٩٦٣ م صدر ملحق لهذا الكود ، وفى اعوام ١٩٧٠م ، ١٩٧٦ ،١٩٨١م حسب ما تقتضيه الحالة .

٠٨ هناك اختلاف كبير بين الكود الفرنسى والامريكى واليابانى وبينها وبين الكود المستخدم فى مجموعة اللغات الاخرى ، فعلى سبيل المثال ، هناك اختلاف واضح بين تمثيل الكود الفرنسى والانجليزى والامريكى للاعداد

" صفر ، ١ ، ٢ ، ٣ ، الخ .. فالكود الانجليزى يستخدم الحروف من " A " الى " أ " " ١ - ٩ " كأرقام وكذلك الحال فى اللغة العربية ،

اما الكود الامريكى فيستخدم الجزء الاسفل من خلية برايل .

والكود الفرنسى النقطة رقم ٦ قبل الاعداد .

ويحتم هذا الوضع دراسة الكود المستخدم فى كل لغة على حدة قبل الشروع فى دراسة الرياضيات كعلم ، مما يشكل صعوبة بالغة امام المتعلم .

٠٩ فى عام ١٩٧٦ م عقد فى موسكو مؤتمر دولى بهدف تحديد مدى الحاجة لكود دولى. موحد للرياضيات والعلوم ، وانتهى الامر الى اهمية وجود مثل هذه الكود وان هذا امر ممكن التحقيق وقد اقرت المنظمة الدولية للمكفوفين ذلك فى اجتماعها الذى عقد بالرياض عام ١٩٧٧ م وشكلت لجنة فرعية لهذا الغرض تكونت من خمسة اعضاء هم انجلترا - المانيا الغربية - الولايات المتحدة الامريكية - الاتحاد السوفيتى - اسبانيا) .

وعلى الرغم من الجهد الكبير الذى بذله الاعضاء فى اداء مهمتهم الا ان فاعلية النتائج كانت محدودة جدا ، وقد كانت هذه اللجنة تهدف الى :

٠١ الاعداد لايجاد كود دولى موحد للعلوم والرياضيات .

٠٢ الاستعانة بالجهود المختلفة للجان المنظمات الخاصة بالمكفوفين .

٠٣ تشجيع المكفوفين على دراسة العلوم والرياضيات عن طريق الكتب المطبوعة بالخط البارز .

٠٤ توفير فرص العمل المناسبة امام المكفوفين المتخصصين فى العلوم والرياضيات الحديثة للاستفادة منهم .

٠٥ العمل على توفير وتطوير الاجهزة والمعدات والوسائل التى تعينهم على آداء عملهم او تيسير دراستهم .

١٠ اما اللجنة التى تشكلت فى الرياض عام ١٩٧٧ م فقد بدأت اعمالها من حيث انتهى عمل مؤتمر موسكو عام ١٩٧٦ م حيث قامت بدراسة التوصيات التى امكن التوصل اليها ، كما وضعت الاسس والمبادىء التى يجب ان يخضع لها الكود الدولى الذى نأمل ان نتوصل اليه .

وعلى سبيل المثال . فقد اتفق على المحافظة على رموز برايل التى يعتمد اساسا على الحروف الرومانية مع معالجته ما قد ينشأ منمشاكل حسب طبيعة كل مشكلة على ان تصل اللجنة فى نهاية الامر الى كود يفى بالمتطلبات المتعددة لمختلف مستويات الدراسة على ان تكون عناصره واضحة قابلة للفهم بعيدة عن التعقيد ، كما اوصت فى نهاية الامر بنقل الرموز الرياضية والعلمية السوداء الى برايل حرفيا واستبعاد ما عدا ذلك من آراء فى هذا الصدد .

واجد المجال مناسبا هنا لاذكر ان وزارة المعارف بالمملكة العربية السعودية ممثلة فى التعليم الخاص كان لها دور بارز فى هذه الجهود وقد شكل فيها فريق عمل بطلب من المجلس العالمى لرعاية المكفوفين لتمثيل العالم العربى .

وفى مؤتمر المكفوفين المنعقد بمدينة " فنيس بايطاليا " عام ١٤٠١هـ ١٩٨١ م زود ممثل المملكة العربية السعودية فى هذا المؤتمر رئيس الفريق الدولى بجميع الرموز والمصطلحات الرياضية المستخدمة فى مجال العملية التعليمية فى العالم العربى بالخط البارز ولا نزال نسعى جادين لانجاح مثل هذه الجهود .

ايجابيات تطبيق منهج العلوم المطورة والرياضيات المعاصرة :

ومن خلال الممارسة والتطبيق لهاتين المادتين خلصنا الى ايجابيات تتمثل فى :

١) سهولة استيعاب الطالب الكفيف للحقائق العلمية والمفاهيم الرياضية .

٢) ايجابية الطالب فى التحصيل وارتفاع مستواه ، وقد زادت هذه الايجابيات وضوحا وبشكل ملموس لدى المسئولين بالمعاهد بعد توفير الكتاب المدرسى البارز والوسائل التعليمية اللازمة لتدريس المنهج . والتى تتميز بمشاركة الطالب الايجابية فى تحصيل المعلومة تطبيقا لمبدأ التعليم الذاتى للطالب الكفيف .

٣) تأمين الاجهزة الالكترونية الخاصة التى تبرز الرسوم التوضيحية والاشكال الهندسية البارزة بمطابع التعليم الخاص التى مكنت من اخراج كتب الرياضيات والعلوم حسب فنيات العملية التعليمية للمكفوفين .

٤) توفير ادوات الهندسة الخاصة بالمكفوفين فى المعاهد .

٥) دمج هذا الطالب فى مجتمعه عن طريق دراسته للمفاهيم المشتركة بينه وبين زميله المبصر .

٦) اعداد بحوث ودراسات تطبيقية للخروج بمفاهيم واتجاهات جديدة فى مجال تدريس العلوم والرياضيات للمكفوفين .

"" الفهـــــرس ""

وفى نهاية هذا البحث ، نرجو ان نكون قد وفقنا فى اعطاء المشتركين فى هذه الندوة فكرة واضحة عن ما يعانيه الكفيف العربى من مشاكل فنية وتربوية لدى استخدامه لهذه الاجهزة الالكترونية المتطورة سائلين الله مخلصين ان يوفق الجميع لما فيه خدمة المكفوفين العرب فى وطننا العربى الكبير ٠ ،،،

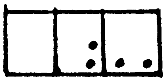
عبدالرحمن سالم الخلف
مدير ادارة تعليم المكفوفين

وزارة المعارف / المملكة العربية السعودية

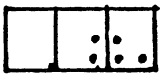
الرموز الرياضية للمرحلة الابتدائية لمعاهد المكفوفين .

١- + (٥٤٣٤٢-٦٤٥) يترك قبلها فراغ

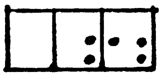
٢- — (٦٤٣-٦٤٥) " " "



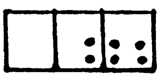
٣- X (٦٤٣٤٢-٦٤٥) " " "



٤- ÷ (٦٤٥٤٢-٦٤٥) " " "



٥- = (٦٤٥٤٣٤٢-٦٤٥) " " "

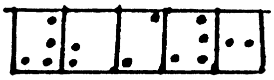


٦- الكسر الاعتيادي وشرطة الكسر (٤٤٣)

١- إذا كان بسط الكسر يمثل الوحدة يكتب المقام فقط بصورته المنخفضة بعد علامة العدد مباشرة.

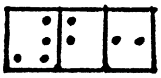
مثال : $\frac{١}{٤}$

$\frac{١}{٣}$



٢- إذا كان الكسر الاعتيادي بسطه غير الوحدة يكتب البسط بعد علامة العدد يليه المقام بصورته المنخفضة .

مثال : $\frac{٢}{٣}$

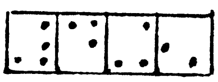


٣- العدد الكسري يكتب العدد الصحيح بعد علامة العدد يليه مباشرة علامة عدد أخرى ثم البسط ثم المقام بصورته المنخفضة .

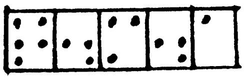
مثال : $\frac{٢}{٤}$ ٢

٧- علامة الأس أو القوة . (٦٤٤٤٣)

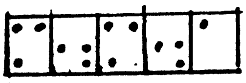
مثال : $٤^{٥}$



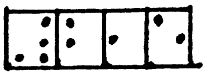
٨- القاسم المشترك الأعلى (ق.م.أ)



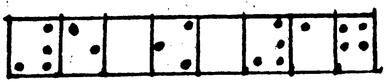
٩- المضاعف المشترك الأصغر (م.م.أ)



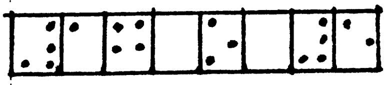
١٠- العلامة العشرية (٢)
مثال ٥و٢



١١- أصغر من < تتكون من (٢، ٤، ٦) يترك قبلها وبعدها فراغ.
مثال: ٥ < ١٧

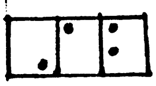


١٢- أكبر من > تتكون من (١، ٢، ٥) يترك قبلها وبعدها فراغ.
مثال: ١٧ > ٥

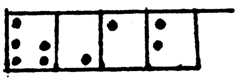


١٣ علامة حرف الهندسة (٦)
مثال: أ   أب

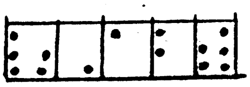
١٤- المستقيم أب كما هو متبع في المصرية يكتب:
مثال: المستقيم أب



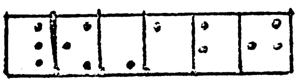
١٥- نصف المستقيم [أب كما هو في المصرية يكتب:
مثال: [أب يفتح قوس كبير (١، ٢، ٣، ٥، ٦)



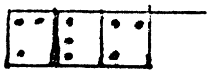
١٦- قطعة مستقيم [أب] كما هو في المصرية يكتب:
مثال: [أب]

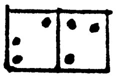


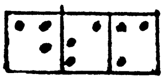
١٧- علامة الزاوية تتكون من (٤، ٥، ٦ - ٢، ٤، ٦)
مثال: أ ب̂ حـ

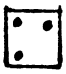


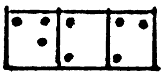
وحدات القياس تكتب بعد العدد

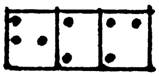
١٨- مليمتر (ملم) تكتب بعد العدد . 

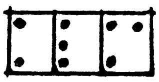
١٩- سنتيمتر (سم) " " " 

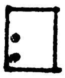
٢٠- ديسيمتر (دسم) " " " 

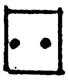
٢١- متر (م) " " " 

٢٢- ديكامتر (دكم) " " " 

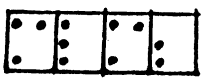
٢٣- هكتومتر (هكم) " " " 

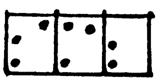
٢٤- كيلومتر (كلم) " " " 

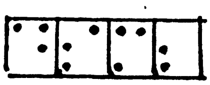
٢٥- علامة التربيع تتكون من (٢ و ٣) 

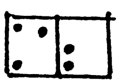
٢٦- علامة التكعيب تتكون من (٢ و ٥) 

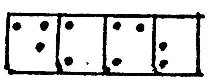
وحدات المساحة تكتب بعد العدد .

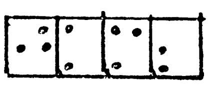
٢٧- مليمتر مربع (ملم٢) تكتب . 

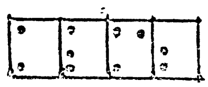
٢٨- سنتيمتر مربع (سم٢) تكتب . 

٢٩- ديسيمتر مربع (دسم٢) تكتب . 

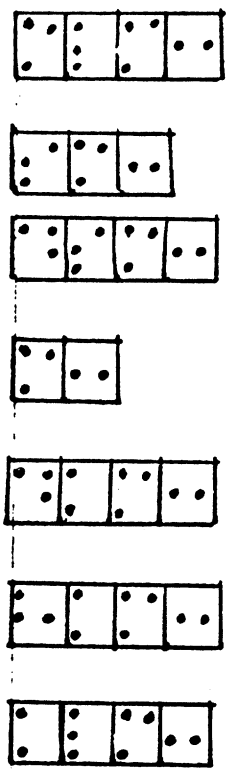
٣٠- متر مربع (م٢) تكتب . 

٣١- ديكامتر مربع (دكم٢) تكتب . 

٣٢- هكتومتر مربع (هكم٢) تكتب . 

٣٣- كيلومتر مربع (كلم٢) تكتب . 

وحدات الحجم تكتب بعد العدد .



٣٤- مليمتر مكعب (ملم٣) تكتب .

٣٥- سنتمتر مكعب (سم٣) تكتب .

٣٦- ديسيمتر مكعب (دسم٣) تكتب .

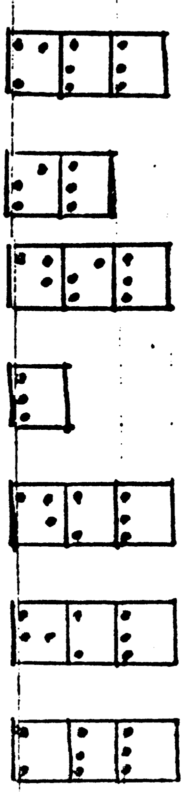
٣٧- متر مكعب (م٣) تكتب .

٣٨- ديكامتر مكعب (دكم٣) تكتب

٣٩- هكتومتر مكعب (هكم٣) تكتب

٤٠- كيلومتر مكعب (كلم٣) تكتب

وحدات السعة تكتب بعد العدد .



٤١- مليلتر (ملل) تكتب

٤٢- سنتيلتر (سل) تكتب

٤٣- ديسلتر (دسل) تكتب

٤٤- لتر (ل) تكتب

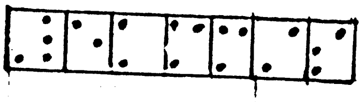
٤٥- ديكا لتر (دكل) تكتب

٤٦- هكتو لتر (هكل) تكتب

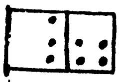
٤٧- كيلولتر (كلل) تكتب

٤٨- علامة وحدة السرعة (٢،٤) تكتب بعد العدد.

مثال: ٥ كم/ساعة



٤٩- (تقريبا) تتكون من (٤،٥،٦ - ٢،٣،٥،٦،٥،٦)

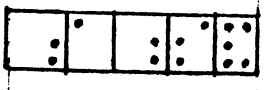


يترك قبلها فراغ.

مثال: ٢,٥ ≠ ٢

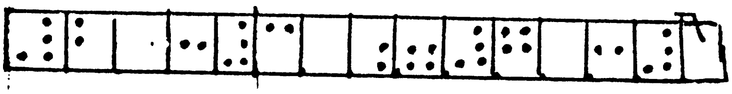
٥٠- علامة الرمز الجبري. (٥،٦)

مثال: أ س ص



٥١- علامة النسبة (٢،٥) يترك قبلها فراغ.

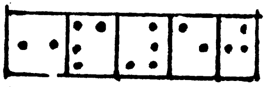
مثال: ٢ : ٢ = ٤ : ٤



٥٢- علامة النسبة المئوية (٪) (٢،٥ - ١،٢،٣،٤)

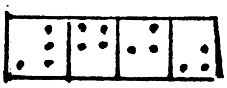
تكتب قبل العدد

مثال: ٥٠ ٪

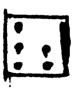


٥٣- علامة الدرجة (°) (٢،٥،٦) تكتب بعد العدد

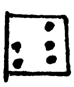
مثال: ٧٠°



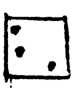
٥٤- القوس الكبير المربع [للفتح (١،٢،٣،٥،٦)



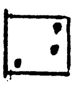
" " "] للقفل (٢،٣،٤،٥،٦)



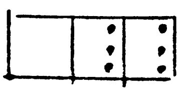
٥٥- القوس الصغير (للفتح (١،٢،٦)



" ") للقفل (٣،٤،٥)

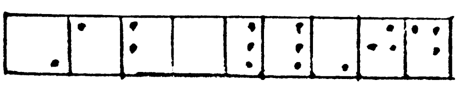


٥٦- علامة التوازي // (٤،٥،٦ - ٤،٥،٦)

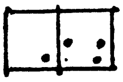


يترك قبلها فراغ.

مثال: أ ب // جـ د



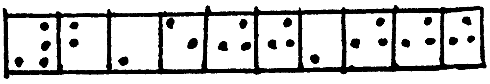
٥٧- علامة الوقف الرياضي . (٦ - ٢، ٥، ٦)



٥٨- علامة الاستفهام الرياضي . ؟ (٦ - ٢، ٣، ٦)

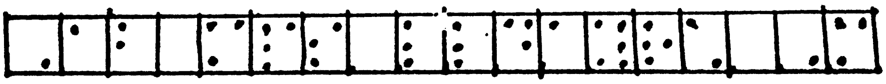
٥٩- استخدام النقطة (٢) في الأعداد الكبيرة تكتب بين كل ثلاث منازل .

مثال : ٢،٥٠٠،٠٠٠



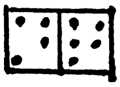
٦٠- المماس يكتب بحروفه

مثال : المستقيم أ ب مماس للدائرة م



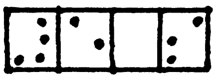
ق = قطر

نق = نصف القطر

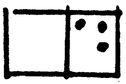


٦١- الساعة س (٢، ٣، ٤) تكتب بعد العدد

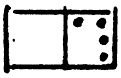
مثال ٥ ساعات



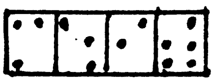
٦٢- الدقيقة د (١، ٤، ٥) تكتب بعد العدد



٦٣- الثانية ث (١، ٤، ٥، ٦) تكتب بعد العدد

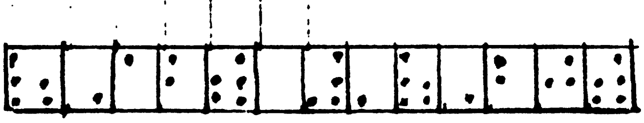


٦٤- محيط . يكتب بكامل حروفه



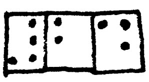
٦٥- علامة عمودي على ⊥ (٢، ٣، ٤، ٥، ٦ - ٢) قبلها فراغ .

مثال : [أ ب] ⊥ [ب جـ]



٦٦- علامة العدد (٣، ٤، ٥، ٦) وبعدها العدد مباشرة .

مثال : ٢٤



AN ELECTRONIC CONTROLLER FOR ARTIFICIAL LEG PROSTHESES

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ABSTRACT

Above knee amputation due to accidents or war results in a handicap which cannot be reversed in totality. Such subjects have to use custom built above knee prosthetic device as an essential replacement of amputed portion of the limb. This is done to restore some of the most essential movements of limb during walking and standing. In order to facilitate the normal operation and also to restore its cosmatic appearance, the prosthetic device is expected to have a knee unit, a shank, an ankle unit and a foot. A coordinated activity is therefore necessary between these portions of prosthesis. A digital electronic control scheme has therefore been proposed so as to achieve this coardination in positional aspects of different parts of such prosthetic unit. The control strategy is based on close scruitiny of locomotion in normal human beings. The necessary movements of different parts of leg (to be replaced by artificial means) have been identified and tabulated. This information is then simulated by using sequential digital electronic network. The output of this sequ-

ential digital electronic network uniquely identifies every desired state of prosthesis during locomotion. The use of such controller would releive handicapped subject of awckward-ness during walking and there will not be unnecessary stress on the remaining part of amputed limb. The energy required in locomotion will also be less. Such controller can be mass produced and has advantage of being compact, light in weight, efficient and reliable. It is hoped that such a network shall satisfy the requirments of the most needy limb handicapped persons of the society.

1. INTRODUCTION;

In medical terminology 'prosthetic device' is the name given to an artificial substitute for a missing or diseased part of natural system. Before accepting any device as prostheses following parameters need to be given full consideration:

(i) Biocompatability
(ii) Incorporation
(iii) Reliability
(IV) Control constraints
(V) Design constraints
(VI) Power sources

The direct copying of even minor parts of living organisms appear to be neither rational nor possible consider-ing the differences of materials and the methods of solving problems of supply and energy conversion in living organism.

The upper and lower extremities of mammals, including

humans, which have developed over millions of years and have been replicated in billions of individuals are proof of their unquestionable merits which allowed them to continue for so long without significant change of farm. Amputations of these extremities due to accident or war results in a handicap which cannot be reversed in totality. The limitations resulting from amputations are obvious. An amputation through the lower extremity makes standing and locomotion (without use of artificial leg) difficult, and impracticable except for very short periods. The loss of joints and the surrounding tissues, and consequently loss of the ability to sense positions, present problem in the use of an artificial limb not commonly recognised by many people. The sense of touch of absent portion is also lost, but in case of lower extremity amputee this loss is not quite as important as it might seem, because the varying pattern of the pressure occuring between the stump and the socket indicate to some extent external loads. Most of lower extreemity amputies cannot bear the total weight of the body on the end of stump. Thus close cooperation of engineers and surgeons is essential to have an acceptable limb prostheses to benifit large number of accident or battle casualities.

2. <u>LIMB PROSTHESIS</u>:-

It is desirable to articulate, shape and finish the artificial limb in such a way as to resemble the normal extremity as much as possible practically. However the limitations of the present knowledge does not allow duplication of

all functions of normal subject. Prosthetist is therefore constrained to limit the goal to restore some of the most important functions. The two essential functions of the lower extremity-support and ambulation-to some extent can be achieved in case of unilateral amputation by the use of crutches. The drawback in the use of crutches are that they

(i) require greater expenditure of energy;

(ii) require the use of hands; and

(iii) offer no cosmatic restoration.

Another simple solution is peg-leg which has advantage of freeing hands and arms but require more energy than that for well trained amputees using custom built artificial leg. Comparison of expenditure of energy for different types of prosthesis is given in Fig.1. Appreciable circumduction and vaulting tendencies are developed by subjects using peg-leg.

3. <u>EMG CONTROLLED A/K PROSTHESIS</u>:-

Amputation stumps are generally classified according to the level at which the amputation is performed. Though it is attempted to replace as much length as medically possible some difficulties are encountered in fitting stumps at certain levels, especially when the joint is exarticulated. Nevertheless, the longer stumps are generally stronger, provide longer lever arms and thus permit lower unit pressures between the stump and the socket, which is the most important factor the level of amputation dectates in requirment of the artificial limb. Thus in general the design becomes more

capability of controlled movement. The overall working of foot is such that it blocks dorsiflexion and permits controlled planter flexion of ankle. If the knee joint is unclocked ambulation can be achieved without appreciable circumduction and vaulting. This results in less expenditure of energy and a more graceful gait pattern.

4. PROSTHESES CONTROLLER:

The prostheses controller controls the status of knee and ankle unit of artificial leg. It locks the knee and ankle joints during stance phase of human locomotion. This prevents unnecessory buckling of knee or ankle when the subject is standing. During walking phase knee and ankle joints must provide certain characterestic angular movement so as to provide comfort and netural feeling to the subject. The control strategy has to be based on close scruitiny of locomotion in normal human beings. The angular morements of knee and ankle in normal locomotion have therefore been thoroughly studied. The data thus obtained is given in Fig.4 In prosthetic unit this coordinated activity at knee and ankle joint can be achieved by different outputs received from controller. Controller output is based on information received by it from toe, heel and emg signal. In every cycle of walking twelve stages have been identified. These twelve stages are characterized by the angular positions of knee and ankle. These stages are tabulated in Table I for right foot.

complex as the level becomes higher. The problem is compounded by the fact that the higher the amputation, less is the residual body power and fewer independent motions are available for actuation and control of prosthesis.

The typical limb prosthesis consists of mechanical components that are mass or semimass produced by a central manufacturer and assembled locally to a socket custom made by a prosthetist. Thus for an amputation throught thigh, prosthesis will be a foot, ankle unit, a shank and a knee unit which is fitted in a socket made exclusively for the patient concerned. A good deal of judgement (based upon biomechanical principles, experience and skill) is required in fitting and aligning these components.

Power for actuation and control of lower-extremity prosthesis is generally derived from the remaining musculoskeletal system, generally transmitted to the device through socket. It has been proved that after some essential training, certain muscles can produce sufficient EMG signal for actuation of prosthetic unit. This emg signal is picked up by either surface or needle electrode and processed by high impedance amplifier, differential amplifier, rectifier, filter & level detector. Output of level detector can be used as one input to the gate which controls the state of A/K prosthetic unit. Complete controller scheme for A/K prostheses is given in Fig.2. Intended outputs at every stage of emg signal processing unit are shown in Fig. 3. The other two inputs received by controller are from foot unit of prostheses. This foot can have a locking arrangement at ankle joint and can have

Table,I: TRUTH TABLE FOR LOCOMOTION FOR RIGHT FOOT.

STAGE	CONDI-TION	HEEL OUTPUT	TOE OUTPUT	KNEE STATUS		ANKLE STATUS	
				ANGLE	BINARY EQUIVALENT	ANGLE	BINARY EQUIVALENT
1	FF	1	1	+22 ↑	1010110	16 ↑	110000
2	FF	1	1	+17 ↑	1010001	7 ↑	000111
3	FF	1	1	+10 ↑	1001010	4 ↓	000100
4	FF	1	1	+29 ↑	1011101	8 ↓	001000
5	FF	1	1	+33 ↑	1100001	12 ↓	001100
6	HO	0	1	+35 ↑	1100011	14 ↓	001110
7	HO	0	1	+27 ↑	1011011	10 ↓	001010
8	HO	0	1	+6 ↑	1000110	5 ↓	000101
9	TO	0	0	-6 ↓	0000110	18 ↑	110010
10	TO	0	0	-23 ↓	0010111	11 ↑	101011
L1	TO	0	0	+20 ↑	1010100	1 ↓	000001
12	HC	1	0	+40 ↑	1101000	0	000000

It could be seen from the truth table that position of limb during the cycle of locomotion can be characterized by specific angle at knee & ankle joint. This angle can be uniquely defined by six bit binary code. The digital controller uses six stage network to obtain this code. Each stage of this controller makes use of 4 to 5 OR gates and 5 to 6 AND gates. A clock has been used to monitor/control the speed of locomotion. Counters and decoders have been used to get six cycle repetative output.

The output of controller is to be given to servomotors which are provided in prostheses unit to achieve required angular position of knee and ankle joint.

5. LABORATORY EVATUATION OF CONTROLLER

An electronic controller for artificial leg prostheses as described above has been constructed for evaluation. The

data for control strategy as given in table I has been obtained after a close scruitiny of locomotion in normal human beings. Development and design of sequential electronic network has been facilitated by karnaugh maps constructed for every stage. A representative map for first stage of knee and ankle controller is given in fig.5. The detailed circuit diagram for knee and ankle controller unit is shown in Fig.6 and Fig.7 respectively. The electronic circuit as given in these figures has been tested under laboratory testing conditions. All inputs from heel, toe and emg signal have been simulated by appropriate power supplies. For testing, normal speed of locomotion has been assumed as 100 steps per minute or 75 m/min. The laboratory evaluation yeilded satisfactory results thereby confirming the validity of controller.

6. CONCLUSION

A digital electronic control scheme has been proposed to achieve coordinated activity of knee and ankle joint in artificial leg prostheses unit. The control strategy is based on close scruitiny of human locomotion. The necessary data to achieve objective has been identified and tabulated. This activity is then simulated by using a digital electronic network which uniquely identifies every desired state of prosthesis during locomotion. Laboratory evaluation of this controller gave satisfactory test results. The use of such controller may releive above knee amputed subject of awckwardness during walking and the energy required in motion will be less. The controller has advantage of being compact, light in

weight, efficient and reliable. It is hoped that such a network will satisfy the requirments of the most needy limb handicapped persons of the society.

7. REFERENCES

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2. "Biomedical Engineering Systems" by Manfred Clynes and J.H. Milsum Published by McGraw Hill Book Co. (1970).
3. "Digital Computer Electronics" by Malvino Published by McGraw Hill Book Co. (1983).

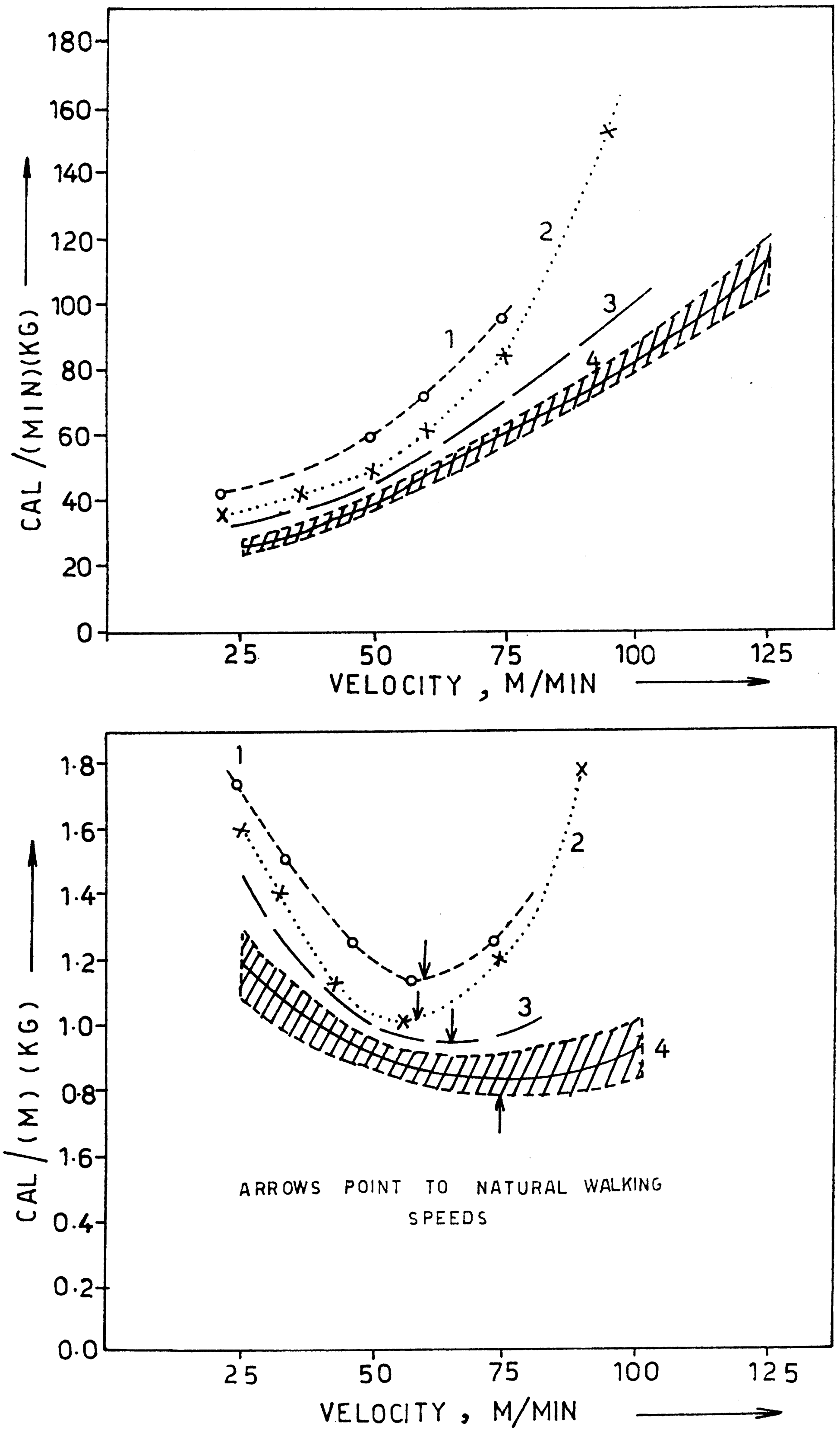


FIG 1 COMPARISON OF ENERGY EXPENDED DURING WALKING BY NORMAL SUBJECTS AND BY AMPUTEES USING VARIOUS ASSISTIVE DEVICES. 4 ≡ AVERAGE ENERGY EXPENDITURE OF NORMAL SUBJECTS WALKING AT VARIOUS SPEEDS WITH ONE STANDARD DEVIATION PORTION HATCHED; 3 ≡ AMPUTEE WITH SUCTION SOCKET PROSTHESIS; 2 ≡ WITH PYLON ; 1 ≡ AMPUTEE USING FOREARM CRUTCHES.

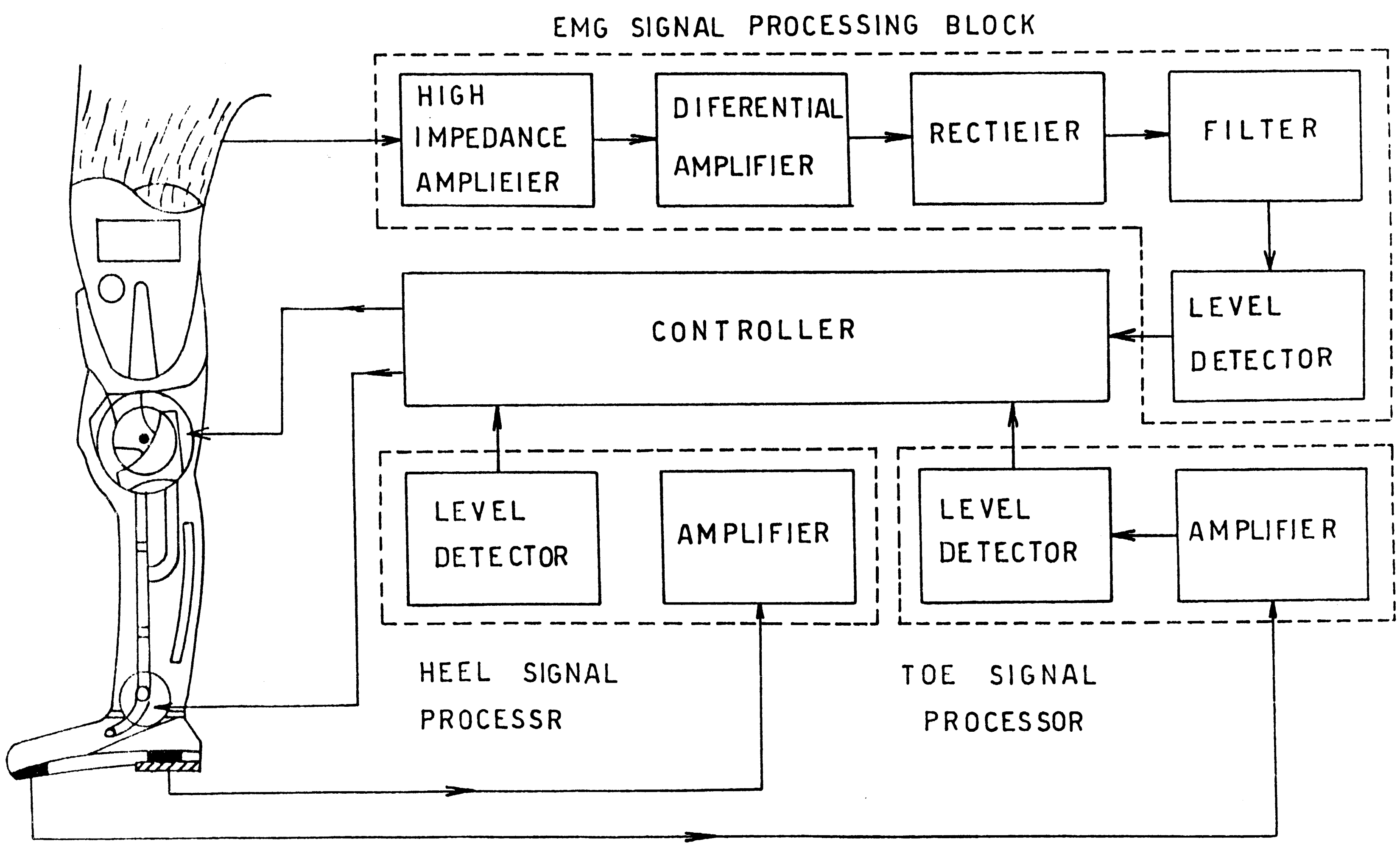


FIG. 2: COMPLETE CONTROLLER SCHEME FOR A/K PROSTHESES

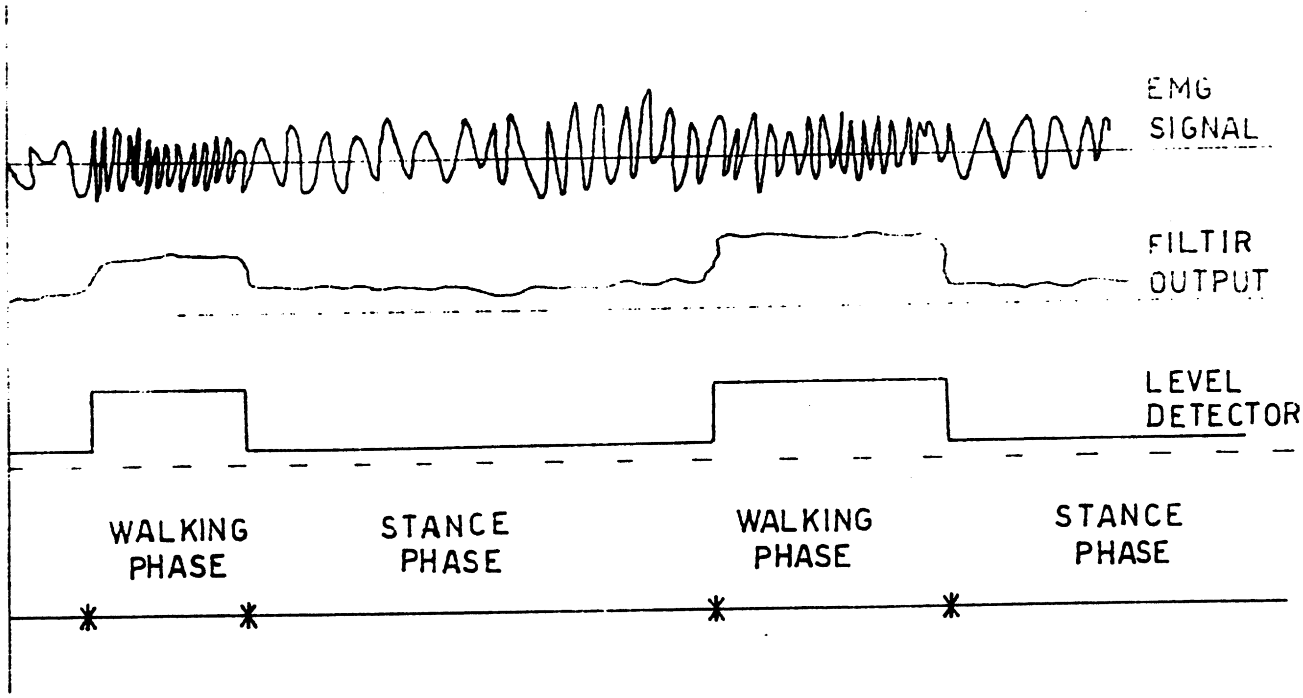


FIG.3: OUTPUT OF EMG SIGNAL PROCESSING UNIT

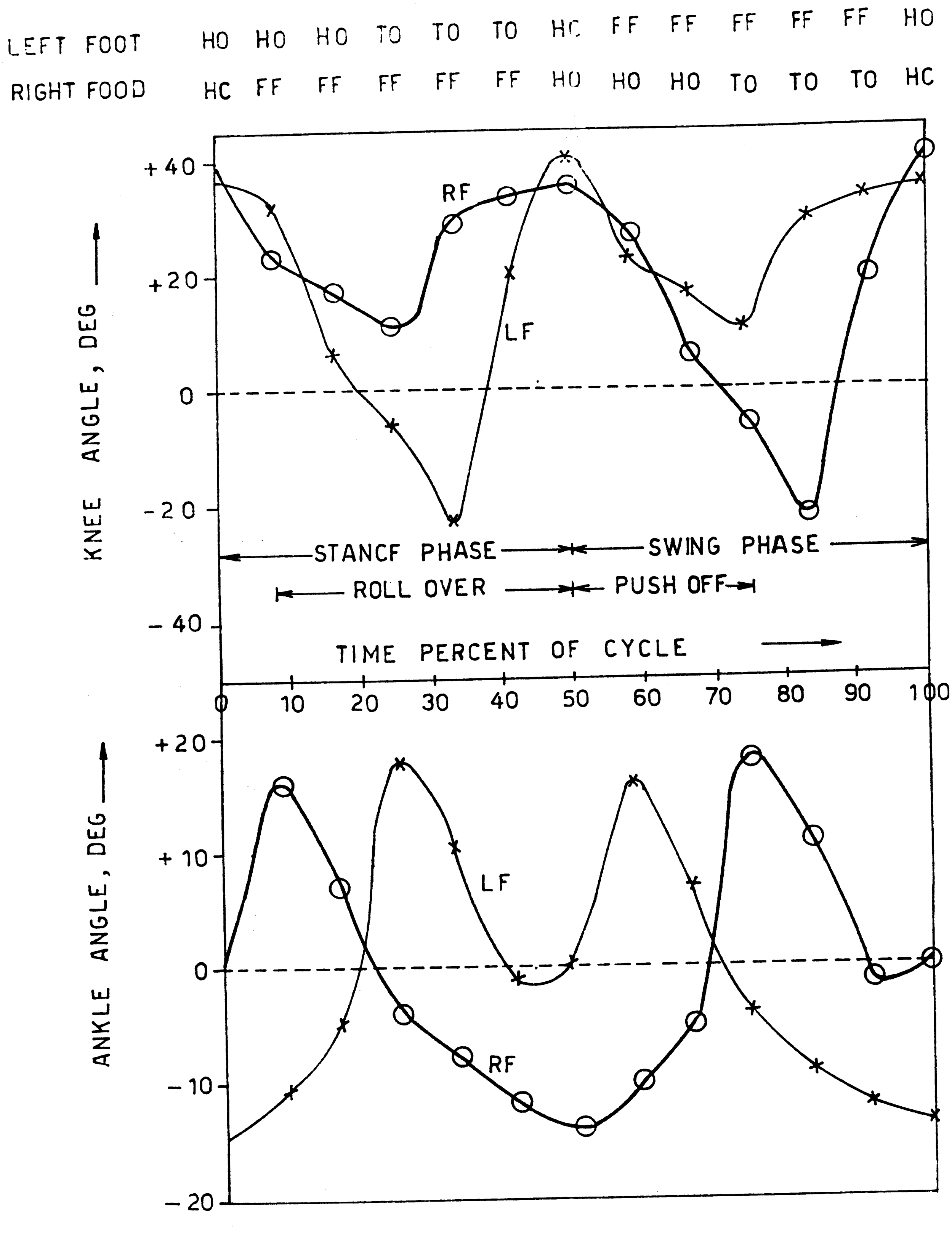


FIG 4 JOINT ACTIONS IN NORMAL LOCOMOTION OF HUMAN BEING. HO≡HEEL OFF, HC≡HEEL CONTACT, FF≡FOOT FLAT, TO≡TOE OFF.

KNEE (1)

3	0	0	1	1	0	0
6	1	1	1	1	1	1
7	1	1	1	0	0	0
0	0	0	0	0	0	0
12	0	0	1	1	1	1
13	0	0	0	1	1	1

H^*T^* \ HT	00	01	11	10
00	X	X	0	X
01	X	X	0	0
11	0	1	X	X
10	X	1	X	X

$\bar{H}\ T$

H^*T^* \ HT	00	01	11	10
00	X	X	1	X
01	X	X	0	0
11	1	1	X	X
10	X	1	X	X

$\bar{H}+\bar{T}^*$

H^*T^* \ HT	00	01	11	10
00	X	X	1	X
01	X	X	1	0
11	1	0	X	X
10	X	1	X	X

$\bar{H}\bar{T}+HT+\bar{T}^*$

H^*T^* \ HT	00	01	11	10
00	X	X	1	X
01	X	X	1	0
11	0	0	X	X
10	X	1	X	X

$HT+\bar{T}^*$

FIG. 5-A

ANKLE (1)

3	0	0	1	1	1	1
6	0	0	0	0	0	0
7	0	0	0	1	1	1
9	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	1	1	1

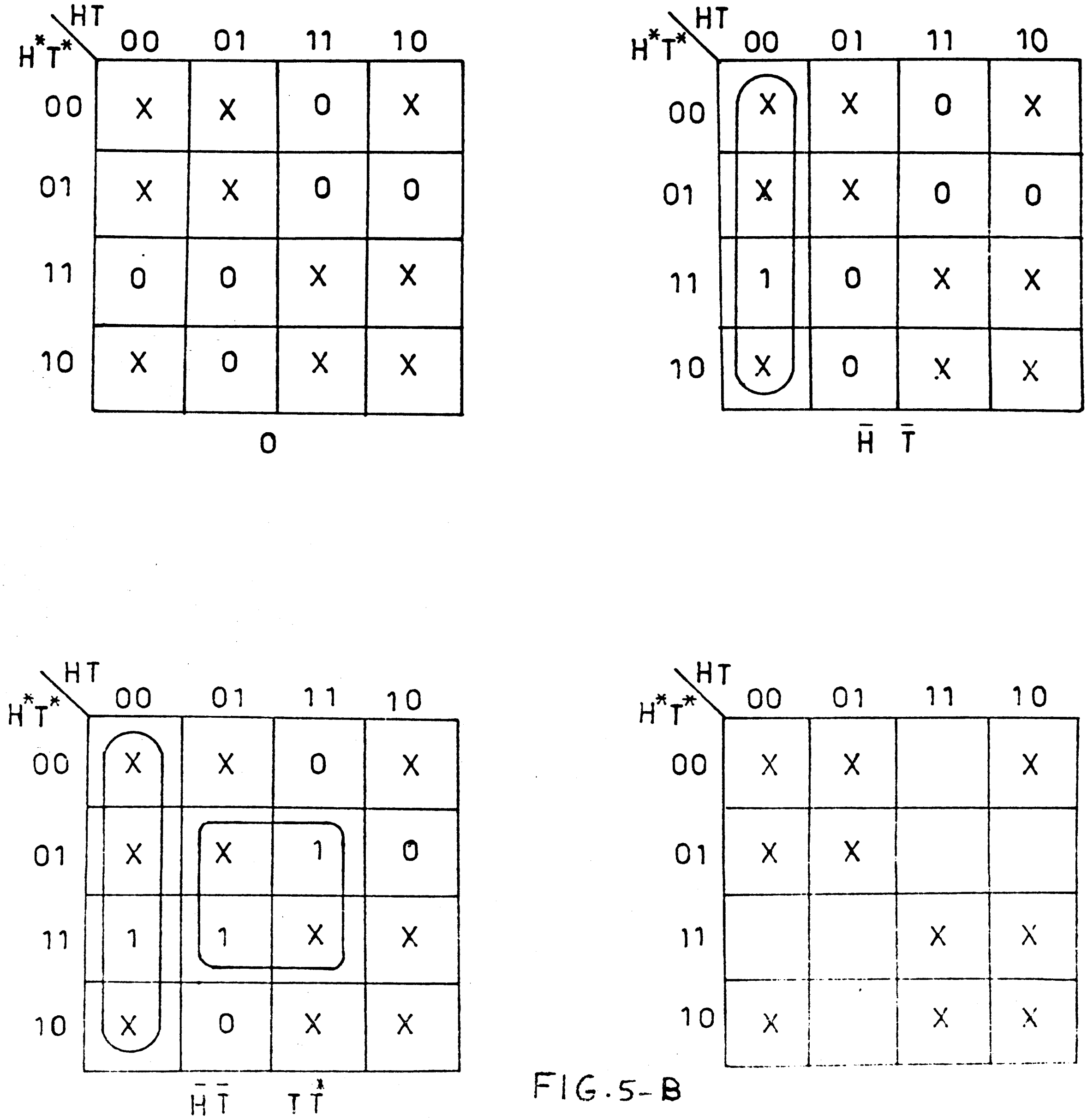
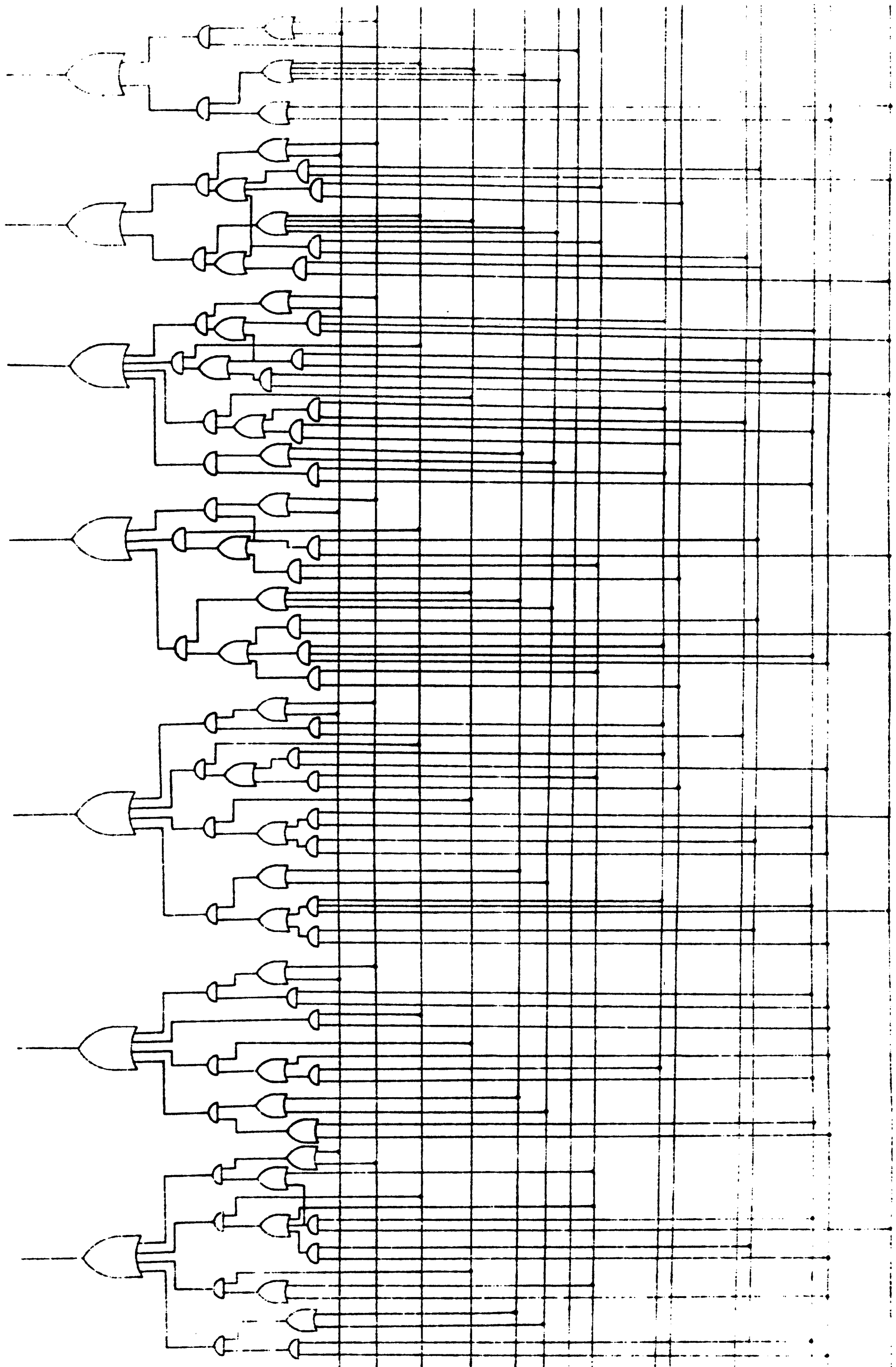


FIG.5-B

FIG 6 DIGITAL KNEE CONTROLLER FOR ARTIFICIAL LEG



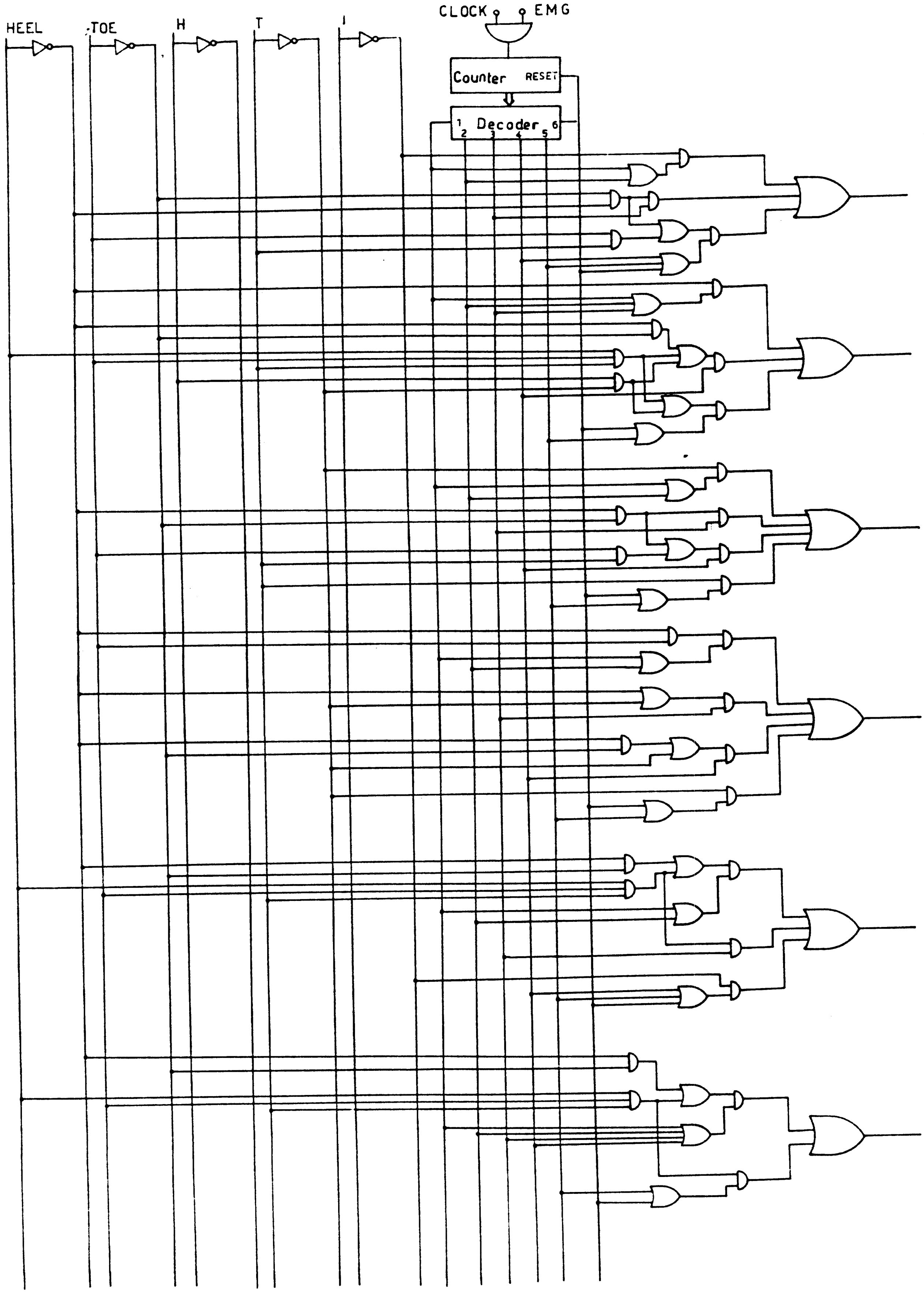


FIG. 7 : DIGITAL ANKLE CONTROLLER FOR ARTIFICIAL LEG

MICROPROCESSOR BASED SPEAKER TRAINED SPEECH RECOGNIZER FOR THE HANDICAPPED AID

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1. ABSTRACT

A real-time isolated word speaker trained recognizer having small Arabic vocabulary is implemented on MPF-IP microcomputer. The supporting hardware used is composed of close-talk quality microphone, a preamplifier,an 8-bit A/D convertor preceeded by a band-pass filter. The recognition is made by applying a matching technique between prestored templates and the spoken words. The recognizer should be trained by the same person who will operate it.

