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ABSTRACT

The monograph provides information on evaluation of technical aids, wheelchairs, and computerized information systems for disabled persons. The first chapter provides a general overview of actions of the European Community concerning technical aids evaluation, information on the "Concerted Action" program called "Evaluation of Assistive Devices for Paralyzed Persons'" and on the HANDYNET project, which aims to establish a European Information Network on disability. Chapter 2 details organizational and scientific aspects of wheelchair testing and evaluation in the Federal Republic of Germany, the United Kingdom, and Scandinavia. Chapter sections consider test methodologies and procedures, the process of using a wheelchair, location of use, propulsion, sitting posture, carryability, wheelchair type, a rolling-road for powered wheelchairs, government supply policy, and evaluation reports. The third chapter gives an overview of initiatives in Europe in the field of computerized information services concerning disability. After a brief description of The Nordic Register (Scandinavia), Bardsoft and BARD (Great Britain), and activities in the development stage in France and elsewhere, the chapter focuses on the Italian system (SIVA) which requires no previous computer knowledge to use, contains information on technical aids for the disabled, allows multilingual access, and is integrated into other Italian services. Flow charts and sample search protocols are included. Appended are the text of a statement by the European Community concerning the social integration of handicapped people, and lists of individuals and agencies concerned with equipment evaluation. (DB)

MONOGRAPH NUMBER THIRTY FIVE

EVALUATION AND INFORMATION IN THE FIELD OF TECHNICAL AIDS FOR DISABLED PERSONS: AN EUROPEAN PERSPECTIVE

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FOREWORD

In May 1984 we visited the Fondazione Pro Juventute Don Carlo Gnocchi, Servizio Informazioni e Valutazioni Ausili (S.I.V.A.) in Milan, Italy where Professor Antonio Pedotti directs an important Technical Aids and Rehabilitation Engineering Center. It seemed from our discussions that Professor Pedotti who also chaired a technical commission for the European Economic Community in 1982-84 could offer the International Exchange of Experts and Information in Rehabilitation (IEEIR) some valuable information about European developments in the field of evaluation of technical aids, particularly wheelchairs and information systems.

Therefore, we made a request that he and then his colleague, Professor Renzo Andrich, prepare for publication significant information about wheelchair evaluation that would be of interest to a U.S. rehabilitation audience.

Professors Pedotti and Andrich have spent considerable time and effort over the past two years compiling and editing material that they felt would be of interest to the U.S. rehabilitation community. Finally, it was put on a word-processor in Italy and the IEEIR is presenting it for distribution in this form without further editing.

The "mission"of the World Rehabilitation Fund's International Exchange of Experts and Information in Rehabilitation is to import knowledge in the fields of special education and rehabilitation from other countries to the U.S. It is our hope that the information will enrich the knowledge base in the U.S. and provide opportunities for trying out new approaches.

This exchange of information, which benefits the U.S., is brought about by providing opportunities to foreign experts to prepare manuscripts for publication in monograph form. The IEEIR also has a fellowship program which provides opportunities to U.S. experts to study overseas. Successful applicants must have identified knowledge sources abroad which can be studied and then "packaged" back here in the U.S. to address knowledge gaps which have been identified by the National Institute of Handicapped Research as "priorities."

In the past eight years, the IEEIR, an NIHR-funded project, has addressed more than twenty-five of these priorities in thirty-five monographs and eighty-six fellowships. A partial listing of monographs and fellowship reports available from the World Rehabilitation Fund appears in the back of this book. A brochure listing all monographs and reports currently available from WRF-IEEIR can be obtained.

Diane E. Woods, Project Director
World Rehabilitation Fund, Inc.
International Exchange of Experts
and Information in Rehabilitation

July 1986

A. Pedotti, R. Andrich

EVALUATION AND INFORMATION IN THE FIELD OF TECHNICAL AIDS FOR DISABLED PERSONS. AN EUROPEAN PERSPECTIVE

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1. EUROPEAN COMMUNITY ACTIONS CONCERNING TECHNICAL AIDS EVALUATION AND INFORMATION.

Antonio Bedotti

This chapter gives a general overview of the actions performed by the European Community in the field, focusing mainly on the Concerted Action "Evaluation of Assistive Devices for Paralyzed Persons" and on the so-called HANDYNET Project, whose aims are to establish a European Information Network on disability.

1.1 VERVIEW

1.1.1 INTRODUCTION

At the end of 1979 the Commission of the European Communities * promoted two important symposium in order to focus on the problems concerning technical aids for the Disabled and the Elderly.

The first entitled "The use of Technology in the Care of the Elderly and the Disabled" was held in London; the second, "Technical Innovation in the Service of the Elderly and the Disabled: Market and Needs" in Berlin.

At these meetings were attended by a wide number of experts, physicians and professionals, representatives from Industry, National Health Services, Ministries and from public and private bodies interested in the subject from the EC Member countries.

Some observations and suggestions which arose from these meetings have become widely accepted landmarks and important guidelines for further actions.

The following important observations deserve to be mentioned:

- the likely enlargement of the market which might include the

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* Presently the European Communities are three, namely the European Economic Community (EEC), the European Community of Coal and Steel (CECA) and the European Community of Atomic Energy (EURATOM). In order to perform their tasks, the three Communities have set up the following Institutions:
- the European Parliament
- the Court of Justice
- the Council, composed of the representatives of the government of the member States (depending on the subject currently being dealt with, the Ministers of Industry, Agriculture etc.; at least three times a year the Heads of the Governments meet and is the "Council of Europe")
- the Commission, composed of 14 members appointed through an agreement among the governments.

The Commission has wide executive tasks, and operates independently from either the Council or the national governments, under the control of the Parliament.

the elderly;
- the role of technological innovations in the development of new devices;
- the present fragmentariness of Industry, represented by small productive unities dealing with an extraordinary variety of of products.

Consequently, some suggestions have been made. In particular:

a) the development of an active information network on the technical aids available on the market;
b) the definition of protocols and the creation of evaluation reports;
c) creation of an up-to-date inventory of research and development activities in order to facilitate coordination;
d) identification of priority areas and initiatives to support and promote specific research projects.

These suggestions were taken into account by the Council of Europe and the general outlines for promoting the social integration of disabled persons are contained in the Resolution of 21 December 1981, reported in Appendix 1.

Several Organizations operating inside the European Community are devoting their efforts towards promoting appropriate initiatives in the different fields of: education, occupation, trasportation, accessibility, research.

1.1.2 THE BUREAU FOR ACTION IN FAVOUR OF DISABLED PEOPLE

In May of 1982 the Commission established within its Social Affaire Service (Directorate General V) a Bureau for Action in Favour of Disabled People, which is promoting and coordinating several initiatives concerning policy, information, innovation, experiences, exchange and dissemination of results.

The programme of District Projects consists of 16 model locally based projects all aimed at improving the social integration and indipendent living of the disabled people in the community. The aim is for each District to develop its own understanding of the needs of its disabled people and on this basis mobilize the available human and material resources in order to best meet these needs. This involves improving the coordination of public services, cooperation between these and the private organizations and social partners, participation of disabled people in decisions and actions which concern them and public awareness of the needs and capacities of people with disabilities. The projects run for four years (1984-1987).

Sixteen Districts are participating in this activity, two in each of the four largest countries, the Netherlands and Belgium, and one of each in Greece, Denmark, Ireland and Luxembourg.

The Districts are:

Belgium:	Genk-Hasselt, Liege City
Denmark:	Aarhus City
Federal Republic of Germany:	Berlin (Spandau) and Gelsenkirchen
Greece	Achaia Province
France:	Dijon, Montpellier
Ireland:	Midland Counties
Italy:	Northern Basilicata (Vulture-Melfese) and the province of Piacenza
Luxembourg:	the Grand Duchy
Netherlands:	Dordrecht and district (the Drechtsteden), North Limburg
United Kingdom:	Lambeth Borough, West Berkshire.

In each District project teams, advisory committees and evaluators have been established, the costs in each locality being supported by the special European Fund.

The Community Network of Rehabilitation Centres is another important project. It consists of thirty-one centres which are concerned with functional of vocational rehabilitation. There is one centre in Luxembourg and between two and five in each of the other Community countries. A number of Network members represent associations or national groups of centres, so that the total outreach of the Network is very large. The aim of the Network is to promote and disseminate innovation and quality development in the field of rehabilitation by means of an interaction programme that include seminars, study visits and professional training sessions. The Network has also made a valuable contribution to the Commission's policy initiative on employment and ongoing work in the field of vocational training.

Other programmes managed by the Bureau for Action in favour of Disabled People concern the subsidies to various bodies, tipically non governmental organizations, initiatives for integration of disabled children into ordinary schools and interchange of experiences for young disabled people.

The need for information is so great that actions specifically devoted to it have been undertaken by the same Bureau. Of these the Handynet Project is a long term project aimed at setting up a Community network of computerized data banks and data bases, covering all questions which relate to disability. It is composed by different modules. The first, in an advanced developing phase concerns technical aids.

The general concept of Handynet and the results already obtained will be widely described in the next chapter.

1.1.3 SCIENTIFIC RESEARCH IN THE EUROPEAN COMMUNITY

As pointed out by the Resolution of the Council, the application of new technologies and the pooling of information are a fundamental means to promote innovative and appropriate technical aids which can strongly facilitate the social integration of disabled persons.

This is particularly true if the important role played by the recent technological developments in the field of microelectronics, of sensors and devices for processing representation and circulation of information is taken into account.

As to research, in 1974 the Council decided to develop a common policy in the field of science and technology. Policies were initially defined for energy, agriculture, and the environment and was later extended to raw materials, social and sociological areas and development aid.

Several criteria have been defined for selecting European research projects:

1) The general political and legal framework of the community
2) Transnational nature
3) Large market
4) Common requirements (a project should satisfy needs common to all community countries)
5) Among the specific criteria which should be used as a sort of check list, the following deserve particular attention:
   - pilot projects
   - standardization and harmonization of methods, measures and information systems
   - services and infracstructures, data banks etc.

Implementation of research activities is done in three different ways: Direct Actions: operation of joint research centres directly managed by the Community.

Indirect Actions: actions operated through research contracts with institutions and industries, aiming at the coordination of teams for specific projects.

Concerted Actions: programs that are commonly defined, but whose individual components and activities are financed by the Member States. This is the form that is mostly used in the field of medical research. Presently the EC research is being performed under the Framework Program 1984-1987.

This Framework Program defines seven community goals.

Medical and Biomedical research is under the heading of "Improving living and working conditions" and is growing more and more inside the EC programmes.

From 1981 to 1985 the number of Concerted Action in this area increased from 7 to 33 and the number of national Institutes involved increased from 230 to 860.

The structure for the research management is composed of:
CREST (the Scientific and Technical Research Committee) which performs the function of research coordination at policy level.
GC CRM (General Committee on Medical and Public Health Research) which is in charge of management responsability and is assisted by four Concerted Actions Committees (COMAC), composed of experts appointed by the competent authorities of the member states. They are Epidemiology, Biomedical Engineering, Biology and Health Service Research.
The CG CRM launched the Third Programme of Medical research and Public Health for the quadriennium 1983-1986.

In this programme, the Elderly and the Disabled have been regarded as one of the main target groups. In fact the "Ageing, Disabled and Handicapped" is one of the three areas considered in the Health Problems Programme (the other two are: "Pre-peri and post-natal care" and "Breakdown in Adaptation").

In this area five projects have been given the greatest priority: "Cellular Ageing and Diseases" (Eurage); "Sensorial Impairment"; "Trombosis and Disabilities"; "Aids to the Disabled", "Care Delivery Systems".

1.2 ASSISTIVE DEVICES EVALUATION

1.2.1 CONCERTED ACTION ON THE ASSISTIVE DEVICES FOR PARALYZED PERSONS

Regarding Technical Aids for disabled people, the opportunity of a short-term intervention to promote a concerted action among laboratories that carry on researches in these fields was acknowledged and a Concerted Action, defined during the workshop "Evaluation of Assistive Devices for Paralyzed Persons" held in Milan in April 1983, was later approved by GC CRM in 1984.

The coordination of this action has been given to the Bioengineering Centre and to SIVA in Milan.

This Concerted Action is managed by COMAC BME which has the largest programme of the four COMACS.

The main objectives of COMAC BME are the promotion of a coordination of research and development, the transfer and harmonization of medical technology in order to improve the quality of health care and rehabilitation and to increase the application of new technological developments in Europe.

About 60 Institutes are coordinated in the Concerted Action "Assistive Devices for Paralyzed Persons" distributed in all the European countries.

This programme is coordinated by a Project Management Group (PMG) and is addressed to a specific category of disabled, namely the paralyzed persons (paraplegic, tetraplegic and cerebral palsied persons), although many other groups of disabled could benefit from this action.

The list of membres of the PMG and their addresses are reported in Appendix 2.

Three main areas have been identified:
- Mobility Aids, including wheelchairs, lifting devices and car adaptations.
- Walking Restoration, including orthoses, mechanical devices, Functional Electrical Stimulation and hybrid systems (combination of orthoses and FES) able to restore locomotion in paraplegic patients.
- "COMEC", which stands for Communication, Manipulation and Environment Control devces.

The final Aims are:
1) coordinating protocols and methodologies for technical and practical evaluation and the sharing of results and experiences between the Centres working in the field in various EC countries A

permanent network of selected institutions, joined by a steering committee, are the core of the organization required to achieve this objective.
2) Improving ongoing research activities into new technologies which are of particular utility and in a well advanced development stage.
3) Establishing close connections between evaluation and research activities and the HANDYNET project, in order to make the evaluation results available and understandable to professionals and to disabled transferring these data into an information system.

1.2.2. MOBILITY AIDS

This area mainly includes devices which are widely available on the market: wheelchairs, lifting devices and car adaptations.

In particular several institutions are actively involved in the technical testing of wheelchairs in France, Germany, Netherlands, Great Britain and in the Scandinavian countries. In Appendix 3 a list of these institutions is reported.

Efforts to coordinate these activities in terms of common protocols and evaluation forms appear of great importance considering the increasing circulation of these devices from one Country to another inside the European Common Market. For this purpose strict collaboration is maintained with the activities promoted at an international level by the International Standardization Organization (ISO) which activated a special Committee (Technical Committee 173) devoted to these problems.

Besides the technical testing, also of great importance is the evaluation based upon practical use which must be tackled according to the views of the disabled users and professionals. In conjunction with recent studies on ergonomics and physiological aspects of wheelchairs driving in various conditions, it can provide fundamental criteria for a better design of the devices and for adapting the wheelchair to the needs of each individual.

