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A STUDY OF THE FURNITURE
DESIGN REQUIREMENTS FOR
CEREBRAL PALSIED CHILDREN

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Submitted to the Council for National Academic Awards
for a Master of Philosophy Degree.

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the requirements for this degree.

The research was conducted at Trent Polytechnic
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Design, and in collaboration with the South
Nottinghamshire Area Health Authority.

February 1981

A STUDY OF THE FURNITURE DESIGN REQUIREMENTS
FOR CEREBRAL PALSIED CHILDREN

Born out of concern expressed by organisations intimately concerned with the welfare of Handicapped Children e.g. The Disabled Living Foundation and Nottingham Childrens' Hospital, a study of the furniture design requirements for Cerebral Palsied children was established.

The first task of the study was to make contact with concerned bodies and define the factors which affected the design of furniture for these children.

This was through a survey of Institutional Care followed by a series of individual case studies.

Results showed that there were seven distinct, but inter-related areas of concern.

1. Correct Physical Support - Improvement and prevention of physical deterioration.
2. Personal Comfort - Reduction of 'spasm' patterns and skin breakdown.
3. Safety - For the handicapped child and others in his company.
4. Care management - Identification of the needs of both clients, the handicapped child and the person responsible for his care.
5. Visual Acceptability - Equipment which is offensive to look at will often restrict its acceptance and use.
6. Personal Development - Unsuitable and uncomfortable equipment can often delay personal development.
7. Reduction of Isolation - Social integration is difficult for the handicapped child if the equipment he uses has not been designed to suit his environment.

In light of these distinct areas of concern, the study continues by evaluating furniture presently available for Handicapped Children.

It became apparent that almost none of the equipment available at that time was satisfactory in all areas, therefore, if the study was to continue equipment would have to be designed to meet these requirements and monitered in use.

Six specific cases were selected for detailed study and even though the designs were developed for one set of circumstances these studies represented many similar cases.

The final results appear in the thesis as a series of design requirements and form the basis for further work so that others may use the information in the development of equipment and facilities for Handicapped Children.

CONTENTS

	Page
1.0.0. INTRODUCTION	1
2.0.0. SURVEY OF INSTITUTIONAL CARE	6
3.0.0. INDIVIDUAL CASE STUDIES	100
4.0.0. SURVEY CONCLUSIONS	154
5.0.0. INTRODUCTION TO NEW WORK (EXPERIMENTS)	160
6.0.0. "FRAMEWORK"	161
7.0.0. ADJUSTABLE FEEDING CHAIR	187
8.0.0. A CHAIR FOR CHARLOTTE	195
9.0.0. A CHAIR FOR ALISON	201
10.0.0. A CHAIR FOR NICKY	212
11.0.0. A CHAIR FOR FIONA	220
12.0.0. CONCLUSIONS TO EXPERIMENTS	227
13.0.0. APPENDIX A - EXISTING PRODUCTS	240
14.0.0. APPENDIX B - SIMILAR WORK	301
15.0.0. APPENDIX C - GLOSSARY	317
16.0.0. APPENDIX D - BIBLIOGRAPHY	323
17.0.0. APPENDIX E - ACKNOWLEDGEMENTS	327

1.0.0 INTRODUCTION

'Taking him camping is really much easier than living here at home', said Nicky's mother, bending herself almost double as she heaved her 17 year old son into a more upright position on their deeply upholstered settee, 'because living in a tent is so simple, everything is to hand and only short distances in moving him from chair to bed and toilet to wash-bowl. In spite of all the gadgets he has at home, Nicky still can't sit comfortably for any length of time'.

Nicky's parents are fairly 'well off', they have a large house and plenty of space, the means even to modify the house for Nicky's benefit: a large picture window has been installed in the lounge so that Nicky can enjoy an uninterrupted view of their large attractive garden and woods beyond. Yet, in spite of their means there was, in 1975 nothing available to them, at whatever price, which would enable Nicky to sit comfortably for any length of time in their lounge.