2. INTRODUCTION:

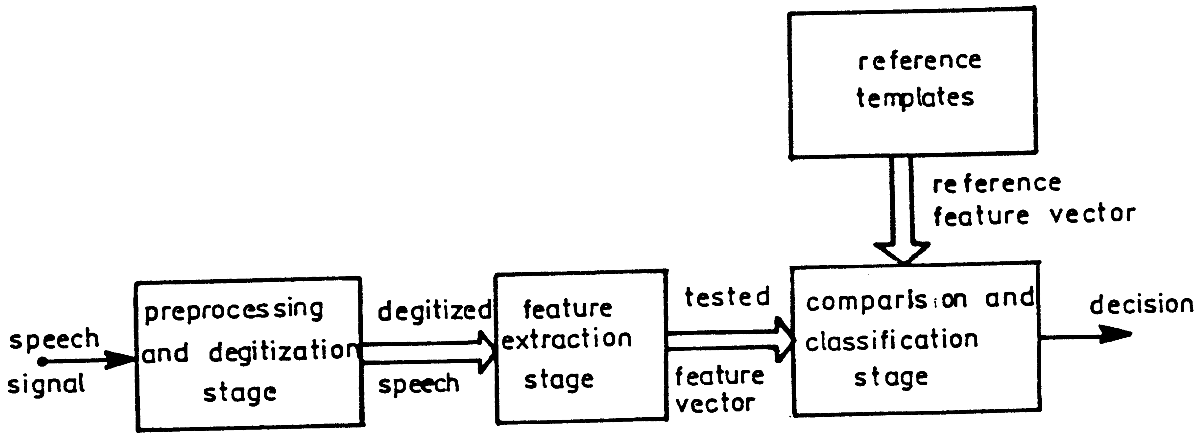
The speech can be introduced in the handicapped applications as an attractive technique in man-machine communications for its special usefulness and high capacity as a human's output channel There exist several handicapped applications in which small size speaker trained vocabularies are required such as the set of commands controlling the wheelchair movement or for telephone dialing ... etc. These vocabularies may compose of commands in Arabic language indicating possible directions of movements. In other applications , the vocabularies may be of numeric type such as using voice instead of dialing in telephone calling.

Through a survey of previous researchs , it can be concluded that the tendency is to implement only popular low cost small size recognizers in the field of handicapped aids [1,2].

Piotrowski [3] has used spectral analysis in word recognition systems which was based on a modified autocorrelation function using clipping. The system operated in speaker dependent mode. Harwin [2] evaluated the suitability of a low cost voice recogn -ition system with special emphasis on its use by cerebral palsy and muscular distrophy children.

In the current research , a real-time isolated word speaker trained recognizer having small vocabulary (about 20 Arabic utterances) is implemented on the MPF-IP microcomputer. The functional stages of this recognizer, similar to the generalized form of speech recognition systems, are constructed basically as shown in Fig.(1) [4], that is the recognition decision is based on a matching concept between prestored templates and the spoken words.

The acoustic samples are segmented into 50 msec segments to model the speech production process as discrete time-invariant one. The end-point detection routine is implemented to indicate the speech/silence boudaries. Waveform crossings over specified level thresholds are used as a reliable descriminating feature. A Zero-crossing histogram or its counterpart for differentiated speech (peak histogram)is applied as the feature set . A special form of dynamic time warping will perform the dissimilarity measurements, then a recognition based on Nearest Neighbor Rule is decided with the possibility of rejecting impostors or ill-conditioned utterances.



[Fig. (1) A general speech recognizer]

3. SPEECH DEGITIZATION STAGE:

One of the main objectives in this research is to minimize the external hardware needed, consequently reducing the overall complexity of the system. The hardware requirement is limited to [5] a cassette recorder or a microphone followed by a standard low noise preamplifier to bring the acoustic signal within acceptable voltage level. A band-pass filtering stage which is made up by a cascade of a 100 HZ 3rd order highpass filter and a 3.4 KHz Butterworth 6th order lowpass filter. The filtering assembly is followed by an 8-bit ADC. The sequence of acoustic samples are transfered to the microprocessor using a polling routine and the digitization frequency can be brought safely down to 8 KHz without aliasing.

A speech/silence descriminating algorithm is introduced as part of the preprocessing stage. Since this algorithm is also incorporated in the feature extraction stage, it is required to simplify the technique, hence minimizing its contribution to the total duration of the speech processing operations. A reliable end-point detection algorithm is one of the most difficult tasks facing a discrete word recognizer [6] . Some proposed speech detection techniques [7] combine both the short time average magnitude and the zero crossing rate to descriminate both high intensity vowels and unvoiced sounds rich of high frequencies from the background noise. Instead of the excess-level technique applied in ref.(5), a more reliable speech detection algorithm is implemented by applying a level crossing rate measurement. A level crossing means the transition of samples between the upper and lower thresholds. Figs.(2) & (3) demonstrate the three types of measurements, namely the Z.C. rate, excess-level samples and the level-crossing rate evaluated over 5 msec segments for the two digits /four/ & /six/ uttered in Arabic.

The first measurement, the Z.C. rate will estimate roughly the speech / silence boundaries of the utterance.Then evaluating the excess level samples, it can be observed that for too high level thresholds, many speech segments at both ends of the utterance will not be detected. On the other hand, a reliable speech / silence classification is lost for a too small level threshold.

When proper levels are selected , the level - crossing measurement offers a more reliable speech boundary detection and better noise immunity as shown in Fig.(3). A flowchart of speech

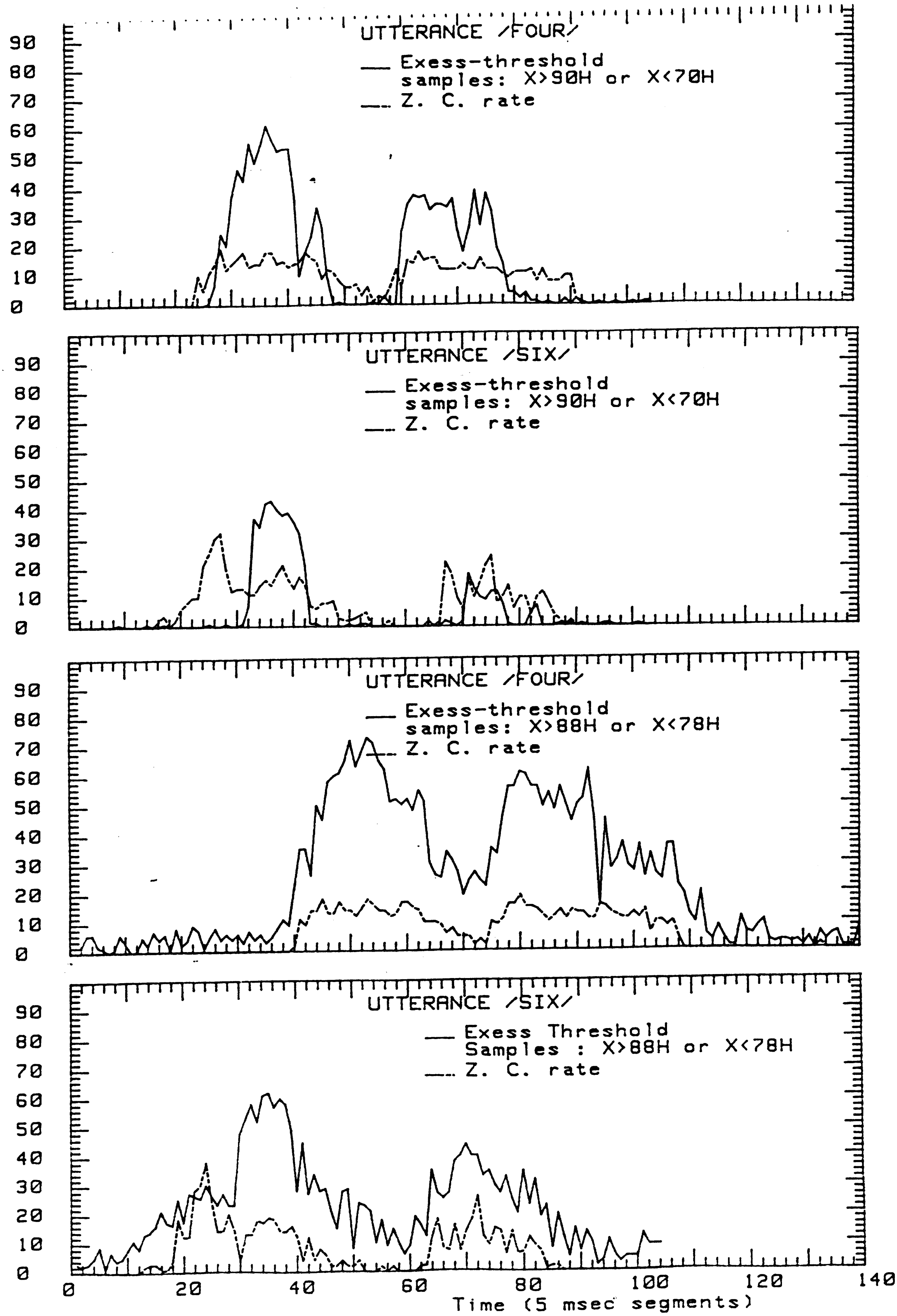


Fig.(2): Speech detection using Z.C. rate & Excess Threshold Samples (a) X>90h or X<70h (b) X>88h or X<78h

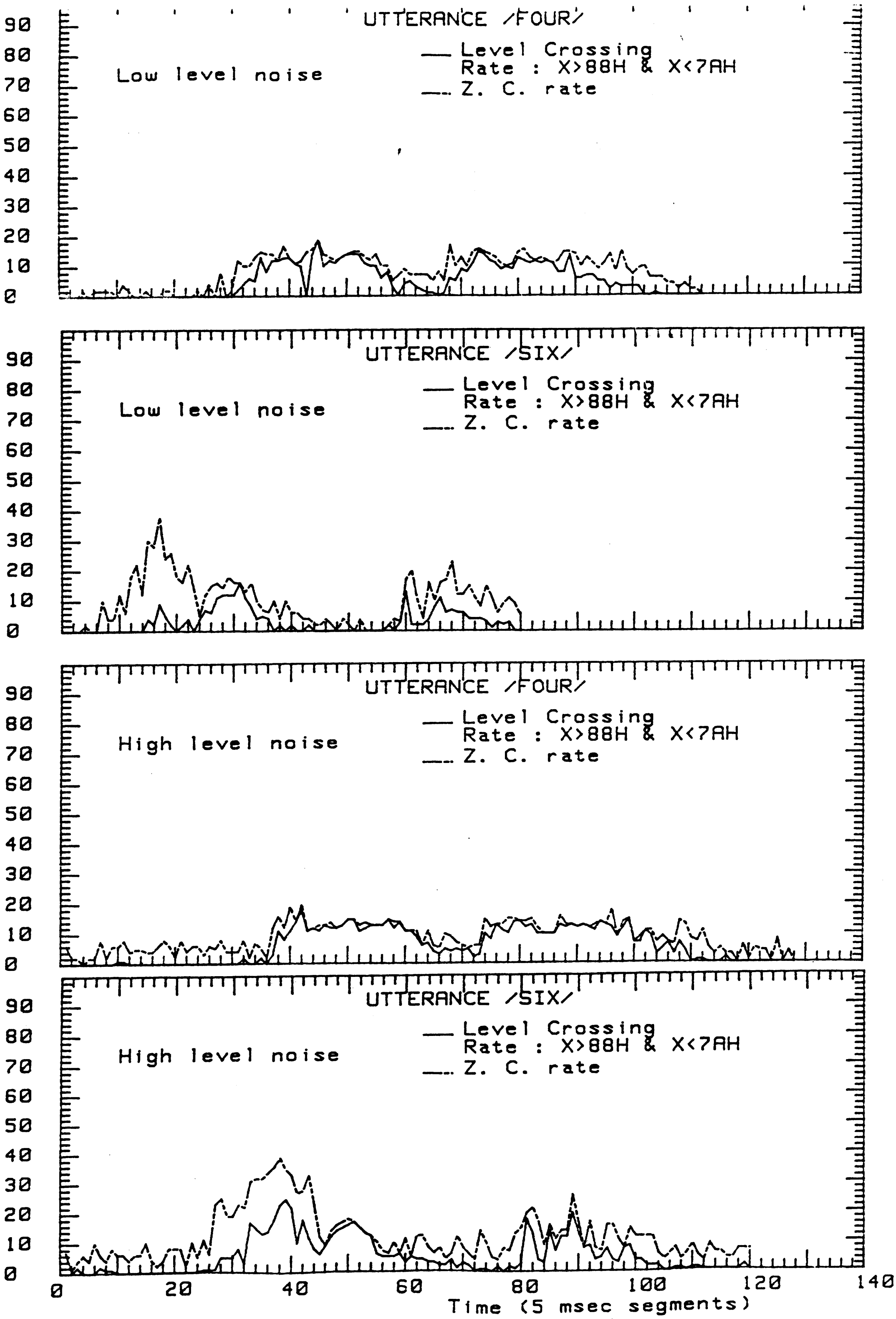
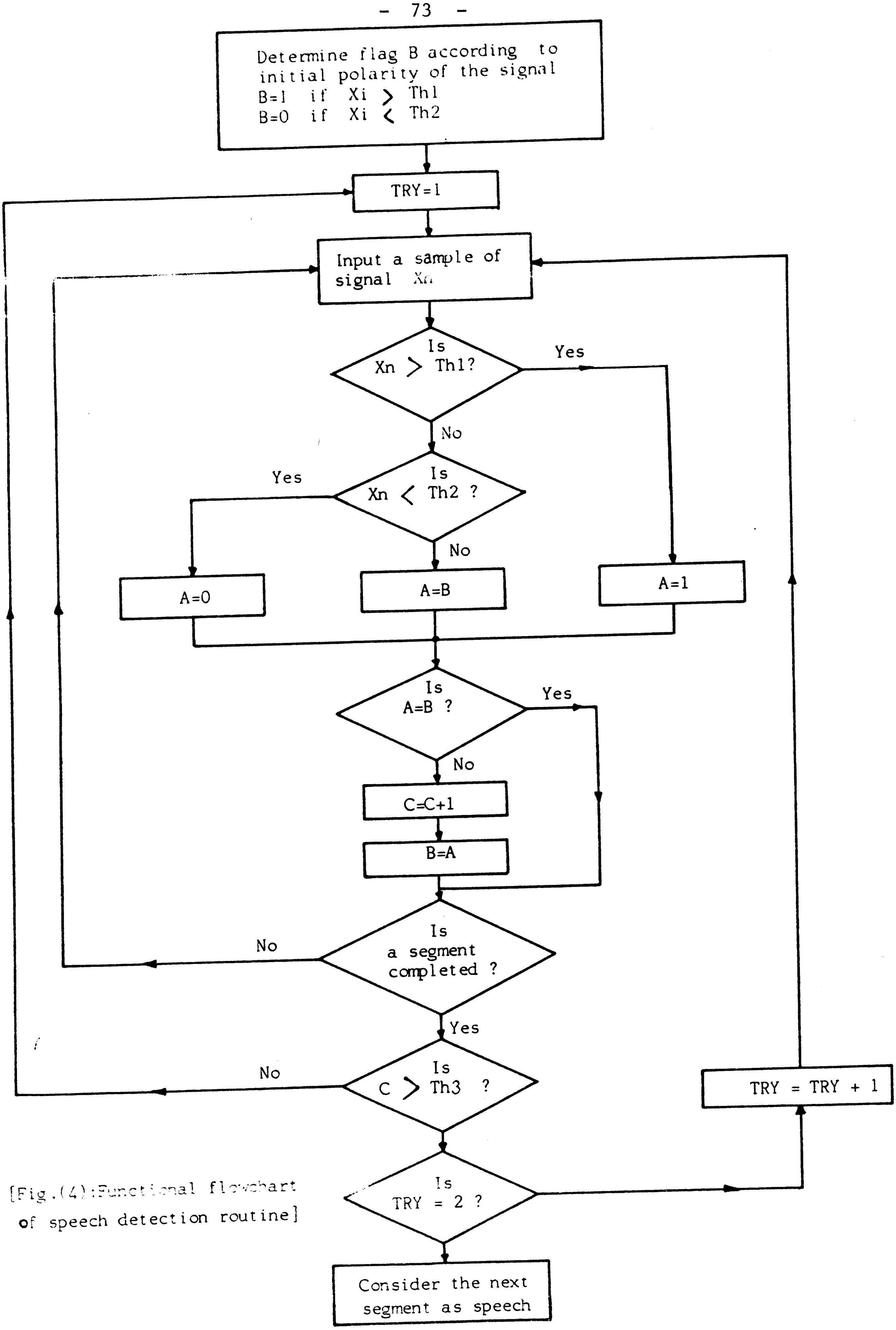


Fig.(3): Speech detection using Z.C. rate & Level Crossings Rate for level thresholds X>88h & X<7Ah
(a) Low level noise (b) High level noise



[Fig.(4):Functional flowchart of speech detection routine]

detection routine is depicted in Fig.(4). The speech detection decision is extended on two consecutive segments with level crossings exceeding a threshold value equal to 5. The reason for a two segment decision is to compensate for sudden disturbances in the signal level due to impulsive noise, mouth clicks, noisy breathing, etc.

4. FEATURE EXTRACTION TECHNIQUE:

Speech is generally a form of communication which involves the generation and reception of a complex acoustic signal [8]. The speech at its highest level as thoughts will be converted into many lower level forms like linguistic level, articulatory movements, until the lowest level is reached with the acoustic signal.The function of the feature extraction stage [9] is to remove redunduncies and irrelevant information parameters which simplify the classification decision to a remarkable extent. The ideal features [5] for speech recognition would be articulatory features describing the position of the tongue, lips, velum, jaw ...etc. as a function of time. However measuring these features is still impractical.

The Z.C. patterns which are some forms of frequency domain measurements offer a real time operation and good convenience for implementation on standard 8-bit microcomputers since they only involve comparisons, additions and subtractions. Z.C. techniques take their significance from the fact that certain forms of infinitely clipped speech is highly intelligible [11]. Through a careful and large test carried out by Ainsworth [12] , the intelligibility for some forms of clipped speech were:

above 98% for normal and differentiated speech
above 85% for infinitely clipped speech
above 98% for differentiated then clipped speech

There exist also [13,14] many mathematical formulae relating Z.C. patterns to the formant parameters of voiced sounds. Close agreement between measured Z.C. rate and that calculated from spectral data had been observed for all phonemes [13]. Also it had been shown that [14] a feature set of a 13 - channel filter bank gives a vowel seperation comparable to that achieved with a 3-channel filter set followed by Z.C. circuits. Z.C.measurements beside they are well-suited to the digital processing techniques are virtually independent on speaker volume, and apparently less speaker dependent than spectral data.

Most of Z.C. techniques developed so far in the literature can be categorized [15] into three main types:

(a) average Z.C. rate
(b) Z.C. histograms: defined as the density of time intervals between axis crossings in the time window T.
(c) excess-threshold duration: defined as the ratio of the sum of time intervals that exceed a threshold value h to the total duration of the time window T.

Since the Z.C. histograms form the basis for the other two type, they are selected as the feature extraction technique in this work. The process of creating a histogram is demonstrated [5] in Fig.(5) for a 20 msec of the vowel /A/ . The correlation between Z.C. histograms and short time spectrum is consistent [4,7]. One may relate the formant resonances in the spectral data to the histogram peaks, however it must be noted that the frequency axis of the spectrum plot is a reciprocal to the time axis of the histogram.

The functional flowcharts for Z.C. & peak histograms feature extraction techniques are depicted in Figs (6)&(7) respectively. It can be noted that the majority of operations involve simple comparisons (to locate an axis crossing) and additions . The algorithms include also the endpoint detection routine to locate the final boundary of the word and an adjustable delay time for limiting the sampling frequency to 8.5 KHz.

5. MATCHING TECHNIQUES:

The problem of time alignment is one of the fundamental aspects in the automatic speech recognition task due to the noncoincidence in the time scales between the tested and the reference patterns [16]. In most cases a non linear time warping is prefered over a simple linear registration because of the local compressions and expansions in the time scales of the compared patterns. The algorithms applied to model the axis fluctuation by a non linear time warping function are known as dynamic time warping (DTW) or dynamic programming (DP) [17]. The DP technique is a searching method for the maximum coincidence between timing scales under a carefully specified constraints.

The test pattern T consists of N vectors [18] and can be rep-represented :

$$T = \{ T(1), T(2), \ldots, T(N) \} \quad \ldots(1)$$

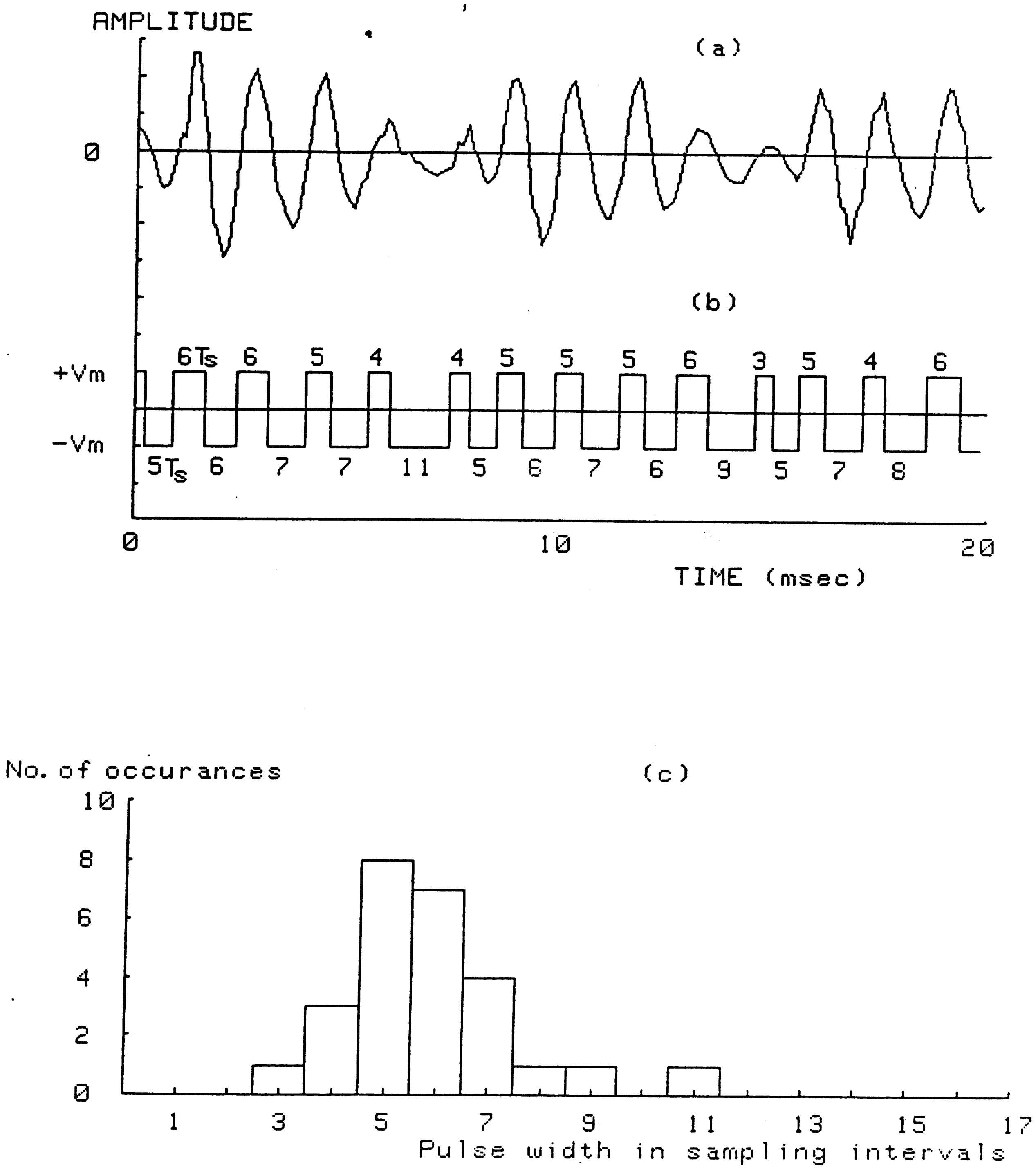
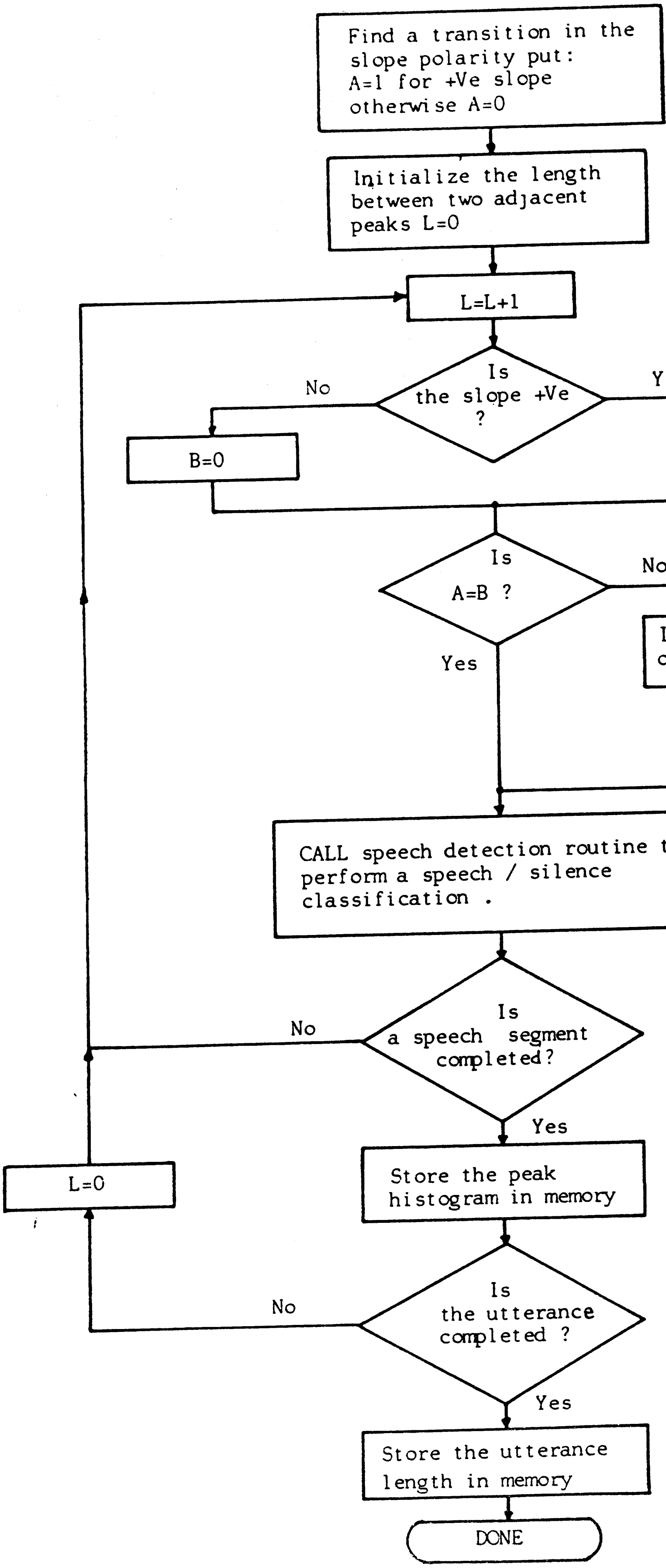
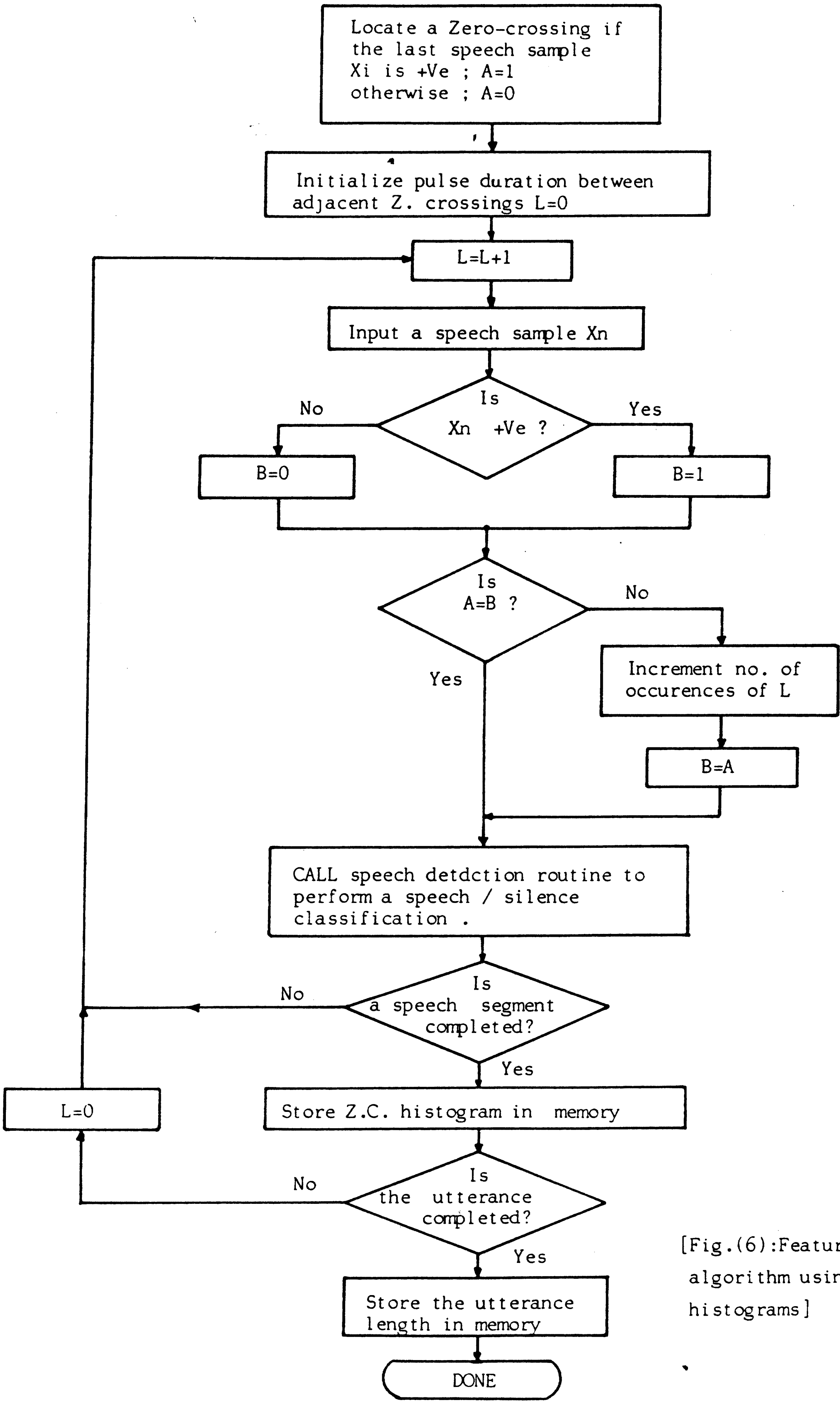


Fig.(5) Steps in creating a zero-crossing histogram
(a)normal speech (b)infintely clipped (c)the Z. C. histogram



[Fig.(7):Feature extraction algorithm using peak histograms]



[Fig.(6):Feature extraction algorithm using Z.C. histograms]

where the vector $T(i)$ is an 8-dimensional Z.C. (or peak) histogram extracted over a 50 msec frame.

The sth reference vector will be expressed :

$$Rs = \{ Rs(1), Rs(2), \ldots, Rs(Ms) \} \quad s=1,2,\ldots,S \qquad \ldots.(2)$$

Where S is the vocabulary size.

The problem is to find the non-linear time warping function $m = w(n)$ which minimizes the overall accumulated distance

$$Da = \sum_{n=1}^{N} D \{ T(n), Rs [w(n)] \} \qquad \ldots.(3)$$

over all possible paths of $w(n)$.
D represents the local distance between tested and reference frames. The sum of absolute differences between the feature dimensions is implemented as the local distance measure to simplify the computation performed by the Z-80 CPU.

$$D [T(n), R(m)] = \sum_{i=1}^{8} \left| t(n,i) - r(m,i) \right| \qquad \ldots.(4)$$

In order to determine the best warping function $w(n)$, several constraints on the path must be specified [19] :

(1) end points of the path.
(2) global path constraints: i.e. the boundaries of possible motions of $w(n)$.
(3) local continuity constraints: i.e. the local possible motions between grid points.

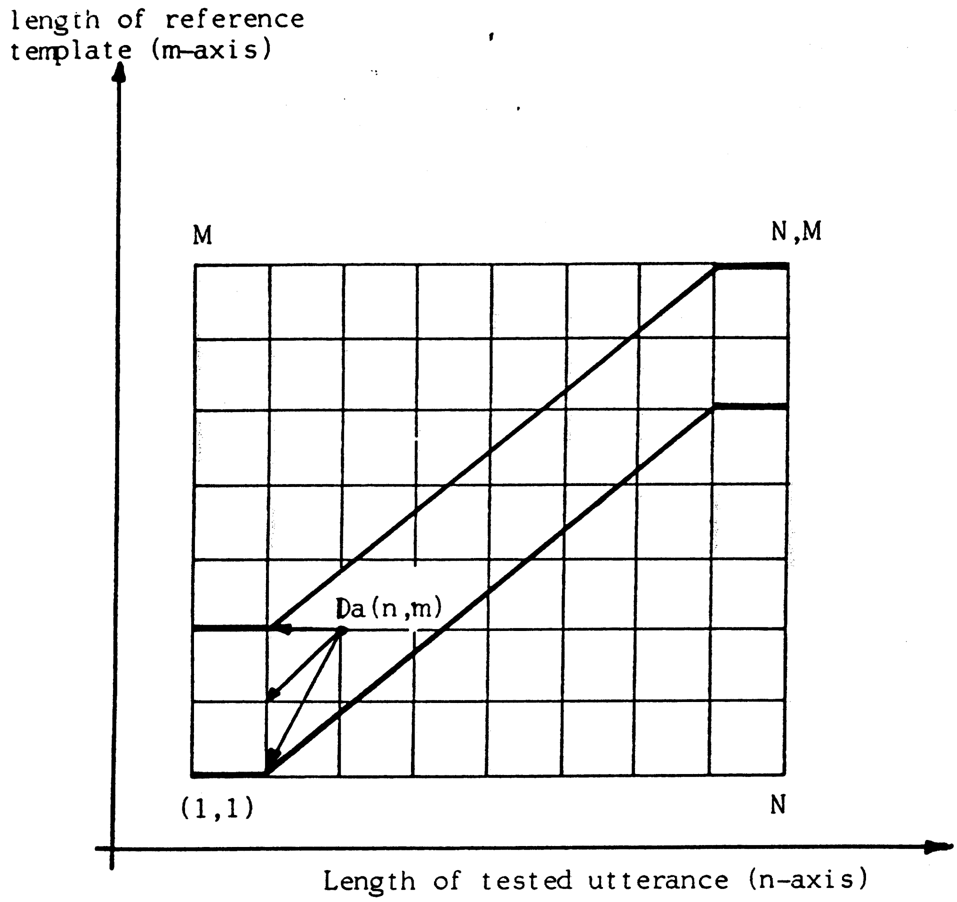
Also due to computation limitations , a simplified version known as the fixed range warping function [16] is applied to constrain both the end points and the global path as illustrated in Fig.(8).

The end point constraints :

$$w(1) = 1, 2, 3, 4$$

$$w(N) = M-3, M-2, M-1, M \qquad \ldots.(5a)$$

This unconstrained end points matching technique is useful in compensating for unreliable end point detections . The boundary



[Fig.(8): Dynamic time warping function]

constraints are expressed as :

$$INT (m * M/N) =< m <= 3 + INT (n * M/N) \quad ....(5b)$$

For each value of n, the lower boundary on m is found through a lookup table, then the upper range is deduced by adding 3 to the lower range. It is found that a range of 4 segments width along the diagonal is sufficient to enclose the optimum warping path while reducing the legal grid points and the overall computation needed to 40% w. r. t. the conventional 2 / 1 slope method .

A local continuity constraint is applied which avoids exessive compression or expansion in the time scale [20] and could be expressed as follows:

$$w(n+1) - w(n) = \begin{cases} 0, 1, 2 & \text{when } w(n) \neq w(n-1) \\ 1,2 & w(n) = w(n-1) \end{cases} \quad ....(6)$$

Eqs(6) will restrict the min. accumulated distance at any grid point to have the formula :

$$Da(n,m) = D(n,m) + \min [Da(n-1,m) * g(n-1,m), Da(n-1,m-1) , Da(n-1,m-2)] \quad .... (7)$$

where

$$g(n,m) = \begin{cases} 1 & \text{when } w(n) \neq w(n-1) \\ \infty & w(n) = w(n-1) \end{cases} \quad ....(8)$$

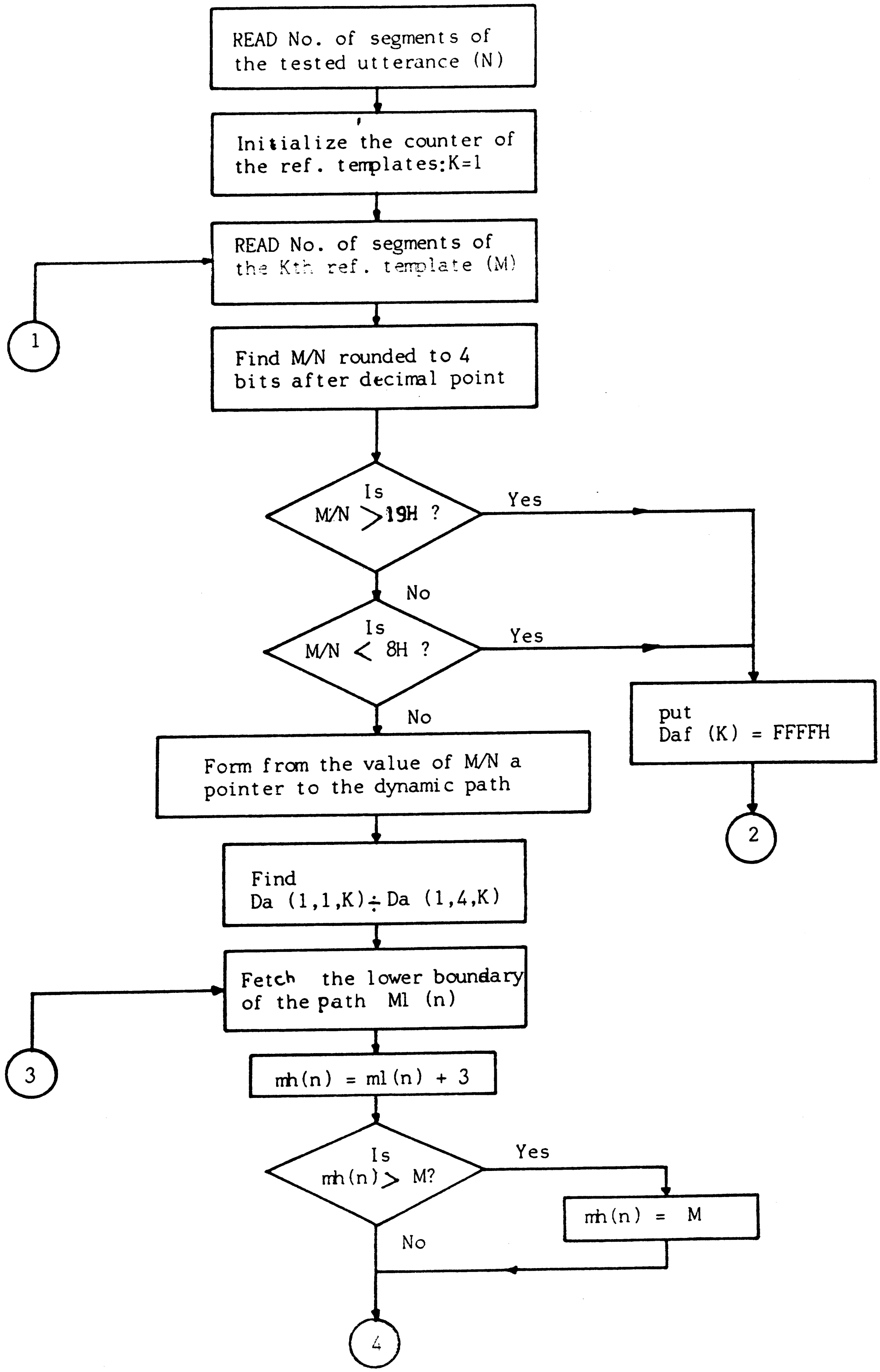
and the final min. accumulated distance Dt is found among last four accumulated distances

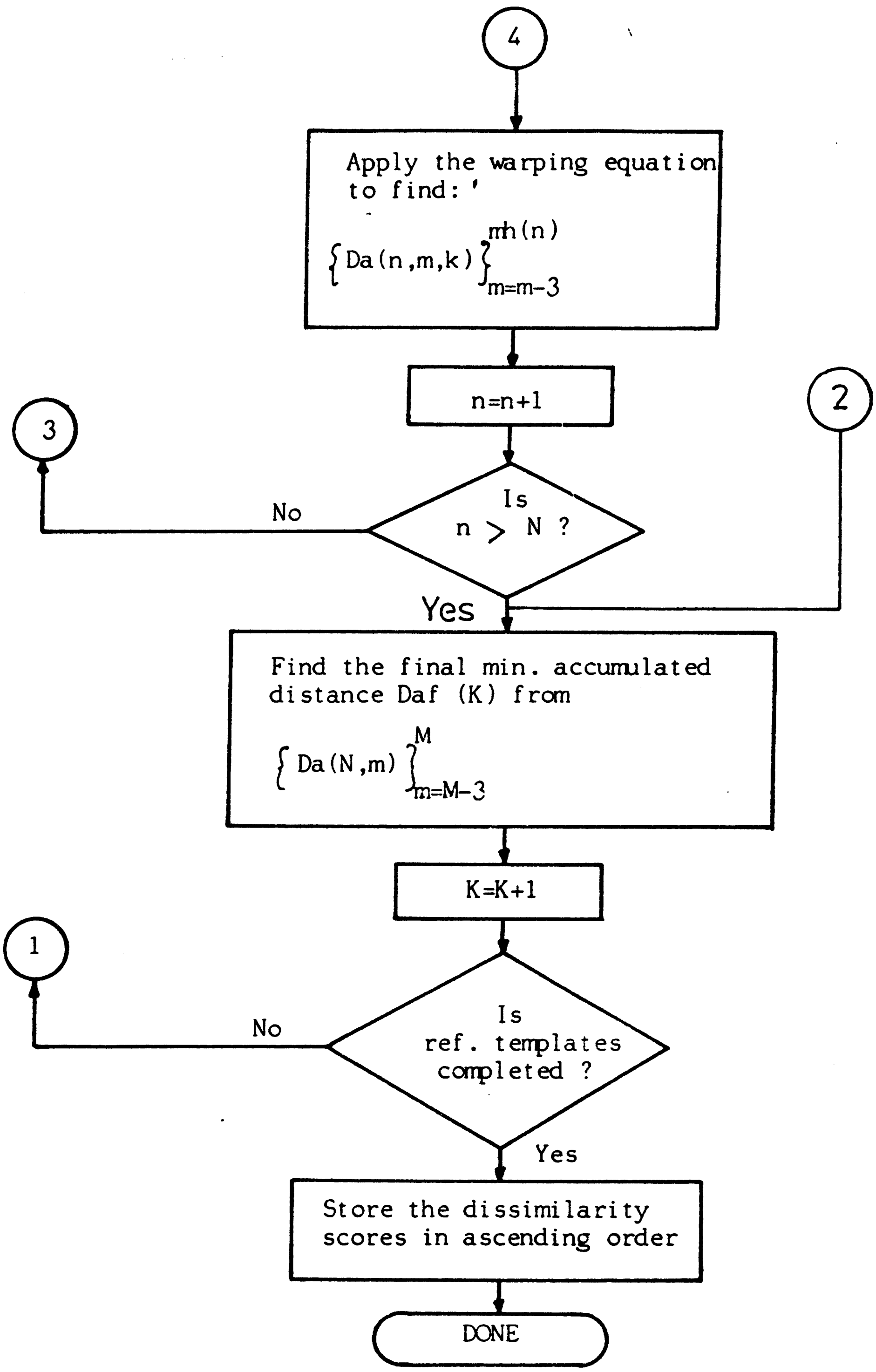
Da(N,M), Da(N,M-1), Da(N,M-2), Da(N,M-3)

The DTW algorithm illustrated in Fig. (9) for real time operation. The execution time of a single distance measure is within 60 msec. Consequently a complete comparison process for the total set of reference templates needs about 1 sec . A 1 sec recognition time could be considered as real time operation only for discrete word recognition systems.