The second point concerns the trasferring of evaluation data into proper information channels. The information exchange brings about several advantages on a short as well on a long run due to the following reasons:

- it appears an important "cultural initiative" it being the first step towards any further European cooperation in evaluation activities, evaluation methodologies, research activities, products and ideas interchange;
- it should offer the professionals guidance in the choice of the appropriate aids for each disabled individual, in terms of proper understanding of adaptability to the user physical and environmental needs, to ergonomic criteria etc.

- it should offer substantial feedback to the producers, through providing them suggestions for product improvements in materials, design, ergonomics, flexibility et.

To reach these goals each country should identify the centres involved in technical and functional evaluation which are likely to contribute to this concerted action and work out a common approach for the collection and transfer of information.

A preliminary "form" designed for the handling of the most significant wheelchair data has been designed in view of a computerized management and of implementation into the Handynet system. At the moment a pilot study is in progress using this special "form".
Other specific problems are involved in the field of car adaptation. Here the recent developments in technology have made devices available that allow driving also for the severely disabled. Therefore a concerted initiative should provide results able to influence also the existing rules for driving licences.

1.2.3. WALKING RESTORATION

In this area those devices which can permit paralysed patients to achieve a degree of useful ambulation are considered. Restoration of the walking function is of great value to paraplegic patients in that it produces both a therapeutic benefit and an improvement of authonomy. Among therapeutic benefits the improvement of urinary drainage, bowel function and peripheral circulation as well as the reduction in osteporosis are recognized.

On the other hand, in order to reach full independence the patient should be able to:

a) walk with low energy consumption;
b) put on his assistive device and remove it without assistance;
c) rise to an upright position from a wheelchair or bed and return to the previous position.

The following problem must be solved: internal stabilization to prevent the patient body collapsing, equilibrium mainteinance and control of forces to permit the phasic activity inherent in walking. Recent researches suggest several possible solutions in terms of special orthosis, multichannels functional electrical stimulation and hybrid systems including orthoses and muscle stimulation.

Several devices have already been developed in the USA and Europe and are presently in an experimental stage for patients suffering of: paraplegia, spina bifida, multiple sclerosis and muscular distrophy. As to the orthoses relevant problems are the choice of the most appropriate material and the proper design. As to functional electrical stimulation

specific research is required into electrodes (surface or implantable), modulation of muscle forces through a proper recruitment of muscle fibers, definition of suitable patterns for coordinated stimulation and of the necessary feedbacks. In both cases an indept knowledge of the basic mechanism involved in walking control is required. Therefore it is important to define the methodologies and technologies required for the investigation of the single patient and for the proper adaptation of the device.

The activities stimulated by the Concerted Action in this area concern the interchange of experiences among the centres and the laboratories which are working on this subject.

It has been also promoted the estabilishment of an appropriate Data Base of those patients and devices presently being studied research or clinical situations in which work is being done on Walking Restoration.

1.2.4. COMMUNICATION, MANIPULATION AND ENVIRONMENTAL CONTROLS (COMEC)

This area is concerned with devices which are particularly influenced by the recent technological developments in terms of complexity of functions, possibility of miniaturization and reduction of costs.

It appears clearly as a possible short term objective the development of assistive devices based on the concept of a "computerized integrated system", through assembling components produced on a large scale and equipment already present in the domestic environment (TV set, telephone, home computer etc.).

In this view it appears of great importance to address the Concerted Action towards the following objectives:

- gathering information from every member Country about the centres and the people engaged in research and development as well the centres and leading people engaged in evaluation so that inventories may be compiled.
- To learn of centres undertaking technical and functional evaluations and of studies which have been published, so as to build these into a second inventory.
- To understand and as far as possible agree on evaluation methods and standards so that the results may be accepted throughout the Community.
- To cooordinate protocols, methodologies, standards for interfacing different machines and components.
- To identify needs and encourage research into technical aids, particularly into topics which have been neglected and in which the greatest benefits will be for a large number of disabled people, by using the opportunities created by fast developing technology and collaboration and sharing experiences and results between centres in the European Community.

- Distributing through the Handynet system the gathered information so that it may become available to all who can profit from it.

1.3. THE HANDYNET CONCEPT

(Summary of the presentation given by Danielle Rimbert, Consultant to the Commission for the Handinet Project, at the Workshop "European Coordination of information concerning disabled persons", held in Milano on September 25-27,1984)

The HANDYNET Project represents one important aspect of the implementation of the Social Integration Programme for the Handicapped in the European Community, launched by the Council Resolution of the Representatives of the Government of the Member States on December 21st, 1981 (see appendix 1).

HANDYNET aims at setting up at Community level a computerized network for multidisciplinary information exchange among institutions, health and social care professionals, voluntary associations and in general all people or organizations which are taking active part in the Social Integration process.

The project is also aimed at setting up on-line services meeting the information needs of the concerned Bodies.

Like other aspects of the Social integration programme, the HANDYNET project is therefore a responsability of the Head of the Bureau for Action in Favour of the Disabled People, which operates inside the 5th Directorate General of the Commission of the European Communities.

A Liason Group, composed of national representatives appointed by the responsible Minitries of the member Countries, has been estabilished as a consultive Body of the Bureau for Action.

The HANDYNET project adopts a decentralized approach to the collection and dissemination of information, based upon the active cooperation of its operational partners at Regional, National and Community level: governmental and non-governmental organizations, rehabilitation Centres, health and social professionals etc., concerned with the various aspects of integration.

In order to achieve the most effective results, a series of guidelines for designing and developing the system have been estabilished, for instance:

- joint development and use of a multilingual information retrieval language (HANDYVOC thesaurus), gradually extended to cover all aspects of social integration;
- joint development and use of minimum basic data sets;
- compatibility with standards arising out of studies carried out by CCITT (International Telegraph and Telephone Consultive Committee) with a view to the future creation of a multimedia telecommunication network

(ISDN, which stands for Integrated Services Digital Network) integrating voice, text and image transmission;
- development of simple and user-friendly research strategies and procedures;
- estabilishment of multilingual interrogation and dialogue procedures;
- case of transition from one information module (data bank or on-line service) to another.

The HANDYVOC multilingual thesaurus (in seven Community languages) is in process to be completed as regards technical aids (see Appendix 4 for its english version); in the future it will gradually cover the various aspects of social integration: prevention, training, transition from school to working life, employment, rehabilitation, social assistance, transport/accessibility, sport and leisure, legislation and administrative regulations, statistics etc.

In the same time the information modules included in the HANDYNET system will gradually be extended to cover all these aspects.

The first area which has been tackled by the HANDYNET project is that of rehabilitation, particularly the so-called HANDYTEC system of information modules dealing with technical aids (see table 1).

At present the first step of this process, consisting of the definition and testing of standardized record structures for describing the technical aids data bank, is going to be concluded.

In Table 1 that step is represented by the third "drum" starting from the left, which has been described as "WHAT", "WHO" AND "HOW" files in the "HANDYAIDS" module.

The main part of the record structure in the "WHO" file, as worked out by the so-called HANDYWHO subproject, is illustrated by appendix 5.

Among the on-line service, electronic news bulletin (HANYNEWS) and electronic mail (HANDYMAIL) are planned for the future.

As soon the system becomes operational, it will represent a powerful vehicle for information circulation in the field, but that will not constitute an end in itself.

Reflecting the activities in progress, both at Community and national level, it will provide them with a basis for coordination and, consequentely, support.

It will represent a operational test-bed for multimedia services developing in the wake of large scale Community projects such as ESPRIT (European Strategic Programme for Research and Development in Information Technologies) and INSIS (Interinstitutional Integrated Information System), making it possible to satisfy gradually the logistic and

technological requirements of the numerous disciplines related to the integration of handicapped persons.

Finally, the HANDYNET project will provide evidence at either social or economic level that advanced technologies are able to achieve a very high cost-effectiveness when placed at the service of the weakest members of society.

2. WHEELCHAIRS EVALUATION IN EUROPE

This chapter revieus some example of organizational and scientific aspects of wheelchairs evaluation in various european countries. Some of the major testing institutions are taken into account in order to present, in the whole, a complete picture of the european activities in the field.

Fig. 2-1

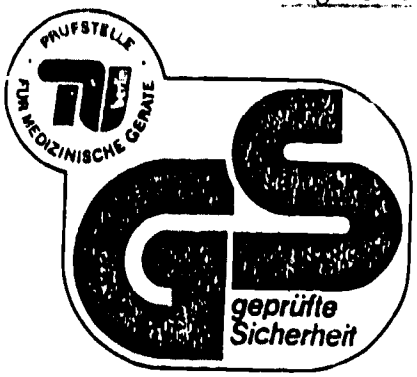
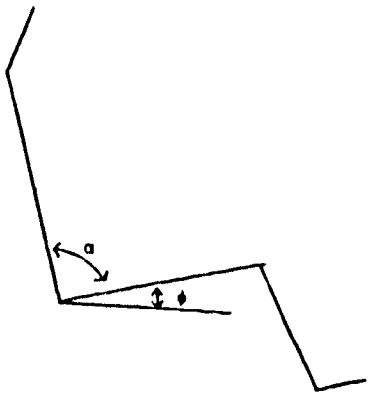


Fig. 2-2

property (functionally)	*aspect* (technically)
brakes	— presence — power needed to operate
parking brake	— presence — power needed to operate
steering	— method
speed regulation	— adjustability — characteristic
freewheeling	— presence
pushing	— pushing power — height/width of handles
gearing-mechanism	— with/without dead-point
gearing-ratio	— adjustability
movement	— size of adjustability
handpropulsion rim	— profile — distance rim to wheel
charger connection	— method of operation — safety
battery charger	— isolation class
electrical safety	— IEC standards
lighting/claxon/mirrors	— presence

Figures
Section 2

Fig. 2-3



a sitting posture at transfer, step in/out (step-in):
$\Phi = 0°$ or $\Phi < 0°$, e.g. $-10°$ in which $\alpha + \Phi > 90°$;

an active sitting posture (active):
Φ between 0° and 10° and α between 90° and 100°;

a semi-active sitting posture (semi-active):
Φ between 10° and 15° and α between 90° and 105°;

a passive sitting posture (passive):
Φ between 15° and 20° and α between 95° and 110°;

a resting posture (rest):
Φ between 20° and 30° and α between 95° and 125°;

a sleeping posture (sleep):
Φ between 0° and 10° and α between 95° and 170°.

2.1 TESTING AND EVALUATION OF WHEELCHAIRS IN THE FEDERAL REPUBLIC OF GERMANY

Ulrich BOENIK

2.1.1 WHEELCHAIRS TESTING ORGANIZATION

In the Federal Republic there is no general legal obligation to subject technical aids for the disabled to tests. The only exceptions are aids provided for war veterans, or their surviving dependents, within the framework of the federal Welfare Act (Bundesversorgungsgesetz). The responsability for implementing this act lies with the Federal Ministry of Labour and Social Affairs (BMA). In order to ensure that the aids provided are perfect under either the technical or the functional point of view, this Ministry has set up an advisory panel of rehabilitation specialists which includes doctors, engineers, orthopedic technicians, representatives of organizations for the disabled, and manufacturers of aids.

This panel, known as the Council for Orthopaedic Technology, has the task of testing aids submitted by manufacturers, and, on the basis of the test results, recommends whether or not the Ministry should accept the aid for use by the Veterans' Service. The types of tested aids range from prostheses and orthoses, through walking aids, wheelchairs, communication and orientation aids, to the so-called "tools for living".

The evaluation procedure normally includes a technical test and a pratical trial carried out on a limited number of disabled people. The technical test of wheelchairs, extremity protheses, walking and manipulation aids is carried out by the Test Centre for Orthopaedic Aids (Prufstelle fur Orthopadische Hilfsmittel) at the Technical University in Berlin, other aids are tested by the Pruf-und Beschaffungsamt (PBHH) in Hannover. The pratical trial was formely carried out by the 27 Orthopaedic Welfare Centres responsible for the care of the war veterans in the individual districts, or by the Test Centre for Orthopaedic Aids at the Technical University in Berlin. Today the field test is exclusively carried out at the Technical University in Cooperation with the Berlin Orthopaedic Welfare Centre.

It should be pointed out that a favourable outcome of the evaluation and testing procedure means only that the investigated aid will be recommended for use by the War Veterans' Service. But, in fact, other interested parties also make use of the results; for example professionals associations and Social Insurance institutes and to this extent the tests have a significantly wider application.

In certain cases, technical aids for the disabled are also tested by the Rehabilitation Foundation (Stiftung Rehabilitation) in Heidelberg.

However, these tests are aimed more towards helping the disabled persons to choose the most suitable aid. The Foundation does not generally carry out tests at the suggestion of a manufacturer, but rather on its own initiative.

Finally, certain aids, such as hearing aids, are investigated in the context of a design trial by the Federal Insitute of Physics and Technology (Physikalisch-Technische Bundesanstalt). Besides the tests already described, which are concerned primarily with questions of function, durability and wear and tear, there is a second category of tests concerned exclusively with questions of safety. The background to these is the Technical work Aids Act, which has more recently come to be called the Apparatus Safety Act (Geratesicherheitsgesetz). This act applies to all technical equipment and requires that the respective aid must be safe for the user and for third parties, in accordance with the accepted rules of technology.

The safety tests are carried out at the suggestion of the manufacturer by legally recognized testing centres. For performing the safety tests on medical devices and rehabilitation aids, to date 11 institutions have been licensed. Among them is the Insitute for Biomedical Engineering of the Technical University in Berlin. If the test results are positive, the manufacturer of the investigated aid is granted the so-called Safety logo, which he may then reproduce on every aid in the series. This logo is made up of the two letters G and S, which stand for the words "Geprufte Sicherheit" (tested for safety), and the name of the testing centre.

For instance, Fig 2.1 shows the safety logo of the Berlin Institute.

2.1.2. TEST METHODOLOGIES AND PROCEDURES

Today numerous wheelchairs models are commercially available, mostly of modular design, whose various combinations can meet the requirements of the majority of the disability cases. Special accessories for different kinds of disability, as well as the provision of electric motors, have increased the practical and functional value of wheelchairs, so that they are now increasingly used.
When investigated in the Berlin Institute, wheelchairs are submitted to either functional or safety tests.