1.0.1 The problems faced by Nicky's parents are still not uncommon. Many handicapped children and their carers are left with little or no choice in the selection of suitable basic furniture for their needs, and this is particularly true of seating. Much of the equipment that is available does little to break down the stigma of handicap that has existed for centuries by virtue of the visual qualities or appeal of that equipment. Very little attention is paid to the joint needs of the real clients - the handicapped child and his or her carer(s). The constraints of mass production, of course, greatly reduce the possibilities of a more individual approach, but many basic requirements are mass requirements, and the desire to look good and feel good should not be regarded as the special preserve of the able bodied. Designers who are concerned about the relationship between a product and its user can find no better critic than a person who uses that product constantly. A disabled person is often aware of the equipment he uses as if it were a part of his own body.

A Wheelchair user knows all the hard spots and rough edges on his wheelchair, and its inability to cope with changes in level. He is also conscious of the fact that it looks out of place in a ballroom, or even his own lounge, just as, like anyone else, he is aware of untidy hair, dirty hands, a tin opener that is difficult to use, or the latest fashion in shoes. A tin opener that can be used even by the disabled and not necessarily specially for them, is bound to be more generally acceptable and gives them the luxury of free choice enjoyed by everyone else.

A number of everyday products have been designed in recent years on this basis, (see 2.23.2). The result has invariably been a more efficient and safer product, filling the gap between the two markets of Handicap and Non Handicap.

1.1.0 From the outset, a stated aim of this programme of research and development was to identify the more general factors which affect the design of furniture for cerebral palsied children. To keep those factors in context it was necessary to study the environments in which these children live and receive treatment, and to talk with those most intimately concerned with their care.

1.1.1 A survey of institutional care was carried out, and this was followed by a study of the individual cases. The award of a Churchill Fellowship in 1974 enabled me to extend these studies beyond the UK to Denmark, Sweden, Finland, and Holland, and this proved invaluable. The results of these investigations provided conclusive evidence that there was very little equipment available to satisfy the design factors identified. It was therefore necessary to carry out experiments to satisfy those design requirements. A number of case studies were selected from those contained in the initial survey, and a more detailed study of each of these was carried out. The first design work then took place with the production of a number of design solutions. These were quickly taken to prototype stage, followed by a period for adjustments and evaluation in use.

1.2.0 Medical Information : Cerebral Palsy.

Nicky, like many thousands of children born each year, suffers from Cerebral Palsy, which is a permanent neuromuscular disability, usually caused by Pre-natal, or birth injury to the Motor Control centres of the brain. It may not only produce a lack of muscular control but frequently creates mental retardation, seizures and other sensory and behavioural disorders. The condition was formerly called 'Littles disease' or 'spastic paralysis'.

1.2.1 The full extent of the problem is not known, but Cerebral Palsy occurs at the average rate of two in every 1,000 live births in the United Kingdom. The death rate among Cerebral Palsied children is much higher than normal, although the condition is not progressive and should not itself cause death. No social geographic, or economic influences are known to affect the incidence of the condition, nor is it inherited.

1.2.2 The brain damage which occurs is primarily the result of lack of oxygen to the brain of the fetus, with consequent tissue damage during the pre-natal period, or during the birth process. This lack of oxygen can occur in a variety of ways, such as illness of the Mother during pregnancy, premature birth, breech birth, improper use of instruments by the obstetrician.

1.2.3 Cerebral Palsy varies in effect and this depends upon the part of the brain that is injured: the severity of the disability depends upon the damage. Damage to the brain stem causes unplanned movements, in the form of either shudders and tremors or the twisting, purposeless, wormlike movements called Athetosis. A child described medically as 'Athetoid' is more usually affected in his arms, neck and head: when he starts to make a movement with the upper part of his body it may extend to his trunk and legs.

1.2.4 The 'Athetoid' group forms a relatively small percentage of Cerebral Palsied children. A far larger proportion is the so call spastic group. Spacticity is caused by damage to the motor cortex of the brain, resulting in stiffness and rigidity. This may occur on one side only (spastic hemiplegia). In the lower extremities only (spastic paraplegia); or in all four extremities (spastic quadraplegia).