6.REFERENCE TEMPLATES CREATION:

It is resonable to assume that a single reference template is sufficient to characterize a specified word in the vocabulary since the system implemented here is speaker dependent [21].


READ No. of segments of the tested utterance (N)
Initialize the counter of the ref. templates:K=1
READ No. of segments of the Kth ref. template (M)
1
Find M/N rounded to 4 bits after decimal point
Is M/N > 19H ?
Yes
No
Is M/N < 8H ?
Yes
No
put Daf (K) = FFFFH
2
Form from the value of M/N a pointer to the dynamic path
Find Da (1,1,K) ÷ Da (1,4,K)
Fetch the lower boundary of the path Ml (n)
3
mh(n) = ml(n) + 3
Is mh(n) > M?
Yes
mh(n) = M
No
4



[Fig.(9): Functional flow chart of the DTW algorithm]

Several techniques known as clustering techniques show a powerful performance in selecting proper replications (tokens) for each utterance in the vocabulary. One of the efficient approachs is to minimize the probability of false recognitions. Referring to Fig.(10), the probability density of tokens is plotted versus their relative distances to a token of utterance A. All the tokens belonging to the utterance A are lumped in a single cluster while all the remaining utterances are shown for simplicity concentrated in the 2nd cluster B.

The ref. template for a specified word is selected as the token which maximizes the quality ratio σ [23] according to the formula :

$$\sigma = \frac{\sum_{j=1}^{mo} Dt(Xk,Xj)}{\sum_{i=1}^{mi} Dt(Xk,Xi)} \qquad \ldots.(9)$$

where mo is the cardinality of the outer cluster B, mi: that of inner cluster A, Xk: the selected token, Xj: all the tokens of the outer cluster, Xi: the tokens of the inner cluster.

In this work, the procedure of reference template creation is to find a single ref. template among 7 tokens for each word. A table is formed for the warped distances between every token and all the remaining ones in the vocabulary. The quality ratios are calculated according to eq. (9), then the ref. template is selected as the token which maximizes σ for any specified word.

7.PERFORMANCE EVALUATION :

The Z.C. measurements offers only a limited recognition capability due to their approximations and infinitely clipping of the acoustic signal . For the above stated reasons , the performance test of the recognizer is restricted to the following specifications :

(i) Isolated words
(ii) Single speaker

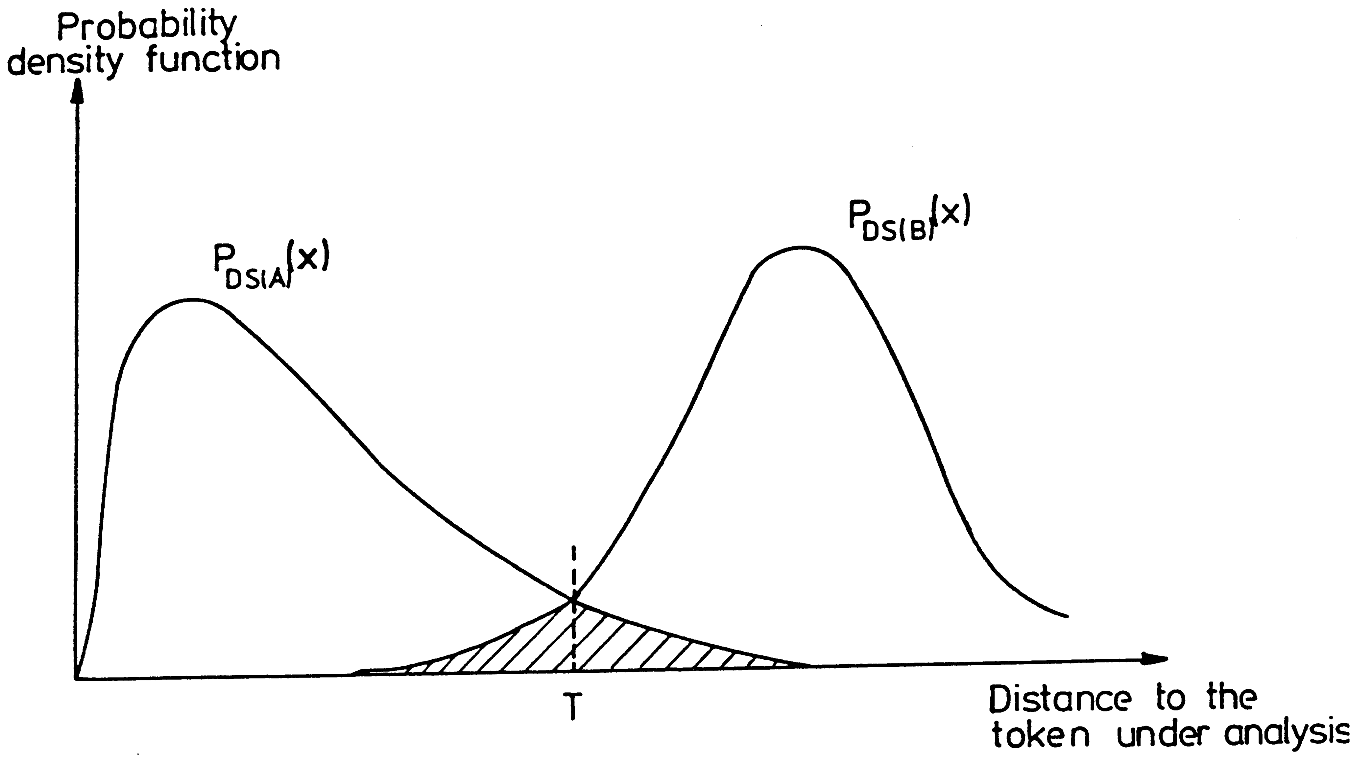


Fig.(10) Probability density functions vs the distance to a specified token for both the correct word and all other words

(iii) Small vocabulary: consists of the 10 digits, zero through nine and the six directions of movement uttered in Arabic.

The two sets of reference templates created for both versions of histograms are tested by 10 trials of each vocabulary word stored in a cassete tape recorder, and the test results are tabulated [5] in a recognition table. A sample of the output list will look like:

Tested Utterance	1st Candidate	Relative Distance	2nd Candidate	Relative Distance
zero	zero	175H	Three	258H

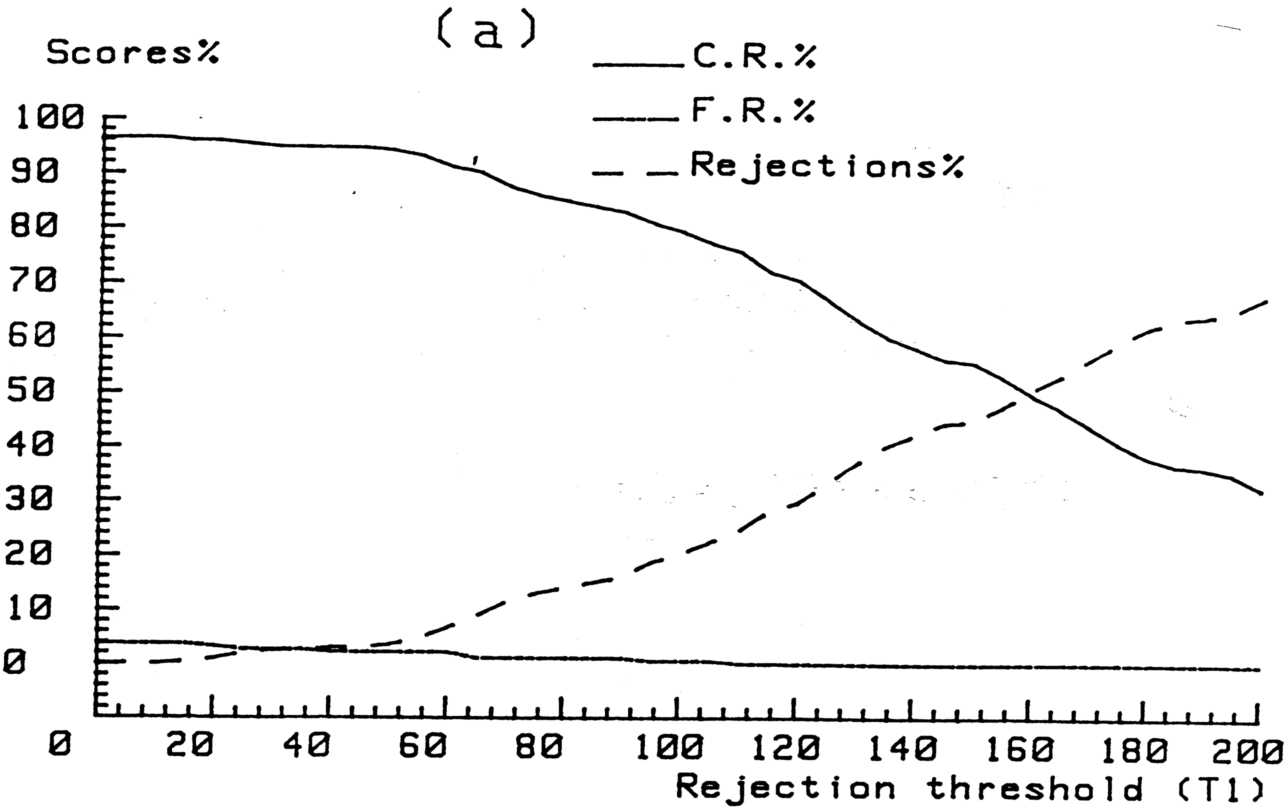
The recognition table forms the basis of two proposed rejection thresholds extended on the two nearest neighbors:

(1) The first rejection concept,T1,can be expressed as ' If the absolute difference between the relative distances to the two nearest neighbors $|Da2 - Da1|$ is less than T1, the tested utterance will be rejected, otherwise it will be assigned to the nearest neighbor '.

(2) The second one, T2 , expressed as ' If the value of $|Da2 - Da1| / Da1$ is less than T2, the tested utterance will be rejected.

The two rejection thresholds are applied on the two features tables, for a certain value of T1 (or T2) , the percentage scores of correct recognitions,false recognitions and rejections are collected up. If the same procedure is extended for a sufficient range of T1 (or T2) , a plot of the rejection threshold Vs recognition scores demonstrating the performance of the recognizer can be obtained as depicted in Figs(11)& (12). Referring to the above figures, the rejection thresholds must be chosen to make the best tradeoff between false recognitions and rejections. On the other hand. one may resonabley assume that false recognitions are more expensive than rejections. Referring to Fig.(11), it can be noted that both types of thresholds give comparable results. For T1 = 52, a 90% correct recognition can be achieved with 1.5% false recognitions and 8.5% rejections . Similar recognitions can be obtained for T2 = .12 with false recognitions and rejections equal .625% and 8.75% respectively.

In the case of peak histogram features, a 90.6% recognition accuracy can be achieved with false recognitions not exceeding



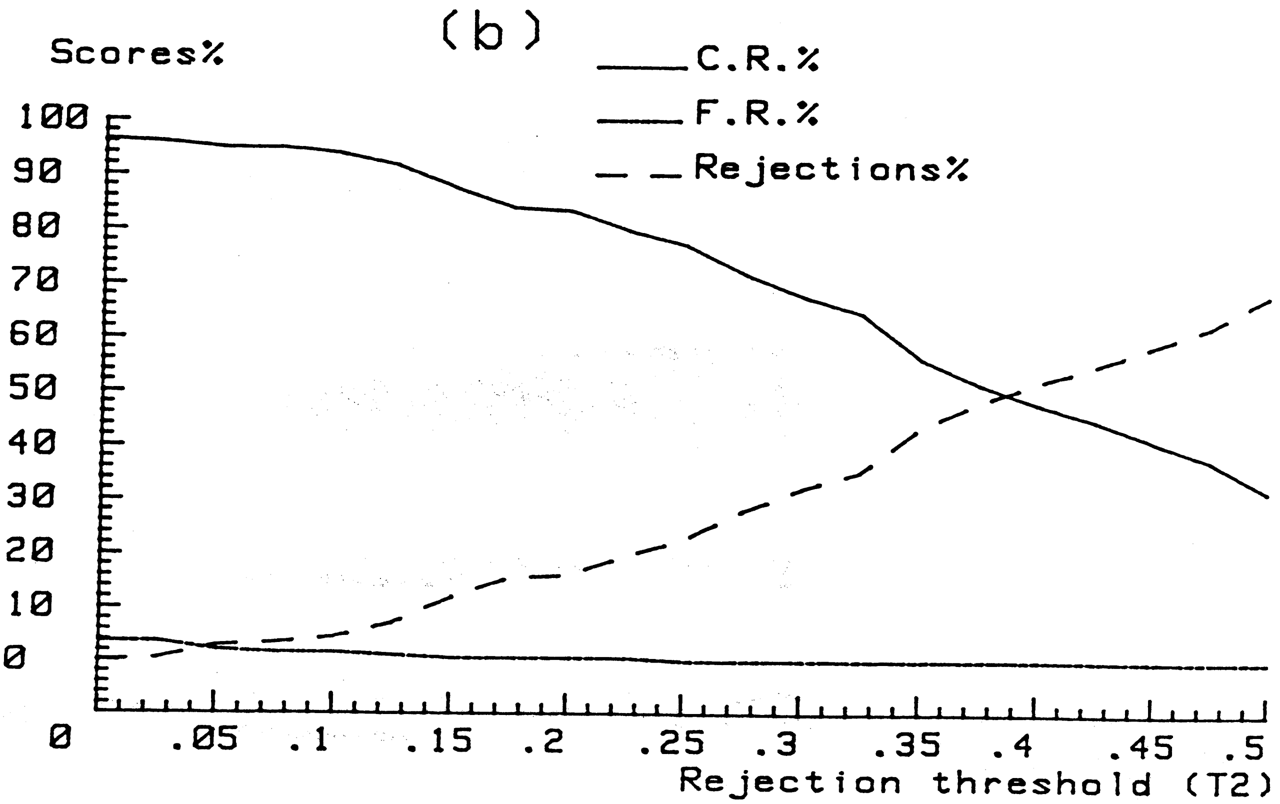


Fig.(12): Peformance of the Peak histograms features Vs the two types of rejection thresholds: (a) T1 (b) T2

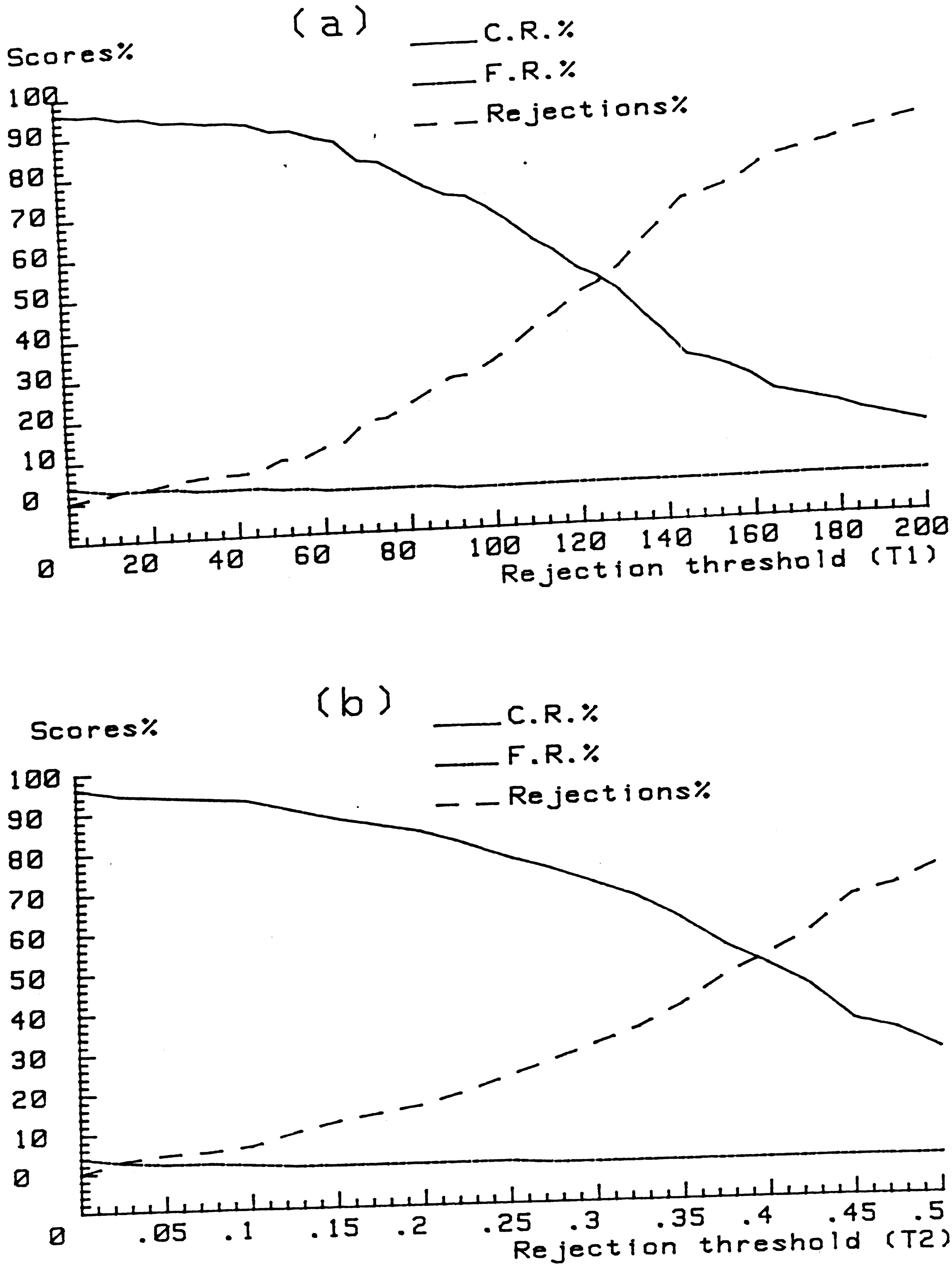


Fig.(11): Peformance of the Z.C. histograms features Vs the two types of rejection thresholds: (a) T1 (b) T2

.625% at T1 = 65, while for T2 = .12, a recognition score equal to 92.5% has been obtained with .625% false recognition.

One may conclude from the illustrated results that the peak features show a better performance compared to the Z.C. for both types of rejection thresholds. However, only a minor improvement has been achieved when applying the 2nd threshold T2. Also it has been noted, when performing the test , that many false recognitions and rejections are due to erroneous endpoints detection which is still a difficult problem for most discrete word speech recognition systems [6].

8. SYSTEM APPLICATIONS & DEVELOPEMENTS FOR THE HANDICAPPED AID:

The increase in popularity of low cost speech recognition systems [1,2] has offered many useful applications for the handicapped aids in home, education and many tasks utilizing speaker trained, small or moderate size vocabularies . The microcomputer based recognizer implemented through this work could have several applications in small size speech entry systems . A direct application is to control a wheelchair movement, for providing telephone calls instead of dialling.

For more complicated applications, large vocabularies and more reliable operations could be crucial requirements. Several developments may be suggested here to increase the recognition capability of the recognizer. A key point is to improve the feature extraction technique. It had been noted when evaluating the performance of the recognizer that each feature histogram shows a better performance for certain classes of phonemes . By combining the two feature sets,the performance of the recognizer will be improved to a considerable extent. If a fast multiplier or a bank of bandpass filters are added as supporting hardware, a radical change in the feature extraction techniques could be introduced. Several techniques describing accurately the spectral information could be implemented in real time.

A reliable end point detection algorithm will eliminate most of misclassifications due to erroneous time registration [6] . The speech detection algorithm described in sec. (3) shows a reliable performance for only a limited range of S / N or peak noise level. Another proposed threshold level adjusted according to the average noise level will detect accurately the speech / silence boundaries for acceptable levels of S / N ratio.

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"THE USE OF MYOELECTRIC PROSTHESIS FOR THE UPPER LIMB AMPUTATION"

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ABSTRACT:

Myoelectric prosthesis are highly sophisticated devices for upper limb amputee which have made astonishing progress since the 2nd World War. Our experience in fitting this type of prosthesis in MUATH IBN AL JUMOH ORTHOPEDIC WORKSHOP will be discussed.

The prescription of myoelectric arm and levels of amputations wanted will be mentioned, stump specification, measurment, fitting delivery, training, maintenance and problems will be discussed.

1. INTRODUCTION:

The natural arm is in many ways a perfect instrument. It embodies multiple degrees of freedom all capable of integrated function. The control system (nerves), power storage (muscles), actuators, provision for regeneration of worn parts, it is manifestly unrealistic to think one could write down all the criteria and performance specifications of the normal arm and hope even to begin to be able to reproduce them in a man made device.

To be acceptable prosthesis must fulfill a need or needs of the user (such as grip force, wrist rotation for a below-elbow prosthesis which we are interested to present). These are considerable grounds for belief that the BEST PROSTHESIS IS THE ONE THAT CAN BE CONTROLLED WITHOUT HAVING TO THINK ABOUT IT. In fact when using EMG signals which are picked up from the wrist flexors and extensors muscles (for below-elbow prosthesis) could be used to open and close the electric hand.

2. THE MYOELECTRIC PROSTHESIS:

A muscle is a biological actuator used to convert energy stored in chemical substance into mechanical output. For below-elbow amputation we usually lose the hand but in fact we still have the muscles which control the functions of the hand, also and (this is the point) the subject can have a same feeling for these muscles as before.

The concept of myoelectric control is very simple, it involves the use of an electric signal from the muscle to contorl the flow of energy from a battery to a motor. In a myoelectric prosthesis, the control signal has normal innervation and thus is the subject to voluntary control. The motor actuates a prosthesis hand. A below-elbow

myoelectric prosthesis involves five distinct elements: the signal source (muscle), a means of making an electrical connection to the signal source (electrode), an electronic system which will translate the control signal into the desired action (controller), a means of storing energy (battery) and a prosthesis appliance (electric hand).

2.1 THE MYOELECTRIC SIGNAL:

Very small signals are emitted from the remaining musculature once used for prehension of the natural hand. The origin of the myoelectric signal is the depolarization of the cell membrane of individual muscle fibres during contraction. The electric currents associated with this depolarization and subsequent repolarization produce measurable potential differences in tissues some distance away. It is these electric potentials, rather than the trascellular potentials, which are used in myoelectric controls.

The smallest number of muscle fibres which can be contracted, under normal circumstances, represents the group which has its innervation from a single axon. This functional unit is called a motor unit. But the electric potentials from single motor unit have not been used widely for myoelectric control.

When a large number of motor units are active, the resulting "gross myoelectric potentials" has a wave form similar to a random noise. If this wave form is analysed will be found that the most of the energy lies in the frequency range 30-300 Hz, and the peak-to-peak amplitude during voluntary contraction may range from a few microvolts to several millivolts.

THIS SIGNAL CAN ONLY GIVE GUIDE TO THE TENSION PRODUCED IN A MUSCLE AND NOT TO ITS LENGTH.

2.2 ELECTRODES:

The electrodes serve two important functions:

A. To pick up the signal from the skin surface.

B. To amplify the signal so it can be used for controlling the prosthesis.

2.2.1 PROBLEM-INTERFERENCE (ELECTRIC NOISE):

When working with such small signal potentials, there is a problem of picking up interference. Speaking in terms of micro-volts, there are constantly in the air surrounding us, many signals having the potential of operating the prosthesis such as : 50 cycle-power lines, motor, lights, television and radio signals, etc.

To keep the 50 cycle noise from being a problem, there is a filter incorporated into the circuitry of the electrode.
Other interference is dealt with by constructing the electrode as a differential amplifier. Each electrode is composed of not only one amplifier, but two identical amplifiers, corresponding to the contact points. By this way we can select only the signal being emitted by the muscle.

When both amplifiers receive a signal simultameously, the circuit remains in balance and the signal is not transmitted. Only when a signal is picked up by one amplifier, is the circuit thrown out of balance. This allows the signal to be sent to the hand.

As the signal travels down the muscle, it will be picked up by the first contact it reaches. If the contact is placed so that the time differential is greatest (parallel to the muscle fibers), the electrode is in the best position for operation. As the electrode is rotated from this position, the time differential decreases to where at 90 degrees the signal would hit both points simultaneously. In this position the electrode would not function and transmit the signal.

For standard below-elbow fitting, the electrodes are positioned so the extensor muscles open the hand and the flexor muscle will close it.

Electrodes are placed on the skin where we can pick up a maximum of signals found by EMG training meter.

2.3 THE CONTROLLER:

A myoelectric controller is a switch which controls the flow of current to an electric motor in accordance with the amount of myoelectric signal. In general we cannot use the raw myoelectric signal in the applications such as to control the electric hand, where the controller must process this signal to estimate the tension levels in the muscle. In MYOBOC system a conventional process is used to determine the mean of absolute value with a time constant of 0.2 seconds. The output of this process is compared with a

certain threshold to throw out the amplifier noise and then gives a digital signal to an electronic relay which switches on the electric hand to open or close depending on which signal is activated.

2.4 THE BATTERY:

The purpose of the battery is to store energy and make it available to operate the prosthesis appliance as needed.

A small 6 volts chargeable battery is used and it is composed of five Nickle-cadium cells, each has a voltage of 1.2 volts, these cells will renew themselves with each charge.

2.5 THE ELECTRIC HAND:

There are many types of electric hands depending on the functions of its level of amputation and the sizes. But in general it consists of a drive unit, 6 volts DC motor, electronic relay, gear system and fingers. The digital controlled signals activate the electronic to switch on the motor, the motor drives a miniature gear system which, in turn, moves the middle and index fingers as well as the thumb. Thus operation of the hand is totally controlled by the remaining arm musculature.

3. BELOW-ELBOW AMPUTATIONS:

3.1 Levels of amputations:

Very short stumps less than 4 cm from the mid line of the elbow joint are not useful for the myoelectric prosthesis for the following reasons:

A. The shape of the stump change during flexion and extension.

B. The electric arm is too heavy for the muscle power which is left.

C. The muscle area is too small to place the surface electrodes on.

Disarticulation in the wrist joint is possible to fit with a special myoelectric hand.

Amputation levels distal from wrist joint cannot be fitted with a myo device causing a too long prosthesis which is cosmetically unacceptable.

An amputation level between the estimated points are possible for fitting except if space is needed for rotation unit.

4. EVALUATION OF UPPER EXTREMITY PROSTHESIS:

One of the basic methods of systems evaluation is the experimental method. With such a method we can test how well the requirements of the system have been met, by making the system perform certain tasks related to these requirements. From the result of such testing we can ascertain how well the sytem performs, what faults there are in the machine design and whether the functions have been allocated correctly between man and machine.

The basic elements in the evaluation experiment are:

4.1 Selection of subjects:

Many variables should be considered such as age, sex, occupation, amputation level, etc.

Age is an important factor and also the period since amputation. The ability to deal with change of habit patterns and behavior would be possibly associated with this. The social role of the individual and his activities in the society are also very important.

4.2 Training and instructions:

It is necessary to ensure that the operator has been trained and is fully instructed to the operation of the system. Training should be continued and this can be achieved by training signal strength.

4.3 Testing, follow-up and checking:

The subject should be trained and tested for a normal activity around the body, all basic grasping patterns that are normally used in daily living, bimanual activities and subject relevant activities. Of course it cannot be achieved in the beginning but with time and the hard training the individual may succeed.

5. BELOW-ELBOW MYOELECTRIC PROSTHESIS:

A successful prosthesis management of a below-elbow amputee with myoelectric prosthesis depends on modern design and the utilization of advanced technology. It begins with a diagnosis using test instrument and ends with the patient receiving a highly functional prosthesis.

5.1 PLACEMENT OF ELECTRODES:

One of the most important thing is to find a good muscle to control the movement provided. By using EMG training meter we can check the signal strength from the muscle to find the best placement of the electrodes.

5.2 CAST TAKING:

With the persons flexed 90 degrees we take some important measurements, circumference and length of the stump, then remark the electrode sites, the cupital fold, both epicondyles, the olecranon and margin of the lateral epicondyle, moisten the rigid plaster to take the cast, wait 5 minutes to become hard then remove the mold.

5.3 PREPARING THE NEGATIVE AS A CHECK SOCKET.

5.4 EVALUATION OF THE CHECK SOCKET:

With elbow at 90 degrees put on the check socket, evaluate range of motion, pressure on the bony prominences, lifting comfort and suspension.

5.5 MODIFICATION OF THE POSITIVE MODEL:

Coat the mold with parting agent and fill with plaster, remove by the negative from the positive, start to modificate the model smoothing with sand screen, then put the model in the heater to be dried.

5.6 LAMINATION OF BELOW-ELBOW SOCKET.

5.7 PREPARING THE SOCKET FOR TRIAL FITTING:

A trial fitting is conducted by evaluating suspension, range of motion, length, alignment and electrode site

selection. Corrections are made to remedy problems before finishing is started.

5.8 CONNECTION OF THE SOCKET AND WRIST UNIT, COSMETIC SHAPE.

5.9 FINISHING WORK.

5.10 DELIVERY AND FINAL CHECK OUT:

The patient is also supplied with two batteries and a battery charger.

6. ADVANTAGES:

A. Controlled movement of the artificial hand by contraction of the extensors and flexors muscles.

B. No auxiliary suspension device is necessary.

C. Cosmetically acceptable.

D. Compared to mechanical hand, the grip power can be controlled by several amounts of contraction.

7. DISADVANTAGES:

A. Heavy weight, about 1 kg.

B. Charging of batteries.

C. Sensitive for distortion from electric equipments such as TV, power lines, etc.

D. Electrodes are reacting on perspiration.

E. Delicate and need periodic checking and maintenance.

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A DESIGN OF BLIND MOBILITY AID MODELED AFTER ECHO LOCATION OF BAT

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ABSTRACT

A new model of the mobility aid for the blind was designed by using a microprocessor and ultrasonic devices. Our mobility aid was evaluated based on psychophysical experiments by the blind. In our model, the downsweep FM ultrasound is emitted from a transmitter with wide directivity to detect obstacles and the reflected ultrasounds from obstacles are picked up by two channel receiver. The frequency of the emitted ultrasound sweeps from 70kHz to 40kHz within 1msec, so it has almost the same characteristics as the ultrasound which bat produces for echo-location. The reflected ultrasound wave is prolonged about by 50 times by using a microcomputer board with an A/D-converter and two D/A converters, so that the frequency of the prolonged wave becomes 1400Hz to 800Hz. The prolonged waves are displayed binaurally through 2 channel earphone. In this method, obstacles may be perceived as localized sound images corresponding to the direction and the size of the obstacles. From the results of psychophysical experiments, it was found that downsweep FM ultrasound was superior to recognize tiny obstacle compared with other ultrasounds and the blind could recognize a wire with 1mm diameter by using our device. It was also proved that the blind could discriminate several obstacles at the same time without any virtual images. Our mobility aid modeled after bat's echo-location seems to be effective to detect tiny and sharp obstacles placed in front of the head.

1. INTRODUCTION

During the last two decades, about 30 models of blind mobility aid have been developed in the world and some of them shown in table 1 are used in practical[1]. Sonic-torch[2], Sonospec, Pathsounder[3], Mowat Sensor[4], Nottingham Obstacle Detecter[5] and Laser-Cane[6] are called clear path indicator or obstacle detector because the blind can only know whether or not there is an obstacle in his/her course[7]. These devices are used to search obstacles in front of the blind like 'torch' which has very narrow directivity. On the other hand, Sonicguide is called environment sensor because it has wide directivity so as to search obstacles at the same time[8]. However, there are some problems to be solved in this device such as that spatial resolution is not high and virtual images are perceived when some obstacles are displayed at the same time. All of the devices must be used together with a long cane or a guide dog for the blind because the searching scope of the devices is limited in the range between head and chest.

Table 1 Some mobility aids in practical use

NAME	DEVELOPED IN	DEVELOPED BY	OBSTACLE DETECTION METHOD	DISPLAY METHOD
Sonic Torch	1965	Lasley Kay (England)	Transmit FM-ultrasonic burst and detect beat sound between emitted and reflected sounds	Display beat sound of which frequency is proportional to the distance of obstacle
Sonospec	1965	Toshin Electric Co. (Japan)	Transmit ultrasonic pulse and detect time delay of reflected sound	Display sound of which frequency is proportional to time delay
Pathsounder	1966	Lindsay Russel (U.S.A)	Transmit ultrasonic pulse and detect time delay of reflected sound	Display sound and vibration of which frequency changes at two levels according to time delay
Sonicguide	1969	Lasley Kay (New Zealand)	Transmit FM-ultrasonic burst and detect beat sound by using two receivers with different directivity	Display two beat sounds binaurally
Mowat Sensor	1972	Geoff Mowat (New Zealand)	Transmit ultrasonic pulse and detect time delay of reflected sound	Display sound or vibration of which frequency is propotional to time delay
Nottingham Detector	1974	J.Armstrong (U.S.A)	Transmit ultrasonic pulse and detect time delay of reflected sound	Display sound of which frequency changes at 8 levels corresponding to time delay

By the way, some species of bats have ability of detecting tiny obstacles and flying insects by using ultrasound echolocation. Though mechanism of the echolocation is unknown completely, according to animal physiology, it is proved that the mechanism of bat's inner ear has similar function to human's inner ear except physical characteristics of basilar membrane [9],[10]. It is expected that the same function as bat's echolocation may be elicited in human auditory system.

Since most of bats transmit downsweep frequency modulated (FM) ultrasound for their echolocation as shown in Fig.1, this downsweep FM sound seems to be advantageous to detect and recognize obstacles[11],[12]. In this paper, we have designed new mobility aid device modeled after bat's echolocation and also we investigated what kind of roles the downsweep FM sound played to detect and recognize obstacles.

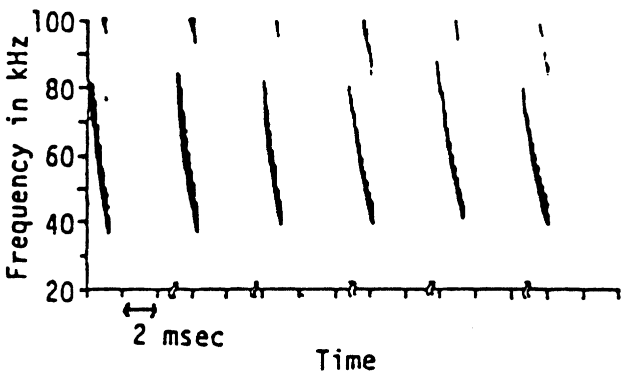


Fig.1
Typical time spectrum pattern of FM bat's orientational ultrasonic

2. MOBILITY AID DEVICE

Our mobility aid device consists of a microcomputer board with 3 channel D/A converter and 2 channel A/D converter, voltage controlled oscillator, one ultrasonic transmitter, two ultrasonic receivers and two earphones as shown in Fig.2.

The downsweep FM ultrasound is emitted from a transmitter with wide directivity to detect obstacles and the reflected ultrasounds from obstacles are picked up by two channel receiver. The frequency of the emitted ultrasound sweeps from 70kHz to 40kHz within 1msec, so it has almost the same characteristics as the ultrasound which bat produces for echolocation.

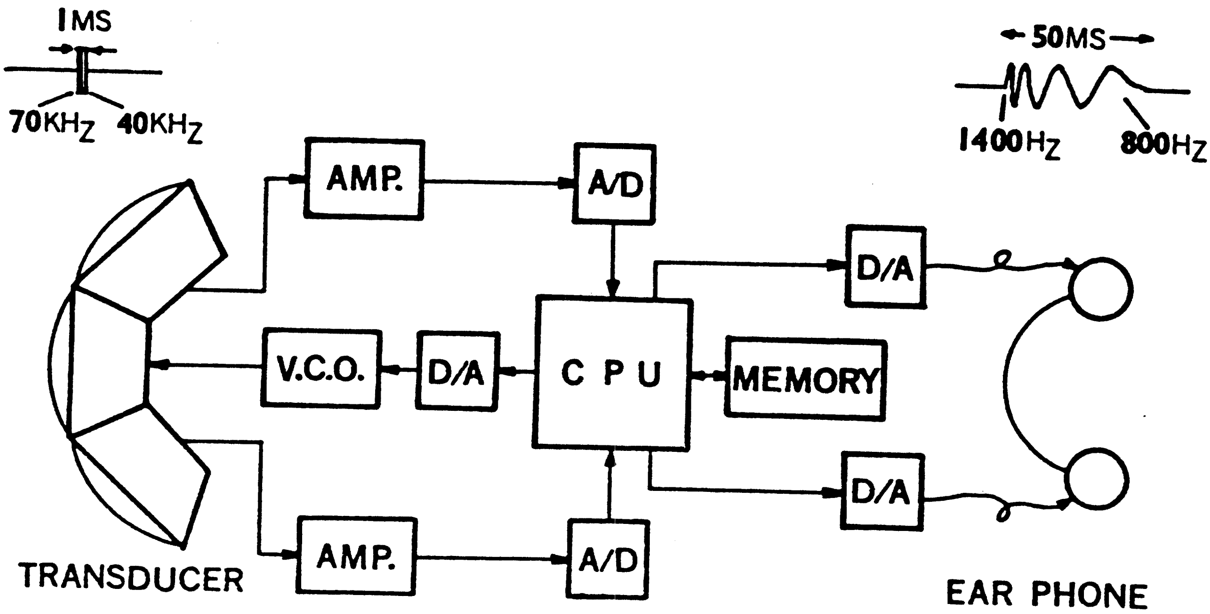


Fig.2 Block diagram of our mobility aid

The detected signals consisting of 8192 sampling points are stored into IC memory through A/D converter with 12 bit resolution at 2usec sampling time and then these data are converted into prolonged wave through 2 channel D/A converter with 12bit resolution at 100usec conversion time. Therefore, reflected ultrasound wave is prolonged about by 50 times so that the frequency of the prolonged wave becomes 800Hz to 1400Hz in which frequency range the auditory sensitivity is very high and the frequency difference limen is low. The prolonged waves are displayed to both ears through 2 channel earphone. In this method, obstacles may be perceived as localized sound images corresponding to the direction and the size of the obstacles.

The transmitter and the receivers were designed by Matsushita Electronic Components Co.,Ltd. and these devices have very wide frequency range and wide directivity as shown in Fig.3(a) and (b).

(a)

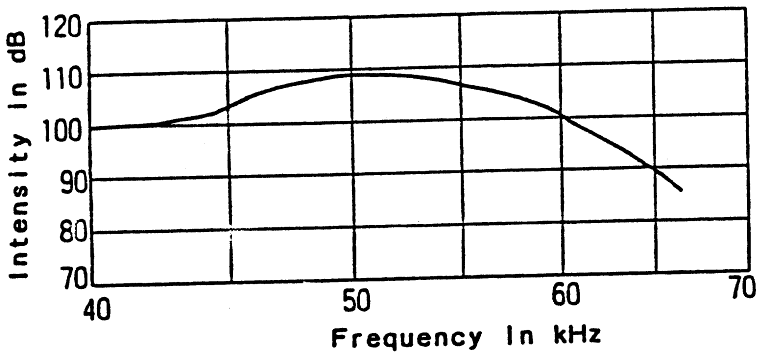
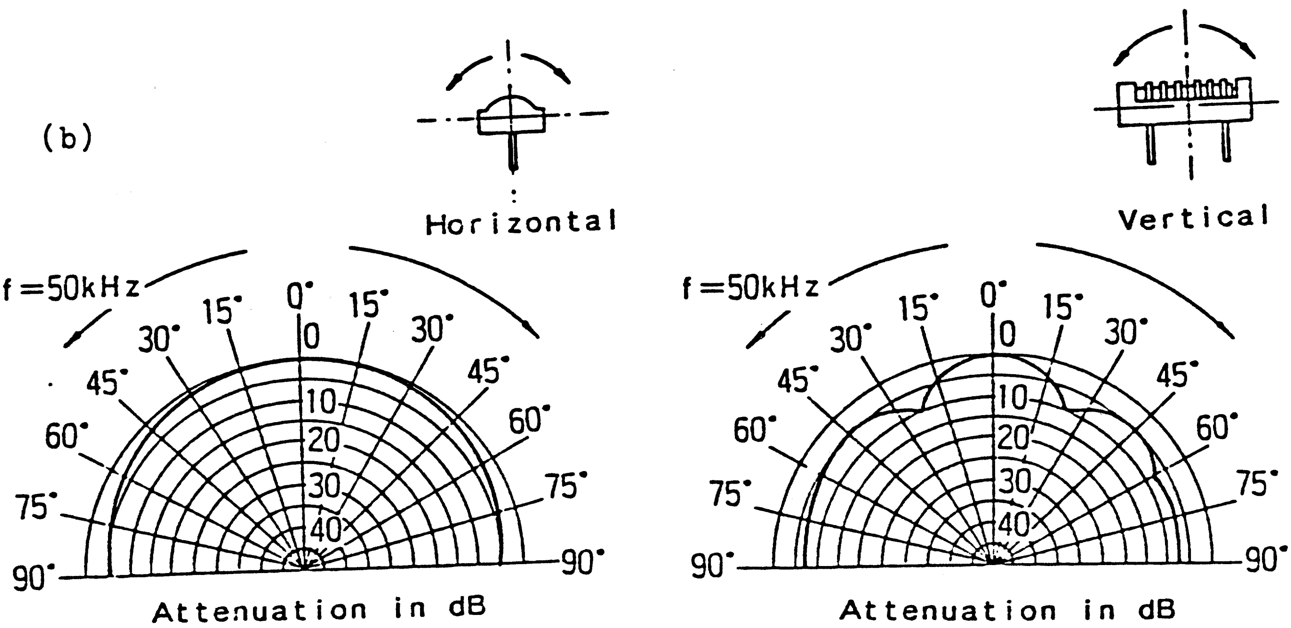
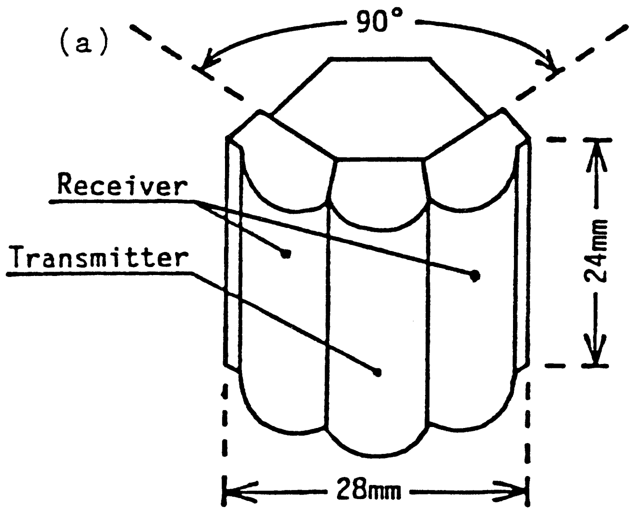


Fig.3
(a) Frequency characteristics of ultrasonic transducer
(b) Horizontal(left) and vertical(right) directivity of ultrasonic transducer

(b)



These transducers are fixed on the center of the frame of an glasses and two receivers are arranged perpendicularly as shown in Fig.4(a) and (b). Fig.5(a) shows relative intensities of reflected sound from a pole placed 1m apart from the receivers as a function of direction of the pole and Fig.5(b) shows arrival time difference of reflected sound between two receivers as a function of direction of the pole. Thus intensity difference and time difference produced between two receivers depend on the direction of obstacle so that direction of sound image produced inside of our head changes depending on the direction of obstacle by auditory binaural function.



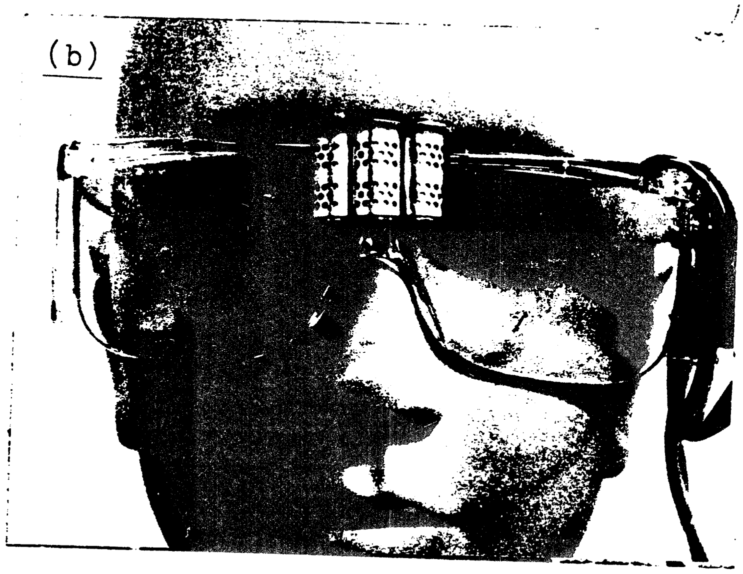
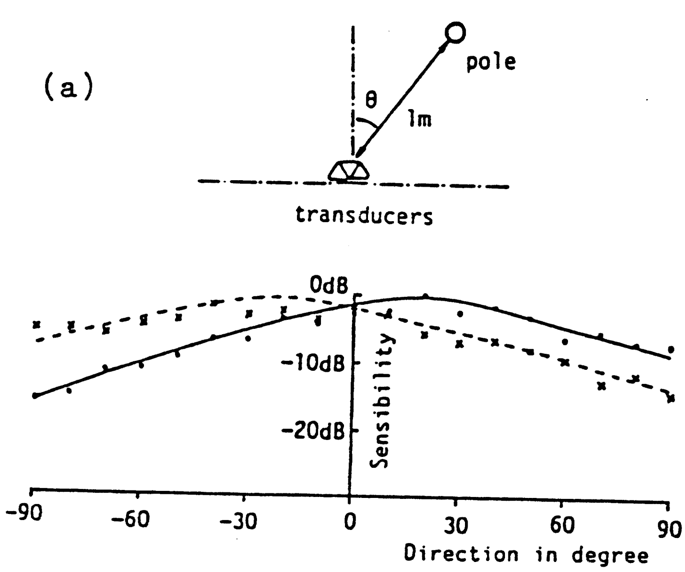


Fig.4 (a)Arrangement of the transducers

(b)Photograph of our mobility aid



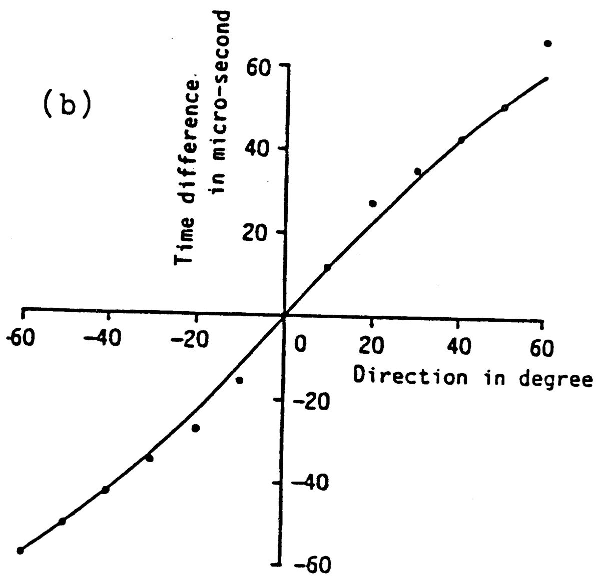


Fig.5 (a)Relative intensities of reflected sound as a function of pole direction

(b)Arrival time difference of reflected sound between right and left receivers as a function of pole direction

3. EVALUATION METHOD OF OUR BLIND MOBILITY AID

First, discrimination ability of two poles placed in front of a subject was evaluated according to the following experiments.

(1) The distance(R) between the transducer and the right pole was measured by which the left and the right poles were perceived at the same distance.

(2) The distance(R) was measured by which two poles were perceived individually when the distance (R) increased.

Where, the left pole was placed 1m apart from the transducer at an angle of 30 degree as shown in Fig.6(a). The diameter of the right pole was fixed at 3cm, on the other hand, the diameter of the left pole reduced from 30mm to 1mm. The height of both poles was 70cm. These poles were made of acrylic resin.

Next, discrimination ability of the right pole was evaluated when a plate made of steel was placed perpendicularly 1m apart from the transducer at an angle of 30 degree as shown in Fig.6(b).

(3) The distance(R) between the transducer and the pole placed on the right hand at an angle of 30 degree was measured by which the pole was managed to be perceived.

Where, the height and the width of the plate were 153cm and 124cm respectively. The diameter of the pole was changed as well as the above experiments.

In these experiments, two kinds of ultrasound were used besides downsweep FM sound to investigate which sound was most suitable to detect the obstacles. One is the ultrasound with 50kHz constant frequency (CF) and with 1msec duration. The other is upsweep FM sound which frequency sweeps from 40kHz to 70kHz within 1msec as shown in Fig.7.