The most important considered characteristics are:

- Brakes effectiveness;
- Static and Dynamic Stability (Tilting safety);
- Manoeuvrability;
- Electrical Safety and Battery Safety;
- Road performance (Driving quality and power)
- Handing;
- Serviceability;
- Durability and wear;
- Brakes.

a) Brakes

Safety in traffic is the prime consideration, since unsafe chairs could result in additional injury to those who are already handicapped. Every wheelchair must be provided with brakes that bring it to a standstill instantly without locking the wheels, and then hold it securely in position.

According to the German traffic regulations all wheelchairs, hand-operated and motorized, must be equipped with parking brakes. They are of importance for entering or leaving the chair, as well as for preventing the vehicle from rolling when on an incline. The brakes should have handles which are easily accessible, they should permit single hand operation if necessary.

In addition, motorized wheelchairs must be equipped with running brakes. German road traffic regulations do not require a separate running brake for self-propelled chairs, since they can be decelerated by the handlevers, the handrims or the parking brake.

The standards applicable to date require that mean brake retardation of folding wheelchairs with a relatively short wheel base should not exceed 2 m/s:, otherwise there is a danger that the vehicle will tip over in the direction of motion while braking, especially on hilly roads.

The parking brake must decelerate the wheelchair to a standstill in an emergency as well as in case of failure of the running brakes. If the user is a unilateral upper limb amputee or if he is too weak to turn a handle, this operation must be possible with only one arm.

To test the parking brakes the wheelchair is positioned on a test plane in such a way that, when the plane is inclined, it faces downwards with is castors in the trailing position. The angle of the plane relative to the horizontal is then increased until the chair begins to roll or slide down the slope, or until it becomes unstable (one or more of its wheels lift off the ground). The maximum slope thus defined is recorded.

In addition the necessary actuating force is measured.
Both forces are registrated by means of strain gauge transducers. The brake force measured should not be less than the static stability (sliding down or lifting the wheels from the ground on a slope). If the brake is acting on the tire while the maximum hand force does not exceed 50 N, its effectivity is air pressure dependent and it might happen that in case of low pressure the required circumferential force be not available. On the other hand the actuating force is often higher than permitted when the tires are appropriately pressurized. Because of this problems air pressure dependent brakes are not accepted in our country any longer.

Running brakes of electric wheelchairs are at present tested on a horizontal plane when the wheelchair moves at maximum speed.
The brakes are actuated to their maximum effect and maintained in operation until the wheelchair completely stops. The retardation and the braking distance are measured and recorded in future this investigation will be extended to tests on an inclined plane.

b) Static and Dynamic Stability

The tilting safety, i.e. the static and dynamic stability of the wheelchair, are of extreme importance for the user. The stability is tested under static and dynamic conditions.

The static test is performed in the laboratory on a tilting platform with the wheelchair loaded with a 75 kg dummy. During the trial the critical inclination at which the wheelchair begins to tilt or to slide is determined by measuring the decreasing reaction forces of the more elevated wheels. The dynamic stability is tested by driving against obstacles of defined heights. As the dynamic tilting safety in the trailing direction does not only depend on the position of the centre of gravity and the weight of the disabled person but also on the brake retardation and the type of surface, these parameters have also to be taken into consideration. In a third test, finally, the lateral tipping safety in both directions is investigated. At present, dynamic tilting safety is tested on level ground and on a slope, outside the laboratory. In the near future the Insitute will be able to perform these test on a 3 x 10 m inclined plane steel construction which is movable around two co-ordinate axes. The present program includes the following tests:

1. Drive towards a sill of 5,10 and 15 cm height located at right-angles to the direction of motion.
2. Drive towards a sill with the front wheels at an angle of 45 degree.
3. Cross a ramp 20 cm high with the right or left hand side wheels;
4. Drive through a 90 curve with the smallest possible radius and at 1/3, 2,3 or maximum speed;
5. Starting the wheelchair uphill and stopping it downhill.

c) Manoeuvrability

In order to assess manoeuvrability, the manageability and the turning radius of the wheelchair must be tested during operation. The smaller the turning radius, the more easily and quickly it can be moved in a narrow space, but the danger of tipping over increases. Manoeuvrability is evaluated by measuring the time taken to drive along a predetermined route. To exclude the effect of individual handling skill, several subjects have to repeat the same tests. The test route is surrounded by lateral walls similar to the hall of a dwelling-house. Each subject must drive over the route several times. The times are then averaged.

d) Driving quality and power

In case of motorized wheelchairs the technical test includes additional aspects of driving quality and power. The mechanical power, the maximum speed, acceleration and rolling resistance have to be measured in this context.

The mechanical power is determined by measuring the speed and the propelling force. The electrical power is calculated by determining the motor current and the actual battery voltage. As a result of both measurements finally the efficiency is calculated. To complete this test the maximum inclination that can be negotiated, and the maximum range of the wheelchiar on a single battery charge are determined.

e) Durability

Durability tests are at present only performed on wheelchairs of lightweight construction. For this purpose some test machines are used. They consist of a motor-driven horizontal shaft with adjustable eccentric disks that drive two of the four wheels, by this means accelerating the whole chair periodically in the vertical direction.

As a premise for these tests the accelerations to which the wheelchair is subjected had to be measured. The results allowed determination of the frequency distribution of the vertical accelerations for handrim wheelchairs which were obtained from these measurements. It becames obvious that the front wheels are subjected to higher accelerations than the rear wheels. The values range from - 1 g to + 1 g, and the masimum of events occurs between 0 and = 0,25 g.

This brief summary has given a rough idea of the wheelchairs tests which are performed by the Berlin Institute.

2.2 FUNCTIONAL WHEELCHAIR EVALUATION IN THE NETHERLANDS

Theo BOUGIE

2.2.1. THE PROCESS OF USING A WHEELCHAIR

Using a wheelchair is a very complex problem since a growing number of selection considerations of fluctuating levels are involved. Generally speaking the impairments and disabilities of the user, the needs for displacement/transportation, the properties of the various wheelchairs are in interaction with each other. A coincise inventory of all the involved aspects of the problem "he has to have a wheelchair" is therefore of the utmost importance in order to create a factual set of problems.

In the formulation of the factual problems their most important aspects should be included. They answer questions like:
- what is the main purpose of use or the usual surroundings, in other words where is the crux of the need for displacement?
- which requirements are there as to ease of carrying-along?
- which propulsion/steering is possible and/or desired? In other words which rest capacity can be utilized in view of purpose of use and circustances of use?
- what requirements are to be made for the sitting parts? In order words which sitting posture is possible, necessary and/or desired in connection with desired activity and exiting disability?

The answering of these questions provides a sort of description of the main properties of the desired wheelchairs. With this analysis of the factual problems in mind and with insight in the technical and functional pote tials of the phenomenon "wheelchair" it is possible to isolate a number of main use-functions which in turn allow different types of solutions. The study group distinguished four of these main use-functions:
- area of use
- propulsion
- sitting posture
- carryability

In each of these use-functions there is a number of different solutions possible. When these are combined a certain wheelchair concept takes shape, in order words a certain type.

When the type of wheelchair has been selected, a second selecting process follows in order to choose the best solution out of the various representatives of this type. In this second process more detailed wishes and needs/restrictions and possibilities and more detailed properties are considered.
In the following paragraphs the four use-functions are roughly described and explained.

2.2.2. AREA OF USE

This function falls into six different types, namely:

a) Indoors

Wheelchairs which are suitable for indoor use. The study group has considered both the adapted and the non-adapted living situation. The wheelchair is characterized by its narrow width, a great manoeuvrability and a distinct non-suitability for outdoors use.

b) Indoors/outdoors

These wheelchairs are meant for indoor use and a limited use outdoors. There is the condition that both the own house and the outdoors situation is adapted in accordance with the existing Dutch measurements recommendations (Geboden Toegang). The measurements are a bit larger compared to the indoors wheelchair and the driving properties are - although slightly - adapted to outdoors driving.

c) Outdoors/indoors

A wheelchair where the compromise has been shifted to properties suitable for outdoor driving in a barely adapted situation, but which can be used indoors in a more adapted situation, even though less easily. Its characteristics are a large slope capacity and obstacle climbing ability, a large turning radius, great dynamic stability and a certain field-manoeuvrability. Its measurements are therefore ample with respect to indoor use.

d) Outdoors: V ˜ 10 km/h

These are wheelchairs which are exclusively suitable and meant for outdoor use in a non-adapted situation. Contrary to the previous concept we have no compromise model here but for the rather low top speed. Due to its measurements and manoeuvrability this wheelchair is insuitable for indoor use. It has a reasonable field-manoeuvrability.

e) Outdoors: V ¨ 10 km/h

Due to the purpose of this type of wheelchair, the wheelchair characteristics are less prominent than the previous types: it is a faster vehicle which is intended for longer distance.
The "type area-of-use" is specified in a lot of technical elements like:
- width;
- turning radius;
- turnings space;

- obstacle climbing ability;
- max. uneveness of driving surface;
- slope capacity;
- dynamic stability;
- static stability;
- field manoeuvrability;
- provisions for springs;
- brakes;
- speed;
- range.

Each of these technical wheelchair characteristics shall be normalized in test-methods. At the moment some of them are I.S.O. draft proposals.

2.2.3. PROPULSION

The various types within the main use-function "propulsion" are based on possible remaining abilities of the users in combination with technical possibilities.

1a) Pushing without extra power: This is propulsion by means of pushing by an attendant;

1b) Pushing with extra power: Here the attendant's pushing power is taken over by an electromotor. The attendant controls the speed;

2) Hand 2x direct: A propulsion/steering by means of both arms/hands without gear: in practice a rim fixed to the wheel with 3 possibilities: front, center or rear;

3) Hand 2x indirect: A propulsion/steering by means of both arms/hands with the aid of a gear. This includes various sorts of lever-propulsions and "coffee-mill", but a rim-propulsion with gear is also possible;

4a/b) Hand 1x direct: A propulsion/steering in combination or not with one leg, provided by arm/hand without gear. In pratice this means double rims driven by one arm/hand or one leg and one arm;

4c) Hand 1x indirect: Propulsion/steering by one arm/hand by means of a gear;

5) Leg direct: Propulsion/steering by means of both legs. This is the so called tripping-chair solution;

6a) Electric wheelchair with powered steering-gear: Both propulsion and steering are electrically powered;

6b) Electric wheelchair with non-powered steering-gear: The propulsion is effected with the aid of an electromotor, steering is done by a mechanical gearing-mechanism without extra gear;

7) Combustion powered: Propulsion is achieved the aid of a combustion motor.

In the datailed specifications of "type of propulsion" in the original report the properties that are related to propulsion are discussed per type. Fig. 2.2 shows a survey of the properties involved.

2.2.4. SITTING POSTURE

In determining the types of sitting posture the study group has taken the view that sitting posture concerns both the limitations of the user and his intended actions in that sitting posture. Changing the sitting posture is then essential for the user's good functioning. A sitting posture is mainly determined by the angles between seat and backrest and the angle between the seat and the horizontal.

Sitting postures can be characterized quantitatively according to the measure of activity, as illustrated in Fig 2.3.

When in a wheelchair various of these sitting postures have to be realized, this means that adjusting mechanism have to be present. According to the nature of this adjusting mechanism four adjusting possibilities are imaginable and divided in:

- P.A.U. adjustment: permanently adjustable by the user;
- P.A.T. adjustament: permanently adjustable by the therapist or attendant;
- I.A. adjustment: initially adjustable;
- N.A. adjustment: not adjustable.

The types of sitting postures distinguished by the study group are likewise based on the nature of the adjusting mechanism; as illustrated in Fig 2.4.

2.2.5. CARRYABILITY

The carryability is very important as main function of use, also in relation to the considerable influence it has on the technical contexts of the wheelchair concept. The study group has distinguished three types of caryability:

1) in car by user: The wheelchair has been designed to be placed and taken along in a car by the user himself. It is supposed that the user has a more or less normal hand and arm function, both left and right.

2) in car, by attendant: This wheelchair has been designed to be placed in the car (and taken along) by the attendant. It is supposed that the

attendant is a healthy 65 yr. old woman. The car is a normal car with boot in the case of non-electric wheelchairs and a station-car in case of propulsion wheelchairs.

3) lockable: The wheelchair has features with which it can be affixed quickly and securely inside a car or bus.
This last property does not have to exclude the first two.

2.2.6. THE WHEELCHAIR TYPE

It is possible to compose types of wheelchairs with the various different use-functions. The result is a list of 50 types in which is indicated which types are "desirable" and which "possible". This list does serve as a basis for the evaluation of wheelchairs on functional aspects.

2.2.7. WHEELCHAIR-EVALUATION

Wheelchair-evaluation has to be based on the functional properties. As explained it is possible to relate a lot of the functional properties to technical aspects. It is very hard to measure the functional aspects pure in an abstract and objective way. Thus wheelchair-evaluation could be done differentiating functional and technical aspects. Functional evaluation should combine:

1) collecting all experiences in the field of using the wheelchair in the pratical and operational view;

2) measuring all the technical parameters of the wheelchair under fixed described conditions and test-methods. After measuring, these technical data have to be transformed to functional wheelchair properties.

A lot of work is done in the Netherlands in the field of the technical aspects in relation of functional aspects. Some people developed devices and apparatus to measure the technical aspects. For instance the Rehabilitation Technology Centre in Hoensbroek has developed a rolling-road for powered wheelchairs and instruments for measurement of wheel-position and wheel-condition. These devices are used now for wheelchair-evaluation in the Netherlands.

2.2.8. ROLLING-ROAD FOR POWERED WHEELCHAIRS

The test-device is divided into two separated flat belts, each of them connected to an electric generator. The wheelchair is positioned on the flat belts in a way that the total wheelchair-system is in movement like in normal driving-condition . The wheelchair is fastened to the frame of the test-device and drives the belts (see figg 2.5 and 2.6).

The following parameters are measured (left and right):
- speed of the belts (the wheelchair-speed);
- surroundings of the drive-wheels of the wheelchair;
- forces of the wheelchair to the frame of the test-instrument;
- output power of the wheelchair batteries;
- joystick signal and/or other signals for wheelchair-steering.

Based on the results of the measurements the following properties can be calculated for example:
- wheelchair-speed;
- action-radius;
- steering-characteristics;
- dynamic aspects in acceleration and deceleration (braking);
- total efficiency of the wheelchair-system.

2.2.9. STATIC MEASUREMENTS

Some easy instruments are developed to measure the position of the wheels, for example toe-in, caster, camber and rolling-radius of a wheel.