1.3.0 Terminology

In the absence of any really ideal terminology to describe children with various physical impairments as a result of Cerebral Palsy, I have used 'handicapped child', 'handicapped children' or 'handicapped people' as general collective terms. This is based on an explanation of the terms most commonly used, as follows :

Impairment	-	'what is wrong'
		Polio
		Cerebral Palsy
		Muscular Distrophy
		Spina Bifida
		Blind, etc.
Disability	-	'what doesn't work'
		legs
		eyes
		arms
		ears, etc
Handicap	-	'what can't be done'
		school work
		listening to records
		playing football
		watching television
		sitting comfortably
		etc.

Impairment, disability and handicap are all negative aspects of brain damage that can be approached towards improvement by medical and/or surgical means. Furniture, like other auxiliary equipment cannot improve upon impairment or disability, but can, as this document will show reduce (and therefore improve upon) handicap, i.e. make more activities possible.

2.0.0 A SURVEY OF INSTITUTIONAL CARE FOR CEREBRAL PALSIED CHILDREN

The following reports are based on personal observations, and staff comments from institutions visited in this country and abroad, and are cataloged into three general functions :

Medical

Educational

Advisory

2.1.0 INSTITUTION: Aspley Wood School, Nottingham

TYPE: Special School

SPONSOR: Education Department

CONTACT: Headmistress

GENERAL DESCRIPTION:

2.1.1 Aspley Wood is a day school for physically and mentally handicapped children from nursery to 16 years of age. It was purpose-built in 1974 in the Aspley district of Nottingham. The buildings are all on ground level and consist of classrooms, therapy and medical rooms, and well equipped bathroom facilities.

DESIGN OBSERVATIONS:

- 2.1.2 Since the childrens' abilities varied so greatly, the staff experienced many problems in providing them with adequate equipment. Small polypropylene chairs were used by some children who were able to maintain a degree of balance, but offered little support to those without much trunk control. Attempts had been made to fix straps to these chairs, but plastic is a difficult material to fabricate by hand.
- 2.1.3 The teacher in charge of the nursery group explained that it was difficult to organise group activities with the children because of their individual requirements, particularly working at table height. A height-adjustable table was provided for this group but the staff found it difficult to use since each telescopic leg had to be individually adjusted by means of spring-loaded pegs locating into holes approximately one inch apart on the upper half of each leg. Apart from the time-consuming nature of the exercise, it was difficult to achieve a level surface. Hence, the table was never adjusted.

2.1.4 Staff were aware of problems of isolation due to a lack of suitable equipment to cope with the range of handicaps, in the provision of facilities for integrated group work.



Aspley Wood School

2.2.0 INSTITUTION: Borocourt Hospital, Reading, Berks

TYPE: Special Care

SPONSOR: Oxford Regional Health Authority

CONTACT: Senior Nursing Officer

GENERAL DESCRIPTION:

2.2.1 The hospital is sited in the grounds of a large country estate, surrounded by woods and farmlands. The old estate house forms the main part of the hospital, with more recent building additions in other parts of the grounds.

Borocourt cares for handicapped children and adults either as out-patients or as residents. The hospital provides facilities for the treatment of a wide range of mental and physical handicaps of varying severity.

The adult wards and the administration section are accommodated in the main hospital building. The large bedrooms of the original house have been adapted to provide ward space, and smaller ante-rooms which link the bedrooms are used as communal sitting and TV areas. The top floor of the building provides accommodation and care for mentally retarded teenage boys. It comprises bedrooms, dining room, play and relaxation areas, and normal toilet and bathroom facilities. Main meals are prepared in the central kitchen but a small kitchenette is provided for the preparation of light meals, drinks and special diets. There are two bedrooms each with six beds and individual lockers.