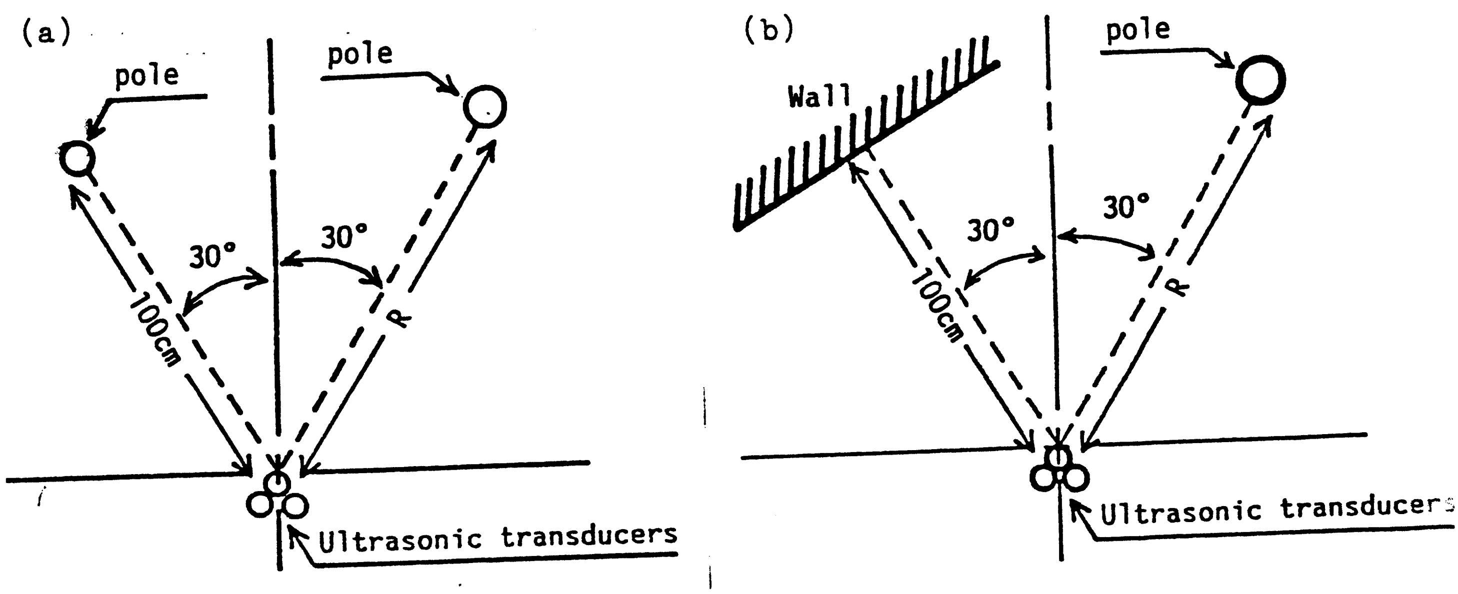


Fig.6 (a),(b) Arrangement of obstacles and transducers for psychophysical experiment as to discrimination ability of poles

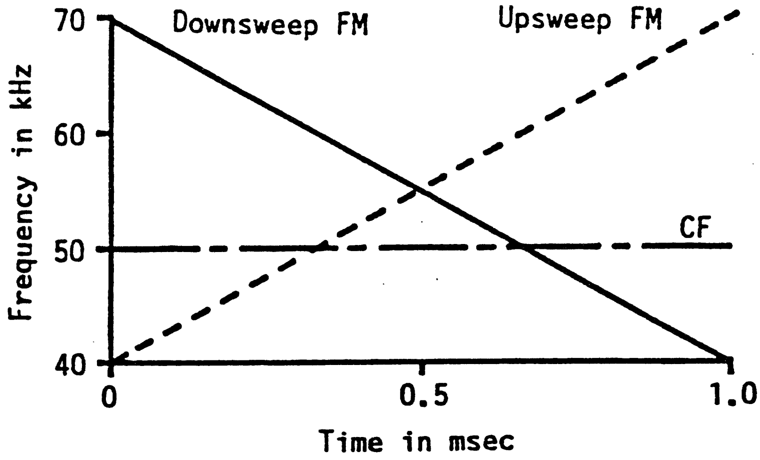


Fig.7
Time spectrum patterns of three orientational sounds which are used for the psychophysical experiment

4. EXPERIMENTAL RESULTS AND DISCUSSIONS

In the experiment(1), the distance(R) by which two poles were perceived at the same distance increased when the diameter of the left pole became less than 2mm as shown in Fig.8. In another word, this result means that obstacles placed at the same distance were perceived at almost the same distance if the size difference between two obstacles was not so large. This phenomena was found in the cases of upsweep FM sound and CF sound as well as downsweep FM.

In the experiment(2), the distance(R) by which two poles were perceived individually was about 17cm and about 30cm in the case of FM sound and CF sound respectively as shown in Fig.9. This means that FM sound is more advantageous to discriminate multiple obstacles than CF sound. The distance did not depend so much on the difference of the diameter of the left pole and no difference was found between upsweep FM and downsweep FM.

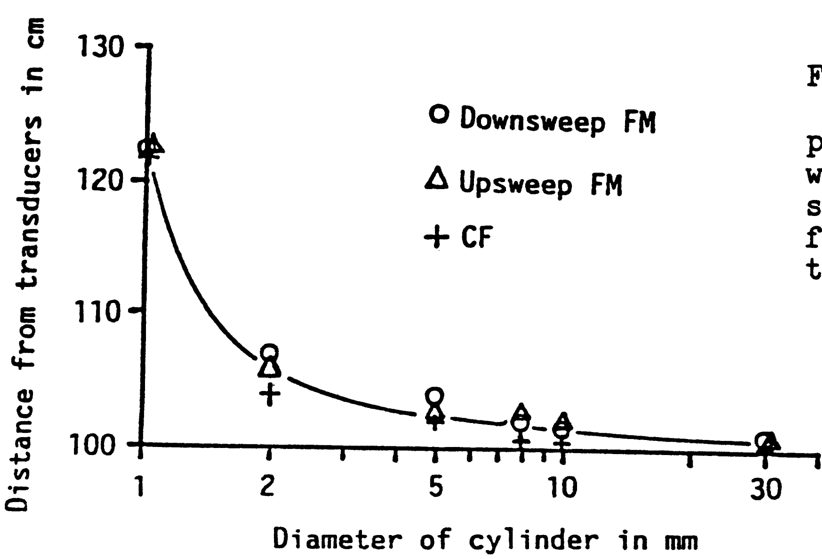


Fig.8
Distance of the right pole which two poles were perceived at the same distance as a function of diameter of the left pole

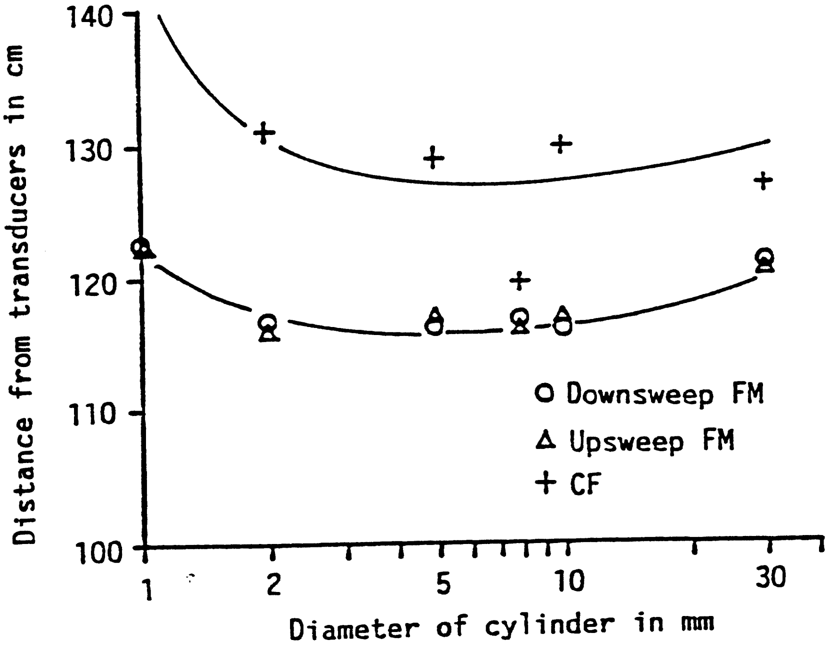


Fig.9
Distance of the right pole by which two poles were perceived individually as a function of diameter of the left pole

In the experiment(3), the distance(R) by which the pole was managed to be perceived was about 113cm and 93cm in the cases of FM sound and CF sound respectively when the diameter of the pole was 35mm as shown in Fig.10. FM sound is also proved much better to perceive obstacle than CF sound though no difference between downsweep FM and upsweep FM was found when the diameter of the pole was larger than 10mm. Downsweep FM was, however, found to be better than upsweep FM when the diameter of the pole became less than 5mm. Downsweep FM sound seems to be effective to perceive tiny obstacle placed near the wall.

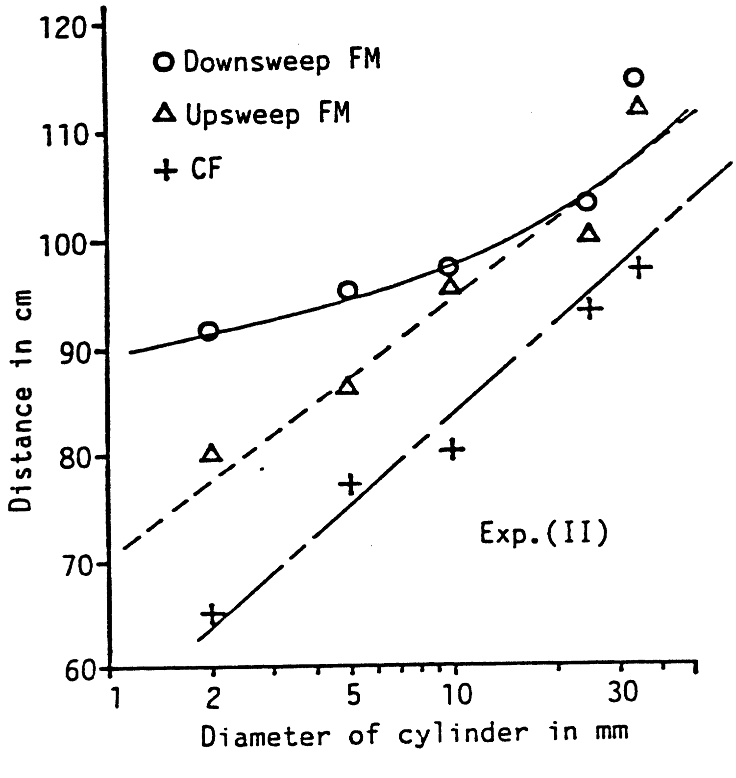


Fig.10
Distance of pole by which the pole was perceived as a function of diameter of the pole

The reason why the downsweep FM was effective might be caused by the auditory characteristics as to temporal masking. Preceding sound is not easy to be masked by the succeeding sound in temporal masking so that the subject can perceive the reflected sound with high frequency component which is advantageous to detect tiny obstacle in the case of downsweep FM. Whether it is true or not, our mobility aid modeled after bat's echolocation seems to be effective to detect tiny and sharp obstacles placed in front of the head.

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مشروع نسـخ اللغـة العربيـة لابجديـة بـراي آليـا

محمـد طاهر ميلـودي
وزارة التعليـم العالـي
المعهـد الوطنـي للتكويـن في الاعلام الآلي
الجمهوريـة الجزائريـة الديمقراطيـة الشـعبية

الفهرس:

المقدمة :

برنامج العمل الدولي للمعوقين هدفه الاساسي ضمان حماية قدرات المعوقين و اعادة تاهيلهم و متابعة الهدف المنشود "مشاركة كلية و تكافوء فرص" في الحياة الاجتماعية و في النمو و التطور مع المساواة.

من هذا المنطلق يجب اعطاءهم حظوظ متساوية مع الاخرين و تسهيل كسبهم كباقي المواطنين لتحسين ظروفهم الحياتية الراجعة الى التطور الاجتماعي و الاقتصادي .

هذه المفاهيم يجب ان تاخذ قيمة و درجة اولوية في التنفيذ في كل الدول مهما كان مستوى تطورها و نمـــــوها .

" عشرية الامم المتحدة للمعوقين (م 1983-1992

نيويورك 1983

لتحقيق هذه الاهداف يجب اجراء ابحاث و دراسات على محورين :

- اجهزة تقنية مساعدة

- طرق و انظمة تربوية خاصة

لأن مجموع المكفوفين في مجتمعات العالم الثالث يشكل نسبة كبيرة تبلغ الواحد بالمئة و بالجزائر يبلغ تعدادهم المئة الف . . . وبالبلاد العربية نسبة اخرى كبيرة .

هذه النسب الكبيرة من الناس محرومة من عدة حقوق و عاجزة عن اداء الواجبات ابتداء بالاعلام و الثقافة و انتهاء بالعمل و المشاركة مع المرور بالتعليم و التكوين .

هذه المجالات رغم اهميتها القصوى و دورها الفعال في حياة الانسان هي محضورة على اكثر المكفوفين رغم سهولة توفيقها و تكيفها حسب امكانياتهم و نجاعتها في فتح ابواب دمجهم في المجتمع و خاصة في التعليم

التعليم و التكوين مهما كان المستوى (..ابتدائى ،ثانوى ،عالى .)

الحاسب الالكترونى يتيح امكانية وضع كتب و نشرات .. تحت تصرف المكفوف و ذلك بتبديل النسخ اليدوى البطئ و العشوائى بالنسخ الالــى

ان الوسائل البداغوجية و المطبوعات بابجدية براي هى تقريبا غير موجودة بمدارس المكفوفين بالجزائر هذا النقص فى الوسائل البداغوجية و الغياب الشبه تام للمطبوعات بابجدية براي هو الذي دفع الباحثين بمخبر المعهد الوطني للتكوين في الاعلام الالي الى انجاز مشروع النسخ الالى لابجدية براي .

هـــدف المشروع:

ان اهداف تنمية المشروع تلتقي في السياق العام مع اهداف برنامج العمل العالمي للمعوقين (الامم المتحدة) الذي يسعى الى دمج المعوقين فى الحياة الاجتماعية و الى تكافوء في الفرص مع الاخرين مع تقيم قدراتهم وذلك بعد تكوينهم و تاءهيلهم لنهوض بالمجتمع العربي و استغلال جميع القدرات الكامنة . وما الابحاث التي تجري بمخبر معهد الاعلام الالي الا رافدا يزود حركة التطور في المجتمع الجزائري و العربي بصورة عامة بادخال فئة من فئات الشعب التي طال زمن حرمانها من المشاركة في حركة التطور.

مجالات مساهمة المشروع:

المشروع يساهم في :

1- دمج المكفوفين في التنمية الاقتصادية و الاجتماعية بالمجتمع العربي وذلك بتهيئة ادوات تعليمية و اجهزة تقنية مساعدة .

2- اشراك المكفوفين في التقدم العلمي والتكنولوجي بعدما عاشوا طويلا على هامش المشاركة في التقدم و التطور - التاريخ العربي لا يقدم في القديم الا ابو العلاء المعرى ،بشار بن برد و في العصر الحديث طه حسين " عميد الادب العربي " لعدم وجود مساعدة - هذا المشروع سييسر عملية التعليم

و التكوين و يفتح آفاقا جديدة للمعرفة امام المكفوفين و بتالي ستتيسر علية الابداع و المشاركة في التقدم

العلمي و التكنولوجي .

الاهـــــداف الفـورية:

1- المجال الثقافي و الديني :

يمكننا المشروع من القيام آليا بنسخ الكتب الثقافية و

الـدينية و طباعتها بابجدية براى ليتسنى للمكفوف الاستزادة من المعرفة.

2- مجال التعليم و التكوين :

تسهيل مهمة المدرس و المعلم اثناء التدريس: وضع كتب

كتب مدرسية خاصة وكذلك طباعة مواضيع الامتحانات و المسابقات.

03- مجال الاعلام :

طباعة الدوريات الخاصة على غرار دورية الايونسكو التي تطبع للمكفوفين

الانجليز و الفرنسيين .

الاهـــداف البعيدة و المتوسطة المدى :

تصميم و انجاز نظام لتعليم بواسطة الحاسب الالكتروني للمكفوفين باللغة العربية وباللغات

اخـــــــرى .

و يسمح هذا النظام بمساواة المكفوف مع المبصر في التعليم

فتح ابواب مهن جديدة امام المكفوف .

التعليم والتكوين مهما كان المستوى (..ابتدائى ،ثانوى ،عالى .)

الحاسب الالكترونى يتيح امكانية وضع كتب ونشرات .. تحت تصرف المكفوف وذلك بتبديل النسخ اليدوى البطئ والعشوائى بالنسخ الالـى

أن الوسائل البداغوجية والمطبوعات بابجدية براى هى تقريبا غير موجودة بمدارس المكفوفين بالجزائر هذا النقص في الوسائل البداغوجية والغياب الشبه تام للمطبوعات بابجدية براي هو الذي دفع الباحثين بمخبر المعهد الوطني للتكوين في الاعلام الالي الى انجاز مشروع النسخ الالي لابجدية براي .

هـــدف المشروع:

ان اهداف تنمية المشروع تلتقي في السياق العام مع اهداف برنامج العمل العالمي للمعوقين (الامم المتحدة) الذي يسعى الى دمج المعوقين فى الحياة الاجتماعية والى تكافؤ في الفرص مع الاخرين مع تقييم قدراتهم وذلك بعد تكوينهم وتأهيلهم لنهوض بالمجتمع العربي واستغلال جميع القدرات الكامنة . وما الابحاث التي تجرى بمخبر معهد الاعلام الالي الا رافدا يزود حركة التطور في المجتمع الجزائري والعربي بصورة عامة بادخال فئة من فئات الشعب التي طال زمن حرمانها من المشاركة في حركة التطور .

مجالات مساهمة المشروع:

المشروع يساهم في :

1- دمج المكفوفين في التنمية الاقتصادية والاجتماعية بالمجتمع العربي وذلك بتهيئة ادوات تعليمية واجهزة تقنية مساعدة .

2- اشراك المكفوفين في التقدم العلمي والتكنولوجي بعدما عاشوا طويلا على هامش المشاركة في التقدم والتطور - التاريخ العربي لا يقدم في القديم الا ابو العلاء المعرى ،بشار بن برد و في العصر الحديث طه حسين " عميد الادب العربي " لعدم وجود مساعدة - هذا المشروع سييسر عملية التعليم

مــراحل عـل النظام

ان تحويل النص العربي الي ابجدية براى يمر بالمراحل التالية:

- ادخال النص العربي بواسطة لوحة المفاتيح
- تخزين النص علي اسطوانة
- مراقبة و تصحيح النص المدخل
- تحويل النص بابجدية براى
- تخزين نص البراى على اسطوانة
- طباعة النصوص على ورق خاص

ان ادخال و تخزين النص على الاسطوانة تتم مرة واحدة و كذلك علية التحويل من العربية الى البراى لكن علية الطباعة لا يوجد حد لعدد مرات تكرارها .و لقد تم الان بواسطة هذا النظام تحويل و طباعة عدة وثائق و مطبوعات و سنتمكن قريبا من نسخ الكتب المدرسية و الجامعية و كل المطبوعات المهمة و هنا تظهر اهمية النظام في مجال التعليم و ستجدون مع هذا التقرير مطبوعات بابجدية براى.

الـــدعم المتحصل عليه:

انجز هذا المشروع بتعاون مع اساتذة مكفوفين بمدرسة العاشور الجزائر الذين بذلوا جهودات كبيرة اثناء تصميم وتطوير المشروع و شجع من طرف وزارة الحماية الاجتماعية و منظمة المكفوفين و عدة مدارس للمكفوفين و قيم المشروع على انه مشروع قيم يخدم المكفوف و البصر ليس فقط في الجزائر وانما في كل البـــلاد العـــربية.

التطـــــــــوير:

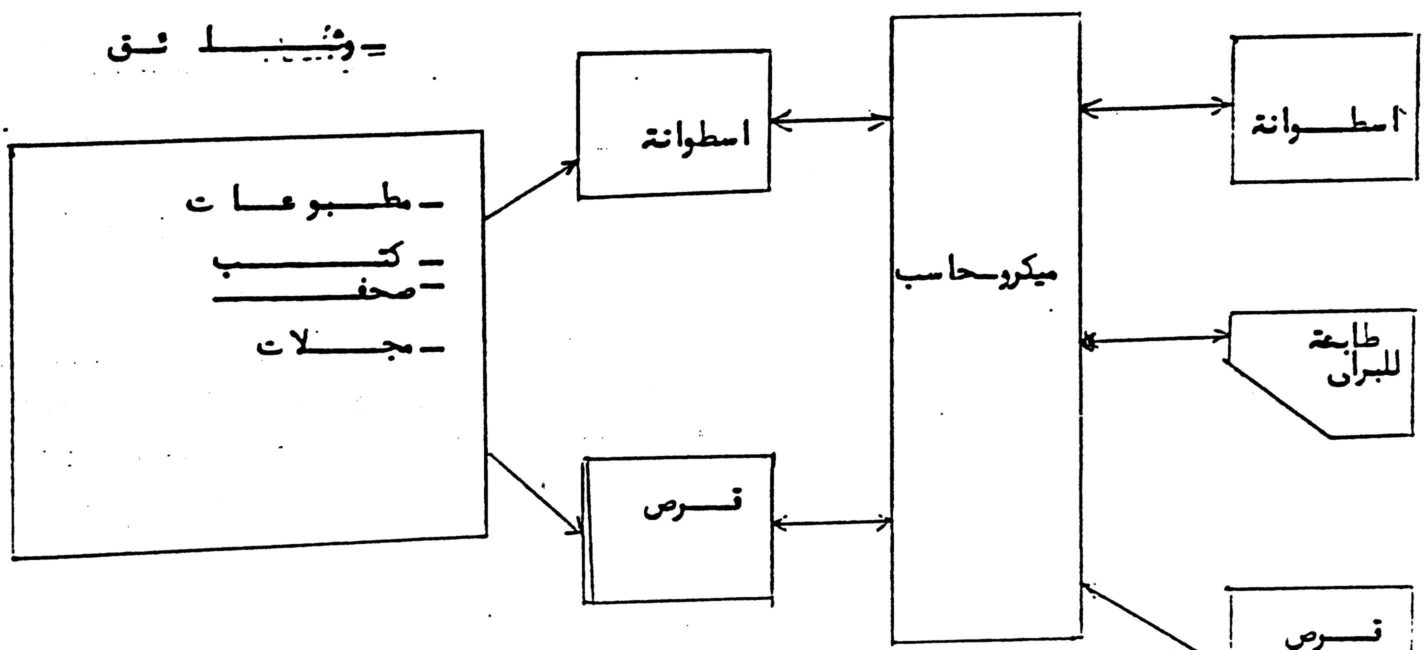
- نلاحظ في تقرير الامم المتحدة لبرنامج عشرية المعوقين (: 1983-1992)

الفقرات (64-66) التركيز على النقاط التالية:

النظـــام المنجـــز

نظام آلية برای هو نظام يقوم بتحويل النص العربي الي نص بابجدية برای (الكاملة/المختصرة) دون اللجوء الي مساعدة مختص حيث لا يقوم المستعمل البصر الا بادخال النص العربي بواسطة لوحة المفاتيح ثم يحصل على نسخ مكتوبة بابجدية برای عن طريق الطابعة الملحقة بالنظام او يتم تخزين النص على اسطوانة لستغلالها فيما بعد .

مـــخطط توضيحي لنظام



ـ ان عشرة بالمئة من الاطفال في العالم معوقين ، و هؤلاء المعوقين لهم نفس الحقوق في التعلم الى جانب خدمات خاصة ، لكن بالامم النامية نلاحظ ان اكثرية الاطفال المعوقين لا يستفيدون من خدمات خاصة و لا من تعليم اجبارى على غرار بقية الاطفال .

ـ لا ينظر بعين الاهمية للامكانيات و قدرات المعوقين و لا توجد ضوابط تحمي و تنمي هذه القدرات و منها نقص الاجهزة و الوسائل التقنية المساعدة و الاساتذة المختصين و سياسة لتعليم الاجبارى في اغلب الـــدول . لتطبيق هذه التوصيات و الحصول على نتائج تخدم الهدف المنشود " مشاركة كلية و تكافؤ فرص " كانت ابحاث مخبر معهد الاعلام الالي و لازالت و هنا المخبر يقترح نظام الي علم مساعد لتدريس المكـــفوفين .

النظام الآلي العلم المساعد :

النظام يحوى عنصرين رئيسين :

01ـ نظام لتعليم بواسطة الحاسب الالكتروني

02ـ ادوات مساعدة للمكفوفين

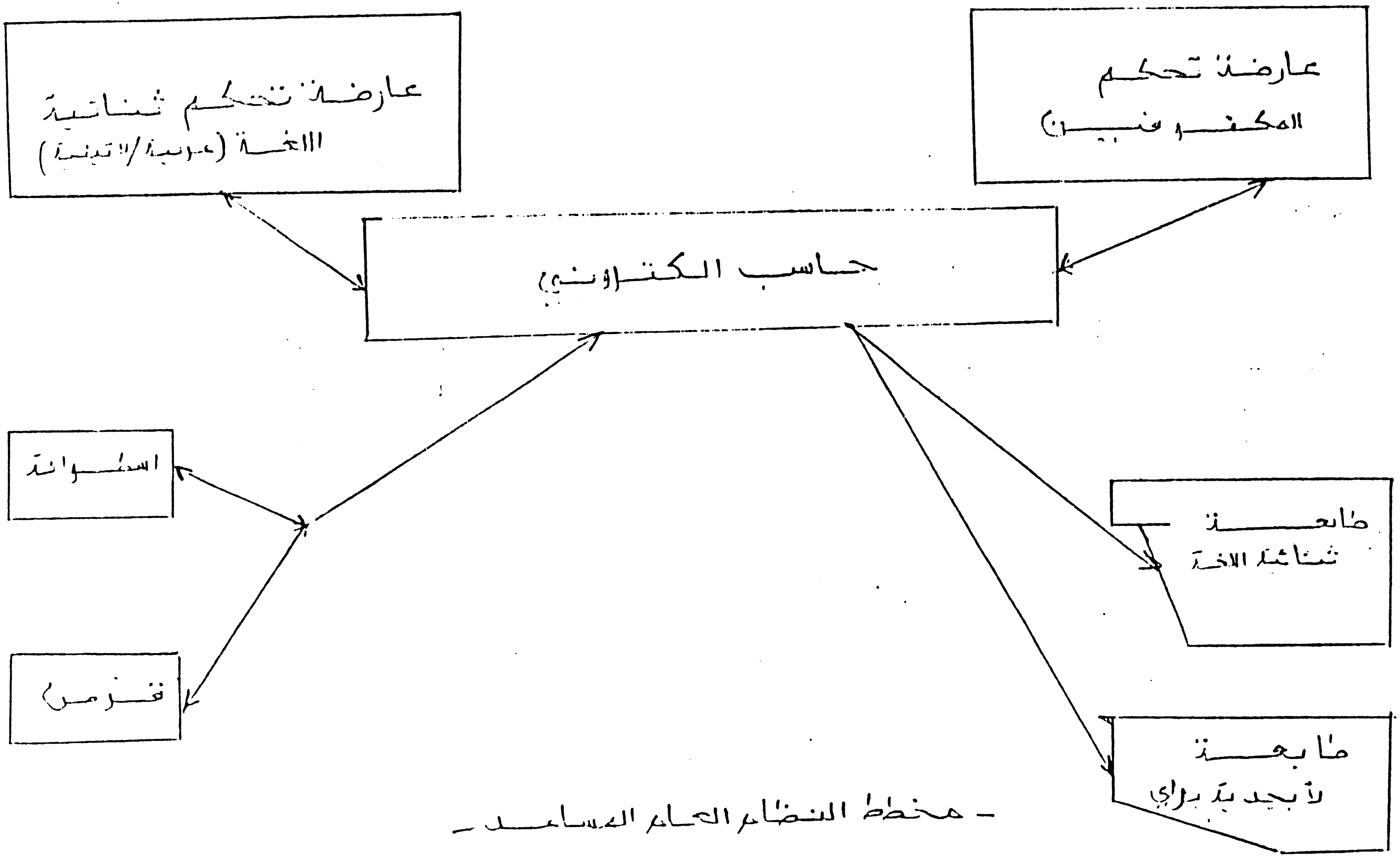
نظام التعليم بواسطة الحاسب

الهدف الذى نرمي اليه من وراء هذه الابحاث هو المساواة و تكافؤ الفرص للمبصر و المـ في التعليم و التكوين و استغلال التكنولوجيا المتطورة المتمثلة في الحاسب الالكتروني ، ان استغلال هذا النظام يسمح للمكفوف بدراسة المواد العلمية بنفس درجة و مستوى المبصر ويسمح للاطفال المكفوفين تعلم ابجدية براى المختزلة .

الاجهزة والادوات اللازمة :

ـ ميكروحاسب الكتروني مزدوج (عربي /لاتيني)

ـ شاشة خاصة للمكفوفين



- مخطط النظام العام المساعد -

النشاطات و الاحتياجات المستقبلية:

لانجاز و تطوير الانظمة و للوصول الى الاهداف يجب اداء الاحتياجات و القيام بالنشاطات التـــــــالية:

الاحتياجات:

- وثـــائق و معلـــومات تقنية
- قطـــع و عــــناصر الكترونية
- اجهزة تطوير لبناء نماذج للاجهزة المقترحة والتي هي على بساط التجربة والتطوير
- منـــح للابحـــاث
- حـــوافز مـــادية و معنوية لتشجيع الباحثين في المخبر

النشاطات:

- عقــد تربصات قصيرة لتقريب المفاهيم و شرح اهمية الاعمال لمستغلي الاجهزة في البلاد العـربيـــــة و العالم الثالث بصورة عــامة
- اجراء اتصالات مع مخابر اجنبية لتبادل الخبرات و المعارف
- ايفاد باحثينا لتعرف عن قرب على اعمال المخابر العربية و الاجنبية
- دعوة باحثين عرب و اجانب مختصين في الميدان للاحتكاك و التعاون

... .

الخـــــاتمة:

لتقدير اهمية الموضوع يكفي ان نعرف ان بعض جوانبه التطبيقية ستخلق ثورة في استغلال ابجدية

برای بعد الكشف على بعض المضامين:

مجال التعليم

- محكم نصوص لا بجدية براي
- طابعة خاصة للبراي
- نظام لتطبيق بواسطة الحاسب (مجموعة برامج تطبيقية)
- برنامج لتحويل النصوص المختزلة الفرنسية /الانكليزية
- برنامج لتحويل النصوص المختصرة من الفرنسية / الانكليزية
- برنامج لتحويل نصوص البراي الى نصوص عربية عادية

الاجهزة التقنية المساعدة :

يجب اجراء بحوث ودراسات وانجاز وتطوير عدة ادوات لبلوغ الاهداف المطنة :

1- تصميم وانجاز ميكروحاسب للمكفوفين بسيط انتكلفة

2- تصميم وانجاز نظام لتعرف ومعالجة الصوت البشري

3- تصميم وانجاز نظام ادخال آلي لنصوص البراي المرمزة الى الحاسب الالكتروني وذلك لزيادة سرعة الادخال والغاء الوسيط البشري المتسبب في الاخطاء والبطء!

تطوير قاموس للبراي العربي لمختصر

ان استعمال البراي المختصر سيربحنا ثلث مساحة الورق حاليا ولكن بتطوير القاموس ومعالجته بالحاسب سيزيد ربحا في المساحة يصل الى النصف وتوفيرا للجهد والوقت،لذا فنحن بحاجة الى تبني هذا الاقتراح من طرف هيئات ومنظمات وطنية واقليمية ودولية.

مخطط توضيحي

مثلا الكتب المدرسية ستصبح بات اد وافرة تحت طلب المكفوف ،مواضيع الامتحانات والمسابقات ستنسخ بابجدية برأى . وفي ميدان الاعلام فالمكفوف كالمبصر سيطالع جريدته صباحا و يتصفح مجلته ظهرا وفي الغد القريب سيقرا المكفوف مجلات ونشرات البنك والبريد والتامين كالمبصر

وبمان البراى المختصر هو تكثيف لمنظومة فان استغلاله في الاتصالات السلكية واللاسلكية سيخلق ثـــورة في تقنيات و تجهيزات محطات الارسال /الاستقبال والاقمار الصناعية لما يوفره من تكاليف وزمن وامكانية تكثيف الارساليات ،وهناك تطبيق اخر لا يقل اهمية وهو استغلال تقنية البراى في تخزين البيانات في بنـــوك المـــعلومات وذلك شرط وجود تجهيزات طرفية تحول المعلومات الى شكلها الاساسي

لـــذا فكل الجهات الرسمية والمنظمات الوطنية والإقليمية والدولية هي مطالبة بتشجيع وتمـــويل هذه المشـــاريع ووضع تحت تصرف باحثي المعهد الجزائري للاعلام الالي كل الوسائل الضرورية لانجاز هذه المشاريع وبلوغ الاهداف المنشودة

....

SOME COMPUTER ASSOCIATED TECHNOLOGIES FOR THE HANDICAPPED

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DR. LINAH HABBAB A:-BANNA

LOGOS GENERAL SYSTEMS INC.
WASHINGTON D.C., USA

1. Introduction

1.1. Scope of the paper

For most people technology makes things easier. For the handicapped, technology makes things possible. For many years now, computers and computer technology have been utilized to increase the independence and improve the quality for the handicapped individual. "The recent explosion in the availability of personal microcomputers has perhaps no more important benefit than in special education and rehabilitation". (Foulds, 1982 , p.155) For the handicapped person, the micro computer is nothing short of a miracle. (Goren, 1984, p.4) Even if a person has use of one hand or just control of an eyelid, can input data into a computer keyboard and communicate with virtually anyone with little or no assistance.

"Just a few of the benefits now available include a microcomputer aided robotic arm which permits quadriplegics to feed themselves independently; computerized classroom management systems that enable teachers to tailor curriculum to individualized education plans; a talking wheel chair which helps nonvocal persons to communicate with others...computer programs for the immediate translation of written material into braille..."(Nave, Browning & Carter; 1983, p.iv) and many more devices already exist to aid the handicapped.

This paper is a survey of these and other similar technological developments that assist the handicapped individual as an instructional resource for learning and as a personal aid. The paper attempts to focus on two aspects of the technology. The first aspect is the input technology. The second aspect is the output technology. We would like to point out that the scope of the technology, available today, is considerably greater than these two aspects and what we shall attempt to cover in this paper is merely a select sample to demonstrate changing trends.

1.2. Handicapped person

A handicapped person, has been identified by Marariou, as the individual who is not able to perform at the same level of proficiency as the majority of the population due to physical, mental and/or emotional disability (1984 p.168). The United Nations states that the handicap is "an estimate of the loss of opportunity with respect to educational attainment, occupational mobility and the like, experienced by an impaired person". (1986, p.8)

The size of the population fitting this definition is sizable and the type of disabilities leading to handicap are varied, born into or acquired through trauma. Depending on how you categorize the handicapped, this population has been estimated between eighteen (18) and thirty (30) million people,

for instance, in the United States. A study presented at a special workshop on education and employment of the handicapped sponsored by Institute of Electrical and Electronic Engineers (IEEE, 1983), referring to the same country, reports that, "... 20 million people in the US (are) affected by some sort of physical disability and another 300,000 (are) born each year with some degree of mental retardation...". (p.iii).

2. The computer

2.1. Impact of the microcomputer

Investigation into the utilization of the computer for supporting the handicapped dates back to the early years of computer development. It was recognized early, that special, often customized, programming of the computer to make it usable for, and by, the handicapped is needed. Microcomputers were to perform a dual role: to help the handicapped individuals perform tasks denied to them, and ,that, they must be physically modified to provide access to all the common general purpose software available to any computer user.(Vanderheiden, 1982) Yet, the majority of the software available for the handicapped has been that which provides a specific function, rather than that which modifies a standard program.

Time magazine (September 22, 1986) estimated that in 1986, alone, the number of disabled Americans using computers, principally doubled from the preceding year to 40,000 users. The speed with which new devices, systems and software are being generated, is reminiscent today, of the peak years in the development of the personnel computers for the the general public. The elimination of some of the technical and economic inhibitions has made the computer more readily available to the handicapped persons.

2.2. The benefits of the computer

Vanderheiden, (1982) the present director of Trace Center for Research and Development reminded us that,

> "It would be impossible to quote an exhaustive list of the special functions microcomputers could provide for disabled individuals. Almost any aspect of human activity that has been impaired could potentially be aided to some degree through the use of microcomputers as processors, manipulators, or controller". (p.2)

Researchers (Gloet, 1983; Morariu, 1984; Hofmeister, 1983; Jones, 1984; Hanley 1984; Apostoles, 1985; Jerome, 1985; Elting & Raimondi, 1984; Goren, 1984) seem to agree that some of the special functions that microcomputer can provide the handicapped individual are:

1- As a special educational tool. Particular attention is

given to Computer Aided Instruction (CAI) in dealing with students requiring special attention. The slow rate of response of severely handicapped would allow the individuals to practice lessons independently and at their own pace. "Boring and repetitive drill and practice routines are no longer a burden for the teacher, and the computer never loses its temper, even with slow learners." (Gloet, 1983, p.20) The severely handicapped, in learning subjects as chemistry, physics, etc., would be able to experiment and manipulate. Computers would ,also, be the adaptive teaching aid needed to respond to a specific handicap - as the need to see, read, write, and take notes;

2- As an effective evaluation device for the mentally retarded;

3- As an effective communications aid for the vocally impaired and in speech therapy;

4- As a specially designed input devices, like remote keyboards and input attachments, to enable cerebral palsied and high-level quadriplegics to access the computer;

5- As an effective office device for supporting clients and students. The handicapped uses the computer as a productivity tool and as a beneficiary of office automation;

6- As a rehabilitation tool. Computer programming is offering a specially adaptive vocation for the handicapped persons. Statistics show that many handicapped persons trained as programmers have been able to compete well in the job market.

7- As a facility to access specialized databases for information that otherwise might have been impossible for the handicapped to attain. These include oral and/or Braille databases that provide the visually impaired person with access to daily news and information;

8- As a classroom management tool to enhance the ability of the special education teacher. Individualized curricula adaptations needed for the learning of the handicapped person, are now feasible. The utilization of artificial intelligence, especially expert systems, for instruction and diagnosis and assessment of individual is providing the better ways for educating and training the handicapped person;

9- As an effective aid for the individuals with severe motor impairments in providing special devices like robotic arms and computerized wheel chairs; and,

10- As sensing devices enabling the severely handicapped persons, who can only move their heads or their eyes, to have access to and communicate with the machine.

3. Computer adaptations

3.1. What is adaptation?

Four classes of adaptations of the general purpose computer are possible. One, The adaptation of the computer for the physically handicapped; two, the adaptation of the computer for developmental handicapped; three, the adaptation of the computer for the special education teachers; and, four, the use of embedded computer systems in devices that are used for handicapped purposes. Some physically handicapped persons develop other forms of disabilities. They have to utilize more than one class of technology. Considerable overlap in the technology exists among these classes of adaptations, especially in the software technology aspects. We are focusing in this paper on the adaptations of the computer for the physically handicapped persons.

The adaptation of the computer for the physically handicapped involves, hardware and software. The hardware adaptations are at the input and output devices level. The software adaptations include several components that are discussed below.

The adaptation of the hardware is necessary to provide the means of communications and interface between the physically handicapped and the computer. The physically handicapped can use the computer, if special input and output devices, are available to provide the means for user-machine communications.

Often the introduction of a new input or output device involve, in addition to hardware, the development of special software to "drive" the device. The driver software insures proper interface of the device with the rest of the operating environment. Other software components might also be needed. This software is usually developed to process the information in a manner which translates the in-flow or the outflow information properly to interface to standard software applications.

The introduction of a peripheral, an input or an output device, to be used in adaptations of the computer for the purposes of the physically handicapped, therefore, involve three new elements. The hardware device itself (e.g. speech recognition device for input, speech synthesizer for output, special keyboard for input, or Braille printing device for output). The software that "drives" (i.e. driver routines) the specialized hardware to enable it to interface with the rest of the computer.

Often, in order to provide the handicapped computer user with the ability to use a standard package of software, an additional software component is required to translate the information. The form of the information expected by the packaged software is different than the that produced by normal input or output instructions addressing these devices directly. It is, therefore, necessary to provide a software interface to translate the form of information used by the devices into a form used by

the packaged software.

3.2. Example of an Adapted system

For example, a speech recognition input device provides a person with the ability to orally communicate, with a limited set of commands with the computer. The input device captures the oral communications and transforms the spoken word into an ASCII string of coded characters for use within the computer. The string of characters produced by the speech synthesizer might resemble a string of characters produced by keyboard. If that is the case, then the same string can be feed directly into a general purpose software like a spreadsheet or a wordprocessor. The handicapped person, that need a speech recognition device to communicate with the computer can then access these software packages and use them in a manner similar to a general user does.

If, as generally is the case, the coded character string that is generated by the speech recognition device is expected to imprecisely reflect the intention of the user, then a filtering and feedback hardware/software (e.g. mouse emulating or keyboard emulating devices) is needed before admitting the string into the general purpose software. In many applications that might mean either echoing the input into more than one form for the user to make a judgment or using more advanced form of processing software to filter the generated character string. The echo of the input speech command is produced through a speech synthesizer output device and through a Braille output machine. (Brandenburg & Vanderheiden, 1987)

The functional software could be developed specifically for the purposes of the handicapped. The structure of such software usually contains the necessary component to filter the incoming coded stream of information or generate the outgoing stream of information in a manner which is directly adapted for the specifics of the output devices. For example, the Kursweil reading machine is an integrated computer system that uses special scanners and speech generators to read printed text. The software that drives these input devices as well as convert the scanned characters into spoken stream of output is an integrated software that uses its own recognition routines and filters (Kamensky, 1983).

4. Input devices

4.1. Keyboard adaptations

Many of the standard input devices are usable for the purposes of the handicapped persons. They are used either with minor modifications or with mechanical adapters that enable the handicapped person to control and manipulate these devices. For some handicapped persons, special input devices are created to facilitate their communications with the computer.

Among the devices that have received considerable attention

in the modifications is the standard keyboard. The standard keyboard being, by far, the most popular input device was a natural candidate for enhancement and/or modifications to meet the needs of a sizable portion of the handicapped. Keyboards designed with large characters, different distribution of characters or equipped with mechanical controls are in common use to meet the need for some of those with limb impairment or motor system impairments. Keyguards and keylatches to inhibit the use of some keys are, also, common. These are, usually, inexpensive accessories or software that modify the keyboards for the particular purposes of a handicapped person.

A technically interesting development is the foot operated shift controls. These enable the user to use the foot to press one of the control keys and hence use only one finger for all the keys. Similar functions are provided by the lock control software that modify the function of the ALT,CTRL, and ESC keys or software that allow keyboard macros to be entered and invoked with one key. (Brandenburn & Vanderheiden, 1987; Gloet, 1983)

4.2. Speech recognition systems

Speech recognition technology has demonstrated considerable progress over the past two decades. Devices and products assembled from the current technology have limited capabilities. These, usually, either understand a limited set of vocabulary, one or two voices or simple sentence structure. A new generation of voice actuated devices was introduced in the market over the last five years. These devices are not only economical, but, also, effective in use if the vocabulary set of the environment is well defined, which is the case for many applications for the handicapped. (Design News, October 24, 1983) Dragon systems, for example, last year introduced a software enhancement that increases the ability of the computer to recognize human speech. The software is good enough for limited dictations and very effective for the command set of many Software (Wall Street Journal, November 18,1985; Design News, October 24, 1983).

The field of voice analysis and speech recognition is an active area of research. And in particular, artificial intelligence research on the understanding of natural languages. Linguistic research on the structure of the spoken language or limited grammar languages, is also, progressing considerably. An interesting product of such efforts is a software product developed by North Texas State University able to interpret the guttural sounds of the speech-disabled persons (Datamation, January 1, 1985). The early versions of the Fifth Generation Computers early versions expected in the 1990s, are projected to realize far more effective speech recognition systems.

The progress of the technology, though limited in comparison to the aspirations and potentials of research, has yielded some very innovative products. A Computer Aided Design (CAD) station using a speech recognition system to enable the handicapped to use the capabilities already been introduced in the market. The

workstation allows an engineer, by talking into a microphone, to add dimensions and annotations, change drawings, and zoom out to check the work.

An innovation of potentially far reaching dimensions for the handicapped is the voice actuated robot. This robot may eventually be able to manipulate small objects for people with muscular dystrophy, cerebal palsy, blindness or other disabilities. The robot is being developed by a joint program of the New England Medical Center and the Tufts University. (New York Times, August 10, 1986). The robot is equipped with a voice recognition device that is able to receive oral instructions and translate them into commands to a robotic arm attached to it. The robotic arm will be able to lift and transport small objects in answer to the command of a person.

4.3. Sensing devices and systems

Perhaps the most innovative and striking advances are in the field known as sensing applications. Special sensors are being introduced which are able either to read the eye movements, read the lip movement, or even read head movements. The obvious implications of these technologies that sense movement is vast for the handicapped, particularly for the severely handicapped. Ashahel Engineering is marketing a flexible muscle movement sensor based on piezo film that allows a handicapped person to activate lights, electric typewriters and computers by minute eyebrow or mouth movement (Modern Plastics, June 1985).

The sensing technology has expanded in a multitude of directions yielding systems that were not possible to imagine in the past decade. A 1984 product is an eyeglass that help deaf lip-read. The eyeglass is controlled by a 1-lb microcomputer, connected to the eyeglasses with a microphone and light emitting diodes on one of the lenses. The computer analyzes what is received through the microphone and relays speech cues designed to distinguish syllables or words that appear identical to a lip-reader. The bearer then positions the cues so they appear beside a speaker's mouth in order to differentiate syllables and words. (Time, September 22, 1986)

Medical Equipment Distributors have designed a Morse code interface. The interface is activated by the user's lips, facial muscles or hands. (Design News, September 19, 1983) Resus, of the Netherlands, introduced a head-movement-operated typewriter for use by the handicapped. The device is designed to be used by the severely impaired persons actually working as programmers. (Electronics, May 5, 192)

5. Output devices for the handicapped

The speech synthesizer is perhaps one of the better known devices. The generation of speech technology is more advanced compared to voice synthesis technology. It is possible to use vast vocabulary in a machine stored dictionary to "read" in a

legible manner sets of messages, commands and fairly complicated text. Several speech synthesizing devices exist today in the market that range in price from US$ 2500 - US$ 10,000. depending on the versatility and advanced functions included in the packet. These devices are used as a general output devices for the blind, in therapy and in training and in education.

Blind programmers are using, today, Braille input keyboards with a speech synthesizer for output. The programming performance of these programmers is, on the average, highly competitive with the general population of programmers. One software, called PC Speak, is able to load in the memory. It captures the output to the standard output device and transforms it into a spoken output. Programmers are able not only to write programs but to use standard packages such as wordprocessors and spreadsheet in their work. (Goren, 1984)

Reader machines for the blind are becoming in wide usage. These include text readers that generate the output in voice, such as the Kurzweil machines. (Kamentsky, 1983) A Special input keyboard is designed to enable a blind person to control the movement of the paper and to instruct the computer on which part to read. The user listens to the output in the form of synthesized speech. Machines that employ Braille printers and "screens" which generate through vibrations erasable sensations of Braille characters are also commercialized. (Brandenburg & Vanderheiden, 1987, pp. 103-111) An associated product is the development of the a computer terminal specifically designed for the visually impaired persons which can be used to transfer computerized information at a rate comparable to that of ordinary users of terminals. (Plastics Design Forum, April, 1983)

The Blissymbole's learning and communications is a meaning based symbol system. The system is used to assist illiterate handicapped individual with a speaking disability. The system is based on a set of graphic symbols that are used to rapidly develop a system of communications between the handicapped and the computer. The handicapped uses any means of pointing to the symbols to express himself to the machine. The Blissymbol system is highly interactive, uses graphics and requires only software to make the ordinary PC computer useful for establishing communications with the reading and speech impaired system. It can be used to eliminate illetracy as well to provide an environment for drill and practice. (Wertz & Wertz, 1983)

An interesting innovation to make the micro computer an effective assistant of the handicapped writer was patented in 1985. The program displays a list of words from a vast dictionary. It allows the user to point to terms they want. The program integrates that in the body of a text being created. (New York Times, December 21, 1985) The system does not require a keyboard or any hand written source for the user to write using the computer.

6. Other technologies

6.1. Software

The most important underlining technology that is effecting the growth of other technologies for the handicapped is the software technology. The software development is what is limiting, at this moment, the utilization of far more capable hardware devices. Regretfully, most of the available educational software has still little advantage over a well-illustrated book. Though, considerable effort has been spent in developing the software that converts small PC's into educational enhancement devices, much remains to be accomplished to be considered good educational software. The handicapped user who could benefit greatly from good software is more affected by this failure of the software developers than is the average computer user. (Friedlander, 1983)

As the number, variety and complexity of programs increase, various professional institutions and associations have established some criteria to identify the 'schoolworthy' software products. Current criteria evaluates what is 'schoolworthy' for the students, in general, and not the learning disabled student, in particular. And what might not be considered 'schoolworthy' for the mainstream student, might be for the student with learning disabilities 'schoolworthy'. Research, has shown, that Computer Assisted Instruction (CAI) software that might be labeled as dull, repetitive, unchallenging for the general student, can be very effective for teaching the handicapped. (Johnson & Van Dusseldorp,1984, p 132) While little software has been created expressly for use of the student with special-needs, some of the existing software, does seem to, lend itself for use in remedial work, in individualized learning plans, and in one-to-one teaching.

The software technology that will enable the handicapped to use the microcomputer as everyone else is becoming more and more essential to help integrate the handicapped in the daily routines of society.

6.2. Information systems for the disabled

An important development associated with the proliferation of computers adapted to the needs of the handicapped, is the development of databases for the handicapped. Tele-information systems that are accessible through a personal computer are a reality today. The computers are usually fitted with a speaking program, like the PC Speak, described earlier.

For example, the Vu/Text is a data base which contains eight major daily newspapers. It is also connected to a number of other bases as an associate service. The database provides the information in a text form for the general subscribers. However, an experiment using PC Speak, was able to retrieve from the data base and receive it in oral form. Blind people now have the possibility of reading daily newspapers through such a service,

or a modified form of the service that will enable them to reach information that, so far, has been available to the physically able. (Goren, 1984) ABLEDATA, is another example, of a database supported by the National Rehabilitation Center at the Catholic University of America. It is a national computerized database with an information network covering over 4000 commercially available aids and equipment useful to disabled persons.(Design News, September 19, 1983)

6.3. Artificial Intelligence and expert systems

Applied artificial intelligence work is effecting the systems being developed for the handicapped. Natural language processing is showing promise for a new voice recognition and conversational systems. The work being conducted in robotics is already providing for robotic arms to be used directly by the handicapped, or robotic systems to be utilized for the support of the handicapped. A promising product which employs some artificial intelligence is the computerized wheel chair. The chair is actuated by voice control or by manual controls. It can be moved, steered, and raised using these controls. It stops automatically when the microcomputer senses danger ahead. (Asian Wall Street Journal, June 30, 1986).

Expert systems for special education, for evaluation and for therapy are providing promise to drastically improve the support to the handicapped and to improve the productivity of the teachers and trainers. Among the expert systems addressing learning disabilities is CLAS.LD EE and CLAS.LD MI developed by Hofmeister and Ferrara. (Parry & Ferrara, 1984, p.10) In response to a series of questions posed by the computer program, the user inputs the psychological and educational information gathered by the assessment team. Then the assessment information and rule-based logic are combined to output a classification for the student. Expert knowledge, built on the opinions of recognized authorities in learning disabilities, with more and more assessment, leads to finer and finer scrutiny until the nature of the problems has been pinpointed.