2.2.10. ON-GOING ACTIVITIES

Some aspects of the on going activities are the following:
- a programm of technical tests is fulfilled by the Joint Medical Services;
- in the future, Social Securities will not supply wheelchairs without a type-certification;
- practical wheelchair-evaluation is done by the rehabilitation centres;
- A study about the relationships of the technical parameters with functional properties is provisionally finished by the working group;
- the development of test-devices is still going on;
- in the future, reports of evaluation-results will be transmitted to the local workers of the social securities and the Health-care-system;
- a new national private foundation for product-test has been just founded, in which a lot of existing organizations in the field of rehabilitaion and consumers are partecipating. The new foundation is starting up their activities.

2.3. THE EVALUATION OF WHEELCHAIRS SUPPLIED WITHIN THE UNITED KINGDOM BY CENTRAL GOVERNMENT

Eric Antony BURNETT

2.3.1. WHEELCHAIRS PRESCRIPTION

A disabled person may be supplied with a wheelchair through an Articifial Limb and Appliance CENTRE (ALAC) on the recommendation of a General Practitioner or a hospital doctor that he needs a wheelchair permanently (for temporary use, a wheelchair can be loaned through the National Health Sevice (NHS) or local authority). The doctor completes a form which he sends to the ALAC. If the doctor is able to give a precise prescription, the wheelchair will be supplied without further delay, but he can call upon a therapist to assist in prescribing or he can ask the ALAC to make the prescription. In the latter case the ALAC will arrange for the patient to be called into a clinic where various models of wheelchairs are available for demonstration.

The wheelchair is then issued from the ALAC Central Store from which time forth it is repaired and replaced when necessary, free of charge to the patient. The DHSS has an Approved Repairer service of some 100 agents throghout the country who carry out repairs on the wheelchairs (as well as on vehicles issued to patients). In the case of power propelled wheelchairs the prescription must come from ALAC doctor from which time the service operates in the same way as described for manually propelled wheelchairs. Powered wheelchairs are provided where the patient or the attendant is too weak to propel a manual wheelchair. Wheelchair supplied may be:

a) for propulsion by the patient;
b) push chairs for propulsion by an attendant;
c) electrically propelled wheelchairs for indoor use;
d) electrically propelled wheelchairs for outdoor use for attendant control.

Patient controlled electric wheelchairs are not supplied in the UK for outdoor use (unlike in some areas of Europe).

The DHSS has at present on issue:

Manually propelled wheelchairs	335,000
Powered indoor wheelchairs	9,000
Powered outdoor wheelchairs	7,000

2.3.2 SUPPLY

Although the DHSS does purchase commercially produced wheelchairs, the bulk of its supplies (50,000 annually) are purchased to its own design. The UK is probably unique in its pratice of having wheelchairs produced to its own design. In 1948 when the NHS was born, wheelchair manufacture was mainly in the hands of many small manufacturers who produced their wheelchairs in small numbers in individual designs and sizes. As the demand for wheelchairs expanded it became increasingly difficult for the DHSS to maintain an adequate and speedy repair and maintenance service and in 1980 steps were taken to develop wheelchairs in standard sizes with interchangeable components. Today there is a gradual drift towards the purchase of more commercial wheelchairs since the industry has evolved into 3 or 4 large manufacturers who are producing well developed and reliable wheelchairs with a ready supply of interchangeable spare parts.

2.3.3. TESTING

The DHSS is responsible for the design and development of its own wheelchairs as well as for the evaluation and approval of the commercially produced wheelchairs which it purhcases. In an effort to maintain the quality of these wheelchairs and to verify the performance of present new materials the DHSS operates a Test House at Blackpool,Lancashire. Details of the principal items of testing equipment used are as follows.

a) carousel type dynamic wheelchair test rig

The test rig comprises 2 radial arms spaced at 180 degree mounted on a vertical shaft and driven by a pulse controlled variable speed DC motor. The wheelchairs can be driven at speeds ranging from 0 to 6,4 km/h. A slip ring is fitted to the vertical driven shaft which allows 24 channels of information to be monitored under dynamic conditions. The 7 meters diameter environmental track includes a number of surfaces with give specific vibration patterns. These patterns have been carefully selected to represent surfaces that would be encountered in everyday use. A kerb drop is set into the test track whereby the wheelchair on test is raised 0.13 meters and rapidy dropped to the base level to simulate the wheelchair being pushed from the kerb. This facility can be varied from once in every circuit to once in every 20 circuits. The kerb drop function has been found to be very severe and its use in a test sequence is stricly controlled. Tests undertaken to date have shown that only a relatively small number of kerb drops cause fracture of wheelchair components, usually the castor assembly, and if countinued the main frame structure. The test rig may also be used as a dynamometer for powered wheelchairs, and by feeding a proportion of the full working voltage to the electromagnetic clutch it is possible to simulate the range of gradients from level to stall conditions.

Carefully monitered tests using accelerometers by the ergonomics department at Loughborough University established that the patterns of the forces imposed upon the wheelchairs by the dynamic test rig compares very closely with those of a wheelchair being subjected to everyday normal use. Obviously the magnitude and frequency of the forces are greatly increased on the test rig, and it has been calculated that completing 15.000 circuits, a distance of 325 km, without major structural failure represents a wheelchair in general use for a period of 5 years.

b) Gradient platform

This consists of a platform, approximately 3 meters square, which can be elevated by means of a pulse controlled variable speed DC motor to an angle of 35 degree. It is thus possible to vary the rate of elevation giving a very fine degree of accuracy at the critical angle. It is used to establish the stability of wheelchairs, forwards, backwards and sideways. It can also be used to assess the gradeability of powered wheelchairs, the platform being large enough to permit them to be driven around it whilst the angle of elevation is varied. The criteria for acceptance in the United Kingdom is specified in British Standard BS 5568 - Folding Wheelchairs for Adults, and in the case of occupant propelled wheelchairs the minimum acceptable angle of stability is 16 in all directions.

c) Performance strenght to British standard BS 5568: 19878 - specification for folding wheelchairs for adults

This standard is based generally on performance requirements. Much of the preparatory work for the standard was carried out in the DHSS Test Centre. The type of equipment required to undertake the tests is not specified and the DHSS has opted for a pneumatic power source and a simple test frame. It is possible to position pneumatic cylinders in various attitudes on the test frame to perform the test. It is intended that all Adult Folding Wheelchairs supplied by the Department will conform to BS 5568, and with this in mind, it is now policy to subject all wheelchairs, submitted for assessment, to the Specification parameters.

d) Manikins and test dummies

An important feature of all testing at Blackpool is the use of suitable manikins in order that realistic repeatable loadings can be applied to the various parts of the wheelchair. The manikins used in the Test Centre were specially produced for the Department by Ogle Design Associates. Child, junior and adult manikins are all used which are anthropometrically correct and ballasted to the 95th percentile (static).

The DHSS also co-operated in stability tests to compare results obtained using test dummies developed by the Netherlands with those previously obtained using the Ogle manikins.
The test dummies, which consist basically of hinged wooden boxes containing steel weights, are in the process of being adopted for ISO wheelchairs testing standards for use in static testing such as stability tests.

2.3.4. ASSESSMENT AND EVALUATION

Unless the wheelchair has been designed and developed by the DHSS, any new model is assessed and evaluated before it is considered for general issue to patients.

Depending upon the type of wheelchair and its anticipated demand, this process can vary from being a fairly simple measurement and strip examination, stability check etc. to a full-scale assessment involving material testing, stress analysis programmes, durability trials under accelerated conditions such as the dynamic test rig and finally field trials by selected patients. Naturally the DHSS models are also subjected to dynamic and user testing, but as they have been manufactured to our own detailed specification and drawings it is not necessary to carry out measurement and detailed examination. except in the course of Quality Control checking on production wheelchairs.

The latter is an on-going process to ensure that manufacturers maintain the consistent level of quality required by the DHSS.

2.3.5. BRIEF SUMMARY OF GOVERNMENT SUPPLY POLICY

As stated at the beginning of this report, the DHSS does not issue wheelchairs specifically for paralyzed persons and it must be said that in general the range of wheelchairs designed and manufactured to the DHSS requirements are not normally the choice of active paraplegics. By far the majority of our clients are elderly arthricts whose prime requirement is a wheelchair which is inherently stable, whereas active paraplegics frequently need wheelchairs which are relatively easy to tip rearwards, thus aiding the common practice of performing "wheelies" to negotiate kerbs, etc.

However, the DISS has for many years issued several types of proprietary wheelchairs which are preferred by such users, and in every instance examples of those models were extensively evaluated and tested before bulk issue commenced.

2.4 THE NORDIC SYSTEM OF TESTING, EVALUATION AND INFORMATION ON WHEELCHAIRS

Borje LUNDBERG

2.4.1 INTRODUCTION

During the last fifteen years there has been an expanding cooperation between the Nordic countries in the area of technical aids for disabled/handicapped people. Specially between the Scandinavian countries (Denmark, Norway and Sweden) the co-operation in testing has been expanding.

There are several reasons for co-operation in the Nordic countries, for instance:

- a well developped social system for supplying the disabled/handicapped people with aids;
- great similarities of the supply of technical aids in the various countries;
- responsibility of the society for the cost;
- generally the same products are available in each country;
- a common need for central information to the prescribers.

In Sweden The Swedish Institute for the Handicapped is responsible for testing technical aids and recommending them for free prescription in Sweden. Similar organisations have been started or are planned in the other Nordic countries. Thus there are very good opportunities to create Nordic co-operation. Testing of wheelchairs has now been carried out for some years.
Wheelchairs are a product group which is very suitable for Nordic co-operation depending on the facts that:

- 80-90% of the products are the same in the Nordic countries;
- 95-99% of the prescribed wheelchairs are the same in the Nordic countries.

The countries taking part in the testing of wheelchairs are Denmark, Norway, Sweden.

2.4.2. GENERAL ORGANIZATION OF THE TEST PROCEDURE

The Nordic procedure of wheelchairs testing follows the general procedure which has been agreed on between the testing institutions in the Nordic countries, that is to say:

- Market surveys in the countries which take part in the testing;
- Proposal on assortment for testing;

- Technical and fuctional Testing;
- [illegible] reports of every separate wheelchair and expert [illegible];
- Distribution of test reports;
- Organisation of product information.

It must be underlined that market surveys and request of products for testing are effected by respective institutions in their own countries. After discussion of what wheelchairs should be tested, all participating institution is responsable to collect wheelchairs in their own country and send them to The Swedish Institute for the Handicapped.

2.4.3. THE ACTUAL TESTING

The test is a type test. That means that when a wheelchair once has been tested it is not tested again, except when the construction has been changed in important parts.

a) Control of the delivered wheelchair

As soon as the wheelchair has been delivered to the institute a superficial control is carried out in order to certify that:
- The right wheelchair is delivered;
- No damage to the wheelchair has been done;
- All parts and written instructions as required are delivered;
- The most important functions of the wheelchair are working, for example the wheels, the brakes, the folding mechanism (if foldable), the electrical mechanism (if electrical).

b) Determination of dimension of the wheelchair

In order to determinate the seating dimension the institute follows the Swedish standard for office chairs but added with some measurements specially for wheelchairs. The overall dimensions are measured in accordance with the ISO draft proposal "Wheelchairs - overall Dimension". The reason for this measuring procedure is to produce compatible measures of different wheelchairs to be published in the product information.

c) Stability test

The stability test is divided into two parts namely;

a) Static stability, following test procedure described in ISO draft proposal "Determination of static stability";
b) Stability with a person in the wheelchair making some previously decided movements.
   For electric wheelchairs the stability test is supplemented by a dynamic test following ISO draft proposal "Determination of dynamic stability of electric wheelchairs".

d) Special tests for electrical wheelchairs

For electrical wheelchairs some supplementary measurements are performed, for example determination of obstacle climbing ability, brakes performance, speed, acceleration, retardation, range, tracking characteristics (also for manual wheelchairs). For most of these procedure there exist ISO draft proposal standards which the institute follows.

e) Functional test

The next step in the test procedure is to decide on fuctional test. The decision is taken by occupational therapists and engineers. Very often at this moment there is a meeting with our expert group which consists of prescribers and representatives from the associations of disabled prople. The persons thus present at the meeting represent wide experience and knowledge of wheelchairs. If a decision is taken to accomplish a functional test wheelchair is sent to a technical aid centre. At the centre arrangements are made so that wheelchair users can test the wheelchair either at the centre, or at home, or in other suitable places (work situation, hospital). For evaluation use we have worked out a questionnaire which is sent together with the wheelchair. The functional test goes on for at least one month but often longer. When the functional test is finished the filled in questionnaire and the wheelchair are sent back to the institute.

f) Fatigue strength test and technical controls

The next step in the test procedure is the fatigue strength test which are performed with two specially made test equipments. These equipments are described in appendix 3 and 4. The last step is that our engineers make a close inspection of the construction and technical workmanship in order to judge the technical solutions, quality, choice of materials, quality of production and so on.

g) Fire nazards

At the same time as we ask the company for a wheelchair for testing, we alsc ask for some examples of parts which we are interested in testing against fire hazard, for example the upholstered parts of the wheelchair. The fire hazard tests are carried out by an institution specialized in fire hazard of forniture. Test report from this test is also sent to the
institute.

h) Additional tests for electrical wheelchairs

Electric wheelchairs go through complementary tests, for example climatic tests, vibration tests, battery tests. Of course the making

of these complementary tests depends on the complexity of the electrical equipment, and has to be judged for each individual product in order to get careful examination of the electrical equipment.

2.4.4. COMPILATION OF TEST REPORT AND EXTERNAL GROUP MEETING

Finally the personal at the institute produce a total test report, based on previous tests and gathered knowledge. This test report has two main headines, namely technical test and functional test. Under each of these headlines the wheelchair and the test results are systematically described. The report usually consists of three to five typed pages.
The reports are sent to the expert group members and to the colleagues at the corresponding institutions of the Nordic countries which take part in the test. At the following expert meeting the reports and the conclusions are discussed, and the group makes a recomandation that the wheelchair be approved or not. After that meeting the total test report is completed with the remarks which the expert group has decided.

2.4.5. DISTRIBUTION OF TEST REPORT

The test reports are sent to those companies in Sweden which have sent wheelchairs for test. For wheelchairs sent from other Nordic countries the test reports are sent to the collaborators in the Nordic country from where the wheelchair has been sent for testing. They in their turn send the test report to the company. Independently of the country the companies have some time (as a rule about two weeks) to make comments on the test report.