DESIGN OBSERVATIONS:

2.2.2 The staff commented that because the boys are severely mentally retarded, special attention had to be paid to the furniture and

fittings. The bedroom lockers for instance, were considered essential in training the boys to have regard for each others possessions, and many had been personally decorated. However, on occasion they did have to withstand harsh treatment from their owners. The Senior Nursing Officer explained that he had to replace lockers regularly and that he was advising on the design of purpose-made lockers shortly to be produced. These would have special features including hinges that the boys could not dismantle and locks that could not be forced from the outside.

2.2.3 Similar problems of exuberant misuse had been found in the dining room. The chairs here were of the plastic shell stacking type with metal legs. The problems began when the boys removed the legs' rubber feet and the bare metal tube rapidly destroyed the plastic tile floor covering. Modern furniture which had also been supplied to the rest room proved unsuccessful. Modern chipboard constructions proved no match for boys who could remove screws with their finger nails. The solution here was to accept the inevitably in-built obsolescence of the furniture and to at least provide the boys with a challenge, with cheap, and extraordinarily robust, second-hand furniture.

2.2.4 The policy of encouraging physical exuberance was also displayed in a special activities room. A large piece of wooden apparatus, which incorporated slides, climbing bars, platforms and swings had been mounted onto a carpeted platform which was bolted to the floor. Although the boys enjoyed playing on this apparatus the staff had to restrict its use. Some of the boys were incontinent which caused the apparatus to quickly become soiled.

2.2.5 The profound lesson learnt from Borocourt was the acceptance that mentally handicapped boys did require to express their physical vigour as much as normal growing boys. A carpeted, reassuring environment was not the design requirement here.

2.3.0 INSTITUTION: Broström^{OO}sgården, Gothenburg, Sweden

TYPE: Special Pre-School

SPONSOR: Local Authority

CONTACT: Physiotherapist.

GENERAL DESCRIPTION:

2.3.1 Broström^{OO}sgården is a modern day school in the suburbs of Gothenburg. It caters for pre-school children having motor handicaps through Cerebral Palsy, Spina Bifida or Muscular Distrophy.

The school buildings surround a central open-air play area and pets accommodation which can be seen from the classrooms.

DESIGN OBSERVATIONS:

2.3.2 The accommodation and facilities were specially designed, and it is obvious that the concern for the childrens' welfare has been reflected in the funds provided. The furniture and fittings are all to the correct child scale and indeed, the school had a happy, lively atmosphere. However, one design decision caused the staff particular problems - this was to carpet the school throughout, a decision born out of concern rather than knowledge. At first glance it seems to have been a thoughtful policy. All the rooms are very comfortable, in fact too comfortable to encourage demanding physical coordination activities.

2.3.3 No areas were suitable for messy creative work with paint, water, clay and sand. These activities, along with the consumption of food, had not been provided for at the planning stage. It was rather as if the children were expected to play constantly in their 'Sunday best' in the lounge. The desire to give the children pleasant surroundings had meant denying them the joy and vigour of playing in the kitchen, in the potting shed or on the street corner.



Broströms - Gården, Gothenberg -
a modern school in pleasant surroundings

Light relief!



2.4.0 INSTITUTION: "Bräcke Östergård, Gothenburg, Sweden
TYPE: Centre for Cerebral Palsied Children
SPONSOR: Swedish Government
CONTACT: Pediatrician

GENERAL DESCRIPTION:

2.4.1 The Centre is situated on the outskirts of Gothenburg in a pleasant suburban district. It was founded in 1958 to accommodate 40 children. In 1968 a new wing was built which accommodates a further 60, making a total of 100 boarding children. Other children living in the locality attend the centre on a daily basis.

The Centre has three full-time doctors, nine physiotherapists, five occupational therapists, five nurses and many helpers, plus a visiting psychologist and a social worker.

All of the children were cerebral palsied and received both treatment and general education at the Centre.

DESIGN OBSERVATIONS:

2.4.2 The accommodation was typical of other such centres seen in Sweden. It had pleasant and colourful rooms thoughtfully designed to provide both children and staff with a cheerful working atmosphere. This was enhanced by the doctors, therapists and nurses wearing casual "civilian" clothes as opposed to medical uniforms.