7. Concluding remarks

7.1. Economics

The evolution of economic microcomputer bases systems, advances in voice recognition, speech synthesis, natural language recognition, robotics and expert systems are placing the foundations of a new revolutionary devices for reducing the effects of biological, mental and emotional disabilities. Humanity is reclaiming the creative power persons inhibited by the disabilities and by their talent from contributing to the betterment of human life.

The systems and devices explored in this paper are only a small part of what is proving to be an expanding field of achievements and technological advances. In spite of these

achievements these technological innovations are far from resolving but a small part of the problems of removing the effects of disabilities. For one things they remain costly systems, even after the great reduction of the cost of the microcomputer. Often cost-effectiveness cannot be demonstrated by purely profit based market research. Research, development and production of these systems have to be supported on the basis of human needs and on the basis of the limitless value to humanity and society when disabled persons become able innovators and producers.

7.2. Psychology

A dimension that requires attention and exploration is that of the psychological impact. Brooks (1984) expresses that impact in stating that,

> "... although the computer offers a wonderful array of opportunity here, it could also be perceived as a threatening, inhuman force. Thus, the professional has a responsibility going beyond installation of the computer-based adaptive devices. 'They 'should remember that there are people who have difficulties in accepting and utilizing general adaptive devices. ... The sheer power of the computer to change lives must be considered". (p.48)

7.3. The Arab countries

Computer aided systems for the handicapped in the Arab countries face added difficulties. Arabic processing, textual, oral and spoken language has to undergo massive analysis in terms of oral, spoken, scanning and other forms of processing of the language. This is necessary to develop systems that will aid a large part of the handicapped. The second complicating factor is the customization aspects of the technology. The technology requires two levels of customization. Customization, for one, usually performed at the laboratory or the factory that requires technological innovation needed to improve the ability to adapt computer technology to meet the needs of the disabled. And, for another, the customization applied by the trained personnel working with the disabled that requires some adaptation for each individual case to access to computers or other equipment. These two level of customization require a well developed technical know-how base to be effective.

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Glossary

Adaptive device: A device that assists a person, usually with a disability, to perform a task; may be custom-made to accommodate an exceptional limitation.

Application Software: A program written to serve a function or solve a problem not related to the operation of the computer system.

Blind: A person with total loss of visual image through light and shadow perception.

Legally blind: A person with best correction who can see at 20 feet what someone with normal vision can see at 200 feet. Peripheral vision is at an angle less than 20 degrees.

Partially blind: A person with best correction who can see at 20 feet what someone with normal vision can see between 199 and 70 feet. Peripheral vision is at an angle less than 30 degrees and images are fuzzy.

Cerebral Palsy: A neurological disorder manifesting partial paralysis and lack of muscle coordination with symptoms of spasticity. Visual, hearing, and speech defects may be present.

Computer Assisted Instruction (CAI): A computer software application in which a computer is used to conduct instruction using techniques such as text screens, graphics screens, etc.

Computer Managed Instruction (CMI): A computer software application in which a computer is used to sequence, branch, test, prescribe, and track progress and report on branching.

Courseware: Educational applications software used for teaching and learning.

Disability: A limitation or loss of use of a physical, mental, or sensory body part of function, or a physical or mental defect or impairment that a person is born with or that is acquired by accident, injury, or disease.

Friedreich's atazia: An inherited disease with hardening of portions of the spinal column. It manifests itself in lack of coordination, speech impairment, and paralysis, usually of the legs.

Functional limitation: Restriction of physical or mental functions that hinder an individual's ability for self-care.

Handicapped: Those with significant limitations in using specific parts of the environment.

Hardware: The actual machinery or physical parts of a computer (mechanical, magnetic, electrical, or electronic devices.)

Input: The data that go into the computer to be processed.

Input Device: A mechanical device used to transmit the input to the computer.

Machine Readable: Data that are directly readable by the machine, such as from disk and tape, or documents specifically prepared for Optical Character Recognition (OCR).

Manual dexterity: The ability to coordinate one's hand or hands to accomplish basic or specific tasks, such as collating or dialing a telephone.

Menu: A list of the features and/or segments of a program which is displayed on the screen and from which the user can select the next program option.

Microcomputer: A computer designed primarily for use by one person.

Monitor: Or Cathode Ray Tube (CRT). An output device that gives a visual display of text, numbers, color and/or graphics from a computer.

Motor control: Control of gross or fine movements, usually of the hands, arms, and legs; seen in the ability to move smoothly from one manual task to another and to grasp and manipulate objects.

Muscular dystrophy: Disease characterized by progressive deterioration of muscle.

Operating System: Software which controls the execution of computer programs and which may provide scheduling, input/output, control, data management, and related services.

Output: Data that have been processed in a computer and are transferred to an external device (e.g., printer, screen).

Paraplegia: Paralysis of the legs resulting from injury to the central nervous system; may include weakness of the arm(s).

Peripheral: Any piece of equipment, distinct from the computer itself, that allows, the computer to communicate with the 'outside' world.

Program: A logical set of instructions written in sequence to written in a language that computer can 'understand' to make the computer perform a task or solve a problem.

Quadriplegia: Paralysis of both arms and legs. Sometimes the arms and/or hands retain some function.

Software: A (set Of) program(s) written to process data and solve problems.

Spastic: A muscular disorder manifesting exaggerated stretch reflexes and muscle spasms; associated with cerebral palsy.

Special Devices: Special purpose peripheral equipment.

Tacticle: Describes an object that can be perceived using the sense of touch.

Terminal: A device, usually equipped with a keyboard and some kind of display, capable of sending and receiving information over a communication channel.

Traumatic injury: The wounding of an individual by external force, such as by an automobile accident.

User: A person or organization who utilizes the hardware and/or software components of a computer system.

Voice Input: Voice communication with the computer system. Voice transmission of data to be processed.

Voice Output: Audio transmission of output from the computer system.

"THE CHANGING WORKPLACE;
THE EDUCATOR'S VIEW"

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U. S. A

CONTENTS

Previous speakers have clearly established the premise that technology, especially computer based technology, will be extremely important within the labour market of the future. As an educator at the Maryland Rehabilitation Center, I am justly proud of the innovative approaches in utilizing micro-technology to aid the disabled clients we serve.

It may be advantageous to the gathering to discuss the Maryland Rehabilitation Center. The Center, an organizational unit of the Maryland State Department of Education, Division of Vocational Rehabilitation, provides multi-disciplinary services to disabled persons, particularly those who are severely disabled. The Center provides services for handicapped persons who seek to prepare for gainful employment. We are one of only ten comprehensive, vocational rehabilitation centers in the United States providing a wide range of services to disabled persons. Included among those services are: vocational evaluation; medical functional evaluation for the severely disabled to determine readiness for specific vocational services; physical restoration services; vocational skills training; training for independant living; and a variety of other medical, vocational and support services tailored to the needs of the individual.

The Center serves persons with various disabilities which may be the result of accidents, injury, or disease process as well as those with emotional and development disabilities. The average age of our client group is 31 years of age. The client served, by major disabilities, are as follows:

1. Spinal Cord Injury.
2. Deaf and Hearing Impairments.
3. Orthopedic Impairments.

4. Amputations.
5. Mental/Emotional Disorders.
6. Other Disabling Conditions.
7. Blind and Visual Impairments.

The programs and services provided attempt to address and resolve the rehabilitation problems experienced by disabled persons. Those problems vary with the individual and their specific disability. The services and programs are planned and implemented to meet individualized needs associated with defining and/or undertaking vocational rehabilitation services. Some problems which may need to be addressed are: medical management of the disease process; development of independant living skills; mobility or communication techniques and skills; development of functional skills required for activities of daily living;

development of skills required to maintain positive mental health. Through our comprehensive services, the Center strives to identify and help address an individual's specific needs in these areas so that vocational rehabilitation goals can be assessed, established, and successfully achieved whenever possible.

The Center, in existence since 1972, already knows from the experience of the last five years that disabled people can compete successfully for most electronically based employment situations because specialized adaptive technology can provide them with necessary alternative means for accessing computers. We provide, through our Technology Resource Office, technical support services, including assessment services, system design, training and consultation to disabled individuals.

Individuals with motor impairments can accomplish data entry tasks through a host of alternative techniques. A switch can be fabricated so that it can be activated by a specific voluntary action. Blinking eye movements and controlled breathing are examples of methods frequently used by severely disabled individuals to indicate the selection of alternative choices which are displayed sequentially on a screen. In this manner, these individuals can use " keyboard emulation " to enter data into a computer for the creation of files that then can be spoken by a speech synthesizer to be used in vocal communication, or be printed as correspondance on reports or be run as a computer program. The expected increased use of speech recognition systems within the school and workplace of the near future is providing many motor impaired individuals with thoughts of increased flexibility.

Blind individuals, on the other hand, who have no problem with data entry when using a standard keyboard, require means to access the information normally displayed visually on a video screen or printed page. Braille displays and synthesized speech systems are now becoming common. The Center utilizes synthesized speech systems for blind clients in vocational assessments and in the Computer Programming Vocational Training Courses. These devices are beginning to provide the highest level of equality between blind and sighted clients. The devices allow the clients to compete equally for education and employment in tasks requiring independant access to and manipulation of alphanumeric information. The computer neither has prejudice nor preference as it relates to the physical characteristics of the individual user or in the way the information is displayed. Micro-computer, braille, and speech displays are providing the visually impaired with newly acquired independance.

Dependant upon the prioritized needs of each disabled individual, specific pieces of software and hardware should be recommended as part of a total system. Initially, a structured, organized method is needed to identify the most consistent and voluntary control available for accessing a micro-computer (i.e., single finger typing or headstick activation). This evaluation should identify the client's residual motor copacities through a process of assessing sample target surfaces which characterize commercially available interface devices. Specialized design and customization of each system is necessary at this point to ensure provision of the exact interface system the individual's needs dictate.

Located within the Center's Vocational Training Department are various applications of main frame and micro-computer usage to enhance the employability of our clients. Sponsored jointly by the Center (MRC), The Johns Hopkins University (JHU) and International Business Machines (IBM) clients participate in a project to select, train, and place in employment disabled persons as computer programmers. The projects are designed to produce qualified business application (COBOL) programmers with the knowledge and experience to become productive on the job in a very short time. This objective is met by ensuring that each graduate has successfully completed and tested a significant number of practical programs during training, and in most cases, has participated in a 4-8 week internship in a business environment. Some employers have evaluated these graduates as equal to college hires with a year's experience in programming. Upon successful completion of the training course, the graduates receive thirty (30) undergraduate college credits. The two principle ways these projects differ from most other vocational rehabilitation training efforts are (1) control is vested in a council of responsible managers from business and industry to ensure that the training is designed to meet current employer needs and that the graduates meet the standards for employment established by the community's employers. and (2) a single individual, the Project Director, who in this case is myself, is responsible for ensuring that all necessary services are provided so that the student, when he graduates, will be ready to go on to employment. The project has been in existence since 1976 and enjoys a 90% placement rate of clients into employment.

The Center administers the project, arranges for funding, provides support services to the potential students, who may be either physically, mentally, or emotionally disabled, and provides all peripheral hardware and adaptive devices. The Business Advisory Council provides guidance to project personnel, identifies technical needs, specifies student selection criteria, participates in

development of the curriculum, evaluates student capabilities and training effectiveness, and provides internship training sites.

Clients entering the Center's training programs are tested in reading and math prior to or upon entry. A micro-computer learning laboratory equipped with the most current software and two computer-equipped classrooms compliment the skills of staff members.

Those clients requiring assistance to achieve success in their training programs are recommended for remediation in the micro-computer learning laboratory. The features of computer assisted instruction (CAI) which are seen as advantageous for instruction with disabled students include individualization and self-pacing, immediate feedback about performance, consistent correction procedures, patient repetition, carefully sequenced instruction, frequent student responding, and motivation. Yet, most of the existing software fails to provide these features in programs for disabled students. Much of the software used within the lab is authored by the instructor to the specifications and requirements of the individual client. There is a supply of prepackaged commercial software that is utilized after careful screening and evaluation by the remedial instructors. The combination of authored software by the instructor and prepackaged commercial software, used intelligently, indicates that the disabled students perform at the level similar to that of their non-disabled peers.

Located within the Drafting Training Program is a Computer Assisted Drafting (CAD) program. CAD has several advantages for the disabled over traditional drafting methods. The most evident advantage is an increase in productivity, which in turn allows the disabled employee more time to experiment and be creative. Computer Assisted Drafting is much more precise, and the plotter output easier to read than traditional drafting procedures, particularly for the design of mechanical parts, electrical circuits and floorplans. Since 1982, the technology has advanced light years. Many micro-computer CAD programs now have as many features and capabilities as the micro-computer systems of the 70's had.

The wave of technological change has had its greatest impact in the employment areas located within the office and business environment. Micro-computers have replaced, and in some cases, enhanced basic clerical and accounting employment opportunities. The Center's Clerical and Accounting Training Area has seen an explosion of electronic technology. Many functions which men and women performed in the past can now be taken over by machines. First, simple mental tasks, then more and more complicated mental tasks.

Some of these tasks are performed better than they are performed by humans. This change has had a tremendous impact, both positive and negative, on the training and employment of disabled individuals. Disabled with visual or orthopedic impairments were excluded from training and employment in many office occupations. With the advent of speech synthesizers, touch keyboards, and other adaptive devices utilizing micro-computers, these disability groups are now entering the work place able to compete with their non-handicapped peers.

In conclusion, I am very enthusiastic about the prospect for additional vocational training and employment opportunities for the disabled through the increased utilization of appropriate technology. The social issue of whether we should mainstream disabled workers into the workplace and everyday society has already been answered. The public and private sectors are beginning to join hands to address the problems that confront us in the field of rehabilitation technology to provide support for the needed innovations. We can make today's dream of technology tomorrow's reality of employment.

"COMPUTER AND ELECTRONICS FOR THE SERVICE OF THE HANDICAPPED : AN OVERVIEW FROM THE U. K."

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My first encounter with computers occured twenty years ago, when I was attempting to remove myself from an institutional environment into normal society. Of course, to do this, I required a source of income. Given my degree of disability, computing seemed the only profession to afford me any opportunities.

Having decided on this course, I went on to take a degree in computer studies, thinking that this would open all doors. Of course it did not and I quickly discovered that even with the correct qualifications, companies were not willing to take, what seemed to them a risk in employing me. In other words, my outward appearance, completely destroyed all of the intellectual qualifications which I had obtained.

I also discovered that Personnel Officers and Management had difficulty, in the time available, to overcome their shock of being confronted by me and be able to carry out their normal interview. The interview situation is something which disabled people have to learn to cope with. My technique, as soon as I had realized the problem, was to initiate conversation which covered all the topics which I knew that they would want to be informed on. In a sense, I was interviewing myself. This seems to put people at ease much faster and I would therefore recommend it to other disabled people. This is an indication of the state of the art in Britain then and now as before I even managed to get into an interview situation, I had to prove my ability to the outside world.

I therefore decided that my only course was to set myself as a consultant and attempt to obtain the contracts which could be undertaken from home. This was when I had my first stroke of luck, in that I heard that the Ford Motor Company were looking for programmers to work remotely and had even considered the possibility of employing disabled people. I contacted them and was soon undertaking major projects for them. Having realized and proved the potential that the computer profession held for the disabled, I decided to try and spread the word to other disabled people, and it was then that I became involved with the British Computer Society, which was the professional body in Britain in the area of Data Processing. The British Computer Society comprises of local groups and groups of special interests and in 1975 the Specialist Group for the Disabled was set up, with myself as Founder Chairman. It caught the imagination of many high level members of the Society and soon became one of their most thriving groups.

The Specialist Group for the Disabled was set up by the British Computer Society in 1975. Its aims could be summarized as follows :

1. To further employment opportunities for the disabled.

2. To enlighten potential employers, and the general public, in the special needs and abilities of the disabled.

3. To investigate and develop ways in which computer technology can aid the disabled in education, training and employment.

4. To assist manufacturers to increase the marketability of their products by consideration of the needs of the disabled.

5. To act as the main collector and disseminator of information in the field of computers and the disabled, so that the currently fragmented resources and efforts in this field may be brought together and be more efficiently used.

6. To initiate and foster links with similar organizations internationally.

A seventh has since become obvious, this being, to make the disabled themselves, and those caring for them aware of the potential that the computer holds for them and we are working hard to correct this oversight. I still find it incredible that the majority of the disabled in Britain and even more for those responsible for caring and advising them are, totally ignorant to the potential of computers. Hopefully, giving presentations and organising conferences we will be slowly breaking down this ignorance and in doing so, increasing the quality of life of many disabled people.

A quick word on the aims : I place great emphasis on the fifth as I am very aware that much effort and resources are being used on projects which overlap. When writing this paper I tried to think of an example of this, and did not have to look very far I found one. On a notice board at GEC Computers Services, where I now work, there are two posters, and if I tell you about them, you will quickly notice that the subject matter of the two presentations is inter-linked. In Rayleigh I was giving a lecture on high technology with regard to the disabled, and on the same night in Chelmsford a lady from the psychology department of St. George's hospital in London, was giving a lecture on how computers can help dyslexic people. What you may not realise however, is that Chelmsford and Rayleigh are only a few miles apart. Much effort had been put into two events, both of which could have merged and made one exceptionally interesting presentation and the audience would not have had to chose

between attending one or the other. This is clearly what we wish to avoid in the future.

Going back to aim two, this is very important and fairly obvious in its meaning. We had some success in fostering this aim - e.g. in 1985 the London Borough of Lameth, which is the largest government employer, initiated a staff recruitment scheme which was positively discriminating towards disabled people. Such was the success, they now employ 36% registered disabled. And in consequence they won an award which our country presents to employers who demonstrate a desire to employ the disabled.

I don't want to labour over these aims, but if anyone wants to go into them more deeply, perhaps we can talk afterwards.

The group has come a long way in the last twelve years and this year will be holding our third Annual Conference, which have been very successful in the past. This year's program will look something lik this.

As you see there is a very powerful lineup, and if anyone here is interested in attending this conference, please contact me. Apart from organising conferences and seminars, the group also initiated special twelve week courses held at a college for the disabled and paid for by Manpower Services Commission, which is a British Governmental Department with the brief of assistting people of all natures, not only disabled, to find employment and necessary training for that employment.

When discussing disability, it first has to be defined. There are many disabled people who dislike such terms as : "disabled", "deformed", "spastic", or "criple". I actually do not want to enter into this scenario, as I believe society, in order to assist the disabled, needs to be able to identify them. If we therefore reject all terms that allow this, then I really don't see how we can expect the kind of assistance we require. I like to use the word "disabled" because to me it best describes my condition, in that, I am disabled or unable to do most of the physical things one would normally expect to do, and the things that can be done are rarely done in the conventional way. i.e., I use my nose to work a keyboard, or turn a page. Professor Heinz Wolfe, of Brunel University believes that everyone can become disabled at a particular time, that time being when they do not have the tools they require to achieve a physical objective. He gives the example of somebody with a flat tyre. They are unable to lift the car and change the wheel unless they have the enabling tool of a jack and spare wheel. He and I extend this argument to the state that the computer is a tool which enables the disabled be it

permanent or transient undertake physical tasks which without such technology, could not be achieved. Perhaps I can now show you some slides which show disabled people being enabled by computer technology.

The majority of queries received by the Chairman of the British Computer Society's Specialist Group, are enquiries on the possibilities of finding work. Even now, with the vast demand for data processing personnel, it is not easy to find employers who are willing to take on the disabled. In Britain there is a quota system which states that any company that has more than twenty employees must include 3% of registered disabled people in their work force. This would seem to be a good system, but the legislation is such that many loop-holes are available to employers, for example, nonaccessibility, and it also places the demand on disabled people to become registered. I believe that is a moral obligation that we should adhere to, but their is a counter opinion which questions the necessity for the disabled to highlight their differences. To me this is not being realistic.

Why is it then that a computer and the industrial and economic conditions are right for the disabled to take full advantage of all possibilities of employment ?... We now live in an information economy.

Why then should we and you be interested in the plight of the disabled ?... Firstly as innovators it is an intellectual challenge but a more down to earth view is that one in ten of the population is, or will become disabled and it is therefore in our interest that we pursue the methods of using High Technology to the advantage of the disabled.

What are the factors that are involved in producing a society in which disabled are more able to take an active role ?...

THE INFORMATION ECONOMY

The advanced civilizations of the world are moving into a post industrial age which we characterise as an information economy. It is generally accepted that until the end of the eighteenth century we had an agricultural economy which em-ployed the vast majority of the workforce, and that since that time, following the industrial revolution, we have lived through an industrial age dominated by the manufacturing industries.

We know that the number of people employed in the manufacturing industries is actually falling in spite of the

continually increasing output to meet increasing consumer demand. The number of production workers employed in the United States dropped from 55% to below 45% of the total workforce between 1960 and 1985. There is unquestionably a fundamental structural change taking place in employment patterns and this is commonly quoted as being a move from the manufacturing sector to the services sector.

However, a more fundamental insight into the structural change through which our society is passing is derived from looking at the number of people who are employed in the information or knowledge industries. These industries were defined originally by Machlup in the 1960 as :

1. Education.
2. Research and Development.
3. Communications Media.
4. Information machinery.
5. Other information activities.

These definitions have been enlarged since Machlup's original work, but there is general agreement that the number of "information workers" is rising rapidly as a total percentage of the workforce. Certainly a substantial proportion of the people attending this conference are information workers - that is, they are not involved in making or producing things, and they are not amongst the 2% of the population now engaged full time in agriculture. If an information worker is defined as someone who spends his working hours taking in information and giving out information, then this obviously covers a large percentage of the working population. Just as agriculture is no longer people intensive, so manufacturing has become capital intensive rather than people intensive and the whole emphasis is on reducing the number of people employed to even lower levels in order to improve productivity and output.

There is a movement of the workforce to the so-called service sectors, but automation is acting as an opposing force to reduce the number of people employed in repetitive service functions. Just as the petrol pump attendants, lift attendants and shop workers have been reduced in number in the past by automation, so will the bank clerks and many other service employees be reduced in the future by the relentless advance of automation, computers and robotics. More and more people will earn their living by handling information and this holds out great hopes for the future employment of the disabled who were so grossly disadvantaged by their physical disabilities in the agricultural and industrial areas.

INFORMATION IS POWER

We have to learn to think of information as a valuable resource, just like any natural mineral wealth or any highly complex manufacturing facility. Information is one of the basic sources of wealth; any organisation which is rich in information will be rich indeed. That is true for individuals, for organisations and for actual nations. Japan, for example, is a powerful nation, despite its lack of any indigenous fossil fuels, significant mineral wealth or substantial areas of agricultural land. Japan is rich in the resource of information workers, and this enables it to compete so effectively in world markets.

The advanced nations are now distinguished not by their capital resources but by their knowledge resources. These resources consist of experts, scientists, designers, librar-ies, information centres and new technologies including all the means of storing, retrieving, communicating and processing information.

Exactly the same argument applies to individuals or groups of individuals as applies to whole nations. To the individual, information is power. Anyone with good information resources will fare better in the modern world than those unfortunate individuals deprived of information.

It is obviously still true that money or capital is an important aid to achieving one's desires, but increasingly a knowledge of the system, how it works and how to gain maximum advantage from it, becomes increasingly important. Disabled people can easily be disadvantaged by being deprived of information, and their lives can be made miserable if those are in control of the information exploit their power in an uncaring or insensitive fashion.

INFORMATION AND THE DISABLED

The information about the disabled starts with the Register of the Disabled Persons. There are of course countless other registers, lists, files and data bases which give information about the disabled or about matters of interest to the disabled. For example, lists of hotels, restaurants, or even public toilets, which are readily accessible to people in wheelchairs, are extremely useful to people in wheelcahirs who are much poorer if they do not possess the information contained in such lists.

The medical records relating to an individual contain very useful information which is almost invariably prepared manually and is unaccessible to the individual concerned.

There are frequently errors, delays and even losses of patients records, which cause great discomfort to the individual concerned. All the information contained in the bulky handwritten files can be stored on a plastic card, the same size as a credit card but with an embeded chip. Smart cards for this purpose are available in the States at a cost of under $ 10 and enable the patient to carry around with him his own medical record in a form which is not easily readable by unauthorized people, which can be duplicated extremely easily, updated easily and can be carried around by the patient himself.

An even elementary example of the use of information to give a better deal to the disabled, comes from the use of simple appointment systems when dealing with doctors in the National Health Service. We must all have wasted many hours in waiting rooms on the assumption that a doctor's time is much more valuable than our time, and that we are not entitled to the information of when the doctor will actually be available to see us. In contrast he or she at all times has the information of our availability, because we are kept waiting until he or shebegins to see us.

Information about our infirmities and disabilities is so imperfect, and obviously will be improved in the new info-rmation era, as we learn to value information and treat it more intelligently. But in addition, information about our physical attributes, or personal qualifications, are kept on numerous lists which could be made more accessible to people who would like to have the information in order to improve our circumstances.

INFORMATION IS NEGENTROPY

It is not simply coincidence that information scientists refer to information as negative entropy or negentropy. Entropy is a rather abstract concept used to describe disorder or randomness and there is a natural law, the second law of thermodynamics, which states that in any closed system, entropy increases. In the absence of information, there tends to be chaos. Where there is good information, that information can be used to make order out of chaos. The thermodynamic analogies are that if there is friction, there will be wastage of energy and where the friction can be removed, there will be less wastage of energy. Again, where there is streamline flow rather than turbulent flow, there will be no wastage of energy. In all these instances, the avoidance of energy wastage can be achieved by the correct use of information.

CONNECTIVITY

If information is valuable to the individual, it is even more valuable when shared with others. There is synergy which makes the collective knowledge greater than the sum of the individual parts. Groups of individuals should be encouraged to pool their information by comparing notes and this means the establishment of an efficient information network. A simple matching operation of the requirements on the one hand, and the available resources on the other, can be an extremely productive use of information sharing.

Disabled people are one of the groups who stand to gain most from participating in information sharing of this form.

HOW I VIEW THE FUTURE !!

Firstly, it is obvious that we must take the more forceful approach on the lines from the system in West Germany. This works, and works in an industrial and economic climate which more or less pertains throughout the whole of Europe. We cannot afford to take the softly-softly approach, it is too easy for people with power to bury their heads in the sand.

Secondly, with the increased efficiency of Telecommunication, it is becoming increasingly possible to work remotely from the work place. This has problems and I would like to scantilly cover a few of them. Let's take a look at the concept. The term "remote working" is used to describe an individual working in a location other than a normal head or branch office of an employing organization. Although three levels of location can be considered, an individual may well operate in a mixture of these. The three levels are :

1. Working primarily from home, either speaking most of the time in the home, or using the home as the base from which to operate.

2. Working primarily in a "Neighbourhood Work Centre", shared between a number of people accessing different markets.

3. Working primarily from a "Satellite Work Centre" in which everyone is working for the same employer whose main operating base is some distance away.

There are three main employment arrangements which are currently used for remote workers:

1. Employment on a regular basis by an employing organisation.

2. Acting as a freelancer either individually or through some agency.

3. Running their own business providing some service or product to a market.

Although telecommunication increase the scope and range of opportunities to work from home, working from home does not necessarily require expensive linking arrangements. At present there are three levels of linkage :

1. A permanent leased line; this is potentially the most costly arrangement and only justified for a few specialist tasks.

2. Dial-up ranging from telephone, telex or view-data links to dial-up terminal access to some host system(s).

3. No telecommunication links with all communication undertaken by person or by post.

The following is a list of possible activities :

a) Provision of educational software to schools.
b) Business graphics.
c) Administration of examinations.
d) Database of hotels.

e) Typesetting.
f) Book-keeping.
g) Personnel records.
h) IT related : Programming.

Working from home, is not the same as working from the office, and a number of issues need to be addressed for a remote unit to be successful. The issues are not only associated with the individual in the home. Though aspects of the tasks that are undertaken in the office are also affected, and there are also issues concerned with work planning and schedulling contracts of employment and so forth.

Not everyone is suited to home working, because the home worker is not observed by colleagues or supervisors there needs to be a higher level of self-motivation.

Normally in an office when something goes wrong, there are others around who can sort it out. This is not the case with a remote worker who needs to be far from self-sufficient in coping with and resolving problems as arisen.

In the office end of a remote working unit, there needs to be a clearer understanding of who does what than if everyone is in the same office, because of job issues that arise or procedural uncertainties that cannot be resolved by casual conversation. This understanding should be reflected in the job specification and operating procedures. Reporting arrangements are also affected as the relationship between the remote worker and the manager is inevitably different from that which exists if they are on the same site. Remote working raises a number of questions about productivity and work scheduling. There is indication that a remote unit can be very productive, more so than a person undertaking a comparable task in the office. Some of this productivity is achieved by the remote working being able to choose when to work.

A strong link with the office activity, however, can constrain this freedom, either because of the need to contact colleagues working to office hours, or through some disruption of the linking arrangements.

Work sharing also becomes more difficult. In a busy office, someone who has a slack period can often help out colleagues. Heavy loads can be spread around. Such work sharing is much more difficult for the remote workers. Working from home, affects, and is affected by the daily routing of the household. Different individuals will cope with these circumstances. A homeworker needs to be more disciplined, with set hours of work, and the family needs to understand this and be tolerant.

Members of the family need to be included when planning to set up a remote unit, and allowance should be made of the impact of family pressures. This is typical of the organisation required. There is a temptation to over invest in technology for remote working. A sensible appraisal of what the job really requires, will usually result in an economical and cost effective solution. These are the basic needed for remote working. This shows how to avoid over investment temptation. On the other hand, because of the remoteness from the offices, equipment may be required which a comparable office working would share with a number of others.

... flexible working for employees.

... freedom of residential location - workers can choose where to live regardless of where their employer is based.

... environmental advantages such as :

- relieving urban congestion.
- increasing standard of living.

... providing a quick solution enabling a rapidly growing company to cope with the load.

The benefits of remote working includes :

1. Enabling those not able to travel to a central site of work to be gainfully employed : women with young children and the disabled.

2. Providing opportunities for those in remote areas from wealth-creating city centres to be employed and help to stop rural de-population.

3. The saving of office space and thereby reduction in the organisation overheads. It should be noted however that there may be economies of scale of individual's homes to be heated (this argument is negated if wife, husband and/or children are home anyway).

4. Savings in worker's travelling time and cost.

The above are the basic steps to successful remote employment.

Returning to the overall subject of computer technology and the disabled, I believe we have not touched the surface of robotics and voice recognition in connection with disability. Feeding and fetching, are just two of the functions which spring to mind. I also find the notion of recording books on disks an exciting one, as to my knowledge, nobody has yet produced a page turner which actually works. The idea of being able to read, refer backwards and forwards with complete ease is something that disabled have always longed for and we can now give it to them. I am sure there are many more applications but without the necessary finance they will never come to fruitition. For those who are interested, I have two videos on special equipment provided by British Telecommunication and Research and Development of voice synthesis, being developed at the city university in London.

In West Germany for example, they have a quota system, as indeed we do in Britain, however, there are fundamental differences. Our legislation states that any company employing more than 20 people, has to include 3% registered disabled in its workforce. There are many loopholes, such as inaccessability and statements implying that they are

employing more than 3% disabled, but most of them are not registered. The latter point is something I feel deeply about, as I am of the opinion that, although in a free society, one ought to be able to become a registered disabled or not, there is a moral obligation on the part of the disabled to register.

In contrast to this, the West Germans have a quota system of 6% disabled regardless of the number employed, and any company falling below the quota is penalised by having to pay a levy of £ 50 per person per month on their shortfall. These put into a central pool, which is already funded by both unions and government. These funds are then used to build work places and rehabilitation centres using the most modern equipment. This is important, as it allows the disabled person(s) to go into normal commerce or indusrty, already being familiar with the equipment they are likely to use.

One example I saw in Munich, was a computer bureau, which was so successful that it could not cope with the demands being made on it; although the workers there work from the centre, there is a concious effort to involve them in the company that their project is being undertaken for, with at least one visit a week to the company, and participation in all the social activities.

Clearly then, the finance has to come from government, unions, and industries, which are not cooperating in attempting to meet the statutory requirement, and equally clearly, the legislation has to be made with the unfortunate knowledge, that the majority of companies are going to try and avoid the law.

I have painted a rather bleak picture of Britain, because, some help is available for buying equipment, or modifications of premises, however the maximum help available is £6,000, and this has an in-built chicken and egg situation, in that, this finance is not available until you have got a job or position, and that job is unlikely to occur until the equipment is available, and the disabled person can demonstrate their abilities to the full.

I therefore suggest that we, in common with many other countries, have a long way to go in providing what I would deem to be services inherent in any society, which porports to be civilized. Each of us are only on this earth once, and the quality of each life should not be governed by its cost to society.

Personal greed, however seems to have destablised the gyoscope controlling most of our moralities, such a phylosophy is extremely shortsighted. We have to stabilise

this gyoscope by emphasizing that in the western world, one in ten of the population will be affected by disability at some stage in their lives. This figure will increase as technology allows less mortality at birth and increases the average life span.

John Keats wrote, "beauty is truth, truth is beauty, that is all ye know, that is all ye need to know". The truth of the human situation is that beauty lies within the inner soul not in the external looks or abilities. If we, with the help of high technology, can release this inner soul, then logically we will create a more beautiful world.

As a closing thought, we must bear in mind, not to overburden the disabled person(s) with various forms of assistance, which will lead to undesirable situation of totally any-self motivation person(s).

CURRENT AND FUTURE TRENDS IN COMPUTER TECHNOLOGY FOR THE PHYSICALLY DISABLED WITH PARTICULAR REFERENCE TO ASSESSMENT AND THE PRESCRIPTION OF APPROPRIATE SYSTEMS

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CONTENTS

CURRENT AND FUTURE TRENDS IN COMPUTER TECHNOLOGY FOR THE PHYSICALLY DISABLED WITH PARTICULAR REFERENCE TO ASSESSMENT, AND THE PRESCRIPTION OF APPROPRIATE SYSTEMS.

1. INTRODUCTION.

1.1 Overview

Over the last few years there has been a tremendous increase in the use of computer systems in the world at large. In the main this has been caused by the rapid development of cheaper and yet very powerful machines called microcomputers which have reached the point where they can outperform many of the large computers of the last decade, and sell at fractions of the price.

There were many quick to exploit this revolution producing applications which were extremely useful in some cases, and extremely farcical in others. Amongst the former category, are disabled people who have discovered a new, and very powerful, tool to assist them in their lives. The machines have proved helpful to those who are in a wide range of disability groups covering the areas of physical and mental handicaps.

Long before the computer became popular, other kinds of mechanisms had been employed to help those with disabilities. Purpose built systems or devices had been produced which, whilst being very helpful, were, in general, more inefficient, more expensive, less versatile and less reliable than those currently being prescribed based around microelectronic or microcomputer systems. Examples that demonstrate this, are the old technique of using a larger than normal keyboard with a conventional typewriter to allow people with physical motor problems to produce text for letters, reports or everyday communication; as opposed to the newer technique of using an expanded keyboard connected to a microcomputer to give control of a word processor. The latter technique gives the user more functions, including perhaps control of devices in the immediate environment, but costs less in real terms than the original, dedicated, equipment.

The above developments mean that it is both reasonable and necessary that those who carry out assessments upon disabled people, be aware of the "state-of-the-art" with regard to the technological tools available to them so that the best compromise can be achieved between efficiency and cost. If a certain type of machine becomes available at a lower price, then it may become more viable as an individual aid.

In recommending systems, cost is obviously not the only factor that needs to be considered. Simply, the recommended device needs to tackle the most immediate problems of the client. This involves a careful examination of the problem, the situation in which the equipment must work, what software is necessary and the finance available. If it is important for the client

to be able to use a particular program, then that of itself, may limit the choice of equipment.

This paper will attempt to elaborate on these points, with emphasis on the problems of physically handicapped people of all ages and types, and will look ahead to the near future to try and decide how best organisations may prepare to meet the needs of their clients. Along with the above points examination will be made of the developing area of Information Technology (I.T.) to see what role it could play in improving the quality of the lives of physically handicapped people.

1.2 The Microelectronics Resource Centre, Dublin

In order to bring whatever new developments there were available, to the benefit of the physically handicapped people of Ireland, it was decided in 1982 to open a centre for the application of new technology in Dublin. The initiative was taken by the Central Remedial Clinic; a centre itself in existence since 1951 with a history of caring for disabled people. This unit, the Microelectronics Resource Centre, is now housed in an adjoining building called the Sir Basil Goulding Research Centre along with other research workers.

Further details of both the Central Remedial Clinic and other research work undertaken, and in progress, by the Sir Basil Goulding Research Centre, are contained in accompanying appendices.

2. SPECIFIC TYPES OF PROBLEM ADDRESSED.

Physical handicaps can be very different in consequence, and may arise from a number of different origins. Broadly, they may be placed in two categories, that of congenital handicaps and acquired handicaps.

By the term Congenital handicaps, it is intended to mean those which are caused either before, during or soon after birth. Disorders such as cerebral palsy, muscular dystrophy, spinal muscular atrophy and spina bifida would be included here.

People in this category may suffer problems of varying degree in motor control, spasms and mobility. Their somewhat uncontrollable movements coupled with the fact that they are often wheelchair bound, lead to them having problems in social interaction. The motor problems often give rise to difficulties in communication making life even harder for them. It is common for people in this group to have a degree of mental handicap or learning difficulty although, it should be stressed, many do not, and it would be a gross mistake to assume mental handicap without careful assessment. Many examples are present in every society where a person of normal or even superior intellect, has become imprisoned within a poorly functioning body, it is the task of the assessment team to analyse the remaining abilities and devise a suitable communication and operating tool.

The second of the above categories, that of acquired handicaps, covers those who have suffered accidents. People in this group often have an inability to operate large sections of their bodies making them either paraplegic or tetraplegic but usually, they retain the power of speech. This, of course, may not be the case, when the person is brain damaged in the accident.

In this instance the demands on the aid designer are different. A person who has been in possession of his faculties for a number of years, then suddenly looses them has already made a number of social contacts who remain with him, and has a clearer idea of what the aid must be able to do. Additionally, if indeed speech does remain, then that provides an extremely powerful means of communication hence going a great way towards relieving the social isolation.

Microcomputer technology can do much to help clients in both the above groups, although the approaches may be different. Systems must be available for a complete range of ages so that varied needs such as education, vocational and leisure may be met.

3. ASSESSMENT PROCEDURE.

The experience of the Microelectronics Resource Centre (M.E.R.C.) in Dublin, and indeed many other places, has lead to the opinion that an efficient assessment calls upon the skills of a number of different professions. It is important that the people comprising the evaluation team are open minded and good communicators, with each other as well as with the client.

The practice adopted in the Dublin centre requires that the client be medically referred to the Central Remedial Clinic (C.R.C) as a whole through the medical director. This allows recommendations to be made on all aspects of patient welfare, not just those relating primarily to the M.E.R.C. unit. Each new referral is discussed at a weekly meeting held between representatives of speech therapy, occupational therapy microelectronics and medical departments to analyse the information to hand and decide on an initial course of action. This may mean either calling for the results of previous tests from other centres, or arranging to have certain prerequisite assessments made. Examples of this could be the laying out of appointments for seating, speech therapy or psychological evaluation.

A standard form has been prepared for new clients to complete or, to have completed on their behalf. This is usually sent out soon after initial referral and is designed to provide basic introductory information for the clinicians, and to help the referring source clarify their requirements. A copy of this form is included in an appendix.

The weekly meetings referred to above, also serve as a forum to discuss the progress of other longer established clients. Decisions are made to continue, modify or abort programmes depending on the results of these discussions.

As soon as possible, the client is brought to the M.E.R.C. for assessment. It is not practical to have too large a group actually in attendance with the client since this causes atypical behaviour and produces an unwieldy group. Normally, a group of 2 or 3 people would meet the client. They would be drawn from microelectronics, speech therapy and occupational therapy; if necessary, appointments are then made for the person to visit others such as the doctor, physiotherapist or psychologist, however, this is not usually required. The session is informal, allowing the client and the team to get to know each other better and establish a rapport. The team would try to assess the person physically, and find out what it is that is most required by the disabled person. Sometimes, they seek a small portable aid, other times the requirement is for a larger, more powerful system. In some situations synthetic speech is helpful, in others it is not.

In the case of young children of pre-reading age, the centre often employs modified toys as a stimulus and as an assessment and practice mechanism. A range of toys to suit all ages have been produced in the centre and are loaned out on a toy library basis. This works well since children tire quickly of the same toy and look for a change.

Also with young children it is helpful to use machines such as moving pointer boards to decide what level of control they have over the controlling mechanism. The board can be decorated with all manner of pictures or symbols to test comprehension once control is established satisfactorily.

With older children computers are used in conjunction with games to decide the appropriate controlling technique, then, as the assessment refines, specialised programs may be used to accurately determine the most efficient combination of input mechanism and program speed. An example of this lies in the MSIP program produced by the Hugh McMillan Centre in Toronto, Canada. The name derives from the first letter of four key factors; Movement, Site, Interface and Position, and allows the clinician to systematically assess these in order to prescribe single-input interface controls.

Once the method of control is clearer, the appropriate system is selected for the requirements of the client. Many people initially seek a more efficient communication system whereas others need environmental control, mobility, vocational or educational assistive systems. These are examined in detail in the following sections.

4. COMMUNICATION SYSTEMS.

People with congenital physical handicaps, such as cerebral palsy, muscular dystrophy and spina bifida often suffer difficulties in communication due to their lack of precise motor control. Depending on the

level of disability and the situation in which the aid will be used, a number of approaches may be made.

4.1 Keyguards.

Modern computer keyboards are very sensitive to the touch. They have been designed so, to make life easier for the able bodied operator, with features such as auto repeat keys. Additionally, the keys are close together to allow speed of typing.

All this makes access more difficult for a person with gross and slower movements so it can often help if a shield or guard is fixed across the keyboard with holes cut into it to allow the operator place a finger or headstick through the opening onto the key.

If suitable, this is a cheap solution leaving the operator able to use the complete range of programs available for that machine, the only problem being that the keyboards of the various machines are not the same shape or size. It is necessary to have the means of producing new guards to suit new machines as cheaply and quickly as possible, since otherwise the disabled user cannot take advantage of up the minute technology, as others do.

The keyboard guard is cheap in comparison with other methods but does not tackle the problem of auto repeat keys. Sometimes, small modifications can be made internally, to either remove the repeat or slow it down. Sometimes this can be accomplished through software eliminating the need to open the machine.

4.2 Expanded Keyboards

Many machines have available an extra keyboard, specially designed to aid those with the above access problems, these are called Expanded Keyboards. This type of device needs to be specifically designed and produced for a particular computer and is more expensive than a guard. The expanded keyboard can be of greater help to the user since in addition to providing a guard facility, the keys are moved further apart, or expanded, to make it easier to distinguish between them.

Some computer operations require the employment of combined keys, e.g. shift, control etc., which are difficult for a disabled person to carry out. The expanded keyboard often uses inbuilt latches to hold down keys for a period of time, allowing the user to get to another key necessary for a combination of the above type.

In addition to all the above functions expanded keyboards can provide variable delays between key press and key acceptance. This helps to prevent accidental key contacts being registered unless the operator keeps the key down for a set time.

The computer is still capable of running all standard, unmodified software thereby leaving the user freedom of application choice. The disadvantage of this approach lies in the extra cost over that of a simple guard.

4.3 Switch Based Systems.

When the client is too physically handicapped to be able to use either of the two previous items, it may be necessary to resort to the use of switches as input mechanisms to the computer. Depending on just how disabled the person is, it may be possible to utilise several switches mounted at different sites around the users body. The number of switches can vary down as low as one, and they could be operated in a number of different ways e.g. hand, head, foot, knee, eye movement etc.

The assessment team must decide on the appropriate number, type and site of switch to be used. They must also monitor the situation carefully at periodic intervals to see if the level of control is deteriorating or improving and make whatever modifications are required. The M.E.R.C. have seen examples of both the above situations, i.e. clients who have improved their switch control skill to the point where more powerful systems could be used, and those who have deteriorated, usually because of their medical condition, requiring fewer switches and slower systems.

The computer can be made interpret the switch operations in many ways. The simplest and most common is to display an array of letters, numbers and symbols and allow the user to use their switches to scan through and select the character desired. Generally speaking, the more switches that can be used, the quicker the overall operation. If switch control is good and accurate, it is sometimes worth trying to use morse code input to directly select the required character. This method is quick, but requires that the user can learn the code in order to significantly increase the communication rate beyond that obtainable with ordinary scanning.

There are many specially written programs available, some at little cost, that can provide the scanning matrix, manipulate the resultant text and adequately print it. Details of some of these are contained in an appendix. Most, however, limit the switch operator to those facilities provided within the suite of programs, impressive as this may be, it is restricted, meaning that a disabled user can only choose software from a relatively small range, when compared to that available to the able bodied.

In an attempt to remedy this last problem, a number of programs have tried to produce a scanning or switch operating environment which allows character input into normal programs. These are sometimes termed "Ram Resident" or background programs and, while not perfect, they can be a very simple solution, easily installed on a machine, and easily removed if necessary. This is suitable to the needs of a disabled computer user at work, for example, since many employers are reluctant to have changes made to the hardware of their machines. The imperfection in the above approach stems from the fact that if a special program is installed, it uses space in the machine memory that may be required by a commercial application. This is often referred to as "non-transparent access".

A better solution, from the point of view of transparency, is to modify the hardware of the machine to interrupt the transfer of characters from the keyboard to the central processor, and allow switch generated input to be accepted. If carried out properly, it can provide fully transparent access, an example being the "Mod-Keyboard" produced by Tash, in Canada. In some cases two screens are necessary, one to allow the switch input to be selected, and one functioning as the normal screen of the machine. Difficulties can arise when the user has to move his head between the two screens, so other approaches use only one, and display the scanning matrix near the bottom. An example of this would be the "Adaptive Firmware Card" produced by Adaptive Peripherals, Seattle, U.S.A, which is designed for use with the Apple IIe computer.

Many of the systems outlined above function well for those who can only operate switches, however, it is quicker to be able to directly select the character required.

4.4 Alternative Direct Selection Techniques.

It is always worth exploring the range of direct selection devices available, before restricting the user to switch operation. At this point, it is assumed that the client is severely disabled otherwise one of the keyboard modifications previously described could be used.

Some time ago a system was produced at the Trace Center in Wisconsin, U.S.A. called the Long Range Optical Headpointer (L.R.O.P.) which is basically a small optical unit affixed to the side of the head which can be used to move a spot of light around a computer screen, when the operator moves his head. A second, auxiliary, computer screen displays a facsimile of a keyboard, and the operation is to move the light spot to the required character on the screen keyboard, pause, whereupon the character is accepted and inputted to the main program.

The system has been widely acclaimed, however, it has been the experience of the M.E.R.C. that patients who are disabled enough to warrant this, have not had the necessary head control to operate the L.R.O.P. The system has not been extensively tried in Dublin, however, and good reports have come from other places.

For some considerable time it has been hoped that it would eventually prove possible to produce a technique that would be able to determine accurately, the direction of a persons eyegaze. An American system called "Eyetyper" can do this, but is very dependant on the operators head remaining in a fixed position. Again the experience of the Dublin centre is that people suffering from severe physical handicaps, have trouble doing this. If an affordable system could be found to track eyegaze without being overly dependant on variations in head position, it would be of great assistance.

Lastly, the method outlined above in which switches can be used to send morse code signals to the computer, may also be considered a form of direct selection.

4.5 Voice Entry

Disabled people who retain good speech have a powerful communication mechanism left to them. Difficulties may arise in generating written text so communication devices are called for to fill this gap.

The obvious way to tackle this is to try to produce a computer that can understand, and distinguish between a number of words. The machine can then either print the text, or act upon spoken commands to control external devices. This technique is called "Voice Recognition".

Computers have been capable of carrying out this function, to a greater or lesser extent, for some time. They use a "Voice Entry Terminal" which usually needs to be trained to correlate the users voice patterns to the various words in the vocabulary. The system requires large quantities of machine memory so as recent computers with large memory size have been developed, the size of the available vocabularies have increased. Typically, a microcomputer based system would be able to discriminate between some 150 to 200 words but special systems are available, at high cost, with vocabularies of 10,000 words The latter machine was developed by the Kurzwiel company.

First hand experience has been gained on two systems, one based on an Apple IIe and more recently, one on an IBM PC. The Apple based system has a vocabulary of 82 words, and is an integrated set of programs allowing control of a word processor, a telephone controller and an environmental controller, and has been developed for a tetraplegic lady. The central voice entry terminal originates from California, U.S.A. Experiments are now being carried out on the IBM based unit.

In order that all possible text can be produced from a limited vocabulary, individual letters, numbers and punctuation are assigned representative words. For example: A is represented as "Alpha", B as "Ballon", C as "Charlie" etc., The exact words used are not critical, but should be sufficiently dissimilar to avoid being confused one with another.

The system performs well with the client and also, strangely, with others having somewhat garbled speech. The conclusion drawn is that the machine can identify the required character or word, as long as the utterances are reasonably consistent. If care is taken to produce a series of representative words which the operator can say most consistently, it should be possible to maximise its performance.

4.6 Speech Synthesis

If an examination were made of the types of communication used by able bodied people, and also where and how each type is used, it would become obvious that in some situations only spoken output will suffice. Speech provides us with a fast and accurate way of communicating, as well as indicating that attention is required. Unconsciously, a system or protocol has evolved where people speaking take turns and constantly, politely,

interrupt each other. Undoubtedly, if written communication were all that was available, the colour and quantity of communication would decrease. Much would change, indeed, if we had to declare war by post, there would be peace in our time.

Disabled people can lose much if they cannot carry out the type of exchanges requiring speech. In addition to the need for vocalisation, as described above, there are the obvious needs such as operating a telephone. Technology can help by the use of speech synthesizers, used in conjunction with communication systems as previously described.

Originally speech output systems began life as mechanisms which stored a finite number of words which could be called upon. Words could be strung together to form sentences, but the output was always limited by the vocabulary size. The quality of these limited vocabulary systems, is good; often producing voices clearly identifiable as male or female, and distinguishable as to accent, age etc. However, no matter how well researched a vocabulary may be, constraints are placed on the person relying on this as their sole method of communication.