2.4.6. PRODUCT INFORMATION

Based on the report, product information is then carried out. At present this is done independently in every country by the institution taking part in the wheelchair test.
Each separate country decides what information from the test reports is to be published. Each country decides what information from the test report is to be published. Each country also decides on all recommendations, and specially comments on the facts that are of value in the country. The product information is written in the idiom of the country.

2.4.7. CONCLUSION

During the last years, the Nordic co-operation, specially in testing, has been an important part in the testing work for The Swedish

Institute for the Handicapped. However, it has taken a very long time to build up the co-operation and we still have problems.

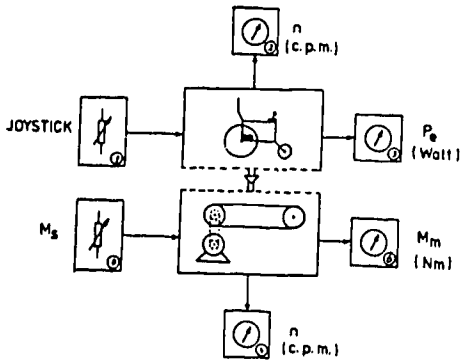
In order to take part in co-operative work there is need of both money and educated people. It is also important to remember that the testing only is one link in a chain which consists, among other things, of provision of technical aids, information (in a broad sense, including education), and influence on dealers and producers.

International cooperation is very important but experiences have taught that it is very difficult and that it takes time, needs resources and must be very much encouraged in the participating countries.One way which shows good qualification for success is the on going international standardization work carried out in the International Organization for Standardization (ISO), technical committe 173, "Technical aids for the handicapped".
The work in this committee is carried out by manufacturers, testing institutions in different countries, representatives from authorities and associations of disabled people (both on national and international level) as well as medically educated people.

Type of chair	Kinds of posture	Adjustability
type 0	transport	not
type 1	step-in or active	not
type 2	two positions out of step-in/active/semi-active/passive	P.A.T. (2a) P.A.U. (2b)
type 3	continuous adjustable over the range active/semi-active/passive	P.A.T. (3a)
type 4	continuous adjustable over the range step-in/active/semi-active/passive/rest	P.A.T. (4a) P.A.U. (4b)
type 5	all between step-in to sleep	P.A.T. or P.A.U.

Fig. 2-4

Dynamic testdevice
for motor-driven wheelchairs



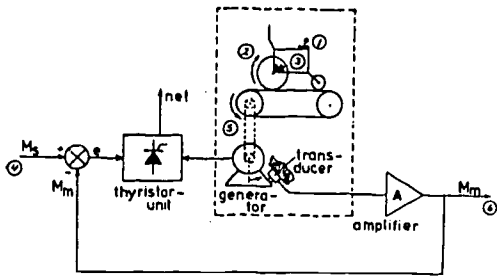


Fig. 2-5

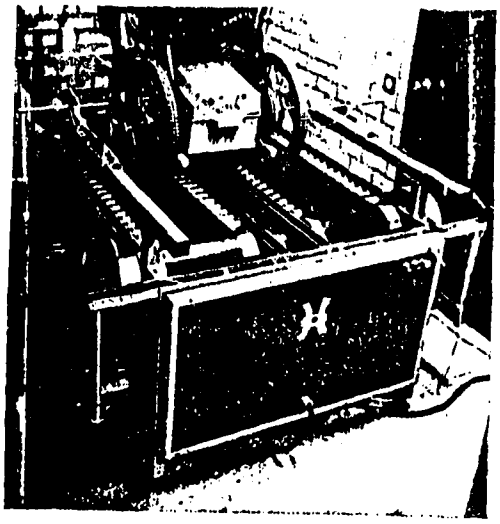


Photo of the testdevice.

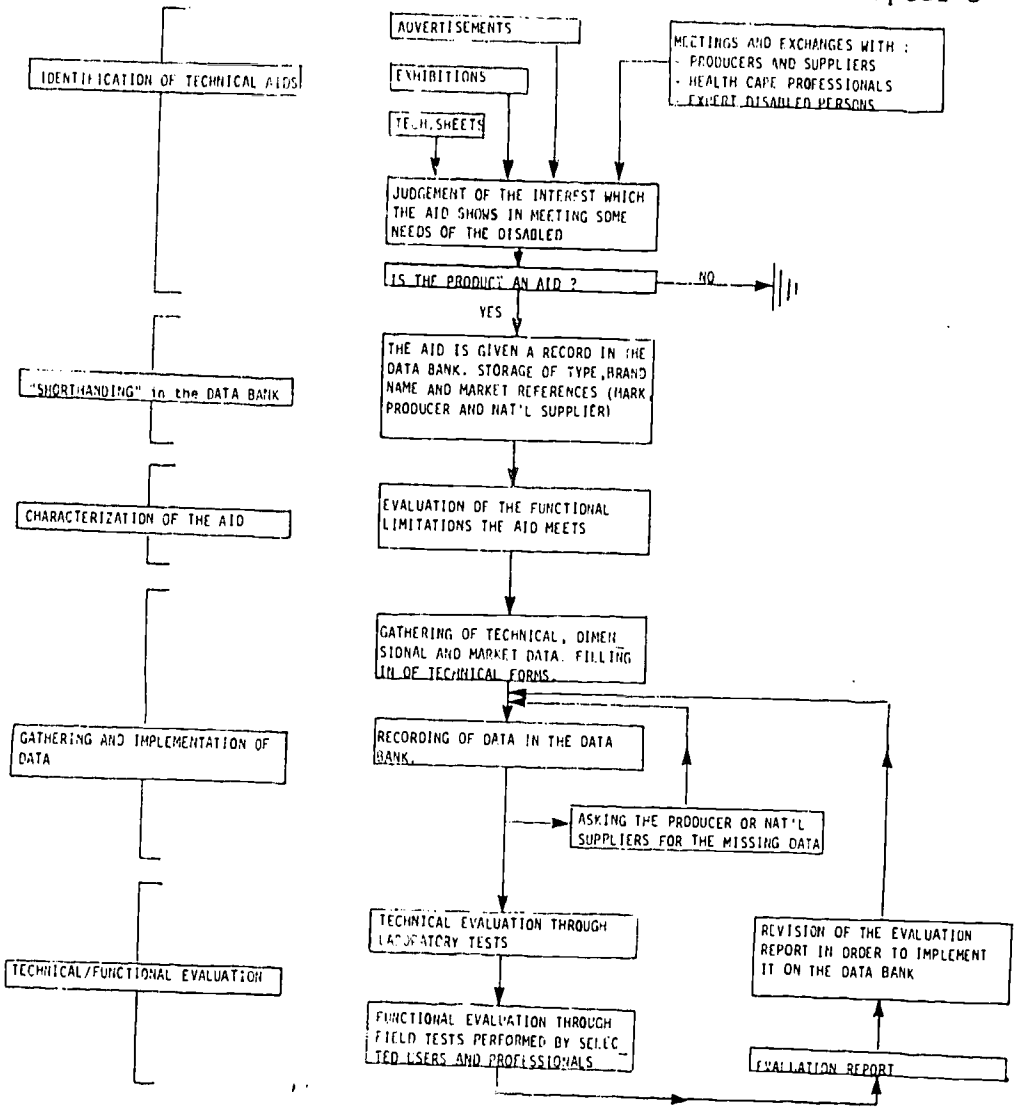
Fig. 2-6

3) COMPUTERIZED INFORMATION CONCERNING TECHNICAL AIDS IN EUROPE

This chapter gives a picture of the ongoing initiatives in the european countries in the field of computerizes information services concerning disability. After a brief overview of the existing systems, the italian SIVA is described with details, while the other existing major system, namely the Nordic Register of Technical Aids, is already described by a previous World Rehabilitation Fund publication. (n.17).

Fig. 3-1

Figures
Chapter 3



Management of data in SIVA's information Network. The first step consist of the identification of the products which might be helpful for indipendent living. An experts team « filters » the collected information keeping into account only those products which are designed on purpose for the disabled and those widemarket products which look really of particular interest. The further steps are relevant to the computer assisted information processing and dissemination.

3.1. GENERAL OVERVIEW OF THE COMPUTERIZED INFORMATION SYSTEMS

The initiatives which the Commission of the European Communities is carrying out in the field of information concerning the disabled have been dealt with by Chapter 1 in this booklet.

The Handynet project is not aiming at creating a quite new information facility in Europe, but rather at coordinating the existing national activities through estabilishing common ways to manage and share information.

The first reason which lay behind the widespread interest in such project is the growing need for transnational information flow in the field, on the ground of the closer and closer market, research and cooperation interactions.

The second one is a general trend towards computerization of information which has recently started in many of the existing information centres in Europe.

In particular, Electronic Data Processing concerning technical aids appears a tremendously powerful means for information dissemination at local, regional, national and transnational level.

At present, only three conputerized systems have been fully implemented and have become operational in Europe on the field of product information (SIVA, The Nordic Register and Bardsoft). Other Systems are now in design or in experimental stage (CEDIAAT, HANDYDATA, RIC, DLF). Other countries use the computer only for indexing documentation, rather than for spreading information (Stiftung Rehabilitation). Finally, a data bank is now operational in the field of research into technical aids (BARD).

3.1.1. THE NORDIC REGISTER

The first conputerized system which was developed is the Nordic Register of technical Aids, set up by the Nordic Council for Disability.

The system consists of five nationally operated databases which make it possible for the partecipating countries (Sweden, Denmark, Norway, Finland and Ireland) to store information in their national longuages and to add other information of pure national interest. Finland operates two databases, being it a bilingual country (Finnish and Swedish). A sixth database is implemented with selected information in English. The data base software is a commercially available one, which is hosted and maintained by a data base vendor.

One of the major objectives of the system is the production of ready-to-print material to be delivered for publication of product catalogues and booklets. In view of such objective, computerized management of drawings

and graphics has also been made possible.

The system has been designed for a wide-range of user-oriented output applications too.

On-line information presentation is intended to become available to a number of organizations dealing with technical aids in the scandinavian country, as it is currently done experimentally in Danmark.

Six different lay-out alternatives for off-line printouts and lists are also available.

The retrieval technique is based upon keywords and a thesaurus, like most of similar commercial data base, including the one which manages the american ABLEDATA files. The used classification system is the well known nordic-one, which originated the HANDYVOC classification (see appendix 1)

Information from the Nordic database is retrieved by expressing the desired set of conditions by means of keywords combined with the boolean (logical) operators. Unlike ABLEDATA, many built-in classifications make it possible to select information (for instance, all products intended for a certain disability group).

A deeper description of the system is offered by a former World Rehabilitation Fund (n 17, "Information systems on technical aids for the disabled").

For further information contact:
The Nordic Council for disability
Box 303 - 16124 Bromma - Sweden.

3.1.2. BARDSOFT

Bardsoft is an extension of the British Data Base on Research into Aids for the Disabled (BARD), which is described later.

The reason which suggested the undertaking of such initiative was the complete lack of information on software concerning the needs of the physically and mentally disabled persons.

The system is implemented on a microcomputer and is intended mainly for production of off-line printout directories containing extensive information about each piece of currently available software concerning "special needs". The directories are divided according to the computer where the software can be run. Such catalogues should be purchased directly from the Handicapped Person Research Unit of the Newcastle-upon-Tyne University (HPRU) in Britain, which design and manages the data base.

HPRU can undertake specific searchs in order to give answer to particular requests. Remote access to information is also possible, subject to appropriate agreements.
The retrieval strategy is based upon the Bardsoft descriptors, a kind of classification grouped under the following ten main descriptors:

- Percentual/motor
- Cognition
- Numeracy
- Communication
- Training/Therapy
- Assessment
- Teaching
- Employment
- Recreation
- General

Each BARDSORFT record includes detailed description of the characteristics of the relevant piece of software, of the required hardware and mass memory requirements, of cost and availability.
For further information contact:

Handicapped Persons Research Unit
Newcastle upon Tyne Polytechnic
1 coach Lane,
Newcastle U. Tyne NE7 7TW
Great Britain

3.1.3. ACTIVITIES IN DEVELOPMENT STAGE

The CEDIAAT (Centre de Documentation sur l'Accessibilite et les Aides Techniques), run by the Rehabilitation Centre in Mulhouse in the frame of its Resource Service, is addressed at providing external users with couselling on indipendent living and help in choosing appropriate technical aids.

Information computerization has been undertaken in recent times, in view of making data accessible to a wide-range of users through the data transmission/telephonic network. The technical means for achieving such purpose is offered by the french Ministry of Post and Telecommunications which is distributing to each telephone user a "Minitel" terminal as a compulsory alternative to the printed phones directories.

The information to be implemented ranges from technical aids through manufacturers and suppliers, accessibility problems, to bibliographic documentation.

Contact: CEDIAAT
Centre de Readaption
57 Rue Albert Camus, 68093 Mulhouse Cedex, France.

Another french Data Bank, namely HANDYDATA, is in process of development and deals with technical aids for elderly and disabled persons as well.

Contact: HANDYSOFT S.A., Service HANDYDATA
30 Rue Pasteur 77240 Vert Saint Renis - France.

Again in France, the CNFLRH (Comite' National du Liason pour la Readaptation der Handicapees) has just undertaken technical aids information computerization.

Contact: CNFLRH
38 Boulevard Raspail, 75007 Paris, France.

Computerized indexing of documentation has been in use for years at the Stiftung Rehabilitation in Germany.

Contact: Stiftung Rehabilitation
Postfac 101409
6900 Heidelberg - W. Germany

Finally, the other following centres are in process of undertaking computerization.

contact: Disabled Living Foundation 380
384 Harrow Road London W92 HU - Great Britain

Revalidatie Informatie Centrum
Lucas Stichting voor Revalidatie
Zandbersweg 111
6432 Hoensbroek - The Netherlands

3.1.4. THE BARD

The British Data Base on Research into Aids for the disabled, or BARD for short, has been operating since 1984.

It is intended to concentrate on information on design and development work, phototypes, "one-offs", latest developments, as well as research projects on the use of aids, surveys and evaluations. The main BARD aim is to facilitate the exchange of ideas and information which is central to R & D stage of producing aids and equipments.

Each record is coded under one or more Main descriptors which largely conform to the new European Classification Thesaurus. These are:

- Therapy and Training
- Prosthetics and Orthotics
- Personal Care
- Mobility
- Household and daily living
- Forniture and Fixtures
- Communication and Environmental Control
- Aids for handling other Products
- Leisure and Sports
- Building/Environmental design
- Education
- Workplace.