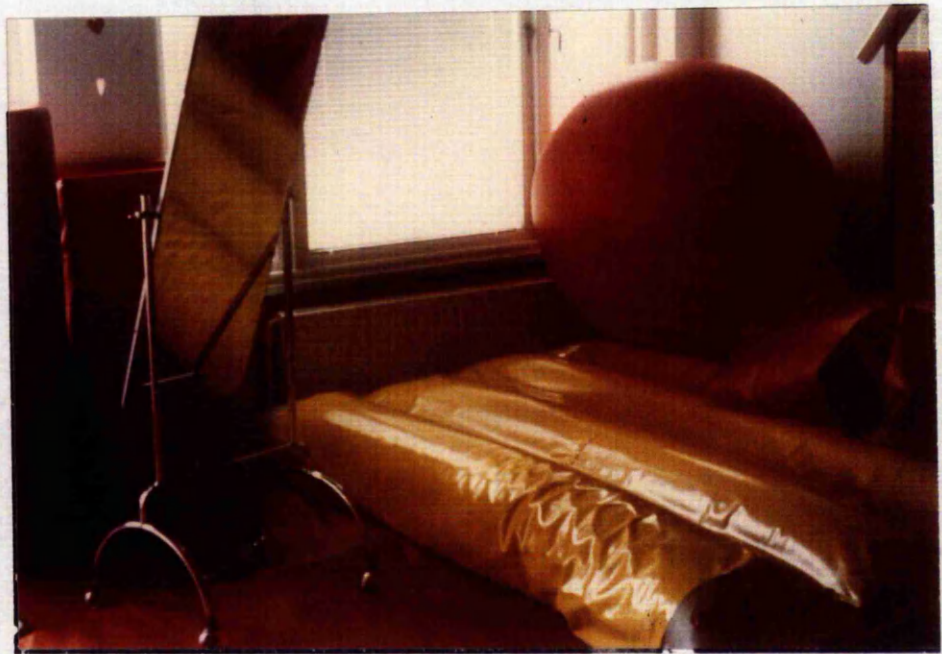
- 2.4.3 However, it was particularly at Bracks Ostergård that the corridors were constantly cluttered with apparatus. Aids tended to be used in the classroom and just popped outside in the corridor when not in use. It was obviously inconvenient to store these aids in a central area, which might be some distance from the point of use, since many of the children required a range of aids during the day.
- 2.4.4 Apparently, aids which could be easily dismantled or folded away were thought to be desirable.
- 2.4.5 It was at Bracke Ostergård that I was introduced to the notion of products designed for one specific situation being suitable to a handicapped child's more general situation. In this case, a child's car seat which originally had been designed to provide restraint while travelling was found to be similar to that required by a cerebral palsied child, particularly during a spasm. One of the therapists in the centre had mounted such a seat on a wheeled sub frame, thereby increasing the range of products suitable for the handicapped, through her understanding of the need.

Corridor storage.



The Swedish "Kilplan"
car seat adapted for
use as a push chair.





Physiotherapy facilities at Brücke
Ostergard



2.5.0 INSTITUTION: "Crocus Fields", Nottingham

TYPE: Residential care unit for handicapped children

SPONSOR: Local Authority

CONTACT: Director

GENERAL DESCRIPTION:

2.5.1 "Crocus Fields" is a new, short-term residential care unit in the Meadows district of Nottingham. It provides care for handicapped children at times when their parents wish to take a break from the demands made by having a handicapped child in the family, or when their normal residential centres are closed. Although the unit was planned to care for mentally handicapped children many are also physically disabled.

The buildings are in red brick which match the surrounding houses. The accommodation is on two floors. The ground floor comprises an entrance area and reception office, Director's office, staff room, medical room, lounge, play room, dining room and single bedrooms. The upper floor houses double bedrooms, and the housekeepers accommodation.