The next group of synthesizers to arrive were the unlimited vocabulary devices. In this case a process was used to split up the written text into a series of sound "parcels" called phonemes One of the first, affordable devices of this type was the Votrax "Type 'n' Talk", which produced speech of lower quality than that of the previous, limited vocabulary kind, but was able to attempt pronunciation of any word. The speech output took on a robot like quality.

Both the above methods have been used in the Dublin centre; the result was a reluctance on the part of disabled users to the first, limited vocabulary synthesizers, due to their restrictiveness, and further reluctance to the second technique on the grounds of poor quality. People still required speech output in devices they planned to use in social situations, even though the above reservations were present.

One system in use in the M.E.R.C. gained universal acceptance, that was the DecTalk speech synthesizer, capable of producing identifiable male and female voices over an age range of a young child to a senior citizen. The DecTalk can synthesise emotions such as sadness and elation, and can output speech with inflexion to question or demand. The only disadvantage lay in the price, approximately US$4,000, a difficult figure to justify spending on individual prescription.

The cost of such devices is falling in real terms, leading to the hope that it will come within individual grasp soon. Additionally, a portable unit is now available permitting connection to a wheelchair in association with the other equipment necessary to form a complete communication system.

4.7 Portable Aids

Reference has been made to the use of communication aids in everyday situations. These could be social, or concerned with the activities of living such as shopping. To address these needs it is necessary to be able to provide assistive devices which are readily portable.

Mention has been made of the developing nature of technology and the fact that computers are becoming more powerful and smaller, making it easier to produce a computer based communication aid which can be used in a varied number of places. These systems may be built around commercial microcomputers, or may be purpose built.

An example of a computer which lends itself well to application in this area, would be the "Tandy Model 200" which, unlike many portable machines, has a large display screen, using liquid crystal technology which consumes only small amounts of power, thereby reducing the weight of batteries necessary. The machine includes a word processor, a spreadsheet, a scheduling program and data communication facilities; it may be used in a keyboard operating mode, with keyguard if necessary, or with a special program for switch operators.

There are a large number of purpose built, portable, communication aids some including speech output. Experience has been gained in the use of the "Light Talker" and "Touch Talker" systems both manufactured by Prentke Romich in the U.S.A. They are both best used in conjunction with a software package called "Minspeak" which allows user defined symbols to represent whatever spoken output sentence, or phrase the user wishes. The Touch Talker has a guarded keypad for finger operation whereas the Light Talker can be used in association with an optical headpointer, or a number of switches. Both these devices have found practical application.

5 ENVIRONMENTAL CONTROL

The provision of communication aids is a very important area of the work of the Microelectronics Resource Centre, however, there is also a major involvement in the production of suitable environmental control systems. These systems are designed to allow the disabled user become more independent in regard to controlling devices in his immediate vicinity, examples would be giving control over lights, radios, televisions, door locks, telephones and a method of signalling alarm.

The process and the reasoning may be examined under a number of broad headings.

5.1 Why is it Required?

Many people, particularly adults, take comfort from their independence and often like to spend time on their own. Further, it may not only be desirable but also necessary for a disabled person to be alone for periods

of time making it important that they be able to do a limited number of things for themselves.

A number of the clients of the M.E.R.C. actually live alone, some in isolated, rural locations and rely heavily on their environmental control mechanisms to perform routine tasks. Health authorities are increasingly seeking ways of removing disabled people from residential institutions and placing them back into the community, meaning that there is likely to be an increase in demand for all techniques which will help in this.

5.2 Implementation Techniques

Up to 5 years ago the approach taken to this problem, was to completely wire the living area of the user, with all controlled devices directly connected back to a central panel. The method of effecting changes depended on the the ability of the operator. This approach was costly and time consuming, the greater the number of devices, the worse the problem became, due mainly to the amount of wiring involved. Further, the control panel had to be specially constructed, and was additional to devices required for communication or mobility.

The trend in recent years has been to utilise the mains electrical wiring in a house to carry signalling instructions between the central unit, controlled by the operator, and the devices to be operated. Techniques such as Infrared control mean there is no longer a necessity to have wires leading to the operators immediate vicinity. Installation is quick, easy to expand or modify and less expensive.

Operation of the system can be by keyboard, switches or voice input recognition. Previously, reference was made to a voice input system developed for a tetraplegic lady; using it she is able to control devices within her home, operate applications e.g. T.V. controllers, and use the telephone. The mains switching is carried out using BSR power control modules plugged directly into electrical sockets, and addressed by number from the central controller. In this case the central unit is a commercial microcomputer but other dedicated systems are readily obtainable. For example the American system, "Butler in a Box" can respond to up to four different voices to operate lights, curtains and electrical appliances, and uses voice synthesis to communicate back to the user to confirm operation, ask for items to be repeated etc.

5.3 Telephone Control

An extension of the environmental control mechanism can provide the user with the ability to fully operate a telephone. This is an important addition since it readily allows communication between the disabled person and the rest of the world. By this means, help may be summoned, purchases ordered and social conversations held.

The voice recognition environmental controller, developed in the Dublin centre and referred to before, permits calls to be answered or initiated to any number. The user has a custom directory available and may add or subtract numbers to it. This means that commonly used numbers may be called by just giving the directory number.

If a cordless telephone is used the whole unit can be made portable thereby allowing the user freedom to move around in a powered wheelchair for example.

The DecTalk speech synthesizer readily interfaces to a telephone line providing a method of using the telephone for nonverbal individuals. Several prepared texts may be made to speed the generation of a message and sent by the communication system to the DecTalk and hence down the telephone line.

5.4 Integration of Several Units

When one considers that a disabled person may require several different types of aid it makes sense to consider ways in which they can be integrated. This maximises the use of equipment and thereby reduces the consequent cost. This was a factor in the design of the voice recognition system described already. It uses an Apple IIe computer, running appropriate software to generate written text, control appliances, switch devices and operate the telephone.

Some commercial systems give all the above abilities with the additional power to use the same input technique, i.e. switches, voice input etc. to control the mobility mechanism of the user. An example of this is found in the system devised by the "Du-it" company in America which provides a complete operating environment to the user, even if severely disabled, and is mounted onto a powered wheelchair.

6. EDUCATIONAL NEEDS.

A disabled child has the same right to a basic education as an able bodied one. The problem arises as to the best way of providing it. The normal school teaching process relies heavily on interaction between student and teacher; an interchange made more difficult when the pupil has difficulty in communicating. At the very least the conversation will take longer than normal and may have to be conducted through symbols or a communication aid.

In addition to the above problem the difficulties experienced by a disabled person make it much more likely they will miss school due to transportation problems, illness or required therapy. Whilst it is desirable to try to keep the student within a normal school if at all possible, there may come a time when this is just no longer a practical proposition and entry should be made to a specialised school, perhaps associated with a clinic so that medical treatment can be carried out with minimum disruption.

The Central Remedial Clinic school is just such a special teaching institution. It caters for some 160 physically handicapped pupils and attempts to provide the special care they require. Computer systems are used extensively throughout the various classrooms, both as communication devices and as tools for Computer Assisted Learning (C.A.L.). A large library of software has been built up suitable for use with a number of different machines in a number of different situations.

The introduction of these machines has proved an unqualified success despite initial teething problems. The pupils, and staff alike, needed time to come to terms with this new tool and be able to use it to its greatest advantage. Each classroom now has its own computer, chosen for the suitability of the machine to the type of pupils in that room, additionally, a database has been developed containing details of each program such as name, price, application area, source, machine and peripherals which can be used in conjunction with it.

7. MOBILITY AIDS

7.1 Impact of New Technology

To improve the mobility of a disabled person it is necessary to produce a better mechanical system of transport. Whatever benefits have been brought by new technology, have largely had the effect of controlling the mechanism in a more efficient manner.

There are many similarities in the processes of assessing a person for a communication aid, and seeking the most suitable controlling interface for a powered wheelchair. Many severely disabled people operate their mobility systems using switches or small joysticks with the speed of movement governed to allow the operator retain control.

7.2 Integrated Control.

The development of an integrated system allowing control of mobility, environmental control and communications is a fairly obvious process. The system referred to previously, from the Du-it company in the U.S.A., is just such an example. From their powered wheelchair, the disabled operator can control communications devices, the telephone, environmental devices and the wheelchair itself, all from the same input system; perhaps only a single switch.

The above approach will lead to a more efficient use of resources and a system which is easier to use, if it is necessary for the person to have many different kinds of assistive devices.

The Dublin microelectronics resource centre has also seen a developing need for a totally coordinated approach to the design of seating in conjunction with the planning of the control mechanisms. This is to allow seating to be right for control, and vice-versa.

7.3 Future Developments

It is possible that machines will be produced, perhaps using robot technology, that will be able to do more for a disabled person. If the equipment can perform more tasks, under control, there may be a reduction in the degree of mobility required. The same comments could be applied to the provision of enhanced communication abilities in that they too, remove the need to travel to the same degree.

The above situation can have both positive and negative consequences. Later sections will explore these in more detail.

8. VOCATIONAL NEEDS

8.1 The Necessity for Activity.

The results of people losing involvement in vocational activities are all too well known. It is desirable to have a sense of purpose and to be able to contribute to the community to the fullest possible extent. Naturally, therefore, a person with a physical disability can suffer the effects of a lack of vocational involvement on top of all the problems they already have.

For many years individuals have felt themselves to be in large part identified with their job, leading to loss of identity when that is no longer there. Again, those with disabilities suffer much since the securing of employment is more difficult for them than for others.

New technology can be used to assist in overcoming these problems if it can, in any way, help to remove isolation and give a sense of participation to those who are denied normal work lives through their poor communication skill or difficulties in mobility. The problems are not confined to disabled people, indeed, unemployment is an increasing problem for many countries, where the nature of work is changing and the role of employment is having to be reassessed. As practices change it may be possible for developments to help the disabled in addition to others.

In Ireland, three organisations have come together to form a group investigating the possibility of helping disabled people by the re-examination of work practices and the possible role of new technology. This is called the "Remote work, pilot study group" and it is composed of representatives of the Central Remedial Clinic, the Rehab organisation (responsible for the training of disabled people) and the National Rehabilitation Board (N.R.B>).

8.2 The Social Dimension to Work.

There is undoubtedly a social dimension to employment, often, the benefit of which is not appreciated until work ceases due to handicap, accident, redundancy or retirement. Reference was made already to the possible negative effects of using technology to eliminate the need for a disabled person to travel; the problem tends to be that the social aspect is removed resulting in a poorer lifestyle.

The experience of the working group in Dublin has lead to a very definite confirmation of the above fact. The approach to new work practices has to be constantly modified to reduce the effects of less social contact with workmates, on the individual. Alternative methods such as endeavouring to provide working capability from day centres are being considered.

If the pleasant, friendliness of work cannot be provided, then thought must be given to replacing or providing that aspect in other areas of the life of the person.

8.3 Barriers to Employment.

Locally conducted surveys have shown the following identifiable reasons why physically handicapped people are less favoured for employment than those of normal abilities:

- Less mobility, therefore unable to move around workplace or vacate quickly in an emergency.
- A feeling that the handicap must, despite contrary assurances, affect the person at least in part, mentally.
- A fear that the person will be unable to produce the same quantity, or quality, of output as a normal employee.
- Fear that a grossly, physically handicapped person will cause distress among other members of the staff.

At the outset it must be stated that many of the above fears are groundless and based on preconceived ideas, however, they do persist in the minds of some employers, so any scheme designed to improve the chances of the disabled would do well to address itself to the above issues.

Experience also shows that irrational fears can be removed by demonstrating clearly the ability of the potential employee. Many employers are quick to realise mistakes and appreciate the value of a good quality, dedicated, employee. The problem arises as to the best way to clearly demonstrate the abilities of the person, and to address those fears which are in some significant measure, justified.

8.4 Remote Working.

As well as being able to shop and transact business from a remote location, it is also sensible to investigate the possibility of providing the means for a person to work remotely. Given the changing nature of work and the new technological tools available, this prospect is realistic. Reasons were outlined earlier for the extra difficulties experienced by physically handicapped people in finding work, if the person is employed remotely the situation if quite different.

The pilot remote work scheme set up by the Central Remedial Clinic, Rehab and the National Rehabilitation Board is now in existence for just over a year, and has been successful in obtaining employment for two people on a trial basis. It is hoped that the next year will see more clients brought into the scheme and the range of disability be extended to cover people more disabled than those at present.

9. INFORMATION TECHNOLOGY.

9.1 What is Information Technology?

The term "Information Technology" (I.T.) has become popular in the last few years and has been used to mean different things. Schools in many countries have developed I.T. programmes for their pupils, often this means the instilling, in the student, of a sense of technological awareness to prepare them for a world which will undoubtedly use microtechnology to a much greater extent than at present.

More often the term I.T. is used to mean the use of suitable technical devices to allow remote access to a large and powerful host computer. This gives the user control of very large stores of information, and considerable computer capability, to carry out relatively complex tasks, or simply the functions of everyday living.

It is likely that developments in both "on-line" and "off-line" systems, will affect each other, and will cause alterations in lifestyle and workpractice, for both the physically handicapped and the able bodied.

9.2 Types of Service Available.

In addition to the well established uses of remote computers for research work, many now offer everyday services such as teleshopping, banking, education and electronic mail. Through the use of viewdata they have become easy to use and capable of displaying limited graphics. These services are being developed for the general population, but may find much application by people with handicaps.

A person with poor mobility and communication problems is an obvious beneficiary of services such as teleshopping and banking. Items can be ordered and paid for, without leaving home or the day centre. The system has the advantage that the transaction is conducted by the person themselves, and they do not therefore, rely on others.

All the above facilities are available through the British Telecom Prestel service, which is easily accessible from anywhere in the U.K. or indeed in Ireland. The equipment necessary to access this service is relatively cheap, and particularly easy to provide to a disabled person already in possession of a computer for use as an aid.

In Ireland the national telecommunications authority, Telecom Eireann, are in the process of setting up a national viewdata service which will act as a pathway to computer services provided by third parties. It is hoped that services for disabled people will feature among these.

9.3 Suitability of Equipment to Use by Disabled People.

To be able to link a microcomputer through a telephone line to a remote database requires a device called a modem and special software. The software on the market already, can easily be adapted for use by a disabled person, or can be used in conjunction with a specialised input device of the kind previously described. The modem used should be of the newer, automatic dialling, intelligent variety, to cut down on the operations required by the operator, and speed the sign-on process.

The Microelectronics Resource Centre have produced many working systems operable by those with a range of physical disabilities.

9.4 Consequent Social Changes.

In recent surveys in the U.S.A. a large proportion of middle to senior executives, rejected the idea of reducing the length of their working week even if the salary were to stay the same. Obviously, work is felt to do more than just provide the salary, indeed, as mentioned before, there is a social dimension to it.

Changing the working lives of people by the use of new technology could give rise to social problems unless carefully introduced, and the isolation introduced is balanced in some way. When dealing with disabled people it should be remembered that we are not often in the fortunate position of being able to choose the type of work, but rather whether the person will work or not.

10. POSSIBLE SIGNIFICANT FUTURE DEVELOPMENTS

There is every reason to suppose, that the present rate at which technology is advancing will be sustained. Computers will be developed with greater power and speed, they will be smaller and more portable as well as remaining low in price. Aids for disabled people which are built around these machines will also advance.

New systems of input and output are likely to accompany the developments in the actual processors, leading to more authentic speech synthesizers, more reliable printers and more responsive speech recognition modules. All this, too, can only be of assistance in the design of aids.

When the above developments are coupled with the advances in systems of Information Technology, significant improvements are close at hand for physically disabled people.

11. CONCLUSIONS.

Organizations throughout the world providing care and treatment for people with handicaps, must become aware, if they are not already, of the potential of microelectronics and computers to give assistance to them. All efforts must be spared to prevent the unnecessary duplication of work on both a national and international scale.

The organisation of strategically placed seminars and conferences, as well as good communication links, are important to help in the dissemination of information, and in the collaboration of overall effort.

The Central Remedial Clinic in Dublin are committed to expansion in this area, and to this end are embarking on an imminent building programme to provide extra space and resources. The new section will give approximately a four fold increase in space.

The Clinic also feel a commitment towards helping other centres, both within and outside Ireland.

Bob Allen
Central Remedial Clinic
Dublin

May 1987

APPENDIX A

THE CENTRAL REMEDIAL CLINIC

Origins

The Central Remedial Clinic (C.R.C.) in Clontarf, Dublin, is today the largest centre for the physically disabled in Ireland, with over two thousand patients in attendance. It was not always so large, however. Indeed, its origins were very humble.

In the 1940s and 1950s Ireland had several outbreaks of poliomyelitis, especially in Dublin and Cork. There was much concern for those who were disabled as a result of these epidemics, with state agencies and voluntary bodies responding in various ways. In April 1951, Lady Valerie Goulding and Kathleen O'Rourke came together to set up a small treatment centre in a house in Upper Pembroke Street in the centre of Dublin. This was the beginning of the Central Remedial Clinic. Lady Goulding, born in England and living in Ireland, possessed a unique spirit of concern and charity , which she steadfastly maintained during her thirty five years of association with the C.R.C. Kathleen O'Rourke was a remedial gymnast, with special interest in rehabilitation therapy. She provided therapeutic exercises and trained others how to do the same.

Lady Goulding was a charismatic and persistent campaigner for her new venture. She gathered together a number of prominent business men and women who helped her raise funds and became her advisers. She was indefatigable in the pursuit of her cause, travelling far and wide to publicise her venture and to look for money from private and public sources. She made two fund-raising trips to the United States in the 1950s, in addition to visiting many Irish cities and towns. The main purpose of these trips was to highlight the needs of those disabled by polio and other physical handicaps and to gather together sufficient funds to open a suitable clinic for children and adults. She achieved this objective and in 1954 the Central Remedial Clinic moved to new premises in Goatstown, a few miles south of Dublin city centre. The building was a large two storey house named Prospect Hall, and it was there that the real work of rehabilitation began. In these early years the emphasis was on medical and physiotherapy services, but in 1956 a small primary school was opened. The school was to remain very small until the late 1960s, as many of the pupils stayed only for a few months while they were on active remedial therapy. A hydrotherapy pool was added in 1960 and a training workshop in 1964. By then the demand for services was so great that the Governors decided to build a new clinic. It was decided to move from the south side of Dublin a to north city location, as there were no services for the physically disabled in that area. By 1968 the dream had become a reality, with the opening of the present purpose-built facility in Vernon Avenue, Clontarf.

Clontarf

The new building was designed by Michael Scott & Partners, a large Irish architectural practice. They had designed a number of important public buildings, notably the Abbey Theatre and the central bus station (Busarus) in Dublin. The design of the new building showed the influence of Mies van der Rohe. It had a very wide range of facilities, a great deal (at the time) of excess space and was a medical as well as an architectural showpiece. It cost just under IR£500,000 to build and equip, which was considered to be an enormous sum of money at that time. Government agencies put up about IR£100,000 and the remaining IR£400,000 was funded by voluntary subscriptions from businesses and individuals. The new building was named after Penny Ansley, who died tragically in a car crash early in 1968. Her father, George Ansley of Ansbacher Bank, gave a very large donation to the building fund and the result was that the new clinic began its work in Clontarf debt-free.

The building is of a single storey open-plan design which facilitates easy movement and communication. Two internal open courtyards, with shrubbery and trees, provide an attractive internal aspect and plenty of light and sun. Today, almost twenty years later, it still looks a fine building, well thought out and designed, although it must now be expanded to cope with continuing expansion and growth.

The Central Remedial Clinic started as a private body with a commitment to provide for the needs of the disabled on a day basis, and it remains so to the present time. It is now largely funded by the state and still remains a nonresidential clinic, whose services are free to all. Over the years it has provided new services as they were needed. There was a rapid change of direction in the mid 1960s. Following the development of the Salk vaccine and a successful nationwide immunisation programme, poliomyelitis was brought under control. Other physical handicaps were in need of specialised services, especially in the north Dublin area. The rapid change in direction was facilitated by Dr Ciaran Barry, who had been appointed Medical Director of the clinic in 1964. Prior to his appointment he had worked at Guys Hospital, London, and with the Spastic Society. He set out to develop services for children and adults suffering from cerebral palsy, spina bifida, muscular dystrophy and other congenital or acquired conditions. As more became known about the needs of the physically disabled, the possibilities of helping them, of educating them and of training them for employment, the work of the Clinic changed and expanded. Developments in medicine, in treatment, in education and in training helped this change and increased the extent of the Clinic's work.

Today

Despite these changes the Clinic remains essentially what it was twenty years ago. It now has many more patients, a much larger staff, a more stream lined structure and an annual budget of IR£2m. Yet it is still a warm, attractive, friendly and welcoming centre and has retained that unique pioneering spirit associated with voluntary effort. While essential

APPENDIX C

SIR BASIL GOULDING RESEARCH CENTRE

OBJECTS OF THE TRUST

The primary function of the Trust is to stimulate and fund research into methods of treatment, care and prevention of those with physical handicaps and especially those handicapping conditions which affect children. A considerable body of this research is aimed at improving and upgrading the quality and range of professional services provided by the Central Remedial Clinic.

ACTIVITIES GENERATED

The income of the Trust has generated a range of research based activities within the Clinic, and has helped our staff, and others interested in the welfare of the disabled, to investigate issues of concern, and to critically evaluate existing practices. The result of this activity is that accepted beliefs and practices are being subjected to scrutiny, and new proposals are being put forward which will deliver service in a more dynamic and, in certain instances, a more cost effective way.

Many of the projects have an appropriate application to the work of the Clinic, and to the management of its patients. Much of this activity comes directly from our own staff and the Research Centre acts as a catalyst to follow up ideas.

Our association with the Universities and other third level institutions has been particularly helpful, and almost all of the work generated has been put forward for higher University Degrees. This is an important dimension to our work because it is subjected to the rigorous methodologies and analyses demanded by the Universities.

APPENDIX B

THE MICROELECTRONICS RESOURCE CENTRE

The Central Remedial clinic (C.R.C.) decided in 1982 to establish a Microelectronics Resource Centre (M.E.R.C.) in Dublin. Much work had been carried out in other countries on the use of computer systems as aids, so it was felt necessary to try to bring the benefits of such technology to the disabled people of Ireland.

The centre was charged with:

(a) Acquiring a range of equipment and software for demonstration and assessment purposes.
(b) Introducing the use of microcomputer systems into the C.R.C. day school for use as both specialised aids for the 160 handicapped pupils, and as a normal educational tool
(c) Disseminating information within the country where possible, to help other groups become established
(d) Keep a watchful brief for developments in the future and review assessment methods when necessary

Initially, it was a trial project planned to last for a two year period, although, in 1984, when the importance of such work became evident, the decision was taken to make the department a service section of the Central Remedial Clinic.

The centre was originally housed in a single room of the C.R.C. school; a room which was in fact the school library. Within the space of a year it had moved to occupy space in a new adjoining building, constructed specifically, to provide facilities for a variety of research work. The new centre was called the "Sir Basil Goulding Research Centre" and was dedicated to the husband of the Clinic co-founder, Lady Valerie Goulding.

State of the Art

The scope of activities of centres such as this is vast. At the start it was decided to concentrate on developing as many systems as possible in the area of communication since the patients of the C.R.C. were in many cases, severely handicapped with communication problems. It was felt that before the centre could begin to help people, it must be able to communicate with them to find out their wishes.

A range of communication systems were acquired and introduced to patients both within the C.R.C. school, and to many other visiting clients of the centre. This work continues, and as experience was gained, the centre was able to offer a full referral and assessment service for people from all over the country.

Currently, there are two electronic technicians and an electronic engineer directly employed. Additionally, there are strongly forged links into both the speech and occupational therapy departments, where members are indirectly employed by the centre, and actively engaged in the assessment process. The overall approach to the care of the clients is a multidisciplinary one, with the weekly meetings held together with the medical director performing a key role.

At this stage, the scope of the work of the centre has advanced beyond just the provision of communication aids. Projects are conducted on the construction of environment control mechanisms, vocational assistive systems and computer assisted learning software.

Future Plans.

A two phase expansion programme is under way at the C.R.C.

Phase 1 involves the construction of a two story building which will eventually house the speech therapy and occupational therapy departments, as well as additional day centre accommodation. The second floor will be used for the Microelectronics Resource Centre and the activities of the present Research department.

Phase 2 involves the construction of a second floor over the centre of the existing building. The space so created will be used the accommodate administration and fund raising sections.

The extra space provided to the M.E.R.C. will allow for for better workshop facilities, a small purpose built assessment area, with video facilities, better display areas and provision for electronic research project work.

The section is scheduled for occupation within 18months.

services are provided by highly trained professional staff, they are supported by volunteers and active community involvement. Over the years the state has funded more and more of the activities of the clinic. In 1985, this subvention was in excess of 75% of all running costs. Nevertheless, there is still a need for voluntary contributions and vanquishing activities, as many new services have to be funded by private contributions. A recent example is the setting up of a Microelectronics Resource Centre, the first of its kind in Ireland, which was established to enable physically disabled children and adults to make use of the developing new technologies such as environmental controls or communication aids.

Today the C.R.C. is a national assessment and advisory centre of children, adolescents and adults with a physical handicap. It provides a broad range of medical and support services in the areas of early assessment, management, education, training and employment. In particular, there are very specialised services available for those with such physical handicaps as cerebral palsy, spina bifida, muscular dystrophy, arthrogryposis and congenital or acquired disabilities.

In 1985, over 2,000 children and adults were being cared for from all over Ireland. There are now 130 people on the staff, including doctors, teachers, physiotherapists, speech therapists, occupational therapists, social workers, nurses, workshop instructors, administrators and support staff.

All services are provided on a day basis. This is possible because of an extensive transport service of minibuses and taxis which bring pupils to the school, the workshop and the various therapists and specialists. Meals and snacks are available on the premises for staff, patients and visitors.

Many members of the present staff of the C.R.C. remember its tiny beginnings in a small room, supported only by charitable donations. At that time it had no grand design, but it did have an abundance of enthusiasm and good will. The fact that it has expanded to its present size is a tribute to the foresight of its founders, to their enthusiasm and optimism and the dedication of its staff. In Ireland today, services for the handicapped receive a high priority from the state and are an integral part of the medical, educational and welfare systems. The Central Remedial Clinic is perhaps a small part of this service, but nevertheless an important one.

In particular, we have worked closely with the Faculties of Education and Psychology at University College Dublin, with the Faculties of Community Medicine and Physiology, Physiotherapy and Education at Trinity College Dublin and the Electronics Departments in the National Institute for Higher Education, Limerick and the Regional Technical College in Galway. These specialist departments have provided us with expert advice and supervision.

The vitality and enthusiasm of all researcher is a continuous source of support, with each year seeing new projects commencing and established ones being completed. A notable feature of all research projects is the ease with which computers have become accepted not only for the storage and analysis of data, but for the preparation of documentation and reports. The proximity of the Microelectronics Resource Centre to the Research Centre has facilitated the easy acceptance of computer technology and having a computer engineer readily on hand to resolve specific problems and consult with on suitable software is of enormous benefit. The Research Department with the support of Microelectronics Resource Centre (MERC) is now self sufficient in this regard.

REPORT ON CURRENT PROJECTS

AN INVESTIGATION INTO THE PREVALENCE OF CEREBRAL PALSY IN THE EASTERN HEALTH BOARD AREA OF IRELAND - PHASE 1 1976 -1981

Researcher: Valerie Dowding Ph.D.

This investigation started in October 1983, and will be completed by the March 1987. A confidential register of all cases of cerebral palsy born between 1976 & 1981 has been compiled, and all available

information relating to pregnancy, birth and neonatal history has been collected. Each case of cerebral palsy has been matched with a control case. Approximately 300 cases of cerebral palsy have been located, suggesting a prevalence rate of 2.0 per 1000 live births. A major report on the study will be presented in March 1987, and it is expected that a number of publications in Irish and International Journals will arise from the study.

It is proposed to extend the study to include the years 1982 - 1985.

PSYCHIATRIC DISORDER ASSOCIATED WITH DUCHENNE MUSCULAR DYSTROPHY (DMD PHASE 1)

Researcher: Dr. Carol Fitzpatrick, MRCPI, MRC, Psych

Phase 1 of this study compared 23 boys with DMD with a matched control group. It found that the prevalence of psychiatric disorder was significantly higher in the DMD group than in the controls. Older boys with DMD are at greater risk of depressive disorders than are younger boys.

Phase II is still ongoing and is providing a psycho therapeutic intervention with the boys and their families. This intervention will be measured by the administration of relevant tests, and will be reported on at a later stage.

Phase I of this study led to the publication of two papers in Developmental Medicine and Child Neurology 28, 1986, 589-595 & 596-599.

A reprint of these papers are available at the CRC.

The overall study is being put forward for a doctorate in Medicine, at University College, Dublin (Department of Psychiatry).

A CLINICAL METHOD OF ASSESSING THE FUNCTIONAL ABILITY AND THE GAIT PATTERNS OF CHILDREN WITH CEREBRAL PALSY 1986.

Researcher - Ann Jenkinson MISCP, M.Sc.

This study devised reliable, effective and reproducible tests and validated them on normal children and on children with cerebral palsy. A series of three tests were designed. These tests help to categorise children with cerebral palsy in terms of the severity of their disability and identify those requiring specialised neurodevelopmental therapy.

The work was submitted as a research thesis for the degree Master of Science at the Department of Physiotherapy, Trinity College, Dublin. A copy of this thesis is available at TCD and CRC.

THE EDUCATION OF PARENTS AS PARTNERS WITH THE PHYSIOTHERAPIST IN THE EARLY MANAGEMENT AND TREATMENT OF THEIR CHILD WITH CEREBRAL PALSY 1986

Researcher: Josephine Mannion MISCP, M.Ed.

The results of this study clarified aspects of parent education, and showed that professionals focused more on the child and less on the parents when considering the management of cerebral palsy. It also made recommendations for improving parent education and put forward a suitable model.

This thesis was submitted for the Master's Degree in Education (Paramedical Studies) at Trinity College, Dublin. It is available at TCD & CRC.

THE INCIDENCE OF NEURAL TUBE DEFECTS IN THE RELATIVES OF PROBANDS, AND ITS SIGNIFICANCE IF PRIMARY PREVENTION BECOMES A POSSIBILITY

1986

Researcher: Susan P. McManus, MD., M.Sc.

This study did a detailed examination of the family histories of 306 couples with one or more offspring with a neural tube defect (spina bifida, anencephaly and encephalocoele). It identified 63 of these couples (20%) as being "at risk" for such a problem due to the presence of an affected second or third degree relative prior to the conception of their affected child. This figure is significantly higher than that found in similar studies in other countries (generally estimated at 10%). The relevance of this finding is discussed in the light of the possibility of primary prevention, by the correction of adverse environmental factors, thereby reducing the incidence of neural tube defects.

A paper on this study has been accepted for publication in "The Irish Medical Journal".

AN EVALUATION OF A SOCIAL SKILLS PROGRAMME WITH PHYSICALLY HANDICAPPED ADOLESCENTS 1986

Researcher: Yvonne Milner, M.A., M.Psych.Sc.

This study on physically handicapped adolescents with learning difficulties showed that social skills training can be effective, and specific improvements were noted in the group.

The thesis was presented for the Masters Degree in Psychological Science at University College, Dublin.

A copy of the thesis is available at UCD & CRC.

AN EVALUATION OF THE CHILD WITH CEREBRAL PALSY: SIX YEARS AFTER PRESENTATION 1986 - 1987

Researcher: Dr. Mary McKay, MRCPI

This study commenced in July 1986 and proposes to evaluate the results of intervention in 100 children with cerebral palsy who presented originally in 1980. Their current functional, educational and psychological status is being determined as is the parents' and child's awareness of handicap. It is expected that the study will provide an audit of the effects of intervention on the child and his/her family.

The study is being put forward for a Doctorate in Medicine at Trinity College, Dublin (Department of Community Medicine).

RETROVERSION OF THE FEMUR IN SLIPPED CAPITLA FEMORAL EPIPHYSIS

Researcher: Mr Timothy O'Brien, M.Ch, FRCSI, Consultant Orthopaedic Surgeon, and Mr Frank McManus, FRCSI, CRC.

This work which is located at Temple St. Children's Hospital and Cappagh Hospital, has been grant aided by the Trust. The preliminary studies have been completed and the data has been submitted for approval. A paper on an aspect of the study has been accepted for publication in the Journal of Paediatric Orthopaedic Surgery.

FELLOWSHIP IN COMPENSATORY AND REMEDIAL EDUCATION (DCRE) AT UNIVERSITY COLLEGE DUBLIN

<u>Recipient 1985 - 1986 Nuala Power M.A.</u>

Miss Power completed her studies in June and was awarded first place in her class. We congratulate her on her success, and the contribution which she made to her class; she was a worthy recipient of the award.

It was agreed with Professor Swan, UCD, that the award be shared between two teachers for 1986-1987. The recipients for 1986/87 are Catherine Forrestal BA, HDE, and Mary Dufficy BA, HED.

APPENDIX D

COMMUNICATION PROGRAMS

NAME	MACHINE	PRICE	SOURCE
** APPLE S			
NEWCASTLE HANDISYSTEM	APPLE S	ENQUIRE	G.FLANAGAN,DEPT.O F MED.PHYSICS,UNIV. OF NEWCASTLE ON TYNE.NE2 4AH
SCREENWRITER	APPLE S	ENQUIRE	AREMCO,GROVE HOUSE, LENHAM, KENT ME17 2PX
TALKING BLISSAPPLE	APPLE S	ENQUIRE	CALL CENTRE, UNIVERSITY OF EDINBURGH
ADAMS APPLE GRUNT CONVERTER	APPLE S		NIGEL WALLACE,9,ST.WORT 'S CAUSEWAY,CAMBRIDG E
MAC APPLE COMMUNICATOR (SEVERAL DISCS & VERSIONS)	APPLE S	ENQUIRE	ACE CENTRE,ORMEROD SCHOOL,HEADINGTON ,OXFORD OX3 8DD
HANDICAPPED TYPEWRITER	APPLE S	ENQUIRE	AREMCO,GROVE HOUSE,LENHAM,KENT ME17 2PX
BLISSAPPLE (400 VOCABULARY DISC AND MANUAL)	APPLE S	ENQUIRE	CALL CENTRE,UNIVERSITY OF EDINBURGH
** BBC S			
AUTOTYPE	BBC S	£15.00 +	J.M.LEONARD,38,CO URT DR,SHENSTONE,LICH FIELD,STAFFS.WS14 0JG
BLISS NEWS PROGRAM (CONCEPT KEYBOARD)	BBC S		SCHOOLS COMPUTER DEV.CENTRE,BILBOR OUGH NOTTINGHAM
BLISS COMMUNICATION PROGRAM (UTILITIES & MASTER)	BBC S	£5.00 +	SCHOOLS COMPUTER DEV.CENTRE BIRCHOVER RD. BILBOROUGH RD.NOTTINGHA

NEWCASTLE HANDISYSTEM	BBC S	ENQUIRE	G.J.FLANAGAN,DEPT .OF MEDICAL PHYSICS,UNIV. OF NEWCASTLE UPON TYNE
BEEBLING	BBC S	£20.00 +	SPECIALISED SWITCHES 58,SAXILBY RD.STURTON BY STOW,LINCOLN,LN12 AB

APPENDIX E

REFERRAL SOURCE

CLIENT INTAKE QUESTIONNAIRE

1. General Information:

Name: ______________________ Telephone: ______________

Address: ______________________ Parents/Spouse: ______________

____

Date of Birth: ______________________ Chronological Age: ______________

Referred by: ______________________ Referral Date: ______________

Address: ______________________ Telephone: ______________

____

2. Medical History

Diagnosis: ______________________ Date of Onset: ______________

Vision Function: Normal _____ Impaired _____ Corrective Lenses _____

Hearing Function: Normal _____ impaired _____ hearing aid _____

Mobility: Ambulates? Yes/No
Wheelchair assisted? Yes/No (if yes complete three below)
Walker assisted? Yes/No

3. Positioning Status / Wheelchair

Wheelchair make: ______________ Manual or Automatic ______________

Does client control the chair? ______________________

Is the positioning believed appropriate / adequate for communication programming? ______________________

Describe adaptive equipment in use:
Lap Tray? Yes/No Feet Straps? Yes/No Head Rest? Yes/No
Other? ______________________

4. Motor Skills

What is most reliable, consistent movement pattern?

Manual Pointing: ______________________

Arm Movement: ______________________

Head Movement: ______________________

Eye Gaze: ______________________

Can the client perform the following self-help skills?

Feeding yes/no Toileting yes/no Dressing yes/no

5. Educational Background: (If Applicable)

Educational Placement: ______________________

Academic Level: __________ Spelling Level: __________

Reading Level: __________ Writing Skills: __________

Is the client performing at or below grade level? __________

Does client show ability to: Match pictures/colours/forms? Yes/No

Categorise by class? Yes/No: Categorise by function? Yes/No

6. Communication Skills:

Receptive Language Skill: ______ Expressive Language Skill: ______

Present means of communicating: eyegaze ____ gestures ____
facial expressions ____ Gestural "yes/no" ____ vocalisation ____
speech ____ standard signs ____ aided communication system ____

Describe speech skills: ______________________

____

Describe Augmentative Communciation System being used: __________

____

7. <u>Unaided</u>	<u>Aided</u>	<u>Symbols</u>
Common Gestures ____	Etran eye gaze frame ____	Pictographs ____
Makaton ____	Communication Board ____	Photographs ____
Lamh ____	Comm. Book portable ____	Rebus ____
Irislan ____	Electronic Aid (type) ____	Blissymbol ____
Other ____	Switch ____	Makaton Symbol ____
	Computer ____	Words ____
	Other ____	Letters ____
		Others ____

Total Number of signs / symbols:

Understood ______________ Used: ______________

Client communicates primarily by: ______________________________

Initiating messages? Yes/No Describe method: ____________________
____

Responding to messages? Yes/No Describe method: __________________
____

Never or rarely initiates? Yes/No

Do you understand why the applicant has been referred to the MERC?
____
____
____

What do you want and/or expect from this evaluation in the MERC, example: what do you want applicant to be able to do? Do you want a communication aid or an educational aid?
____
____
____

Other Programmes

List professions from whom he/she is currently receiving therapy or instruction:

Name	Type of therapy or instruction

Funding

Please indicate funding source, if any
____
____

Please return completed form to

Microelectronics Resource Centre,
Central Remedial Clinic,
Vernon Ave.,
Clontarf,
Dublin 3.

"ASPECTS OF MOBILITY FOR THE DISABLED"

G. BUSBY
MA, FBCS

DISABLED SPECIALIST GROUP
13 MANSFIELD STREET
LONDON, U. K.

I have been asked to talk on mobility and technical aids for the disabled in Britain, and the situation in general. I have to stress that mobility is the weaker of my expertise, but this paper is a true reflection of the situation in Britain. I trust many of you will come to my workshop, where I am speaking on the subject about which I am more knowledgeable.

Since the turn of the centrury, the methods of conveying people to and from have increased enormously. Previous to this, the inability to walk was disastrous, but as the centrury has progressed, in my opinion it has become less, although having said this, most able bodied persons find the notion of being chairbound the worst of disabilities. To me however, it is probably the least of my problems. I am quite able to transport myself in my chair for 1 - 1 1/2 miles, by using my left foot for backwards power, and steering with my right foot.

Not being able to drive however, in modern society is a disadvantage. It has generally become the norm to be able to choose when, and where you go, as the ownership of a car is considered a necessity rather than a luxury. I therefore submit, that it is the inability to drive that is the greatest disabler in a modern society.

In my opinion there is even more to the problem, than purely the transportation aspect.

Within the ability to drive, there are further aspects, for example, drivers are known to become aggressive, and give vent to their latent frustration, and the names given to various models, and the kind of advertising techniques to sell them, have underlying sexual connotations. The non driver therefore, is at a great disadvantage in modern society.

The last two factors mentioned, regarding driving are insoluble. Freedom of movement can be achieved however, and the king of things that need to be considered in providing this freedom are:

(a) Extra costs incurred.

(b) Design of wheelchairs.

(c) Design of vehicles.

(d) Mechanical assistance and seat designs to overcome the problems in conveying oneself from the wheelchair to the vehicle.

(e) In travel assistance, e.g., escorts and help on and off various forms of transport.

In Britain the financial problem is overcome in two ways: firstly, there is a state allowance, called mobility allowance, this is currently £ 24.05 per week, which is intended to overcome the social immobility and is available to anybody who cannot walk to the nearest bus stop. Secondly, we have a scheme "fares to work", kwhich is a further allowance for anybody who incurs extra cost, to work above that, for the normal person on the same journey. This is not a definite amount, but equates approximately to half of the extra cost.

Returning to the mobility allowance, the recipient of it is also able to obtain a free vehicle licence, which is currently about £ 100 per year, also discounts of about 17% on new cars. They are also eligible for the disabled orange badge. Which one places in the car window, to be allowed parking in a normally non parking area. To be a holder of an orange badge, one does not have to drive, for when a non-driver, has to be driven in various cars, and because of the necessity for this, I can place my orange badge in any vehicle. However, abuses of the system frequently occur, if discovered, they are quite rightly, heavily fined.

Moving away from private transport, the situation is very poor; although I have a video produced by the Ministry of Transport, makes the situation appears to be much better than it really is, e.g., the video shows people being helped on and off trains, special buses, taxis and aeroplanes, with the exception of most airports, the picture created is just not true. You can attempt to organize help on to a train, but in reality, either the message is not relayed, or staff shortage does not allow this to happen. The special buses have gone out of business, because they had several misconceptions, the kind of which always occur when the consumer of a service is not consulted. In this instance it was felt that a service from main line, London stations to Heathrow Airport, was what was needed. You won't be surprised to hear, that a full size bus was never full, or hardly ever used.

It seemed obvious to me, that the type of vehicle required, was a small one which can be orderd and destinations dictated by the consumer. As far as the modification of the ordinary London taxi goes, this is one scheme, I believe, which will be successful. Unfortunately, there are only 12 in the whole of London, although the company involved is trying to raise the capital to convert 30 more, the cost being in the region of £ 2,500.- per cab,

because of this small number, other difficulties arise which ought to be avoidable, such as, most of the staff involved in hiring these cabs, are not aware of the adapted vehicles, and therefore, some staff education is necessary. Another factor is that one has to order them four day ahead which is not always possible.

I do believe however, if these problems can be ironed out, and the number of converted cabs increased, this scheme has the highest potential for transport of the severely disabled, when and where they are wanted.

Staying with taxis, we also have a new design called "metro cab", which, at last, has the ability to carry wheelchairs. In 1979, I was told by the Ministry of Transport, that these cabs would be on the roads in 1984; however, I have report, they are only just beginning to be seen, and only 1in London.

Moving on to the design of wheelchairs, unfortunately, the number of models available through the state system is very limited e.g., my chair is not available, and therefore, as the average life of chairs, even sensibly used, is about two years. We are discussing a regular outgoing of about £ 250 at the lower end of the market, and an infinite amount at the top. We therefore have the technology, but as a society are unwilling to provide it.

Modification to cars is very common and is usually based around paraplegics, who have no use of their lower limbs, and therefore, all controls have to be on the steering column. Technically this is not difficult, I am sure, most of you are familiar with these designs. I am happy to say we are now looking to help disabled people who have limited use of all limbs. The leading company in this field is KEMPF. Perhaps, I ought to have mentioned it when I was discussing wheelchairs, but it seemed more appropriate to discuss their modifications to wheelchairs and cars together.

They have recognized the potential of voice control, and as early as 1984 were producing electric wheelchairs which were completely controlled by voice commands, and cars with non-critical functions. If we look at the wheelchair, the commands set are: "go ahead", "return", "faster", "slow down", "on right", "on left", "straight on", and "omega", the command for stop. The programme enables the user to combine the 8 phrases in 96 different driving situations. e.g., "go ahead", followed by "faster" equals 2nd speed, then "faster" again equals 3rd speed. Similarly "slow down" repeated enables you to slow down by degrees. This speech recognition computer applied to the electric wheelchair is really a wonderful technical aid. It has been devised by

Martin Kempf, who is a student in astronomy at Bonn University in Germany, the microcomputer 8 bit with its eprom 11k byte, its ram of 2k byte and its eprom 2k byte consumes 4.8 watt. The cruising range of this wheelchair, about 60 km or 37 miles is barely affected by the presence of the computer. The wheelchair itself, is of the speed controlled type, and therefore, keeps its course, even when used outdoors on a cambered road, the car has voice controls for opening and closing the doors, hand brake, automatic gear shift, radio and windscreen wiper, sun visor, seat positioners, indicators and headlights, and they have also developed a hydraulic lift controlled by voice command.

The next step I feel, is to take the limited reliable abilities of a disabled person and combine them with voice control. This combination would enable one to give the command "slow" for example and then modify that command. Similarly, other functions could be achieved I see no reason why this theory cannot become a reality in the near future. The problem of transferring from the wheelchair to the car, and vice versa can be overcome in two or three ways, which I would like to mention.

Firstly, it is now possible to purchase a "car chair", which enables the wheelchair users to transfer themselves in their chair into the car. This is achieved by:

1. The car chair is reversed to the open door;

2. The car chair locates on to the lift system and is lifted;

3. The wheels are raised;

4. The chair swings round into the seat well;

5. the car chair is automatically locked into position for the journey.

The second system purely transfers the person to the car. Car hoists slide onto fittings attached to the car roof. Small mobile hoists can also be used but, either the car must be driven onto the pavement, or into a driveway, because the chassis of the hoist must go under the car. Someone has to work the hoist for the disabled person by pumping the hydraulic system which provides the lifting power. I cannot see, however, any reason why the car ignition cannot be activated by voice control, thus providing the power, and similarly, why the actions of the hydraulics cannot be controlled in the same way.

Another idea which I like for its simplicity, is a passenger seat which swivels through 90 degrees, in order that a disabled person can slide or be lifted from his chair onto the car seat, the seat can then be returned to its normal position.

I have attempted in this paper to inform you of the more important aspects of mobility and the state of the art in the U.K. I hope that some of the concepts have excited you as they excite me. Mobility is fundemental, and there is no excuse for its not being available or simplified for those disabled people who wish to have it.

V I S I O B R A I L L E

La Lumiere Noire

PHILIPPE BALIN

INTRODUCTION

Lorsque l'on m'a parlé pour la première fois de VISIOBRAILLE et de l'utilisation des PC et compatibles par les non-voyants, j'avoue que j'étais quelque peu sceptible.

Puis, la curiosité étant la plus fote, j'ai expérimenté ce système avec l'aide de Philippe, non voyant et utilisateur du système, qui a joué le jeu en me laissant découvrir VISIOBRAILLE sans intervenir.

N'étant pas aveugle moi-même, il m'a donc fallu imaginer ce qu'un utilisateur non-voyant pouvait ressentir en face de ce système.

Le résultat m'a fortement impressionné car il montre combien les micro-ordinateurs peuvent révolutionner la vie de ceux qui souffrent d'un handicap aussi important que celui de ne pas voir.

UN SYSTEME ETUDIE PAR UN NON VOYANT, POUR LES NON VOYANTS.

Le système VISIOBRAILLE est livré dans une petite valise.

Une valise dites-vous? Nous sommes loin des progiciels dont nous avons l'habitude et qui sont fournis avec un petit classeur de documentation et quelques disquettes de programmes!

VISIOBRAILLE comprend, de fait, un nombre impressionnant de composants parmi lesquels je note immédiatement une épaisse documentation technique dans laquelle, je vais sans nul doute trouver toute l'information nécessaire pour mettre en place le système sur mon PC.

Mais au fait, comment un non-voyant peut-il faire pour lire toute cette documentation? Doit-il avoir recours à un ami ou un collègue pour l'aider dans cette opération?

Je remarque un deuxième document rassemblant une trentaine de feuilles épaisses et où des caractères braille sont embossés.

Je n'avais jamais vu de document Braille de près mais il ne me semble pas possible que ces trente pages reprennent toutes les informations contenues dans la documentation technique, d'autant qu'un caractère braille occupe une surface de presque un centimètre carré!

Philippe, vient à mon secours et, lisant à haute voix les titres en haut des pages braille, me dévoile que ce document est en fait un mémento d'utilisation reprenant sous une forme très concise les principales commandes du système; je suis donc en présence de l'équivalent braille des petites cartes aide mémoire livrées avec tous les bons produits.

Mais le système n'est toujours pas installé!

Je viens de comprendre la marche à suivre en prenant dans la main les six cassettes pour magnétophone sur lesquelles sont collées des étiquettes plastifiées indiquant, en braille, leur contenu.

En y regardant de plus près je remarque que la même information est également écrite en clair pour les voyants;

- "en noir!", me corrige Philippe
- "pardon?"
- "l'écriture habituelle est appelée écriture noire par les non-voyants!"

Me voici un peu plus savant !...

Les deux premières cassettes contiennent le manuel technique enregistré par une personne qui a de toute évidence l'habitude de lire des textes pour les non-voyants car sa diction est lente et claire.

Les quatre dernières contiennent un cours de formation dont nous parlerons plus loin.

COMMENT LE NON VOYANT VA-T-IL COMMUNIQUER AVEC LE PC

Philippe me tend son "terminal à affichage éphémère".

Quel est cet appareil bizarre?

Les non voyants peuvent, depuis plusieurs années, acheter des terminaux appelés, dans le jargon des aveugles, "terminaux à affichage éphémère".

Cette appellation provient certainement du fait que de tels terminaux peuvent afficher de façon temporaire des caractères braille sur une petite tablette (appelée "plage tactile"), alors que les terminaux braille d'y a quelques années embossaient les caractères de façon définitive sur du carton.

Le terminal à affichage éphémère est composé:

- D'une plage tactile percée de nombreux trous dans lesquels se meuvent électromécaniquement de petites tiges qui peuvent, soit disparaître totalement sous le niveau de la tablette, soit dépasser d'environ un millimètre.

Ces tiges, en se levant et se baissant, composent des caractères braille lisibles en passant les doigts sur la tablette.

- D'un clavier braille composé d'au moins 7 touches, exploitées de façon combinatoire (c'est à dire que la frappe d'un caractère s'effectue par enfoncement simultané d'une ou plusieurs touches).

Les deux composants ci-dessus sont gérés par un micro-processeur qui lit les caractères frappés au clavier et les envoie vers un interface de télécommunication (RS232), et qui reçoit des caractères venant d'un calculateur à travers ce même interface pour les afficher sur la plage tactile.