The process of retrieving information is quite similar to the one described for BARDSOFT, which adopts the same hardware/software structure. As for BARDSOFT, therefore, the HPRU Staff can either perform specific searches on request or produce off-line printout directores divided into subjects. Remote access through telephone/Modem has been successfully experimented.

Contact: Handicapped Persons Research Unit
Newcastle U. Tyne University
1 Coach Lane, Newcastle U. Tyne, NE7 7TW
Great Britain.

3.2. DEVELOPING NATIONAL COMPUTERIZED INFORMATION NETWORK FOR THE DISABLED: THE ITALIAN EXPERIENCE

Renzo ANDRICH

3.2.1. THE CARE DELIVERY SYSTEM FOR THE DISABLED

Act n. 833 of December 23rd, 1978, known as "The Health Reform Act", has effected a deep change from a social security system based on insurance to the principle of social security secured by a National Health Service (N.H.S.) to every citizen or person who is in Italian territory. Public Health expense is a State's task, i.e. a citizen's task that depends on his income, through a unified collection of the contributions by the National Institute for Social Security (I.N.P.S. "Istituto Nazionale della Previdenza Sociale").

The actual delivery of the Health Service is carried out by the "Unita' Sanitarie Locali" (Local Health Units - abbreviated USL), which are territorial administrative institutions whose borders are established on the basis of the resident population (50.000-200.000 inhabitants), and the prexistence of other administrative institutions and health facilities. One USL may be a part of a big city as well one city or an association of smaller municipalities.

The N.H.S. offers different facilities to disabled persons depending on the cause of the disability. Act n. 482 of April 2, 1968 establishes the following categories:
- Disabled by war accidents;
- Disabled by Public Service accidents;
- Disabled by Labour accidents;
- Civil Disabled;
- Persons who are blind;
- Persons who are deaf.

Of course the most numerous category is that formed by the Civil Disabled.

Disability is officially ascertained by the Percentage of Inability (up to 100% i.e. total inability), which must be assessed by specific local commissions.

For the registered Civil Disabled the following facilities are provided:

- Basic and Specific Health Service including rehabilitation facilities;
- Provision of "Protheses", which in the law viewpoint include prostheses, appliances and technical aids;
- Facilities for attending normal classes at any level of study;
- Professional education in normal classes, special classes and social-medical centres;

- Compulsory employment, (provided the inability has not been assessed as total);
- Economic facilities;
- Travelling facilities;
- Removal of the architectural barriers in the public premises.

As regards provision of technical aids (which are considered by the law in the same way as the Prostheses and the Orthoses), the list of devices which can be provided free of charge by the N.H.S. is updated yearly: it is called "Nomenclatore Tariffario", a kind of National Registers of devices and relevant prices. Aids which cannot be included in the "Nomenclatore Tariffario" can also be prescribed if a particular need occurs. Aids for education in school or for the worksite can also be provided by local authorities if a particular need occurs.

3.2.2. INFORMATION NEEDS CONCERNING DISABLED PERSONS

A well defined trend of the N.H.S. in the field of Rehabilitation and Care of the disabled is the dissemination of basic and specific medical services at local level.

This policy is supported by the concept that Rehabilitation is a global process which begins from medical treatment and ends with social integration, so that the life environment of the disabled persons play a role of paramount importance.

Unfortunately carrying out a Social Sevices Reform has not been possible together with the Health Services Reform, and up to now the Government has not been able to set up well defined guidlines for integrated management of Social and Health Services at local level.

In consequence of that, great administrative problems may arise when trying to complete the rehabilitation process outside the medical facilities.

It is very common that the disabled is left alone after the medical treatment, without any professional support just when he has to learn how to cope with the new situation of life with disability. Several Regions have tried to overcome this difficulty charging their USL's with Social Services, starting from the argument that Social Service is a Municipality's task and that the USL's can be considered as associations of Municipalities. This action has increased somewhere the possibility to improve notably the quality of the Rehabilitation process. Nevertheless, looking at the general Italian situation, a gap does exist between the service which is provided inside the medical facilities and the situation which the disabled must cope with outside them.

In order to bridge this gap three action at least must be taken:

- A clear definition at national level of the administrative means which are needed in order to secure easy integration among medical, technical and social facilities and resource which intervene in the Rehabilitation process.

- An improvement of the professional training of the health care professionals aimed at a better education in multicompetence work.

- The creation of a network of Information and Advice Centres scattered throughout Italy, whose task is to secure the needed information to the disabled themselves, to the health care professionals, to the technicians and architects, to the school professional and in general to all the professional community involved in Rehabilitation and Social Integration.

Keeping into consideration both the Italian decentralization policy and the above mentioned gaps, information is a tremendously powerful means for improving the quality of Rehabilitation service through allowing interdisciplinary flow of experience and competence. Information should focus the following points:
- information on technical aids for independent living and their characteristics, their producers and suppliers;
- experiences exchange on evaluation of technical Aids;
- information on facilities which can secure the most appropriate treatment of particular pathologies;
- information on facilities and social resources for social integration, education, partecipation to work;
- information on Civil rights;
- information on architectural designing for the disabled.

Up to a few years ago information on technical and social resource was almost totally neglected being limited only to certain local activities. In recent years several new organization have been set up generally aimed at coping with selected items of information.

Among these new initiatives, the Technical Aids Evaluation and Information Centre in Milan (SIVA) deserves particualr mention, being it the only one aimed at setting up an integrate computerized national information system.

3.2.3. THE TECHNICAL AIDS EVALUATION AND INFORMATION CENTRE

In 1980 The Fondazione Pro Juventute in Milan, in the frame of its research activities (Bioengineering Centre) carried out in conjunction with the Politecnico of Milan, decided to undertake a project aimed at designing and putting into operation a computerized Data Bank of the Technical Aids available in Italy for the disabled persons. After an experimental period (1980-1982) the project brought about the establishment of the Technical Aids Evaluation and Information Centre

(SIVA), which has been offering information and counselling service for the last two years.

Owing to the computerized management of product information, SIVA is designed to be the central node of a network of user directed Advice Centres scattered throughout Italy (the first ones are just now being established in other regions) whose task is to help the disabled, his relatives and friends, the health care professionals, the architects etc. to identify the most effective solutions of adapting the environment so as so meet his needs, finding out the required aids and the direction an how to buy them (or to have them delivered by the Health Service).

SIVA itself runs and Information and Advisory Service mainly addressed to the users of the Region of Lombardy, which besides being an actual service to the disabled can been considered a means of feedback of the effectiveness of the information network.

a) The Data Bank

The close connection between software development and pratical use has allowed continuous improvement of the computerized Data Bank based actual information needs. The final version was completed by the end of 1984. The Data Retrieval Program (specially designed by SIVA) offers its user (to whom no experience in informatics is required) guidance in finding the information needed, starting from the functional and environmental problems of each disabled person.

SIVA's package includes:

- The main data file (composed of fixed length records whose contents include about 50 items regarding the type, the brand name, the use, the disabilities which the aid meets, technical data, market data, comments and evaluation), with the relevant index files;
- the bibliographic references file, including manufacturers and suppliers;
- several groups of ausiliary files (one group for each chosen mother-togue) containing messages, menues and decoding of codified items;
- a "history" file for registration of the transactions, allowing the processing of statistics about the actual use of data bank;
- the Data Retrieval Program (AUSILI);
- the Programs for updating the main file and for management of auxiliary files (for SIVA use only).

b) Gathering of Information

Data relevant to each technical aid are collected by filling in forms:

- the first form asks for general data (type, classification, brand name, sizes and weights, disabilities which are met, market characteristics, optional extras and possible adaptations);

- a second form asks for particular data which are meaningful only for same categories of products;
- if necessary, there is a third form gathering evaluation data based upon pratical use.

Each product is given a record in the data bank and the index files are updated during the storage stage.

Special pieces of software have been designed in order to perform yearly updating of the stored data relevant to each product through submitting the contents of the records to the manufactures and suppliers (fig. 3-1). Most of them have shown to be very active in co-operation.

c) Multilingual Access Operation

In order to play an active role in the Handynet project (aimed at creating an European information network on the technical and social resources which can promote care, rehabilitation and social integration) which is run by the Commission of the European Communities, the data bank has been given a Multilingual Access feature, allowing retrieval of data in several mother tongues even if data are stored in a different language. In other words, the five retrieval operations can be performed choosing the interactive dialogues in any mother tongue (at present in Italian, English and French) without the need to translate the description of each aid. This facility allows access to information on technical aids available on the Italian market from abroad; on the other hand the software might also be used by other institutions for management of data relevant to the products available in their country (fig. 3-2).

The data bank software allows the following operation:

1. "searching" the technical aids which meet specif disabilities or have certain technical characteristics. Up to 26 access keys are allowed, which can be used singly or together.

2. "Drawing out" all information relevant to a specific product, whose record number has been found through the foregoing operation.

3. "Market search", locating manufacturers and suppliers dealing in a certain type of aid at national level.

4. "Off-line printing", of cross-reference printout books, which are very useful to professionals or Centres being they the basic information for choosing appropriate aids.

5. "Statistical processing", allowing monotoring and "field evaluation" of the use of the data bank. This facility offers a powerful tool for identifying the information needs as well for receiving feedback from the information brokers.

d) Searching operations

In order to achieve the multilingual access feature most of the data relevant to each product are codified. This brings about also the further advantage of a dramatic reduction in memory requirements.

Only the staff performing input of data must know the code system: the data bank user does not need to know any code, since conversion routines, help functions and software dictionaries allow real time decoding.

A "searching" operation may be performed using up to 26 access keys (singly or together), falling into three groups:

- Nordic/European classification codes;
- General access keys (11 keys) relevant to any product;
- Particular access keys (14 keys) relevant to selected categories of products showing similar characteristics (e.g. B-2).

Among the "general" keys, the "type" of aid deserves a mention, being it the most common name given to a specific group of aids in a particular country. Data are stored according both to SIVA's type code system and to Nordic/European classification, bringing about two advantages at the same time:

- International compatibility in the European-Scandinavian context;
- no limitation arising from use of an international classification whose evaluation may need necessarly longer time than the development of information needs in one country can afford. For instance, the scope of information dealt with at SIVA is broader than the scope of the Nordic/European classification as proposed by the EEC Handyvoc project.

The international classification and the type code system have been interfaced through a specially designed piece of software, which is included in the Data Bank retrieval software. In consequence of it, the Data Bank user can undifferently perform a searching operation according to the international classification as well to the type code system without worrying about their relationship at all. This feature has shown to be very welcome by the professionals.

The main output of a serching operation is a printout (fig. 3-4) which supplies the basic data for the identification of the suggested products and for looking through all the relevant available documentation (technical and market data stored in the computer, brochures, pictures etc.). It can be printed choosing among several formats.

Fig. 3-5 shows a sample computerized record relevant to a wheelchair.

e) Data Bank use Evaluation

At the end of each retrieval operation the user can request automatic registration of the performed transaction and of his opinion, through a kind of "software mailbox". The recording makes possible statistical processing of the use of the data bank (fig. 3-6).

Of course the Data Bank software includes a special piece of software aimed at reading the registrations and the contents of the mailbox as well to print statistical tables (fig. 3-7).

f) Other Data Bank Operations

In order to meet the needs of technicians, architects and administrators a retrieval operation has been made possible which lists only manufacturers and suppliers relevant to each type of aid. Other pieces of software have been developed allowing processing of data and printing of general directories of the availability of technical aids on the Italian market (in Italy). They are very useful to professionals or centres as first-guidance handbooks in choosing apropriate aids and in getting into touch with the relevant firms.

They can be purchased singly or upon subscription basis. Printed pubblications, with monographic or general subject, constitute another aspect of SIVA's activity, sometimes carried out in conjunction with other institutions.

g) SIVA's Advice Service directed at the Users

SIVA's staff, operating in the frame of the Bioengineering Centre, is composed of full time (1 engineer, 1 occupational therapist), and 3 part-time (1 documentalist with rehabilitation therapy background, 1 rehabilitation therapist, 1 education specialist) professionals. Besides to performing the gathering, evaluation, processing and management of information, SIVA runs its own Advice Service addressed at the users.

Three "tools" are used in carrying out this activity:

- the professional experience;
- the data bank (fig. 3-8);
- the permanent exhibition.

A permanent exhibition fig. 3-9, 3-10) permits the description of those products which cannot be fully explained by the data bank, makes it possible the testing of the aids for which experience is required, suggests new ideas for the solution of several problems of the user, presents new technologies not yet available on the market but admitting of important developments.

It is divided into several sections corresponding to the most common living environments where the disabled persons can overcome practical problems through using technical aids.

The products shown in the exhibition are frequently updated subject to free-of-charge basis agreements with the manufacturers.

h) Dissemination of information to other regional advice centres

Since its creation SIVA has been designed as the focal point of a network of Advice Centres scattered throughout Italy, servicing disabled people, health care professionals, social workers and architects at regional and local level.

During 1985 the first "satellite" centres have been set up by public authorities or by voluntary association. Fig. 3-11 shows the logo of the italian information network.

Several different technical means make available remote access to the information updated and collected by SIVA, each one suitable to the different information needs and economic possibilities of the Centres and Organizations asking for connection (fig. 3-12). The data bank is hosted on a DEC VAX 11/750 Computer, where updating of the contents is performed daily by SIVA's staff.

Therefore information is accessible from any terminal in the world subject to appropriate agreements, and the Multilingual Access Feature overcomes any problem of data translation.

i) Advice Service Monotoring and Evaluation

When beginning to set up peripheral Centres a common procedure was established in oder to monitor the whole service both at national and at local level and to allow information exchange and comparison among different centres.

In fact, use of the data bank occurs only for a certain amount of information enquires, since a large amount of them can be relevant to a broader field than product information. Each couselling service relevant to a client is recorded through a standard form and stored in SIVA's computer (fig. 13). Software has been developed on purpose allowing production of stastical and analytical reports, which give a powerful tool for evaluation of all aspects of the service.

j) Technical Aids Evaluation

The complexity of the problem of technical aids evaluation, which has never been faced in Italy before, has suggested to get soon into touch with other institutions already working abroad in the field. Therefore SIVA is actively involved in EEC activities aimed at coordinating the efforts performed in the member countries, and has been charged with the secretariat of the COMAC/BME project "Evaluation of Assistive Devices for Paralyzed Persons".

SIVA has also been charged by the National Research Council Special Project on Biomedical and Health Technologies with the task to carry out a program of "comparative evaluation of technical aids". This brings about an active involvement in the Technical Commission "Technical Aids for the Disabled" created by the national body for standardization (UNI).

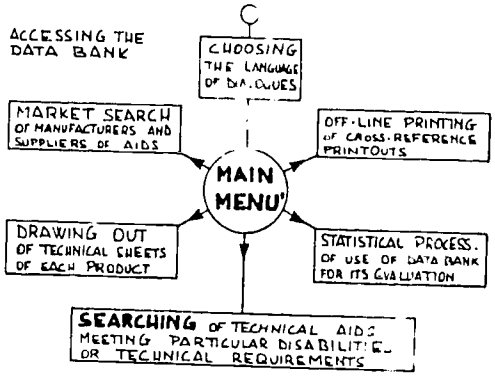
As regards evaluation based upon practical use, work is now in progress in cooperation with some rehabilitation centres in order to establish simple functional evaluation reports which might be easily filled in by health care professionals looking after selected users. The reports, whose responsability should be assumed by each institution, might be implemented on the Data Bank and made available to its users. Therefore, for the time being a double-way flow of information is envisaged with other information Centres and Rehabilitation facilities throughout the Country. One the one hand they will access SIVA's information through the available tech[illegible] means, on the other hand they will send evaluation data which will be implemented into the computerized information network.

Fig. 3-11

Logo of the Italian information network for the disabled.

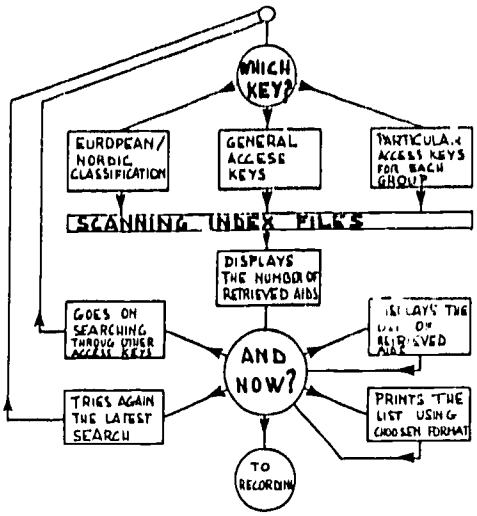
Fig. 3-2 Section 3

Stage 1



Before accessing the five functions performed by the Data Bank Software («AUSILI», from the Italian translation of «technical aids»). The user is asked to choose the access language. At present AUSILI works in Italian, English and French.

Stage 2 (relevant to searching) Fig. 3-3

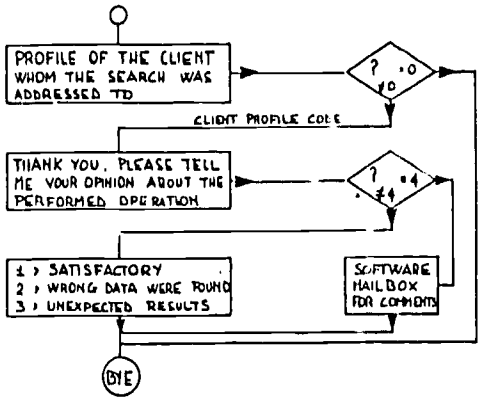


Three categories of entries are allowed by AUSILI:

- The Nordic/European classification (whose descriptors can be easily updated depending on the further agreement which might happen at international levels).
- 11 « general » access keys which are meaningful for any kind of technical aid: type, use, disability the aid meets, overall width, length and height, foldability, detachability, manufacturer, inclusion in the National Register of free-of-charge aids.
- Several « particular » access keys, whose number differs in one another category of technical aids showing similar structural features. For istance, the following access keys are allowed for the wheelchairs: propulsion type, seat width, adjustable backrest, commode attachment, detachable armrests detachable legrests, adjustable legrests, rear castor wheels, seat depth.

Fig. 3-6

Stage 3 (recording of operation)



Before coming back to the main menu, AUSILI collects some data whose processing allows monitoring and evaluation of the data bank use. The purpose is achieved through 3 simple questions.

Fig. 3-4

S.I.V.A. EVALUATION & INFORMATION CENTRE ON TECH.AIDS
MILANO, 24-APR-85 H.15 18:52

List of aids meeting the following characteristics

Type: Wheelchair
The aid is of interest for persons with these disabilities:
Difficulty in using either arm
Overall width in the range between mm. 1 and mm. 650
Folding
Use: Locomotion
Width between armrests in the range mm. 400 to mm 430
Detachable armrests
One arm propulsion
Commode attachment

Record	Type and Brand name	Commercial ref.
4	1: Wheelchair 177 PER EMIPLEGICI	16: BERTO VASSILLI
296	1: Wheelchair 20 AG 77 ADULTI 44 CM.	28: E.M.A.
1494	1: Wheelchair PIEGHEV.60 1510060 MONOG	240: OFFICINE ORTOPEDICHE RIZZOLI
1498	1: Wheelchair TRANS.61 1510061MONOGUID	240: OFFICINE ORTOPEDICHE RIZZOLI
1592	1: Wheelchair HEMIPLEGIQUE 41 CM	31: POIRIER S.A.

>>>> retrieved products no. 5

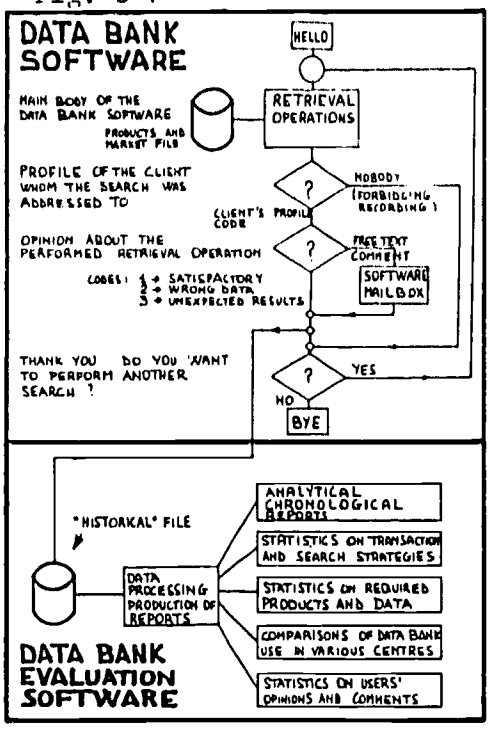
Instance of printout obtained through a searching operation. Among the about 1000 wheelchair items available on the Italian market, five items have been found showing the listed characteristics. The search has been performed using general keys (type, use, width, foldability, disability) and particular keys (internal width, detachable armrests, propulsion, commode). The record number (left) allows to draw out all data relevant to each item.

Fig. 3-5

```
S I V A                                   SERVIZIO  INFORMAZIONE E VALUTAZIONE  AUSILI
                                                     MILANO, 24-APR-85    H 15 13 20
...............................................................................................
D A T A   B A N K   OF TECHNICAL AIDS  > > > > > Record no.     2
Type                 Wheelchair                               Cn.      11
Brand name                            1996
Use.                       Locomotion
...............................................................................................
The aid is of interest for persons with these disabilities
* Difficulty in using both legs
* Difficulty in using both arms
* Impossibility to use one hand
* Difficulty in using both hands
...............................................................................................
Width        (mm)                  MIN.:     560      MAX.:     560
Length       (mm)                  MIN.:     590      MAX.:     920
Height       (mm)                  MIN.      510      MAX.:     920
Weight       (gr)                                             53000.
Material                        Steel
Detachable
Battery feeding
Capacity (hours)                                                 6
...............................................................................................
Manufacturer and supplier, or contact person
  1A --> BERTO VASSILLI
         VIA IRPINIA,1/3                                   TEL.  049/640398
         35020      SAONARA                     PD
...............................................................................................
Price (lire):    1676.000 TVA excl. under to date:     31-12-81
The price is in the range of the Ministry established charges
Photographic documentation is available at SIVA's
-----------------------------------------------------------------------------------------------
ACCESSORIES AND OPTIONALS
(* Disabilities which the accessories and the optionals meet)
...............................................................................................
Safety Belt
* Difficulty in sitting for a long while
Chin operated driving joystick
* Impossibility to use both hands
Hand operated central joystick
* Difficulty in using both arms
* Difficulty in using both hands
-----------------------------------------------------------------------------------------------
Electric traction
Max. speed (km/h)                                                3
Max. gradient which can be negotiated (%)                        8
Seat width (mm)                    Min. :    400      Max. :    400
Seat depth (mm)                    Min. :    370      Max. :    370
Seat heigth  (mm)                  Min. :    510      Max.      510
Backrest heigth  (mm)              Min. :    410      Max. :    410
Heigth of armrests  (mm)           Min. :    230      Max.      230
Seat upholstery                 Skay
Commode attachment
Detachable armrests
Detachable leg supports
Pneumatic rubber front tires
Pneumatic rubber rear tires
Wheel number:                                                    4
Front castor wheels
Front wheel tire diameter                                      200
Rear wheel tire diameter                                       200
Electrical brakes
...............................................................................................
CARROZZINA A COMANDO ELETTRONICO PER USO INTERNO FACILMENTE MANOVRABILE SU
SPAZI LIMITATI.
...............................................................................................
```

Sample record relevant to a wheelchairs. It is fully readable in english even if data have been stored in Italian. A field has been reserved for a short free-text additional comment, which obviously cannot appear translated into other languages.

Fig. 3-7

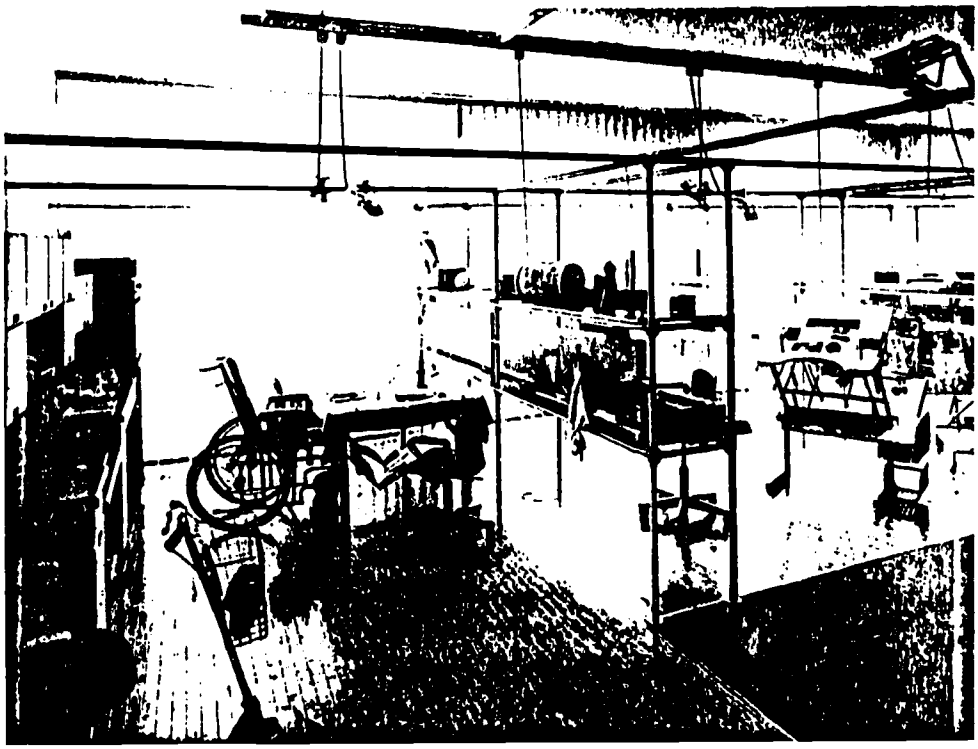


Monitoring and evaluation of the data bank use. After each operation the user can store his opinion on the result, as described by fig. 6. A « software mailbox » is also available, which allows storage of free-text comments, offering a powerful tool for communicating among information brokers as well between the brokers and SIVA system manager. A data bank evaluation software has been designed on purpose in order to read the information brokers opinions and to obtain statistical printouts.

Fig. 3-8

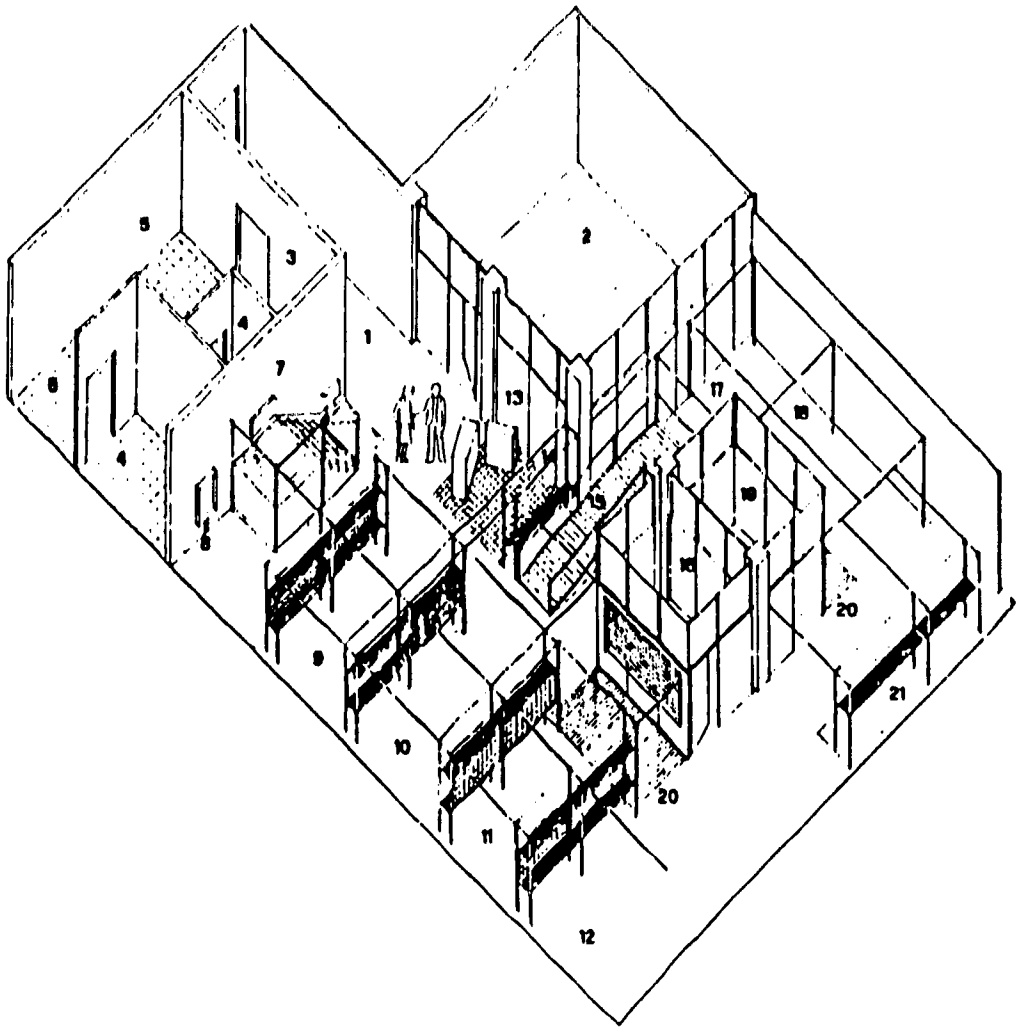
A SIVA's staff using the Data Bank during a counselling service. The data bank is a powerful tool for fast retrieval of the information appropriate to the solution of each individual situation bound to disability. Each disabled client's need must be discussed with a professional staff who must be experienced with the problems of disability and independent living. For this reason « AUSILI » has been designed in such a way that its use does not require any experience in informatics.