Les terminaux à affichage éphémère sont en général portatifs et possèdent des fonctions locales qui en font de véritables bloc-notes pour les non-voyants (petit traitement de textes pour composer et relire des textes par exemple).

L'INSTALLATION DES LOGICIELS

Passons à l'installation !

Au niveau du PC, celle-ci est plus que simple puisqu'elle se résume à la copie de la disquette programme fournie, sur le disque dur de mon PC et à la mise à jour des fichiers AUTOEXEC.BAT et CONFIG.SYS conformément à la documentation.

Le terminal à affichage éphémère (puisque tel est son nom) se branche sur l'interface RS232 du PC grâce à un câble fourni avec le système VISIOBRAILLE.

Je note ce point très positif car, bien que le PC, la carte RS232 et le terminal à affichage éphémère aient été achetés indépendamment de VISIOBRAILLE, la société ZYGOTE, fournisseur du produit, a fait le choix de fournir un câble de raccordement entre ces composants, choix qui illustre bien le fait que ce produit, très soigné, a été conçu dans le sens de la facilité de mise en oeuvre.

Enfin, je déballe un clavier de 32 touches, dont le moins que l'on puisse dire est qu'il a l'air très solide (son boîtier est fabriqué en acier d'au moins 8/10ème), clavier que je connecte, grâce à un câble plat, à l'interface imprimantède mon PC.

Je dispose le clavier à côté du terminal à affichage éphémère et me sens prêt à initialiser le système.

UNE FORMATION BIEN CONCUE

"contrôle/alt/del"... et le système démarre !

Un logiciel résidant s'initialise depuis AUTOEXEC.BAT; Un cliquetis retentit au niveau du terminal braille et un certain nombre de points émergent de la plage tactile, faisant apparaître trois caractères braille.

Parallèlement, le rituel "C>" est apparu sur l'écran du PC.

Philippe m'explique que précisément, c'est ce "c>" qui est affiché sur la plage tactile suivi par une représentation symbolique du curseur.

Timidement, j'enfonce une touche du clavier braille au hasard; un caractère apparaît sur l'écran ainsi que sur la plage tactile.

Je me remet dans mon rôle d'expérimentateur supposé non-voyant et introduit dans le magnétophone la première cassette du cours de formation; Philippe frappera pour moi sur le clavier braille, et la formation commence.

Je suis guidé pas à pas, et on me demande de lancer un programme de démonstration qui va servir de support de manipulation pendant toute la formation; cette idée me semble excellente et pourrait avantageusement être reprise par bien des fournisseurs de logiciels.

PRINCIPE DE FONCTIONNEMENT DU SYSTEME

Puis, on m'explique les principes de VISIOBRAILLE qui effectivement semblent très simples (la réalisation doit par contre être plus complexe qu'il n'y paraît):

- L'écran du micro-ordinateur est découpé en 100 fenêtres (4 fenêtres de 20 caractères par ligne, sur 25 lignes).

- Le programme résidant assure l'affichage sur la plage tactile du terminal à affichage éphémère, d'une fenêtre judicieusement sélectionnée dans l'écran.

- Le non voyant pilote les algorithmes permettant de déterminer les coordonnées de la fenêtre à afficher, à l'aide du clavier auxiliaire de 32 touches.

Ces algorithmes peuvent être soit très simples (par exemple affichage systématique de la fenêtre contenant le curseur) soit très complexes.

Il existe même des touches paramétrables permettant de déclencher de véritables "programmes" de recherche d'informations dans l'écran.

Le résultat semble performant car Philippe est capable de "lire" très rapidement tous les écrans que je lui verrai manipuler dans la suite et de, malgrè la petitesse de son "champ de vision" limité aux 20 caractères de la plage tactile.

Il me signale d'ailleurs un fait que je n'imaginais pas.

Les non-voyants sont habitués à ne "voir" que les quelques caractères qu'ils ont sous les doigts à un moment donné, et pratiquent couramment la gymnastique mentale qui consiste à reconstituer un texte ou un document à partir des vues ponctuelles qu'ils ont accumulées.

De ce fait, la petitesse de la plage tactile n'est pas une gêne car il est strictement équivalent pour eux de promener les doigts sur une feuille de grande dimension, ou d'utiliser une plage tactile de petite dimension en faisant "défiler" le texte sous leurs doigts grâce au clavier auxiliaire.

Au contraire, la puissance des algorithmes de détermination des coordonnées de la fenêtre à afficher, est pour eux une aide considérable.

TOUS LES LOGICIELS FONCTIONNENT SUR LE PC

J'avoue que n'ayant pas suivi la formation jusqu'au bout, je suis un piètre manipulateur de VISIOBRAILLE.

Toutefois, ce début de formation m'a permis de démystifier le système et d'imaginer, au-delà du brio avec lequel Philippe utilise le PC, combien VISIOBRAILLE ouvre la porte de l'informatique individuelle aux non-voyants.

VISIO 1, 2 ou 3, MULTIPLAN, LOTUS 123, DBASE III, une émulation Minitel, une connection à un ordinateur central, les langages de programmation ... Philippe a tout utilisé devant moi avec une facilité déconcertante.

Tous les logiciels qui ont été expérimentés étaient totalement standard et n'ont pas eu à être adaptés pour une utilisation par des non-voyants !

Philippe m'affirme qu'il n'a pas encore découvert de logiciels incompatibles techniquement avec VISIOBRAILLE (hormis les logiciels utilisant des fonctions graphiques, bien entendu), et que la proportion de logiciels difficiles à exploiter compte tenu de leur façon "très visuelle" de gérer l'écran, ne sont pas nombreux.

Enfin, j'ai trouvé un intérêt à ce que l'écran du PC ainsi que son clavier restent opérationnels malgrè l'utilisation du terminal braille, car ceci m'a permis de suivre toutes les démonstrations sur l'écran et d'intervenir au clavier autant que nécessaire.

Ce monde de travail devrait permettre à un voyant et un non-voyant de travailler ensemble.

ENCORE QUELQUES PETITES CHOSES

L'utilisation du PC par l'intermédiaire d'un terminal Braille est bien sùr la chose la plus marquante de ce produit qui pourtant comporte tout un ensemble d'utilitaires qui facilitent l'exploitation par les non voyants:

- Un utilitaire de programmation du clavier auxiliaire de 32 touches permettant de charger les algorithmes de détermination des coordonnées de fenêtre les plus adaptés au logiciel que l'on se propose d'exploiter.

- Un device handler permettant de gérer une imprimante braille (pour ceux qui en possèdent une).

- Un programme de maintenance permettant de déterminer la source d'éventuelles pannes (terminal braille, clavier auxiliaire, carte RS232 ... etc).

- Un logiciel de lecture prenant les textes produits par les traitements de textes ou par les lecteurs optiques de documents et les présentant au non-voyant en respectant les règles de présentation du braille (oui! le braille a ses règles!).

CONCLUSION

VISIOBRAILLE est un système étonnant qui permet aux non-voyants de faire des choses que j'aurais jurées impossibles avant de les avoir vues moi-même.

Son prix (25.000 F.HT pour le module de base) est négligeable lorsqu'on le rapporte aux possibilités nouvelles et à l'indépendance qu'il confère à son utilisateur (nous, voyants, ne nous payons-nous pas des voitures plus coûteuses pour avoir cette impression d'indépendance?).

Il ouvre de nouveaux horizons aux non-voyants.

VISIOBRAILLE est fabriqué et distribué par la société ZYGOTE, 30 rue de la gare, 92780 Chatillon sous Bagneux.

Il fonctionne sur de nombreux compatibles PC, avec de nombreux types de terminaux à affichage éphémère et d'imprimantes braille.

VISIOBRAILLE est également distribué (dans le cadre d'un package comportant PC, terminal à affichage éphémère et imprimante braille) par AGENA.

Des extensions od VISOBRAILLE sont annoncées:

- Un "agenda/bloc note" adapté aux non voyants et untilisable sans interrompre le logiciel en cours (sidekick est vraiment trop "visuel" pour une utilisation permanente par les non voyants),
- Des utilitaires de chargement des mémoires du terminal à affichage éphémère depuis le PC, permettant "d'emporter des textes à lire dans le métro",
- Des utilitaires inverses de déchargement des mémoires du terminal à affichage éphémère, permettant de ré-introduire "les notes prises dans le métro" dans le PC.

V I S I O B R A I L L E

LA LUMIERE DANS LA NUIT

Notre société et les handicapés

Depuis plusieurs années, notre société semble prendre conscience de l'existence en son sein des handicapés; cette prise de conscience paraît même, à certains moments, être à la mode.

C'est ainsi qu'on ne s'étonne plus que ce soit organisée une année des handicapés, que les bâtiments récents aient des accès prévus pour les fauteuils roulants, que des aménagements en tous sens soient faits dans les édifices publics ou que paraissent des brochures recensant les salles de cinéma ou les stations service d'auto-route accessibles aux handicapés moteurs.

Petit à petit, chacun s'habitue à côtoyer dans la vie quotidienne ces voisins différents, et il est maintenant commun d'imaginer que, leurs problèmes de déplacement étant résolus, les handicapés soient élèves dans un lycée, étudiants à l'université, ou salariés dans une entreprise au même titre qu'une personne valide.

Il est cependant d'autres formes de handicap, peut être moins familières au grand public, qui inquiètent ou restent entourées des brumes d'un folklore misérabiliste hérité du XIXe siècle.

Ainsi l'"Aveugle", évoque-t-il plutôt l'image du passant un peu perdu qu'on aide à traverser la rue, voire du mendiant dans les couloirs du métro, que celle d'un cadre ou d'un employé actif et dynamique, bien inséré dans une vie professionelle.

Pourtant, depuis quelques années, cette deuxième image est devenue une réalité grâce aux progrès de l'informatique.

L'alphabet braille: la première révolution pour les non-voyants

Depuis 1852, les aveugles disposent d'un système performant d'écriture, l'alphabet braille, dans lequel à chaque lettre correspond une combinaison de un à six points en relief que l'on peut lire du bout des doigts.

L'écriture braille s'inscrit sur des feuilles de papier fort, soit directement à l'aide d'un poinçon, soit par l'intermédiaire d'une machine à écrire spéciale.

Ce système a permis aux aveugles de communiquer entre eux; il leur a donné accès aux livres transcrits en Braille par des bénévoles et leur a permis de sortir de l'isolement total où ils restaient enfermés.

Cependant, la lenteur de la transcription des livres en Braille (faite page par page, à la main), le choix limité des titres disponibles ainsi que leur encombrement (plus de 10 fois supérieur à celui d'un livre traditionnel), rendaient la méthode de plus en plus inadaptée aux rythmes de la société moderne et particulièrement à ceux du monde du travail.

Jusqu'à une date récente, on ne trouvait des aveugles dans les administrations ou les entreprises que dans des emplois déterminés (standardistes par exemple); la lourdeur du système de transcription de leur écriture ne leur permettait guère de sortir de ces métiers.

Si néammoins quelques non-voyants arrivaient à accéder à d'autres professions (professeurs, avocats), c'était sous condition de disposer de l'aide permanente d'une tierce personne.

Les même raisons rendaient par ailleurs nécessaire l'existence d'écoles et de collèges spécialisés où les jeunes aveugles pouvaient apprendre le braille et suivrent une scolarité adaptée à leur handicap.

L'informatique ouvre aux aveugles l'espoir d'une communication aisée

Depuis les années 70, l'informatique a pris de plus en plus de place dans la vie professionelle et quotidienne et les outils informatiques ont commencé à être mis à la disposition des aveugles par l'intermédiaire de terminaux adaptés.

Vers 1975 sont apparues les prelières imprimantes Braille qui embossaient automatiquement en braille sur du papier spécial, les caractères reçus du calculateur à travers une ligne de télécommunication.

Ces imprimantes étaient généralement dérivées de modèles utilisés par les voyants et traduisaient chaque lettre de l'alphabet ASCII en un équivalent Braille.

Ces terminaux, connectés à des ordinateurs ont apporté un gain de temps apréciable dans la transcription des textes qui n'avaient plus à être saisis en Braille.

Peu de temps après sont arrivés sur la marché les premiers "terminaux Braille à affichage éphémère" ainsi appelés parce qu'ils étaient capables de faire apparaître, grâce à un dispositif électromécanique, des petits picots représentant des caractères Braille sur une petite tablette.

Ces caractères, une fois lus, pouvaient s'effacer et être remplacés par d'autres.

L'intérêt de ces terminaux résidaient dans le fait qu'ils offraient un accès relativement facile aux textes stockés sur ordinateurs et dispensaient leur utilisateur d'imprimer en braille une masse énorme de papier pour n'en garder que quelques informations.

Cependant, ces systèmes étaient lourds et peu souples et nécessitaient des logiciels adaptés sur les ordinateurs centraux.

Or, le coùt de réalisation d'un système de traitement de texte performant, pour ne prendre que cet exemple, est élevé.

Cette difficulté est aggravée par la diversité des matériels informatiques existants sur le marché, et par le fait que, de la même façon qu'il n'existe pas de traitement de textes universel pour les voyants, il fallait envisager de développer plusieurs produits pour couvrir tous les besoins des non-voyants.

Toutes ces raisons ont fait que, faute de logiciels adaptés, les imprimantes braille et les terminaux à affichage éphémère n'ont connu qu'une expansion limitée.

L'IBM/PC: un standard de fait, conçu pour les voyants

Depuis 1983, l'IBM/PC est devenu un standard de fait, qui a permis le développement d'un très grand nombre de logiciels dans tous les domaines.

L'idée d'offrir cet outil aux non-voyants a été poursuivie par beaucoup, et de nombreux essais de connexion d'une imprimante braille ou d'un terminal à affichage éphémère à un PC ont été tentés.

Or, ces terminaux sont bien adaptés à une utilisation de l'informatique de type "question/réponse", où chaque ligne implique logiquement la suivante, et ne répondent plus du tout aux exigences actuelles de la bureautique.

En effet, les outils informatiques utilisent aujourd'hui pleinement les possibilités des écrans d'affichage, faisant apparaître simultanément les informations les plus diverses, qui ne sont plus reliées les unes aux autres par une séquence immuable de questions/réponses, mais qu'il faut appréhenser globalement.

VISIOBRAILLE: le trait d'union

Il fallait donc imaginer un système qui permette la connexion d'un terminal à affichage éphémère à un micro-ordinateur de type PC respectant les caractétistiques de ces nouveaux produits.

Un tel système, appelé VISIOBRAILLE, existe depuis peu et a été mis au point par deux ingénieurs dont un non voyant.

VISIOBRAILLE est composé de logiciels techniques chargés sur un micro-ordinateur de type PC, et pilotés par un clavier auxiliaire de 32 touches.

Ces logiciels permettent, pour faire fonctionner le micro-ordinateur, d'utiliser un terminal à affichage éphémère standard en lieu et place du clavier et de l'écran habituels.

VISIOBRAILLE permet ainsi d'exploiter en Braille, avec les mêmes caractéristiques de confort et d'ergonomie, tous les logiciels fonctionnant sous MSDOS (tableurs, traitement de texte, gestionnaire de base de données, logiciels de télécommunication, jeux etc ...), et ce, sans que les logiciels eux-mêmes aient dus être modifiés.

Des utilitaires complémentaires permettent si nécessaire l'utilisation d'une imprimante braille.

Avec le clavier du terminal Braille à affichage éphémère, le non voyant a accès à tous les caractères de l'alphabet IBMPC.

Il lit du bout des doigts la plage tactile sur laquelle apparaît une portion de l'écran du micro-ordinateur où peuvent s'afficher en même temps 25 lignes de 80 caractères.

Fabriqué et distribué par la société ZYGOTE (30 rue de la gare 92780 Chatillon), VISIOBRAILLE est d'ores et déjà utilisé par plusieurs sociétés.

Ce système est également distribué en France par Agena, le plus grand distributeur de matériel informatique, dans le

cadre d'un ensemble comprenant également le micro-ordinateur et le terminal à affichage éphémère.

VISIOBRAILLE donne leur pleine dimension aux actuels terminaux Braille

On pourrait penser qu'il est peu pratique de lire un écran informatique de près de 2000 caractères par sous ensembles d'une vingtaine de caractères (taille d'une plage tactile du commerce), et qu'il vaudrait mieux créer un écran tactile de grande dimension capable de reproduire tout l'écran en une seule fois.

En fait, il n'en est rien, car VISIOBRAILLE permet une grande souplesse dans le choix de la fenêtre qui apparaît sur la plage tactile.

Par ailleurs, les non-voyants sont habitués à ne "voir" que les quelques caractères qu'ils ont sous les doigts et à reconstituer mentalement la totalité du contexte; il est donc équivalent pour eux de promener leurs doigts sur une vaste plage tactile, ou de balayer informatiquement l'écran en laissant leur main immobile.

VISIOBRAILLE fonctionne sur tous les compatibles PC et supporte une grande variété de terminaux Braille à affichage éphémère et d'imprimantes braille.

Voyants et non-voyants à égalité

Un cadre non voyant peut donc utiliser, au même titre que ses collègues, tous les outils de bureautique de l'entreprise:

Il gère sur son micro-ordinateur son répertoire téléphonique et son agenda auxquels sa secrétaire a très simplement accès,

Il écrit son courrier, lit les lettres ou rapports qui lui arrivent et peut se connecter sur un gros ordinateur en simulant un terminal traditionnel.

De retour chez lui, il peut continuer à travailler sur son micro personnel, accéder à tous les services du MINITEL, consulter des bases de données.

En voyage, il peut utiliser son terminal à affichage éphémère pour lire les documents qu'il y aura chargés avant de partir; les notes qu'il prendra sur son terminal pourront être reinjectées dans le micro-ordinateur et y être remises en forme.

Avec VISIOBRAILLE, le non-voyant dispose donc, sur un matériel standard, de toutes les possibilités de la micro-informatique moderne et peut les utiliser avec la même souplesse que tout autre utilisateur.

On peut ainsi imaginer que la liste des professions qui s'ouvrent naturellement aux aveugles est sans limite, informaticien, secrétaire, agent administratif, mais aussi journaliste, avocat, comptable, chercheur scientifique.

De plus l'utilisation de VISIOBRAILLE dès le début de la scolarité permettra une intégration complète des aveugles dans les établissements scolaires non spécifiques, car, dès que les enfants non voyants seront capables de lire le braille, ils pourront suivre les mêmes cours que leurs camarades.

<u>Est-il rentable pour une entreprise de faire l'investissement d'une station bureautique pour non-voyant?</u>

Le prix de VISIOBRAILLE (de l'ordre de 25.000 F.ht pour le module de base) est un investissement faible pour une entreprise ou une administration, comparé au salaire d'un de ses employés.

Or, le coût spécifique à l'équipement d'un non-voyant se limite au prix du système VISIOBRAILLE et d'un éventuel terminal à affichage éphémère (si le non voyant n'en possède pas déjà un).

Le micro-ordinateur, les logiciels standard utilisés, le support et la formation dispensés à tous les agents de l'entreprise, conviendront sans autre adaptation à l'utilisateur non-voyant.

En outre, il n'y a plus besoin, comme ceci se pratique souvent, d'affecter une personne pour seconder le non voyant dans son travail quotidien (lecture des documents, transcription de textes).

L'investissement est proportionellement encore plus faible dans le milieu scolaire où les études d'un non voyant dans une institution spécialisée coûtent environ 250.000 F par an.

Le monde du travail est-il prêt à acceuillir les non-voyants?

Les entreprises et les administrations ont depuis plusieurs années l'obligation d'employer un certain pourcentage de handicapés.

Le monde du travail peut donc voir en VISIOBRAILLE un moyen de "rentabiliser" les non voyants en leur confiant les mêmes tâches qu'aux autres.

Or, les entreprises, faute d'outils adaptés, n'ont longtemps pu considérer le problème des handicapés qu'en termes humanitaires; elles ont accepté d'en accueillir un certain nombre, sans s'imposer qu'ils soient aussi "productifs" que le reste de leurs employés, gâchant ainsi de fortes potentialités.

VISIOBRAILLE mettant à la disposition des non-voyants toutes les possibilités de la micro-informatique et de la bureautique, leur confère une réelle autonomie. Il fait tomber les dernières barrières, tant économiques que techniques, à leur insertion totale dans la société moderne.

Notre société est-elle prête à admettre simplement qu'elle peut offrir aux non voyants les mêmes carrières qu'aux autres?

Les non-voyants ont généralement développé, au gré de leur histoire personnelle, des qualités différentes une sensibilité, une opiniâtreté qui leur est propre et qu'ils peuvent mettre au service de l'entreprise.

Recruter un non voyant autonome et motivé n'est plus une charge et peut donc se révéler une opportunité pour l'entreprise!

Verra-t-on bientôt un directeur de grande société, un député ou un président de la République aveugle...?

La question reste posée.

UNE NOUVELLE JEUNESSE POUR LE BRAILLE

Dès l'arrivée de tous les nouveaux matériels rendant accessibles aux non-voyants les produits informatiques développés pour les voyants, une bagarre est née:

"l'avenir est-il dans la synthèse vocale ou dans le braille?"

Sommes-nous en train de comparer des choses identiques, et s'adressent-elles au même public?

Le présent document présente rapidement les avantages et les inconvénients de ces deux procédés.

I. UTILISATION DU BRAILLE

1. AVANTAGES

Son utilisation n'entraîne pas de problème d'environnement: en effet l'utilisation du braille est silencieuse.

Le braille est sans ambiguïté dans la lecture et la compréhension d'un texte: il permet plus facilement à un voyant et à un non voyant de travailler ensembles.

Il permet d'utiliser plus facilement les logiciels standard, même ceux-ci utilisent les attributs d'écran tels que semi-intensité, surbrillance, clignotement, inversion vidéo.

Il permet de relever plus facilement les fautes d'orthographe ou les fautes de frappe lors de la lecture d'un document.

2. INCONVENIENTS

Son coût est plus élevé car un terminal braille à affichage éphémère est d'un prix supérieur à celui d'une carte de synthèse vocale.

Il n'est pas utilisable par des gens qui ne connaissent pas de braille.

Les mal-voyants considèrent qu'utiliser le braille les intègrent dans le monde des aveugles et se considèrent dépréciés.

II. SYNTHESE VOCALE

1. AVANTAGES

La synthèse vocale est accessible aux gens qui ne connaissent pas le braille et trop âgés pour l'apprendre.

2. INCONVENIENTS

Bien qu'il existe beaucoup de cartes de synthèse vocale différentes, elles sont encore bien éloignées de la voix humaine et sont parfois difficiles à comprendre.

La lecture de texte en majuscule est difficile pour les mots où les accents ont été omis puisque la pratique veut que l'on n'accentue pas les majuscules.

Elle nécessite, pour l'utiliser, soit d'être tout seul dans une pièce, soit d'avoir un casque sur les oreilles, ce qui dans un environnement professionnel entraîne des difficultés.

Elle mobilise chez le non-voyant un sens précieux: l'ouïe, qui sera moins disponible à d'autres utilisations.

III. CONCLUSION

La synthèse vocale reste un outil nécessaire pour ceux qui ne connaîtront jamais le braille, ceux pour qui l'impératif financier est l'unique critère de choix, ou pour ceux qui n'ont pas d'impératifs de rapidité et de rentabilité; la synthèse vocale peut, dans un usage domestique être une aide précieuse et indispensable aux aveugles. De plus, les produits qui apparaîtront demain pour les voyants utiliseront certainement en complément l'utilisation de la synthèse vocale dans certains logiciels pour améliorer leur ergonomie; par conséquent ces aides additionnées au braille ne feront certainement qu'accroître la productivité des personnes non-voyantes.

Le braille demeure pour les non-voyants qui le connaissent ou qui sont prêts à l'apprendre, l'outil le plus performant surtout dans une utilisation professionnelle; la différence de prix par rapport à l'augmentation des performances fait pencher fortement l'étude économique finale en faveur de l'utilisation de braille.

Enfin, le véritable débat, n'est-il pas d'une part, de rechercher des terminaux braille bon marché, ou d'autres part d'aider ces produits à être vendus en plus grand nombre afin de bénéficier des baisses de prix dues à l'économie d'échelle.

"Informatics for the Handicapped in France : Benefits and Limitations"

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A B S T R A C T

Various informatics applications developed in France will be described and their limitation will be analysed. The potential benefits of informatics applications for the handicapped will be treated along two main lines:

(1) Physical and sensorial disability, description will include:

- Visual feed-back aids for deaf persons, and potential usage in communication and computer aided learning (CAL).
- Speech synthesizers and automatic translation into Braille for the blinds.
- Adaptations of advances in robotics to develop aids for mobility and environment control for the physically handicapped.

(2) Informatics applications for specialized schools and schools for children with severe disability, inlcuding:

- CAL, simulation, LOGO like languages, etc. as tools and factors for integration approaches in schools.
- Advances brought by research in aritifical intelligence, as factors for potential changes in the educational systems.

These advances, and other informatics applic- tions for the handicapped, will be analysed pointing out to risks of potential inadequancy and fruit- lessness as well as psychological dangers induced by the fast introduction of these advanced techniques.

Nos civilisations occidentales ont d'abord rejeté dans tous les sens du terme, tous ceux qu'elles vivaient comme différents.

Rares alors étaient les handicapés qui avaient une chance de survivre ou de s'insérer, les autres étant abandonnés, enfermés, maltraités, parfois supprimés; dans le meilleur cas, certains périmètres leur étaient alloués.

Ce n'est que récemment que les handicapés ont vraiement été l'objet d'intérêt et qu'un lent et long travail de rapprochement s'est amorcé. Ce rapprochement a pu commencer dès que l'homme a su comprendre ou imaginer les mécanismes et les causes de ces handicaps.

C'est dans ce rapport de l'homme normal et de sa pathologie que le rejet, dû à la peur de l'inexplicable et de ses corollaires de punition divine et d'intervention satanique, s'est estompé.

Il reste pourtant beaucoup de cette coloration dans nos comportements. L'impossibilité de justifier rationnellement la mise à l'écart encore très forte des handicapés, n'a déclenché souvent hélas que des réflexes de charité et de culpabilité volontiers visibles et mal vécus par ceux qui doivent les endurer.

Heureusement un facteur de rapprochement, de sésenclavement entre les hommes est leur consommation technologique.

Notre civilisation actuelle se rassure en se nourrissant de ces technologies qui deviennent de puissants médiateurs. Il ne s'agit ici ni d'accepter, ni de condamner mais de constater ce phénomène.

La représentation mentale d'un paralytique au volant de sa voiture crée moins d'inquiétude que sa représentation sur un fauteuil mécanique. Les appareils sophistiqués, nous rapprochent des handicapés car la technique joue un rôle magique aseptisant et rassurant. Elle écarte de ce fait les restes de phantasmes de punition divine, ou de contagiosité associé au handicap.

L'informatique se classant parmi les technologies les plus sophistiquées répond au mieux de ce point de vue à ce pouvoir.

Il est alors réconfortant qu'actuellement les handicapés les plus toniques ayant senti cette ouverture se situent en pionniers des nouvelles technologies. Ils savent qu'ils gagneront en confort mais surtout qu'ils mettront moins mal à l'aise ceux qui se croient normaux.

Nous allons maintenant examiner les apports potentiels de l'informatique selon deux versants:

- le premier versant: informatique et aide technologique dans le cadre des handicaps physiques.

- le second versant: l'informatique comme solution intégrative pour des enfants en grave difficulté scolaire voire pour certains handicapés mentaux.

I. TROUBLES SENSORIELS ET INFORMATIQUE

I.1 Les mal-entendants

Les jeunes enfants mal-entendants ont toujours un accès problématique à la parole. L'apprentissage de la parole peut aller d'une difficulté légère quand les compensations prophésiques sont satisfaisantes à une difficulté quasi insurmontable pour certains troubles très profonds où la compensation est négligeable. Cette difficulté est due à l'absence plus ou moins totale de contre-réaction auditive.

Depuis longtemps, les spécialistes ont essayé de compenser le manque de contre-réaction auditive par une contre-réaction visuelle. Un nombre impressionant de systèmes, souvent très sophistiqués, ont ainsi été mis à l'épreuve. Les plus simples consistent en jouets animés par la voix. Ils sont très attrayants pour l'enfant et les résultats obtenus dans le domaine de l'entretien des émissions laryngées sont positifs. La motivation liée à l'introduction d'un jeu à règle est flagrante- l'enfant parle: l'auto roule; l'enfant se tait; l'auto s'arrête. La parole n'est plus là pour faire plaisir à l'adulte, mais pour obtenir un résultat qui ne peut apparaître par aucun autre moyen. Non content de découvrir un pouvoir magique de la parole, l'enfant ressent le peisir de parler. Malheureusement, le mouvement de la voiture n'est lié qu'à un seul paramètre, ce qui est évidemment limite sa portée.

D'autres appareils très variés, demandent à l'enfant de reproduire des images obtenues par le professeur, courbes diverses, plages lumineuses, toutes supposées caractéristiques de phénomènes, de mots, de phrases. Toutes ces images apparaissent sur des tubes cathodiques, des colonnes ou des lampes.

Ces dispositifs électroniques ont l'inconvénient de manquer de souplesse et pèchent souvent par une représentation de la parole d'une trop grande complexité.

Cette complexité est présente tant au niveau de la forme de l'image que dans la comparaison des images de deux faits locutoires différents ou que dans le nombre de facteurs inclus dans le codage visuel. Ces configurations entraînent naturellement pour l'enfant une difficulté supplémentaire par l'incapacité fréquente qu'il a d'associer les schémas moteurs de la parole aux éléments du code visuel engendré par l'appareil.

Le manque de stabilité des modèles diminue aussi la portée de cette contre-réaction visuelle.

S'il est demandé à l'enfant d'imiter un modèle, cela suppose que celui-ci soit toujours présenté sous la même configuration. Il suffit de très peu de chose pour introduire des altérations. Nous savons que les réalisations d'un phénomène, d'une phrase, d'un fait prosodique peuvent varier d'un individu à l'autre d'une manière appréciable. Cette remarque vaut aussi pour deux réalisations, d'un même individu, espacées dans le temps. Il est pourtant nécessaire d'obtenir une bonne précision, car il importe que les paramètres extraits soient totalement fiables. Il serait regrettable d'utiliser un indicateur de phénomènes qui n'assurerait pas une discrimination parfaite. La notion de sécurisation directement liée à celle de reprère, serait alors caduque.

L'enfant doit aussi saisir le lien entre l'altération de l'image qu'il a engendrée par rapport au modèle et l'erreur articulatoire commise, grâce aux indices perceptibles dont il dispose: souffle, image labiale, etc .

Les appareillages électroniques ne permettant pas de dominer correctement ces problèmes, expliquent le relatif échec de cette technique.

L'avènement de l'informatique et des disciplines connexes a permis de répondre en partie à ces critiques qui limitaient, l'efficacité du recours au canal visuel. Une des caractéristiques de l'informatique traite automatiquement les informations en suivant le programme d'instruction, il suffit de modifier ces programmes pour faire varier à l'infini les opérations et aussi la manière de présenter ces résultats. L'apport des recherches en reconnaissance de formes et en reconnaissance de la parole, a révolutionné la conception même des appareils. C'est dans cette optique que nous allons étudier trois réalisations françaises:

S.I.R.E.N.E. (Système de Rééducation Vocale des Enfants Sourds Assisté par l'Ordinateur)

Ce système mis au point à Nancy, est très puissant et bénéficie de tous les acquis des connaissances en traitement de la parole. Il visualise en temps réel, le plus souvent possible sous forme de jeux, un grand nombre de paramètres vocaux. Il s'agit des paramètres prosodiques: mélodie - rythme - intensité de la voix, des paramètres fréquentiels pour l'apprentissage des sons élémentaires ou phonèmes, des paramètres articulatoires, des mots isolés par les techniques de reconnaissance des mots.

Ce système est conversationnel. Le professeur choisit le paramètre à étudier et le dialogue avec l'élève s'instaure sans aucune connaissance en informatique. Les enfants peuvent aussi s'entraîner personnellement. Avantage original, l'appareil peut ainsi interpréter les productions vocales de l'enfant et les noter. Les notes, semble-t-il, dans beaucoup de cas, ont été d'une grande importance pour la motivation des enfants.

Institut National de Jeunes Sourds de PARIS

Il s'agit ici d'un autre système, qui visualise un grand nombre de paramètres de la voix de l'enfant. L'enfant améliore sa voix ou la prononciation de certains sons, grâce à divers courbes ou dessins animés. Le professeur peut, selon son désir, faire ainsi contrôler le volume de la voix, faire travailler l'intonation en choisissant sur un clavier. Quand le professeur prononce une phrase par exemple, une courbe apparaît sur l'écran; l'enfant parle à son tour, une courbe correspondante se dessine. C'est grâce à la comparaison immédiate entre les deux courbes et à une répétition jusqu'à une similitude satisfaisante que des progrès rapides sont enregistrés. L'enfant peut lui-même, s'il en a le désir, s'entraîner tout seul.

Le système offre alors des jeux contrôlés par la voix. Un dromadaire et une série de palmiers, par exemple, apparaissent sur l'écran. Le dromadaire se déplace de gauche à droite en remuant les pattes, lorsque l'enfant prononce un son voisé. Il s'agit de guider le dromadaire de manière à ce qu'il évite les palmiers et cela par simple modulation de la voix. L'animal monte alors plus ou moins vers le haut de l'écran selon que le ton de la voix de l'enfant est plus ou moins aigu. Une grande variété de jeux de ce type sont proposés ainsi à l'enfant, pour une utilisation de type libre service.

Système de l'Institut National des Jeunes Sourds de CHAMBERY

Il s'agit ici d'un ensemble modulaire d'aide visuelle à l'apprentissage de la parole. La modularité se situe à deux niveaux: celui des paramètres acoustiques et celui de la complexité de la tâche demandée à l'élève.

Les principaux points de contrainte consistent en l'extraction automatique des données acoustiques pertinentes dans le domaine de la production de la parole et la visualisation de celle-ci sur la base d'exercises progressifs. Des jeux sont actuellement utilisés avec de très jeunes déficients auditifs profonds. Leur but est d'intéresser l'enfant au monde sonore et plus particulièrement à la voix humaine par une prise de conscience de sa propre voix et par un contrôle de ses émissions vocales. La prise de conscience des émissions vocales se fait à travers l'apparition d'un "bonhomme" sur l'écran, dont la taille est proportionnelle au niveau de l'émission. La figure obtenue peut se réduire à un point ou dépasser les limites de l'écran, toutes les tailles intermédiaires étant possibles. Ce jeu est le premier présenté à des enfants aphones ou n'ayant que des émissions de voix incontrôlées. Après une période de mutisme généralement observée, l'enfant est rapidement tenté d'obtenir lui aussi le dessin lumineux et se rend vite compte que le seul moyen d'y réussir est d'émettre de la voix. Dès qu'il a compris qu'il peut agir sur la taille de la figure, il ne se lasse pas de passer du grand au petit bonhomme, en faisant varier l'intensité de son émission vocale. Le but et les limites de ce jeu étant atteints, le passage au deuxième module peut être envisagé.

Il s'agit ici du placement du niveau sonore entre deux limites. L'enseignement fixe au départ le nombre de réussites qu'il impose à l'élève et celui des essais infructueux qu'il permet. Une émission vocale provoque le départ d'uneballe sur une trajectoire parabolique dont le paramètre de commande est le niveau sonore. ce jeu s'arrête lorsque le score obtenu est égal au nombre de réussites fixées ou lorsque le nombre d'échecs a été atteint. Le professeur peut alors modifier le facteur d'amplification et les deux paramètres de départ, pour encourager l'élève qui aurait subi trop d'échecs, ou pour faire varier l'exercise. Le principe de ce jeu est sensiblement le même, la satisfaction de mettre la balle dans le panier n'est obtenue que si l'intensité de la voix correspond au niveau choisi par l'enseignant. Lorsque l'enfant a réussi le nombre de "paniers" fixé, le jeu s'arrête et une lampe s'allume. Le score obtenu est également affiché; seuls les plus grands des enfants sont sensibles à cet aspect.

Le troisième module s'adresse à l'autre aspect de l'émission vocale qu'est la tenue de la voix. Le jeu consiste à faire monter une barre horizontale sur l'écran, en maintenant une émission sonore à un niveau constant pendant un temps facilement programmable par l'enseignement. Lorsque la tenue n'est pas constante, la barre oscille de bas en haut. Si la tenue dure le temps demandé, le rectangle se ferme et une maison apparaît alors.

Le rééducateur peut modifier le temps de montée de la barre pour moduler le travail de l'élève. Ce dernier jeu a généralement les faveurs des enfants. Il est aussi le plus intéressant au plan pédagogique, car il aide l'enfant à acquérir un des mécanismes les plus importants pour l'intelligibilité ultérieure de sa parole. Il s'agit de la maîtrise de son souffle et de sa tension musculaire.

Les premières analyses de l'application de ces appareils ont permis de déceler deux types de comportement des enfants envers la machine. Il peut apparaître soit une certaine anxiété, soit une certaine fascination.

L'anxiété est d'une durée très variable, c'est évidemment la relation maître-élève qui permet de la dépasser. Pendant cette période l'utilisation de la machine ne donne que de piètres résultats.

La fascination est une réaction qui est souvent néfaste à l'efficacité du procédé, car l'intérêt pour la machine prend alors le pas sur ses possibilités. L'enfant est plus attiré par la manipulation du matériel que par le travail demandé. La durée de cette période diminue avec l'âge et la maturité de l'enfant. La résolution de cette fascination est pourtant difficile.

Pour éliminer les facteurs de dispersion il faut séparer les claviers de commande de l'écran, en réduisant les manipulations au strict minimum. L'enseignant doit attendre que l'enfant ait totalement découvert cet environnement pour l'amener à s'intéresser aux exercises. Son rôle est ici capital. Il paraît plus facile de diminuer l'anxiété que la fascination.

Il ne s'agit pas actuellement de tendre vers un enseignement autonome de la parole, qui d'ailleurs n'est absolument pas souhaitable, mais d'apporter une aide efficace dans la contre-réaction visuelle intégrée aux autres techniques.

Il est souvent difficile sinon absurde, de faire la part de l'homme et de la machine dans une réussite. On ne peut qu'affirmer certains succès, dans ces cas réputés très difficiles et jusqu'ici peu améliorés, après un enrichissement de l'environnement pédagogique par l'Enseignement Assisté par Ordinateur.

Il faut d'emblée noter que l'échec d'un de ces modes de travail est toujours dû à une mauvaise stratégie, à une sous-estimation des difficultés de l'exercice ou à une aversion temporaire de l'enfant. Dans ce cas, l'enseignant ne peut qu'arrêter la machine.

De tels systèmes auront un avenir et dépasseront le stade expérimental si les enseignants, les utilisateurs potentiels, continuent à jouer dans leur conception.

Il fqut élargir cette réflexion à l'environnement futur de ces handicapés, pour lesquels l'introduction de la télématique pourrait prendre rapidement en charge leurs besoins spécifiques et permettre un meilleur épanouissement relationnel.

Les progrès en reconnaissance de forme, en reconnaissance de la parole, conduiront probablement à des dispositifs capables d'inscrire sur l'écran de télévision les communications téléphoniques. Ces systèmes pourraient aussi être étendus au sous-titrage des émissions de télévision. Dans un proche avenir, il sera donc techniquement possible de résoudre, grâce à la télématique, un grand nombre de problèmes d'isolement de graves mal-entendants, dont les espérances d'amélioration sont assez faibles. L'arrivée de l'informatique dans ce champ du handicap sensoriel, prouve à l'évidence son immense potentialité d'amélioration et de recherche, tant au plan des prothèses auditives qui ne bénéficient pas de tous les progrès de la technologie, que de l'aide à l'apprentissage de la parole et de la lecture labiale et de l'enrichissement communicationnel de l'environnement quotidien du mal-entendant.

Passons maintenant brièvement aux handicapés visuels. Sujet qui sera pleinement développé par Monsieur BALIN.

I.2 <u>Les mal-voyants</u>

Tous les livres étant photocomposés; il est possible théoriquement de passer automatiquement de la bande de photo-composition à une bande codée braille. La difficulté majeure réside dans la multiciplité des

standards de photo-composition. Il existe des dispositifs informatiques qui s'adaptent à n'importe lequel d'entre eux, par changement de paramètrage. Il existe aussi des possibilités de reconstituer une bande de photocomposition à partir d'un texte ancien même photocomposé.

Les livres obtenus par l'intermédiaire d'imprimeurs spécifiques en braille intégral ou abrégé pourront aussi être offerts, sous forme de cassettes magnétiques traduites sur une sortie plage tactile créant un éphémère. Cette solution est dans la stratégie d'offrir aux aveugles le choix de lire seul en braille plutôt que de les écouter interprétés par une voix amie; mélodieuse et bénévole. Mais rien ne prouve après tout que les aveugles aient plus envie de lire que leurs contemporains.

Cette solution assez lourde doit être complétée par le système de lecture optique (ou de système de TOULOUSE) de textes imprimés couplés à une sortie en braille éphémère sur plage tactile. Cette technique fait appel à la reconnaissance de forme pour reconnaître chaque lettre.

Une sortie sonore peut être ajoutée par synthèse vocale. Cet appareil a l'avantage de faire accéder à presque tout l'écrit imprimé instantanément. Il suffit de déplacer la microcaméra sur le texte, ligne par ligne. Ainsi, la solution de la bibliothèque informatisée permettra au non-voyant d'acheter un ouvrage en braille; une cassette braille par le canal le plus court souhaitable. Néanmoins, il demeurera une certaine difficulté d'accés immédiat. La solution lecture en temps réel par le système permet de lire instantanément un journal, une revue achetés dans un kiosque.

Il faut noter l'existence de recherches sur l'extraction par analyse automatique de scènes et de bruits significatifs dans l'environnement visuel. Ce problème est aussi de trouver la représentation la plus commune de ces traités et les meilleurs moyens de les communiquer au non-voyant.

Enfin, la stimulation directe du cortex pose des problèmes fondamentaux qui ne paraissent pas pouvoir être résolus dans un futur proche.

Elle reste une voix de recherche essentielle et prometteuse mais ne doit pas susciter de vains espoirs dans l'immédiat.

Toutes les tentatives qui sont faites pour connecter des capteurs au cortex occipital (ou à la pour les sourds) achoppent souvent par la non harmonie entre les indications des détecteurs naturels ou artificiels. Les patients doivent dans ce cas apprendre à interpréter les réalités extérieures à travers des sensations probablement sans grand rapport réel avec celles que fournissent normalement les organes des sens.

Enfin, dans l'environnement privé les systèmes de télécommande manuelle ou à la voix, les appareils ménagers dotés de synthétiseurs de paroles ne pourront qu'augmenter le confort des mal-voyants.

II. HANDICAPS MOTEURS ET ROBOTIQUE

Etudions maintenant les handicapés moteurs et la place de la robotique.

II.1 Les paralysés

La robotique peut améliorer les conditions de vie des paralysés; d'une part en proposant des orthèses programmables aidant au fonctionnement du membre atteint.

Si ces appareillages sont actuellement encore trop lourds et perfectibles, ils permettent déjà d'élargir considérablement les possibilités de rééducation. La verticalisation possible ici est aussi un facteur psychologique positif. Actuellement, la partie informatique de ces dispositifs est en avance sur les techniques mécaniques et électriques satellites.

Il reste à trouver à des coûts non prohibitifs des moteurs à la fois puissants et ultra légers alimentés par des sources d'énergie d'un poids acceptable.

II.2 Les handicapés moteurs

Le handicapé moteur peut être aidé par le contrôle d'environnement. Les progrès récents de la micro-informatique ont un peu relégué au second plan les robots universels très lourds et très coûteux hérités de l'industrie nucléaire.

Maintenant, on voit apparaître une multiplication de dispositifs indépendants contrôlés par micro-ordinateur

commandé par moteur et/ou par la voix. Il est possible alors à distance d'allumer, d'éteindre la lumière, d'ouvrir ou de fermer des ouvertures, de répondre au téléphone, de composer un numéro, de tourner les pages d'un livre, etc.

Si l'on combine avec les possibilités de la bureautique et de la télématique, une réinsertion sociale et professionnelle est envisageable à condition que les possibilités de la télématique ne fassent pas oublier que malgré ces progrès l'isolement de la personne reste encore dramatique.

Des recherches en cours essayent de rendre un certain usage aux membres défaillants en envoyant des impulsions électriques contrôlées grâce à un traitement informatique par le handicapé.

C'est un problème complexe car un geste résulte d'une séquence compliquée d'instructions complexes appliquées à différents muscles et non pas d'une suite de signaux électriques directement appliqués à un seul muscle. La régulation de l'ensemble, même lorsqu'il est coordonné par des sous-programmes déclenchés de manière réflexe met en jeu des boucles de réactions multiples et imbriquées. Un projet encore plus ambitieux et déjà exploré serait de tenter de shunter la lésion nerveuse (on cherche aussi à repérer les lésions froides) en récupérant directement l'impulsion qui traduit l'ordre de solliciter un muscle et en la transmettant vers ce muscle cible.

II.3 Les infirmes moteurs cérébraux

Je finirai cette série par quelques mots sur les infirmes moteurs cérébraux.

Comme dans les cas antérieurs; par un seul canal restent au moins des possibilités intéressantes par contrôle d'environnement; mais l'écriture; donc la communication peut être facilitée par le biais informatique. Malgré une lenteur certaine, le couplage avec un synthétiseur de parole rend enfin le sujet demandeur, acteur et parlant. Il n'est plus condamné au "oui" "non" de la tête aux questions posées. Cet homme ou cet enfant peut enfin sortir d'un silence faisant trop facilement croire qu'il n'avait rien à exprimer.

Pour accélérer la communication, le "blis symbolic" conçu pour permettre cette communication plus rapide et plus simple à travers des symboles, et non par le biais de nos langues hypersophistiquées; a grâce à l'informatique un regain d'intérêt.

Ce langage était très intéressant pour certains de ces handicapés moteurs cérébraux, mais peu de gens pouvaient le comprendre et il se heurtait de ce fait à un certain rejet provoqué par la crainte de recréer une autre forme d'isolement. Actuellement, le système Sahara II donne une traduction instantanée en clair et en systhèse de la parole. La lenteur de l'écriture normale est ainsi moins pénalisante par ce sytème Bilis-symbolic.

Voyons maintenant le deuxième volet des potentialités de l'informatique dans le champ du handicap et de l'inadaptation, soit: l'informatique et l'intégration scolaire des élèves dits difficiles, voire handicapés mentaux.

L'école ou la société doivent-elles obéir à un équilibre statique ou dynamique? Doit-on les identifier au cristal qui puise son harmonie de son ordre figé et donc de sa froideur, ou de la flamme dont la stabilité de la forme repose sur son désordre interne et donc de sa chaleur?

Les technologies nouvelles, rationnelles, cristallines, peuvent encore plus "refroidir" le système scolaire et social si elles sont utilisées (comme c'est leur destinée) comme amplificateur de logique. Si, par contre, leur potentialité d'intégration est bien exploitée, alors on peut raisonnablement espérer qu'elles faciliteront le maintien et la réussite du "mauvais sujet" et enrichiront l'école d'autres enfants jusqu'ici techniquement inintégrables.

Alors moins homogènes, moins figées, plus désordonnées, mais toujours stables, l'école et la société conserveront leur versant chaleureux.

Dans cette optique, étudions les nouvelles pédagogies et les nouveaux concepts induits par l'informatique.

- L'enseignement assisté par ordinateur dont on peut résumer le fonctionnement ainsi:

    * L'ordinateur imprime une question (assortie éventuellement de plusieurs réponses possibles);

    * L'élève choisit une réponse et si celle-ci est correcte, l'ordinateur propose la question suivante. Si elle est incorrecte, il affiche un message d'erreur et demande un nouveau choix.

L'appareil est conçu pour répéter à volonté les apports d'information, les corrections en fonction des besoins cognitifs décidés par le professeur ou dans le cadre d'un libre service. L'intérêt de la répétition se situe ici dans l'hypothèse que la transmission de la richesse cognitive d'un milieu humain dépend de sa capacité à répéter dans la variabilité. Sans vouloir surestimer ce paramètre, cette pédagogie insiste sur l'intérêt de doter l'ordinateur de cette capacité, mais d'une manière infatiguable.

A cette stratégie de base, une tentative de pseudo-personnalisation est souvent associée. Au lieu d'afficher "erreur", l'ordinateur peut indiquer "Non Pierre, tu t'es trompé. Essaye encore une fois". Il s'agit d'une kystification de programmation créant une illusion de dialogue. Les concepteurs d'émissions radiotélévisées appliquent depuis longtemps ce subterfuge.

- Dans l'apprentissage adaptatif, l'ordinateur est programmé pour que le niveau de difficultés des questions soit fonction des réussites antérieures. Il s'agit de réaliser un apprentissage qui tente d'adopter la progression des acquisitions et des raisonnements à l'élève et non l'inverse.

- Une recherche du degré optimal de nouveauté est à determiner; les acquisitions ou raisonnements proposés peuvent-être soit:

trop nouveaux et ils rebutent ou découragent l'élève, trop peu nouveaux et ils l'irritent ou l'ennuient.

L'optimum de nouveauté est fonction de chaque individu, le programme le détermine en fonction de l'étude des scores, des temps de réponse, des arrêts spontanés en libre-service.

Ces deux dernières notions ne sont pas actuellement maîtrisées. Il faut insister sur le fait que dans cette première et incomplète énumération des moyens pédagogiques informatisés, la nouveauté vient du support technique.

L'ordinateur rend plus aisées les pédagogies, connues mais difficilement applicables; qui mettent l'accent sur le travail individuel, autonome, auto et hétéro-évaluatif.

La possibilité de "langage auteur" accessible aux enseignants sans formation informatique particulière, autorise ou invite ceux-ci à créer et introduire leurs propres exercises. Ce langage auteur permet l'échange de didacticiels entre enseignants et surtout leur évite d'être esclaves des seuls programmes du marché.

- <u>L'ordinateur inducteur de nouvelles pédagogiques</u>

La simulation: l'ordinateur permet de reproduire des modèles interprétatifs des phénomènes relatifs aux réalités physiques -biologiques- sociologiques. Il y a ici simulation par la machine sur l'écran ou toute autre sortie, de processus connus ou non de l'élève.

Par un jeu de paramètre, ce dernier peut modifier les caractèristiques qui sont matérialisées et prendre ici vraiment conscience de l'influence de tel facteur sur tel comportement.

- <u>L'apprentissage autonome</u> (Environnement LOGO - Cf. PAPERT), a pour pari de faire prendre conscience, par la maîtrise progressive de la programmation, et dans cet environnement informatique LOGO, de certains mécanismes de la pensée. Une fois l'enfant instruit d'un rudiment de langage de programmation, celui-ci conduit à explorer interactivement les possibilités de la machine.

L'ordinateur commande les déplacements d'une tortue qui laisse ou non des traces de ses allées et venues. On indique seulement au début comment leur donner des instructions par l'intermédiaire du clavier. (Avance de x pas - recule de x pas - tourne à droite de x degrés, etc ...). Le travail de programmation commence véritablement dès que l'enfant a l'idée de regrouper sous le nom d'une nouvelle commande (qu'il baptise lui-même), une série fastidieuse de commandes simples qu'il répète fréquemment.

Cet enseignement espère faciliter l'analyse du problème choisi par l'enfant, (dessiner un carré, une maison, une fleur, jusqu'à des objets eux-mêmes complexes et en mouvement).

Le biais visuel permet de matérialiser ce qui n'était avant que des abstractions:

- de diviser la solution d'un problème en une suite de solutions de sous problèmes,
- de considérer les erreurs comme des obstacles provisoires qu'il convient d'éliminer mais aussi d'attendre avec calme et parfois gaieté, la survenue des prochains,
- de développer le comportement autocritique qui permet de découvrir une solution après une suite d'erreurs et d'approximations.

Des claviers spéciaux ou des moyens d'entrée par code devraient êtreexpérimentés pour des enfants ne sachant ni lire, ni écrire. La solution probable consisterait à introduire les ordres par des badges codés dans une fente.

Pour tous les autres systèmes décrits, les concepteurs cherchent à atteindre un dialogue homme/machine en langage naturel, mais beaucoup de progrès restent à accomplir.

- La recherche en intelligence artificielle

Une description du cahier des charges de ces technologies n'est pas suffisante pour nourrir le débat.

L'offre technologique précède dans notre siècle très largement la demande sociale et professionnelle. Cette demande est très limitée et s'exprime lentement. Il existe fatalement une anticipation des concepteurs de ce qu'ils essayent de rendre nécessaire pour demain.

La conséquence de ce décalage est la primauté des approches de type technocratique s'appuyant sur les points de vue de spécialistes choisis pour leur capacité à distribuer un discours généreux et général (sans aucune restriction, sur l'intérêt de toutes ces techniques informatiques, pour tous y compris pour le tiers-monde).

L'esprit de conception est donc seul capable de laisser entrevoir l'avenir et les conséquences de ces pédagogies.

L'intelligence artificielle peut se définir comme un domaine où les chercheurs imaginent le fonctionnement d'un système de traitement de l'information (machine ou homme) qui permet de comprendre, d'apprendre, de juger, de généraliser, de transposer ce qui lui est transmis.

L'ordinateur permet de faire les expériences, et donc de vérifier experimentalement les hypothèses proposées. La seule contrainte, innée à la conception même de l'informatique, est que les processus de perception et de raisonnement ne peuvent être analysés qu'en termes d'algorithme.

Les deux problèmes, objets des travaux les plus fréquents, sont actuellement:

- L'étude de la compréhension du langage naturel par la machine;

- La résolution de problèmes.

Il faut noter que ces travaux se nourrissent de recherches psychologiques ne s'intéressant qu'aux activités de l'homme qui lui permettent une compréhension logique du monde, à l'exclusion de toutes les influences dûs à sa personnalité, son affectivité.

La pédagogie informatisée intégrera probablement les acquis de l'intelligence artificielle pour ces programmes de compréhension du langage et pour cerner automatiquement les erreurs des élèves dans la résolution des problèmes.

Il faut préciser que toutes ces interventions ne pourront s'effectuer que dans un seul code "mental", en général linguistitique. Or, l'enfant opère simultanément dans plusieurs codes (images, sensations, linguistiques, idées).

- La démarche Heuristique

Les recherches en intelligence artificielle ont permis de déterminer des règles pour la machine (des hypothèses pour l'homme) afin d'augmenter ses capacités de compréhension, d'analyse, c'est-à-dire tout ce qui demeure implicite en pédagogie.

Le concept mis en évidence est la démarche heuristique. Une heuristique est une règle de choix qui précise comment agir en l'absence de tout résultat théorique sûr. Si donc un enfant est persuadé de ne pouvoir arriver immédiatement aux mêmes et belles démonstrations qu'on lui enseigne en mathématiques, physique, biologie, etc..., il a raison. En effet, aucun mathématicien, biologiste, etc... n'ont suivi les démarches exposées en cours.

De plus en plus des chercheurs sensibilisés à cette approche oxygénante analysent leur propre activité d'invention et donc essayent de préciser leur vraie démarche heuristique. Les heuristiques testées en machine qui sont les plus intéressantes actuellement cenx qui interdisent des actions stupides plutôt que les heuristiques suggérant des actions apparemment intelligentes.

Testera-t-on ces hypothèses dans les futurs apprentissages en enseignement assisté par ordinateur pour les enfants?

- L'enseignement assisté ou induit par ordinateur est un facteur d'intégration

L'enseignement passe du menu à la carte.

La venue d'enfants ayant des difficultés de compréhension importantes implique de leur donner fréquemment des tâches très différentes de celles des autres enfants de la classe.

Même si l'on comprend l'intérêt de cette demande pour ceux qui sont en difficulté légère, il est facile d'imaginer l'énergie et les difficultés à surmonter pour rendre cohérente la dynamique de la classe.

Regrouper temporairement les enfants à problème entre eux revient à reproduire dans l'esprit ce qui veut être dépassé.

L'introduction d'une pédagogie informatisée règle définitivement ce problème, chaque enfant ayant son terminal et son propre plan de travail adapté par l'enseignant ou auto-adapté.

Les problèmes pédagogiques entre enfant handicapé mental, et enfant normal, sont strictement du même ordre.

Nous l'avons vu que l'enseignant peut programmer en langage autre simplifié, ses propres exercises.

Cette technique implique au plan pédagogique deux exigences:

- d'une part, la clarté, les questions ne devront présenter aucune ambiguité;

- d'autre part, l'imagination, tous les types et cas de réponse devant être envisagés.

Dans un premier temps, il faut tracer un itinéraire représentant les différents points à développer pour qu'une notion soit acquise.

L'itinéraire séquentiel suppose dans un deuxième temps la décomposition de cette notion en questions complémentaires, etc... Le troisième moment, qui n'est pas nécessairement le dernier car il peut ramener à l'un des deux précédents, consiste à rectifier le contenu et la forme du dialogue en fonction des ensembles de réponses enregistrées par la machine après le passage des élèves. C'est en effet à ce moment que sont détectées, grâce à l'enregistrement des temps de réponse, les difficultés que le rédacteur n'avait pu prévoir, même en testant sa rédaction pas à pas. Cette étude plus détaillée permet de vérifier ici que la démarche est la même pour l'enseignant quel que soit le niveau de difficulté de l'enfant. Elle est même plus excitante intellectuellement, plus l'enfant est en difficulté, car les réponses sont plus imprévisibles.

De plus, si tel enseignant décidait de faire concourir ses élèves, les scores pourront ne pas dépendre des acquis en valeur absolue, mais de progrès en valeur relative. Les machines, dans ce cas de figure, inscriront les handicapés à un classement imprévisible, comme dans toute course avec handicap (sans "chouchou" ni "mauvais sujet" car les machines sont impartiales).

L'informatique peut ici supprimer deux effets pervers de l'intégration, soit la surprotection ou l'abandon de l'enfant handicapé (l'enthousiasme des pionners risquant d'être à la longue émoussé).

- L'enfant handicapé mental face à son maître sent plus que tous, dans cette situation de dépendance hiérarchique, combien il doit donner une réponse juste pour gratifier l'adulte.

Quand il se trompe, il développe des sentiments puissants de culpabilité et d'agressivité envers son maître et d'infériorité pour ses camarades.

Tout enseignant, même sensibilisé, même s'il ne le montre pas, se sent d'autant frustré qu'il a fait un effort important pour l'enfant. L'enfant le ressentant, s'inscrit dans un cercle vicieux d'échec par déception, manque de confiance, etc.

Il est à redouter que dans une classe volontairement trop hétérogène ces phénomènes soient plus intenses que pour des classes adaptées.

Devant un ordinateur, dans le cas d'auto-apprentissage, ou de stimulation, les rôles sont souvent inversés.

L'enfant n'est plus exécutant, il devient moteur, concepteur. Le droit à l'erreur est d'autant plus évident que l'enfant sait que la machine ne peut le gronder ou pire, lui en "vouloir".

Dès qu'il découvre que les erreurs antérieurement punies ou sanctionnées, dans cet environnement deviennent fécondes, on peut espérer une boucle d'auto-émulation.

L'enfant handicapé qui risque de se résumer à celui qui se trompe le plus dans la classe, perd ici les conséquences négatives de sa particularité, sans aucune démarche charitable. Comme tous, il expérimente ses idées, et sa place est la même que pour les autres.

Un autre problème règlé par cette pédagogie informatisée est la difficulté des changements de classe. Plus l'enfant grandit, plus le différentiel d'enseignement avec ses camarades du même âge est important et plus les problèmes pédagogiques dans le cadre intégratif traditionnel se compliquent.

Dans le cadre de la pédagogie informatisée, cette difficulté disparaît, car chaque enfant est habitué à un enseignement à la carte individuel. Il n'a aucune raison de redoubler.

Les groupes ou classes se forment par affinité ou en fonction de stratégies indépendantes de contraintes d'un niveau scolaire.

- <u>L'informatique est aussi facteur de non-exclusion</u>

Si l'école se doit d'être plus perméable aux enfants ayant des difficultés majeures de compréhension, elle se doit aussi d'arrêter d'exclure les "instables", "les caractériels", à la problématique trans-culturelle, "les réfractaires à l'école","les révoltés", etc.

La fin dans cet enseignement informatisé, de la hiérarchie entre celui qui sait et celui qui ne sait pas, la fin de l'erreur complexante, la valorisation par l'informatique (sa banalisation en diminuera sûrement l'effet), sont probablement des atouts de reconciliation avec une formation enfin acceptée. Quand on connaît l'extrême sensibilité, voire susceptibilité de beaucoup d'enfants, futurs candidats au rejet par l'école, on peut espérer raisonnablement en un distributeur de connaissances qui ressemble à un "juke box".

Il ne suffit pas que le distributeur de connaissance soit une chose pour diminuer les blocages, encore faut-il que les pédagogues analysent le contenu, et les sous-entendus implicites des connaissances ... Celles-ci sont souvent loin d'être neutres. Enfin, la possibilité de modélisation (fabrication d'une représentation mentale correcte de toute interaction avec l'extérieur) est favorisée par la visualisation des expériences de l'écriture action de la programmation.

Les raisonnements abstraits perdent ici leur inutile caractère d'exercise pour ces enfants qui ne veulent apprendre que des "trucs qui se voient ou s'écoutent".

- L'informatique développe des potentialités pour la recherche chez des handicapés sévères

La création d'interfaces informatiques compatibles avec des enfants ne sachant ni lire, ni écrire, posent le problème de l'intérêt de ces technologies dans le cas de handicap mental important.

D'autres recherches veulent adapter les procédures expérimentales utilisées pour l'apprentissage de forme de communication artificielle avec des anthropoïdes, à certains enfants lourdement déficitaires.

L'échange se fait par interface informatique grâce à des lexigrammes auto-appris. Le but est de faire assimiler à l'enfant un sous-langage artificiel simple mais avec une syntaxe stricte (comme le Yerkish par exemple).

L'hypothèse serait de tenter d'approcher la complexité de nos langues par palliers successifs mais par auto-apprentissage.

Il faut remarquer que beaucoup d'enfants handicapés sévères peuvent spontanément acquérir, comprendre et retenir les signaux de circulation routière ainsi que d'autres idéogrammes et pictogrammes quotidiens.

Ce type de constatation encourage ces recherches de communication par idéogrammes et lexigrammes.

La médiation de l'ordinateur permet de commander par le biais de ces sous-langages, un contrôle sur l'environnement des distributions d'objets convoités.

Le risque évident est d'obtenir un simple dressage à la place d'un embryon de communication.

En terme d'espérance, ces expériences sont nécessaires et au plan éthique, s'il y a dressage, il ne paraît pas plus dangereux que ceux employés quotidiennement par les publicitaires (sans volonté pédagogique au contraire et sans que personne ne s'en alarme vraiment).

Il est probable que les travaux sur l'apprentissage de nos langues naturelles aux machines permettront aussi d'optimiser certaines de ces procédures expérimentées.

Vaudra-t-il mieux conduire ces recherches en milieu scolaire intégré qu'en milieu spécialisé? Il est difficile de répondre à cette question qui est de toute évidence d'un niveau inférieur à la problématique de l'intérêt de l'apprentissage de sous-langage pour les handicapés sévères.

- Les risques d'inutilité

Les hypothèses antérieures prennent pour élément durable la fascination qui est décrite chez tous les enfants, handicapés compris, pour ces technologies.

Il n'est pas certain que l'intérêt pour ce "média froid" existe, est stable, et va continuer.

L'enfant handicapé mental, insuffisamment stimulé, ne se lassera-t-il pas le premier de cette pédagogie? La machine ne risque-t-elle pas de devenir un élément phobogène?

Les dialogues enfant/machine, en langue naturelle n'étant que pour un futur assez lointain, il demeure maintenant des contraintes fastidieuses qui n'apportent aucun intérêt et qui risquent de rebuter l'enfant handicapé mental (et les autres).

Les problèmes visuels et neuro-physiologiques que peut poser l'usage régulier de l'écran cathodique de l'ordinateur, sont mal connus. Des contre-indications comme des risques de crises comitiales peuvent en écarter certains enfants.

Enfin, l'enfant pour se servir efficacement d'un ordinateur doté d'un écran de lecture, doit actuellement posséder la lecture et l'écriture, ce qui restreint considérablement son application au champ des handicapés mentaux.

Nous avons vu, par contre, que des solutions par badge peuvent permettre de correspondre avec l'ordinateur, et que l'on expérimente actuellement des entrées et des claviers spéciaux.

- Il existe les dangers psychologiques de ces technologies

Le premier danger est un danger de confusion, d'augmentation de l'attitude de passivité, de respect et de crainte de ce que l'on ne comprend pas.

S'il est potentiel pour tous les enfants, il est plus probable pour ceux qui ont des difficultés importantes à comprendre et à maîtriser leur environnement.

Il est acquis que ces technologies vont sûrement augmenter les acquisitions et les raisonnements scolaires. La médiation par "boîte magique" est de toute évidence un facteur de confusion important. Il faut apprendre par "boîte magique" un système de traitement de l'information qui ne laisse voir de son état que la réalité de l'entrée et de la sortie.

Le monde pour l'enfant handicapé mental est mystérieux, chaotique, imprévisible, donc dangereux et hostile. Toute attitude pédagogique doit tendre à lui donner une meilleure compréhension, donc une meilleure prévision des phénomènes qui l'entourent. La pédagogie informatique c'est l'explication la plus simple possible par un moyen totalement incompréhensible. Les enfants nés au milieu de cette technologie domineront cette perversion pédagogique, mais les plus fragiles risquent d'augmenter encore leur crainte et leur passivité devant ce qu'ils ne peuvent comprendre.

(Il est savoureux de constater que dans les sciences humaines beaucoup de travaux se voulant plus respectables et plus scientifiques truffent ou pire se construisent autour de traitements informatiques vécus comme "magiques").

Si l'enfant refuse, délaisse l'ordinateur il existe le risque réel d'un abus de l'utilisation de ce dernier. Si pour certains l'ordinateur peut aider à une meilleure compréhension et simulation du réel, il existe un risque potentiel non négligeable que les enfants fragiles adoptent cet environnement et s'y réfugient pour fuir leurs difficultés relationnelles.

Pour diminuer, ou lever, ses tensions affectives, l'enfant s'imagine fréquentant un monde qu'il rationalise, géométrise et peut dominer. Le micro-monde informatique peut correspondre totalement à son rêve de géométrisation et de pouvoir.

Il faudra donc se méfier d'une trop grande appétence de ce monde artificiel qui risque de le combler au point de l'isoler et de ne lui donner envie de communiquer exclusivement avec la machine (refusant les difficultés de dialogue avec les pairs).

Si ce point paraît un peu trop "journalistique", il faut insister sur les fréquentes difficultés relationnelles dont se plaignent les informaticiens ou leurs proches, après plusieurs années d'exercise (amplifiées ou acquises elles méritent maintenant qu'on y réfléchisse).

- Il existe aussi un danger théorique

Nous avons constaté que toute la pédagogie informatique se nourrit des recherches en intelligence artificielle. S'il ne faut pas sous-estimer les acquisitions théoriques, peut-être extensibles à notre fonctioneement mental, il faut préciser que pour beaucoup de ces chercheurs, et les psychologues cognitifs qui sont en raisonnance, l'aspect réductif va jusqu'à poser comme hypothèse "qu'être intelligent peut se résumer à la simple acquisition d'une grande d'algorithmes appropriés".

S'il n'est pas inutile de prendre pour hypothèse qu'une part du fonctionnement élémentaire mental conscient procède par cette similitude, il est peu probable que ce fonctionnement soit le seul. Ce schéma est le plus rassurant mais le moins exaltant et il est troublant que l'idée de fonctionnement inconscient ne puisse être débattu au plan algorithmique.

L'école spécialisée ou non, intégrative ou non, ne doit pas introduire sans chercher à compenser ou neutraliser les nouvelles générations de pédagogies informatisées qui risquent de procéder plus d'une tentative de vérification de ces hypothèses réductivites que d'une volonté d'épanouissement des enfants.

Une règle voudrait que l'on évite de faire simuler exclusivement par ordinateur ce qu'un enfant peut faire lui-même.

Ainsi, la pédagogie par ordinateur permet des acquisitions en quantité et qualité compatibles aux problèmes de l'enfant en difficulté, qui perd ici toute particularité dans cette situation. Le handicap sévère, par contre, ne peut être abordé par ces techniques que dans un esprit de recherche*. Erreurs fécondes, hiérarchie enseignant/enseigné bousculée, leçons à la carte, auto-apprentissage, pas de redoublement, voilà brièvement quelques caractéristiques qui rendent l'école moins forteresse pour l'enfant handicapé mental, mais aussi moins rejetante pour le mauvais sujet.

A l'inverse, la froideur du média, la nécessaire connaissance de l'écriture, les contraintes pointilleuses, en limitent l'usage.

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* (avec toutes les prudences restrictives que cela implique).

Ces hypothèses qui président à l'élaboration de ces techniques, sont superbes au niveau de la machine, mais tragiquement réductionnistes si on les étend à l'homme. Il faut donc voir ces "boîtes merveilleuses" comme de nouveaux moyens pédagogiques avec leur indication, leur contre-indication et leur posologie.

Les craintes développées dans cet exposé proviennent à près tout peut-être d'une simple résistance au changement.

Pour finir, ces ordinateurs vont donc offrir aux enfants handicapés ou non les premiers matériaux instantanément remodelables sans déchets matériels (à l'inverse des travaux manuels) et sans déchets temporels (à l'inverse des jeux de construction).

Il paraît donc souhaitable que dans la cour de récréation (le premier lieu d'intégration et de très loin le plus important pour tous les enfants, tous handicaps confondus), il n'y ait pas d'autres objets que ceux que les enfants découvrent avec délice dans les terrains vagues.

Ainsi, pour conclure si les dangers d'une informatisation sauvage sans éthique ni humanisme sont certains, ils toucheront tous les individus. Par ailleurs, certaines spécificités de l'outil et de la recherche informatique ouvrent des possibilités irremplaçables pour le monde des handicapés. Le couple handicap et informatique est donc un couple prioritaire.

Mais pour finir j'aimerais poser le problème humain de ce qu'est une aide technologique. Cette problématique concerne tous les handicapés amis aussi bien d'autres humains.

On peut concevoir que des savants, des chercheurs, des médecins, des thérapeutes, des pédagogues, essayent de mettre au point des techniques, cherchent des moyens ayant pour but d'aider. Mais ce n'est pas parce qu'un appareil ou un système a été conçu pour aider qu'il apporte obligatoirement à chacun une véritable aide.

C'est ainsi que le téléphone est évidemment un bon moyen de communication. Il peut ainsi aider un timide à déclarer sa flamme, mais il peut aussi être une cause de difficultés pour celui qui ne peut parler sans voir son interlocuteur. Et aussi, il peut trouver une utilisation peu orthodoxe entre les mains du délinquant qui ne s'en servira pas pour parler, mais en détruisant la cabine et l'appareil qu'elle abrite. Il s'agit là aussi dans ce dernier cas, d'une authentique communication à la société.

Un autre problème se pose sur la sensibilité humaine au sujet de certaines prothèses ou solutions chirurgicales. Il est parfois difficile pour un chercheur qui a consacré beaucoup de temps de travail et de coeur pour mettre au point une technique qui lui semble idéale dans son système de référence, de comprendre pourquoi sa solution est refusée par le patient. La tentation est grande parfois de l'imposer dans l'intérêt supérieur du malade surtout s'il est enfant. Derrière toute idée, il y a une idée de normalisation qui peut être bien ou très mal reçue par le sujet.

Ainsi, tout résultat proposé ou induit par une technique ou une thérapeutique ou une pédagogie doit faire briller de joie les yeux de l'enfant ou du patient.

Il ne faut surtout pas que soient seuls à briller de joie les yeux du thérapeute, du pédagogue, des parents ou de ceux qui ont des responsabilités ou des intérêts dans ce traitement.

BLIND-USER ACCESS TO A WANG VS-100 SYSTEM

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BLIND-USER ACCESS TO A WANG VS-100 SYSTEM

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Abstract

A blind user performs all his work on a Wang VS-100, both in Word Processing and in Data Processing modes. In this paper, underlying considerations are discussed, and hardware, software, support, and short term trends are reviewed.

Preface

At least one blind user at Wang has had several years' experience working with Wang VS and OIS machines. This is a discussion of one blind user's experience, over the last two years, with the VS-100 (a 32-bit supermini computer). In general, the term user, as employed here, refers to this single individual and is not generic. The author's role has been one of technical liaison.

VS, OIS, VS-100, Integrated Information System, and Wang Office are trade marks of Wang Laboratories, Inc. VersaBraille and BraT are trade marks of Telesensory Systems, Inc., Mountain View, California, USA.

The user and his work

Our user is employed as a teleprospector, that is, he is given a list of names of individuals (prospects), each with his or her company's name and telephone number, and is given a series of questions (a script) to ask each prospect. The printed script has spaces in which the responses can be written; a sighted teleprospector's daily work is likely to consist of a number of copies of a given script, each filled in with the responses from one prospect. The script (and the corresponding list of prospects) changes from time to time.

Our user is totally blind, and he has a severe hearing loss in both ears; the second handicap is partially compensated for by hearing aids. He receives each script in the form of a Word Processing document file on the VS, and he records the responses he obtains, one after the other, in a new Word Processing document each day. He precedes the responses of each prospect with a heading line which identifies the call. He can read either type of document by downloading it to his Braille terminal, as will be described; in addition, he may convert a much-used script into Braille hard-copy using a manual brailler.

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Morgan studied applied physics and acoustics extensively. He holds A.B., S.B., and A.M. degrees from Harvard University.

Our user also receives messages via Wang Office, an electronic mail and office automation system, which he can download to his VersaBraille.

Underlying considerations

Computer methods of communicating with blind persons:

A totally blind user must rely on his or her other senses. Braille printing and display exploit the sense of touch, and "talking" workstations exploit the sense of hearing. (Our user already has his hearing capacity heavily loaded, both because of his hearing handicap and because he talks on the telephone for a living; we therefore have avoided, after consideration, any form of talking workstation.)

The VersaBraille System is a proven touch-oriented terminal for the blind. Using a specialized set of keys, the VersaBraille user can build a new text file which is stored either on a cassette tape (VersaBraille) or on a diskette (VersaBraille II), can position him or herself within an existing file, and can receive or transmit files over a serial data link. Using a touch-pad which displays up to twenty Braille characters with pins which are raised and lowered, the VersaBraille user can read an existing text file. (Note that the VersaBraille is neither sold nor supported by Wang Laboratories, Inc., but by Telesensory Systems, Inc., Mountain View, California, USA.)

VS Workstations for the blind:

The VersaBraille is not capable of acting directly as a VS workstation. The reasons for this have less to do with the details of communication links than with the intelligence that Wang builds into its workstations. Each VS workstation is really a special-purpose desktop computer; it is programmed by the host VS, which transmits a program (microcode) to the workstation when the workstation is turned on. The microcode governs the workstation's behavior, and some programs, notably Word Processing, load different microcode into the workstation when the workstation's user calls the program in question. The VersaBraille neither accepts nor interprets VS workstation microcode. (As an aside, please note that we have had great success in connecting the VersaBraille to a computer bulletin-board service, such as The Source, in two-way communication using a modem and an ordinary dial-up telephone line; our user has had much enjoyment from this kind of hookup, which he uses at home.)

Presentation of formatted text to blind persons:

Information is presented to the VersaBraille user in sequential fashion, that is, the first line appears on the touch-pad, in twenty-character segments, from beginning to end, then the second line, and so forth. We have not found a way for the blind user to perceive several lines at one time, while a sighted user can give a workstation screen one glance and immediately spot the one missing figure in a column, for example, or the one data-entry-screen item that has not been filled in. This difficulty means that, even if our user could attach his VersaBraille directly to the host VS as a workstation, he would have to read each screen image generated by the VS program from start to finish in order to interpret it; additionally, such common host-to-workstation operations as Clear Screen and Scroll have little meaning in a sequential-display context. (Ironically, the internal structure of a VS Word Processing document file, being essentially sequential, with formatting matters such as indenting and paragraphing being governed by single-code characters, is very nearly appropriate as it stands for downloading to the VersaBraille, but we would have no way to receive such a file back on to the VS, as a validated document file, once it had been modified by simple insertions and deletions.)

Current hardware and software

The workstation:

The workstation is a conventional 2256C VS workstation, modified only by the placement of Braille character tapes on a few key tops. Our user has a plastic-label embosser which embosses in Braille rather than in print-style characters, and needs assistance only to place each small self-adhesive label on the appropriate key-top.

The VersaBraille System and VS/OIS Interface:

Our user's VersaBraille is connected to the VS-100, not as a workstation, but as a printer. This requires the use of a Wang Model 9126 VersaBraille Interface, which adapts the VersaBraille's communications channel to the VS/OIS configuration and protocol. (The Wang Office Information System is a word-processing and office-automation system supporting up to 96 users.) We configure the VS port for a model 5535 Matrix Printer.

Word-Processing software:

Our user runs the VS Integrated Information System as sold by Wang. The Interface comes with a set of Word Processing Glossary entries to aid the blind user. (Glossary recalls and types one of a number of user- or pre-defined sequences of keystrokes when the user enters the corresponding two-key code). Salient features of the Glossary package include (1) the extensive use of workstation-alarm signals to prompt and inform the user and (2) the exclusive use of a system work document to which all material to be "printed" (sent to the VersaBraille) is first super-copied. (One reason for the work-document arrangement is that a Word Processing document is unavailable during the course of a printing operation. When the material is printed from the work document, it is the work document that is tied up, and the user is free to access his own work at any time.) The identifier of the work document is hard-coded into the glossary package in several places, and must be changed throughout, using Edit Glossary, if the work document must be changed. The author has customized this package extensively to suit the particular needs of our user; among the additions is a where-am-I entry which sounds the workstation alarm a different number of times according to whether the user is at the main menu, at a document summary screen, or in a document. Another addition removes any underlining from a document which may have come from another person; underlining generally results in a more cumbersome VersaBraille document image.

Data Processing software:

To facilitate Wang Office use, the workstation port is configured as a Multiworkstation, which allows Glossary activity within Data Processing as opposed to Word Processing. The author adapted an existing MWS Glossary file to our user, adding a where-am-I entry which tells the user, by sounding the workstation alarm a different number of times, whether he is at the VS log-on screen or at the command-processor screen. Provision for identifying different Wang Office screens is not working yet.

Current usage

Data path:

Because the VersaBraille emulates a printer in the current scheme, it can receive data from the host VS but not transmit it back, and because our user cannot see the workstation screen he can transmit data to the VS using the workstation but not receive it back, with the exception of the alarm signal. As a result, our user's working data flows in a circular pattern, from the user via the workstation keyboard to the VS and from the VS via the Interface and the VersaBraille back to the user.

Data flow:

We have found no way to print the user's work continuously as he types. For this reason, the data flowing from the VS to the user is batched, that is, it is sent all at one time, but only when requested, and the user can review his work, not continuously, but only occasionally. This is important when our user is running Word Processing or is performing data entry, because it slows him down seriously, and it is somewhat important when he is printing Wang Office memos.

Cursor location and VersaBraille text output:

Word Processing Glossary entries provide for the user to send to his VersaBraille not only entire documents, but short extracts defined in various ways, so that he can review just the area of the document where he is working. However, the user's VS workstation cursor position in the document is lost during the printing process, and in any case does not show in the VersaBraille image, so that the user must employ the Search capability in Word Processing with care in order to return to the specific place, in a document, where he has been working. This is important, because it slows down the user considerably.

Data Processing output to the VersaBraille:

Our user is able to "print" Wang Office memos so that their texts are sent to his VersaBraille. The first time he does this after using Word Processing, the VS holds up the printing until the operating staff responds to a prompt to start the printer which is the VS representation of the VersaBraille; this often requires the user to telephone the machine room and prompt the staff.

To summarize, our user has effective but somewhat unwieldy communications with the host VS using the present scheme.

Future improvements

Our user would greatly benefit from a better approximation of the sighted user's eye-hand coordination. He should be able to sense, on his VersaBraille touch pad, the immediate area of a screen where he is actually working, in real time. This would require a direct connection between the VS workstation and the VersaBraille. We have found no way to do this with our user's current 2256C workstation.

We have used, in demonstration, a program package called "BraT" which runs both on the VersaBraille II (which is fully programmable) and on a personal computer which is linked to the VersaBraille. (Note that BraT is neither sold nor supported by Wang Laboratories, Inc., but by Telesensory Systems, Inc., Mountain View, California, USA.) This program sets up a secondary cursor on the computer screen, a rectangle twenty characters wide, which is controlled, not by means of the computer keyboard, but by means of a set of cursor-control keys on the VersaBraille itself. The VersaBraille touch-pad displays, at all times, the text highlighted by the secondary cursor; and the VersaBraille's "home" key causes the secondary cursor to unite with the primary cursor, allowing the user to sense the text where he is actually working at any time. In addition, because the workstation screen arranges formatted text, such as menus or columns of data, in the intended way, the user is able to scan columns or other graphical structures directly. Our user has tried out this system, on a desktop computer emulating a VS workstation, and can hardly wait to have it for his own use, as he will in the near future.

We have not been able to run BraT on the Wang Professional Computer with all the program's features intact. However, we expect that Wang will have for sale, in the very near future, a desktop system which will run BraT as designed.

Because we have not yet had extensive use of BraT, the author is not prepared to discuss the nuts and bolts of its use in the Wang environment. He would, nevertheless, encourage interested parties to begin their own inquiries.

Summary

Our blind user has employed effective means of communicating with the Wang VS-100 host computer for two years, in the course of his daily work as a teleprospector. It is hard to overestimate the benefit of the current arrangement in an environment where a blind user would otherwise have no useful access.

A desirable improvement would be to facilitate data transmission from the workstation screen image to the output device. Substantial progress is expected in the near future.

VISIOBRAILLE

DESCRIPTION OF A WORKSTATION FOR BLIND

I. GENERAL INFORMATION

Based on an existing workstation, VISIOBRAILLE has been developed in order to offer the full utilization of the Personal Computing by the blind people. Whatever the application is, the blind user gets the same capabilities as the non blind one. The system includes: one personal computer IBM-PC or compatible running under MS-DOS, one non permanent display Braille terminal connected to the PC through the RS 232 interface and optionally a standard printer and/or a Braille Printer.

VISIOBRAILLE runs on the PC and is made up of two different sets :

1) VISIOBRAILLE 1 -- includes the BRLPC software, resident in main memory, and providing for both management of the Braille display terminal and of the secondary keyboard, the secondary keyboard connected through a standard parallel interface (printer card), the dedicated software BRLU allowing especially the down-line loading of coded functions in order to customize the system for using different packages, a computer aided diagnosis program (BRLT) to locate the possible disfunctions, a self-training tutorial for the VISIOBRAILLE, and a reference manual.

2) VISIOBRAILLE 2 -- includes a software module to drive the Braille printer (BDLDH), a software allowing the screen hard-copy in Braille (BRLHC), a software LTB to read and print texts, following the Braille specificities and a reference manual.

II. HARDWARE COMPONENTS SUPPORTED BY VISIOBRAILLE

2.1 Personal computer

Any 16 bits IBM-PC compatible running under the MS-DOS operating system. All additional devices are chosen by the user (hard disk, extended memory, graphic card...) but it has to contain at least a printer card.

2.2 Non permanent display BRAILLE terminal

This terminal may be a standard one.

- Tactile field of 20, 40, or 80 characters.
- At least 7 keys of the standard Braille Keyboard, as available on most of the Braille typewriters.

. A RS 232 interface.

The blind users being used to the Braille keyboard, better skills because typing errors are more difficult to identify on a QHERTY keyboard. It will also prevent them from having to use a combination of keys (control and upper case) for generating characters required by most of the packages.

The users having already a non-permanent display Braille terminal will still be able to keep it, and those not having one will be able to choose any of them, because any non-permanent display Braille terminal may work with the system.

2.3 Standard printer

The user may select a printer among any standard product, compatible IBM-PC.

The printer may either be connected through the RS 232 C interface or through the CENTRONIX one. In that case, since the interface may be used for the secondary keyboard, it is suggested to use a switching device in order to allow the connection of both systems on the same plug and the selection of the right one.

2.4 BRAILLE printer

The user may select a printer among any Braille product, connectable through an asynchronous serial interface (RS 232). The number of characters per line and lines per page may be equally defined because the adaptation is realized by a simple modification of parameters values and transcoding tables.

III. VISOBRAILLE SYSTEM

3.1 VISIOBRAILLE 1 which includes the BRLPC software, secondary keyboard, a BRLU utility software aid and a computer aided diagnosis program.

3.1.1 The BRLPC software

It drives the non permanent display terminal and the secondary keyboard which has 32 multifunction keys.

It gives to the blind user the following capacities:

- access, from the Braille keyboard to all characters (alphanumeric, and semigraphic) of the PC keyboard and of the IBM PC alphabet.

- display on the tactile field of the non permanent display terminal, by windows of 20, 40, 80 characters, of all screen characters and attributes sets due to the scanning of the screen through the secondary keyboard.

Functions of BRLPC may be selected, either by the keyboard of the non permanent display terminal, or by the secondary keyboard; it allows the use without any modification of all the non graphic packages running under MS-DOS.

It remains possible for a non blind to use the keyboard and the screen of the PC simultaneously.

The screen of the PC is logically divided in independant windows; 20, 40 or 80 characters large. From the current window on the tactile field, it is possible to access:

- the first window of the line.

- the last window on the screen which contains displayable text.

- the first and last window of the screen.

- the above and left screen window.

- the window where the cursor is displayed.

- the above, under, left and right windows.

- the first window of the above, under line .

- any window which coordinates have been explicitly given.

- the next or previous window which contains displayable text.

By the way, miscellaneous functions are offered to the users:

- cursor moving in all dircetions.

- the cursor may be displayed or suppressed in order to display the hidden character behind.

- permanent display on the tactile field, either of the window where the cursor is (spotting or blinking), or of the window before the cursor and with displayable text, or of the window selected by the user.

- capital or small letters.

- repeat key of the last character or of the last key function entered on Braille keyboard.

- display of the current window and cursor coordinates.

- Six programmable keys in order to generate character sequences and previously programmed functions.

- display of the attributes (over lighting, blinking, under lining, reverse video, capital letters, special character).

- display of semi-graphic characters.

- fast storage of a screen window coordinates in order to get it back easily.

- entering and search for Braille character strings or attributes in the screen.

- ability to activate the survey of a window: as soon as a modification occurs, a bell will inform the user that the window has been updated.

- activation or deactivation of the management of the secondary keyboard in order to use a printer through a parallel interface (if those use the same adapter).

- activation or deactivation of the bell.

- activation or deactivation of the windows' display on the Braille terminal.

3.1.2 Secondary keyboard

- This 32 keys keyboard may be used with only a single hand to enter most of the common commands while the other hand is reading on the tactile field.

- its human engineering has been especially studied so that the keys can be quickly and easily located.

3.1.3 The BRLU software module

It is a module running under MS-DOS; it gives the capacities of storing sequences of characters or functions and specially the facility of initializing automatically the 6 programmable keys of the secondary keyboard. All these make easier the customization of the secondary keyboard in order to use any standard package.

3.1.4 Computer aided diagnosis (BRLT) software

This software is for the facilities of locating the possible faults and defining the source of any occuring trouble, as being: the non-permanent display Braille terminal, the asynchronous board RS 232(regular or modified), the secondary keyboard or the transcoding tables.

3.1.5 Training

Training is recommended to get the future user used to the basic functions of the Visiobraille 1. The self-training tutorial is included in the set.

3.1.6 Reference manual

With each system a black reference manual, an abstract printed in Braille and an audio-explaining tape are provided.

3.2 VISIOBRAILLE 2 which includes three software modules: BRLDH, BRLHC AND LTB.

3.2.1 The BRLDH software module is a printer driver defined for the Braille printer to be used.

It gives the possibilities of using it the same way as a standard printer through the MS-DOS functions or through different common application packages.

3.2.2 With the module BRLHC screens hard copies can be printed transparently after having been stored with BRLPC.

3.3 Expandability of the openess

Given the flexibility of its interface, an IBM compatible PC can be connected with a large scale of systems. VISIOBRAILLE allows to use system such as Data Processing terminal (3270 emulation, VT100, VIDEOTEX TERMINAL) or to transfer or receive files and documents. Furthermore this system should benefit from all the enhancements of MS-DOS products.

- connection of optical readers with character recognition.
- connection of OPTICAL NUMERIC DISK readers to provide for access to important publications proposed with this new storage facility (dictionary, encyclopedia).
- cards and software for vocal analysis.
- IEEE interface to connect a large scale of measure instruments.

3.4 Hardware and software tested with VISIOBRAILLE

3.4.1 Personal computer : IBM-PC, IBM-XT, IBM-AT (AT1, AT2, AT3), BULL BM 30, BULL BM 60, LEANORD ELAN, COMPAQ PLUS, NYXDORF, ITT.

3.4.2 Non permanent display terminal such as : VERSABRAILLE (modele P2, B, C, D) TSI, VERSABRAILLE (modele ii) TSI, DIGICASSETTE DC20 1980 d'ELINFA

3.4.3 The LTB software : It gives the possibili ties of reading without previous printing any documents on the tactile field of the non-permanent display terminal, from normal text following the Braille specificities:

- non cutting of the words at the tactile field limits.
- selection of the corresponding Braille mode (mathematic, literary, dataprocessing).
- suppression of the useless blank lines or characters.
- handling of the punctuation at one's choice
- numbering of the Braille pages and of the corresponding black pages.

- indication of the black position of the initial text paragraphs.

- indication of the location of the initial text paragraphs.

- indication of the capital letters and special ones.

The display is driven by the Braille keyboard and gives moving facilities as: from a tactile field to another tactile field, from word to word, from paragraph to paragraph and from page to page (all these, backward and foreward).

The LTB software offers additional functions:

- printing of a document, either on a Braille printer following the Braille writing rules, either on a standard printer.

- automatic display of a text on the tactile field at a selected speed at the Braille keyboard and with the possibility of returning to the manual mode at any time.

3.4.4 BRAILLE printers : SAGEM REM8BR, TEM8BR BRAILLO PERSONAL PRINTER,

3.4.5 Software

With a Braille terminal connected through a RS232 standard card:

- Wordprocessing : VISIO1, VISIO2, VISIO3, WORD, WORDSTAR, MULTIMAT.

- Worksheet: MULTIPLAN, LOTUS 123.

- Data Base Management System (DBMS) : DBASE3 - Languages : assembler, Pascal and C language.

- Others : electronic mail, chess SARGON3, etc.

With a Braille terminal connected through RS232 modified card (in addition to the above list) :

- Windower : OPEN ACCESS.

- Telecommunications: SMARTERM (emulation VT100), ASYNCHRONOUS IBMPC (emulation 3270), H-COM, KXTEL (emulation of videotex terminal).

- Languages: basic interpreted and compiled.

IV. CONCLUSIONS

This system can be used by a non-blind person, the extra investment for blind is minimum and corresponds only to the price of the adaptation softwares.

Using packages widely marketed, this system allows the blind people to use world-known software in the office automation.

With the releases of some softwares implemented for peculiar professions (lawyers, stand artists, architects, secretaries, programers, physicians, attorneys journalists) this system will provide the blind with access to new jobs.

The utilization of the system as early as in the first years at school makes possible a comprehensive integration of the blinds in the non specific school. Therefore their handicap will not be a drawback in their scolar courses anymore.

A NOTE ON
INFORMATION, TECHNOLOGY AND THE HANDICAPPED

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The quest for the accumulation and centralization of information to serve the purposes of policy-making, assumes a particular urgency when the technological apparatus is already available on the market. Further pressure is, of course, exerted by the sheer example of the rapid manner in which data banks, and data retrieval facilities, have mushroomed over the past few years. This is indeed the condition imposed by technological innovation. What is technically feasible often dictates what ought to be done; the question of the technological imperative remains one of the central questions of our time.

In consideration of the problems in the area of disability, it is no surprise that attempts are underway at harnessing the computational facilities that are becoming increasingly accessible in terms of ease of operation as well as cost. But in an area as complex as disability, it is central to direct more attention to some matters and less to others, in other words, the question of selectivity of data becomes important. Clearly, answers will need to be provided to the classic questions of "Why collect data?" as well as "Data for what?". The equally classic answer is usually the one that states that good data are essential for the purposes of arriving at good decisions. Decision-making usually implies a question of levels where policy options are considered and choices formulated. In an area such as disability, the choice is on the one hand technical and on the other hand political. The provision and distribution of resources is essentially a political task, and because this is so, it is necessary to clarify the content and direction of social policy and its stance on matters of interest to the disabled persons. Purely technological solutions have a tendency to remain on the shelves under situations of perceived resource constraints and the competition for these resources by a large number of highly organized groups. There is a trade-off between "desirability" and "feasibility", between "political preference" and "technical possibility".

Serious attempt at dealing with questions of disability will involve attention to not only the question of information but also the design of a delivery system. This obviously involves a policy of financing, the question of the allocation of scarce resources.

There are some examples of how disability could be handled from the days before the computer made its impact upon our world. In the understandable temptation to utilize the most modern technology, it is often overlooked that this involves the creation of a setting in material and specialist technical personnel that is not possible to create in a short period of time. Often the pre-computer era has in it a range of possibilities that can be usefully acted upon.

Predating the computers and electronics era is a remarkable source-book and guide for the disabled with over 250 illustrations demonstrating how those suffering from disabilities can manage to function. The book : "Living with a Disability" 1/ demonstrates how devices in everyday use can be transformed into specialized objects for the use of the disabled. Where access to complicated devices is difficult, or prohibitive, much of the information on all aspects of daily living and how to make it more comfortable for the disabled is available in a lucid manner in this volume written over thirty years ago and still of refreshing utility almost everywhere on the globe.

Another example of one of the clearest resource guides compiled for ease of reference without sacrificing content, remains the compilation of the Job Development Laboratory of George Washington University's department of Rehabilitation Medicine: Communication Resources for the Developmentally Disabled: A Guide for Parents, Paraprofessionals and Professionals, published a decade ago. Using nine categories it describes relevant publications in terms of title, author, source, target, purpose, format, users, cost and finally, provides a subjective assessment of ten item. Devices and aids are similarly described by name, type, portability, description and use, cost and an address from which further information may be obtained. The four sections of this publication are:

i) communication, screening and assessment.
ii) therapy resources.
iii) communication alternatives and devices.
iv) guides, source books, and services.

The publication is directed at developmentally disabled persons including the multiply handicapped which includes those who might have motor, visual, hearing, and cognitive impairments, while no substitute for professional assistance, the publication is an excellent example of what might be achieved with minimal resources but with a potential impact that can be surprisingly great.

A resource guide of this order can be easily adapted to the particular situation of a country and its existing knowledge and capability base in the area of disability. Of equal importance, is the feasibility of rapidly recording such resource data on a micro-computer. The importance of a resource guide lies especially in the opening up of options, of assessing them and of providing access to desired options. Depending upon existing resource capacities in knowledge and personnel trained for work in the area of disability, choices are open whether to initiate the older (but still very worthwhile) resource guides, such as the one referred to above, or to switch directly to electronic data

storage and retrieval facilities, or even to have a mix of both capacities. Again, no global prescriptions are possible here, for not only is there the diversity of socio-economic conditions and capacities, but also there are variations in terms of what kind of welfare system is politically and/or culturally preferred. It is probably sufficient for the present purposes to underline the importance of such resource materials, their organization and dissemination in a compact and comprehensible format.

The centrality of information can perhaps be no better illustrated than in the reflections that are stimulated by the responses generated by a survey conducted in the United States among therapists and clinicians who were responsible for the prescription of technical aids to disabled persons. The survey results demonstrated that over 90 per cent of the therapists and clinicians were not aware of the immense range of devices already available on the market. This lack of information was acute especially where interfaces were concerned. B. Kitous has aptly remarked upon the results of this survey that "this lack of information means failure to find an appropriate solution, the costs incurred when something which already exists is reinvented, the absence of comparative studies and a multiplicity of ad-hoc solutions which are incompatible, etc." 2/

The Commission of the European Communities 3/ noted that pioneering work in the area of information regarding technical aids has been carried out largely by Sweden's Handikap Institute. Examples of publications -- referred to as "Produkt Information" -- are:

- 1979/No. 9106: auditory and acoustic aids (bells, amplifiers, earphones, radio/TV control, amplified telephone sets, alarm clock systems, emergency alarms, Citizens Band radio, acoustic remote control, etc.);

- 1980/No. 0103: Bliss communication aids (communication boards, cards, grids, etc.);

- 1980/No. 0106: cassette players (ordinary cassette players, Braille cassette players, dictating machines, etc.).

On a country-level, a pertinent example is provided by the feasibility study for a National Information System for the Netherlands, ordered by the Dutch National Commission for the International Year of Disabled Persons. The question posed by the Dutch National Commission to the Stanford Research Institute (SRI) was: could a national information network -- so designed and organized as to inform all types of handicapped people about the services and provisions available to them -- be established in the Netherlands with

its estimated disabled population of one a half million? The SRI response was that access through telephone or computer terminals could be made possible, with provisions for permitting access by people with communication disorders such as the blind and the deaf.

The feasibility study initiated by the Dutch National Commission was in the recognition of the fact that serious problems were faced by the disabled primarily due to the lack of information . The National Commission identified that the areas where the disabled most needed information were: medical treatment, financial assistance, social security provisions, and technical aids and devices.

Stanford Research Institute recommended three phases of activity in order to implement the system: about three months of transition phase to prepare for implementation, a twelve month pilot project to design the sytem and another six month programme in order to expand the pilot programme into a National Information System. 4/

The International Labour Organization (ILO) is one important source for both data as well as facilities for training staff from institutions which have working relationships with it. A source for information, and the exchange of information, in the area of computerization and documentation activities, the ILO's International Occupational Safety and Health Information Centre (CISDOC) is an outstanding example of data covering literature on safety and health in the workplace. Its data base includes materials on legislation, standards, guides, monographs, research reports, periodical as well as audiovisual materials.

A new addition of the ILO Thesaurus is relevant data pertaining to the disabled. The 1985 edition of the ILO Thesaurus, for instance, contains pertinent information on materials dealing with vocational rehabilitation, vocational rehabilitation methods, mobility of the disabled, rehabilitation services, centres for the disabled, etc. This broad listing can only convey a hint of the rather extensive information that is available on sub-topics within each of these areas. To illustrate, centres for the disabled as a description includes information on communities for the disabled, crisis intervention centre, halfway house, residential care home, specialized halfway residence, therapeutic community, and work activity centre. Further information on vocational rehabilitation descriptors is available in the latest edition of the ILO Thesaurus.

Integral to the ILO's activities in this area is the ILO World Bling Union Information Service on the Rehabilitation and Employment of the Visually Handicapped.

This system, known as BLINDOC, was launched in 1974 in a collaborative exercise between the ILO and the World Council for the Welfare of the Blind (WCWB) and the International Federation of the Blind (IFB). In its mission of providing support for the vocational rehabilitation of the visually-impaired, BLINDOC is an information facility on the latest developments and approaches directed at the integration of the visually handicapped into the normal life of the community. BLINDOC not only contains research publications in its area of interest, but also specializes in documentation on technical cooperation activities in developing countries, reports of seminars, training courses and the reports of experts on country missions. BLINDOC targets its audience in such a way that field-workers, clinicians, and practioners in the area of the rehabilitation of the visually-impaired are served directly. BLINDOC's documentation covers a wide range of information from guidance, job training, workshops, to the area of technical aids and devices for the visually-impaired.

On a national scale, the classification of technical aids and the establishment of a Thesaurus as well as a data bank at the Heidelberg Institute for Reintegration in the Federal Republic of Germany offers a good example of commendable efforts in this area.

The preceeding pages have attempted in a rather cursory manner to direct attention to the different kinds of ways in which information in the area of disability has been utilized. The question of where a country should focus its attention and what kind of information technology it ought to utilize, is obviously partly a matter of available resources and partly a matter of public policy. What is essential is that while modern technology is being considered, the pressing problems of the disabled should not have to wait the adoption and assimilation of the latest technology. There should be mechanisms whereby existing disability issues continue to command attention, at whatever technological level is currently available, even as efforts at harnessing more technologically solutions are scrutinized for their utility.

Notes:

1/ H.A. Rusk and E.J. Taylor: Living with Disability, Garden City, New York: The Blakiston Company Inc., 1953.

2/ B. Kitous, Communications Facilities for the Disabled Technical Aids (Personal needs, existing means, possible developments), Luxembourg, Directorate-General, Information Market and Innovation, Commission of the European Communities, 1982.

3/ Ibid.

4/ Based on information from Secretariat Stichting Nationale Commissie Internationaal Jaar van Gehandicaptern, Rijswijk, May 1982.