Fig. 3-10



A view of the kitchen environment of SIVA's permanent exhibition.

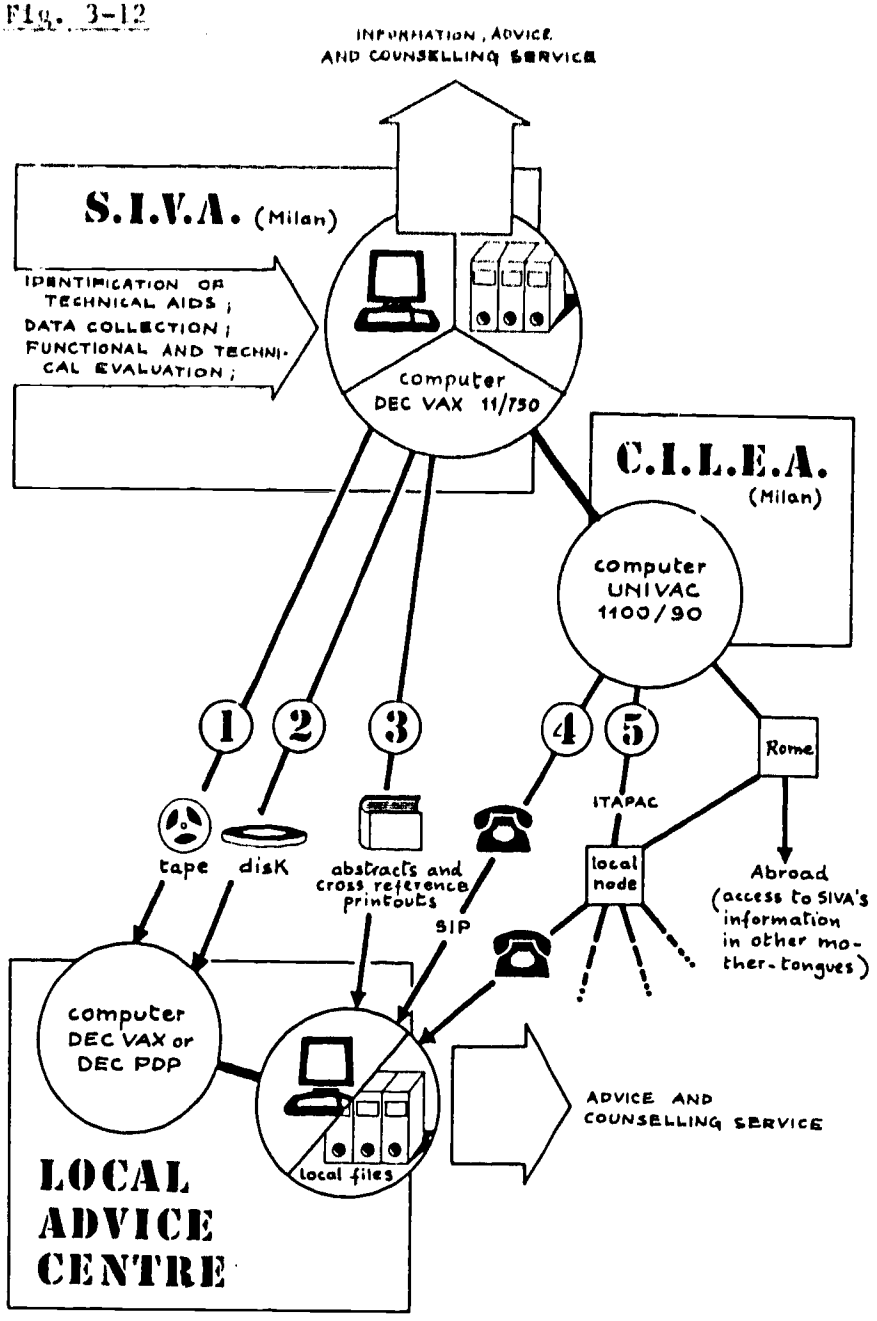
Fig. 3-9



1. entrance; 2. documentation, information and advisory centre; 3. equipment bath- and the shower-room; 4. equipment for wc; 5. examples of handbasins; 6. aids for people with incontinence problems; 7. architectural obstacles (stairs); 8. telephone for the disabled; 9. aids for work and hobbies; 10. communication aids; 11. aids for play and teaching; 12. equipment for kitchen and dining-room; 13. area for experimenting practical usability of rooms fitted out for disabled persons; 14. projection of slides; 15. ramp with adjustablle gradient; 16. room for research work; 17. electric and electronic systems for controlling room; 18. equipment for bedrooms; 19. clothes fitting room; 20. different types of floor coverings; 21. aids to help handicapped people move around, and stay in ergonomically correct and comfortable positions.

The permanent exhibition is a powerful tool for helping the client to understand how the aid can be used appropriately in a particular environment.

Fig. 3-12



SIVA is designed to be the node of a network of advice and information centres scattered throughout Italy. These centres must be equipped with their own professional staff and can access SIVA's information through various technical means which are shown in this picture.

APPENDIX 1

Council Resolution

of the representatives of the Governments of the Member States of the European Communities, meeting within the Council

of 21 December 1981
on the social integration of handicapped people

The representatives of the Governments of the Member States of the European Communities, meeting within the Council:

Have agreed as follows:

I. Member States are invited to continue, and if possible intensify, their measures to promote the economic and social integration of handicapped people, in order to enable them to make a productive and creative contribution to society, and in particular to:

- ensure that due account is taken, in the development of policies affecting the living and working environment of handicapped people, of the need to remove barriers to the full participation of handicapped people in society;

- facilitate the coordination, at national, regional and local levels of services concerned with handicapped people, and to encourage cooperation in this respect between the different bodies active in the field, including associations of handicapped people and the social partners;

- promote the participation of handicapped people, their representative organizations and, where appropriate, their families in the framing and implementation of measures which directly affect them;

- ensure that handicapped people may lead as independent a way of life as possible;

- ensure that handicapped people do not shoulder an unfair burden of the effects, on both employment and resources, of economic difficulties;

- promote measures to prepare handicapped people for an active life, in particular by integrating them in normal education and training systems wherever possible;

- develop and implement measures on the housing and mobility of handicapped people and improved access to public buildings, transport and other public facilities, so as to promote the fullest possible integration and participation of handicapped people;

- encourage information activities designed to enable the public to understand the contribution it can make to the integration of handicapped people, and those activities directed at handicapped people themselves;

- promote the development and availability of technical aids, the pooling of information and experience in the field and the application of new technologies so as to facilitate the communication, mobility and employment of handicapped people.

II. In order to complement and support the efforts of the Member States, the Commission is invited, within the limits of the financial resources available under the Social Fund, to set up, in close cooperation with the Member States, a network of selected development actions to promote model coordination of the actions undertaken, especially at local level. This network will be based broadly on the guidelines set out in the Commission communication and will operate for four years beginning early 1983.

In addition, the Commission is invited to pursue its efforts in particular by:

a) further developing existing activity at Community level based on the network of rehabilitation centres in order to promote and disseminate good practice and to restructure the network, taking into consideration the institutions and associations that are especially well-placed to carry out the tasks of the network, so that all such institutions and associations are included in the information issued by the network and can benefit from the outcome od such work;

b) continuing to promote pilot projects on the housing of handicapped people in order to identify those experiences which are wor of Community application;

c) pooling the information and taking into account the existing national information systems, and ensuring an exchange of information between the services involved in framing and implementing the above measures, including representatives of handicapped people.

APPENDIX 2

List of the Project Management Group members of the European Concerted Action "Evaluation of Assistive Devices for Paralyzed Persons".

ANTONIO PEDOTTI, Project Leader
Bioengineering Centre, Fondazione Pro Juventute Don Gnocchi
Via Gozzadini 7, 20148 Milano, Italy

RENZO ANDRICH
Technical Aids Evaluation and Information Centre (SIVA)
Fondazione Pro Juventute Don Gnocchi
Via Gozzadini 7, 20148 Milano, Italy

THEO BOUGIE
Centrum voor Revalidatie Techniek "Hoensbroeck"
Zandbergsweg 111, 6432 JC Hoensbroeck, The Netherland

GEORGE COCHRANE
Mary Marlborough Lodge, Nuffield Orthopaedic Centre
Headington, Oxford, Great Britain

CLAUDE HAMONET
Serviece de Reeducation Fonctionnelle et Readaptation Medical C.H.O.
Henri Mondor
94010 Creteil Cedex, France

HANS JOCHEN KUPPERS
Forschungszentrum fur Rehabilitation und Praevention
Post Fach 101409, DS9 Heidelberg 1, Germany

PIERRE RABISCHONG
Unite' de Recherches Biomecaniques
Avenue des Moulins, 34000 Montpellier, France

GORDON KENNETH ROSE, Director
O.R.L.A.U., Robert Jones & Agnes Hunt, Orthopaedic Hospital
Oswestry, Salop SY10 7AG, Great Britain

WALBURGA SKUPINSKI
Commission of the European Communitits, DGXII
Rue de la Loi 200, 1049 Bruxelles, Belgium

ALBERT TRICOT
Centre de Traumatologie et de Readaptation

Place Van Gehuchten 4, 1020 Bruxelles, Belgium

APPENDIX 3

List of Centres concerned with wheelchair evaluation activities in the frame of the Concerted Action "Evaluation of Assistive Devices for Paralyzed Persons"

Technical Aids Evaluation and Information Centre (SIVA) (contact R. Andrich)
Via Gozzadini 7, 20148 Milano, Italy

Dundee Limb Fitting Centre (Contact G. Bardsley)
133 Queen Street, Broughty Ferry, Dundee DD5 1AG, United Kingdom

Technische Universitat Berlin (contact U. Boenik)
Prufstelle fur Orthopadische Hilfsmittel
Dovestrasse 6, D-1000 Berlin 10, West Germany

Lucas Stichting voor Revalidatie (contact T. Bougie)
Zandbergsweg 111, NL-6432 Hoensbroeck, The Netherlands

Department of Health and Social Security (contact E. Burnett)
Block 1, Warbreck Hill Road, Blackpool FY2 0U2, United Kingdom

Gemeenschappelijke Medische Dienst (contact R. Den Adel)
Bos en Lommerplantsoen 1, NL-1055 Amsterdam, The Netherlands

Centre de Readaptation (contact P. Dollfus)
57 Rue Albert Camus, F-68093 Mulhouse Cedex, France

Rehabilitations-Klinik (contact P. Engel)
D-3436 Hessisch Lichtenau, Germany

Stiftung Rehabilitation (contact H.J. Kuppers)
Postfach 101409, D-6900 Heidelberg 1, Germany

Technische Hochschule Darmstadt, Institut fur Arbeitswissenschaft (contact W. Rasser)
Petersenstrasse 30, D-6100 Darmstadt, Germany

Handikappinstitutet (contact B. Lundberg)
Ibsengatan 14, Blackeberg, S-16126 Bromma, Sweden

CERAH (contact X. Maillard)
Po. Box 104, F-57140, Woippy

Centro di Bioingegneria (contact A. Pedotti)

Via Gozzadini 7, I-20148 Milano, Italy

Centre de Traumatologie et de Readaptation (contact A. Tricot)
Place Van Gehuchten 4, B-1020 Bruxelles, Belgium

Technische Universitat Berlin, Prufstelle fur Orthopadische Holfsmittel (contact A. Wawrzinek)
Dovestrasse 6, D-1000 Berlin 10, Germany

Landesbeauftragter fur Behinderte beim Landesamt fur zentrale soziale Aufgaben (contact U. Berg)
An der Urania 12, D-1000 Berlin 30, Germany

Bundesarbeitsgemeinschaft Hilfe fur Behinderte e.V. (contact R. Jordan)
Kirchfeldstrasse 149, D-4000 Dusseldorf 1, Germany

Spastikerhilfe Berlin e.V. (contact [illegible]. Heilmann)
Prettauer Pfad 23, D-Berlin 45, [illegible]any

Ets Poirier (contact J. Hergan)
Usine des Roches Fondettes, F-37230 Luynes, France

Vessa Limited (contact D. Temple)
Paper Mill Lane, Alton, Hampshire, GU34 2PY, England

Ortopedia GmbH (contact M. Starck)
Salzredder, D-2300 Kiel 14, Germany

Friederich Albrecht GmbH (contact H.J. Albrecht)
Skalitzer Str. 131, D-1000 Berlin 36

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#M32 - Life Transitions of Learning Disabled Adults: Perspectives from Several Countries eds. K. Garnett, P. Gerber -

#M33 - Bridges from School to Working Life for Handicapped Youth: The View from Australia, T. Parmenter (published April 1986)

#M34 - Independent Living and Attendant Care in Sweden: A Consumer Perspective, Adolph P. Ratzka

#M35 - Evaluation and Information in the Field of Technical Aids for Disabled Persons: An European Perspective, eds. and authors, Antonio Pedotti and Renzo Andrich

FELLOWSHIP REPORTS

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#F47,48 49 On-Site Reviews of Education and Related Services for Handicapped Youth in England - by Frank E. New, Roger Brown, Gary Makuch (comes as one report)

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