DESIGN OBSERVATIONS:

2.5.2 It would appear that the Architect had two different criteria when designing the building. Obviously, the very specialised needs of the users had to be considered, but the building also had to relate (from the outside) to the surrounding new development. The result was a building of an irregular shape. Exciting and stimulating to look at from both inside and out. However, the Director found many problems when he came to planning the furnishing layout. For instance, one bedroom had no two walls at right

angled to each other, which posed a problem not unlike a Japanese interlocking puzzle, when it came to arranging two beds, storage facilities, sets of drawers, and chairs to fit the room. Furnishing decisions made before the Director had been appointed also highlight the problem of designing without real awareness of the building's future use. An area demarked "medical treatment room" had been furnished with soft pile carpet, low unit upholstery and coffee tables!

2.5.3 Since many of the children were physically handicapped, the groundfloor bedrooms had all been allocated for their use. Unfortunately, they were all single bedrooms, further reducing the opportunity of mixing. The wheelchair access to the toilets on this floor is also difficult since there is no turning space once inside. The corridors are just wide enough for wheelchairs but the fire fighting equipment now installed makes it something of an obstacle course.

2.5.4 On the whole, the centre appeared an exciting environment for the intended short stays, where the problems created by the building's style need not be endured for long. On the other hand, the permanent full-time staff could well find that with increased problems the adventurous architecture might not be justified.



2.6.0 INSTITUTION: Department of Handicap Research,
Gothenburg University

TYPE: Advisory

SPONSOR: Swedish Government

CONTACT: Team Leader

GENERAL DESCRIPTION:

2.6.1 The Department of Handicap Research is part of Gothenburg University. Although financed to some extent by the Swedish Government, many of the research projects are financed by independent bodies.

The research team leader, Sven-Olof Brattg^ord, a wheelchair user himself had led many projects which have improved conditions for the handicapped in Sweden. The most notes of these "the Focus Flats".

DESIGN OBSERVATIONS:

2.6.2 In the spring of 1964, two programmes were broadcast on Swedish TV which aroused attention. They concerned young people who were severely physically disabled because of Cerebral Palsy, polio, rheumatism etc. These young people had a strong common desire - to be useful. But most of them were relegated to unemployment and isolation in their homes or in convalescent hospitals. Sven Brattg^ord proposed in the programme to improve the situation for the handicapped by organising a society. Its aim was to build in conjunction with city housing councils, suitably serviced housing and to assist in obtaining opportunities for work for the handicapped.

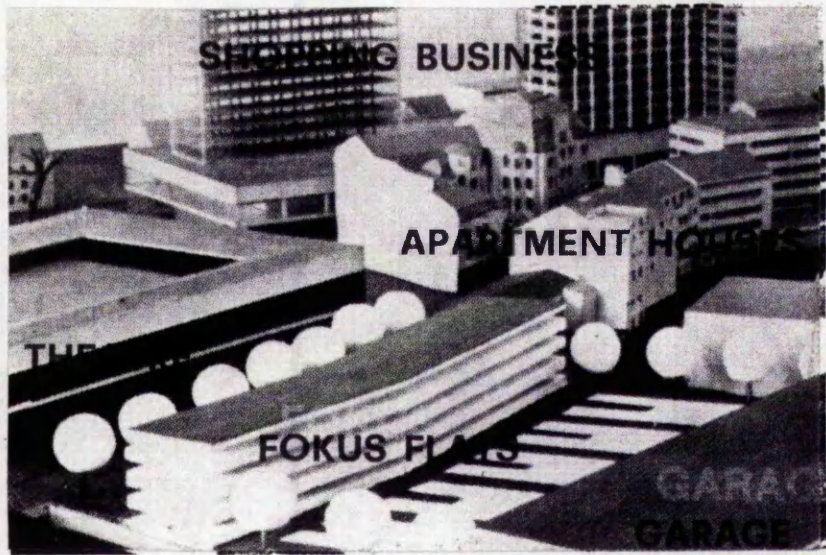
The response of the public was such that Sven Brattgård and his team were able to develop their suggestions and their proposals were realised in the building of the first "Focus Flats" near Stockholm in 1968.

- 2.6.3 The flats are integrated into the central housing areas which provides the handicapped with opportunities for contact with the whole of the community, and to work and shop nearby.

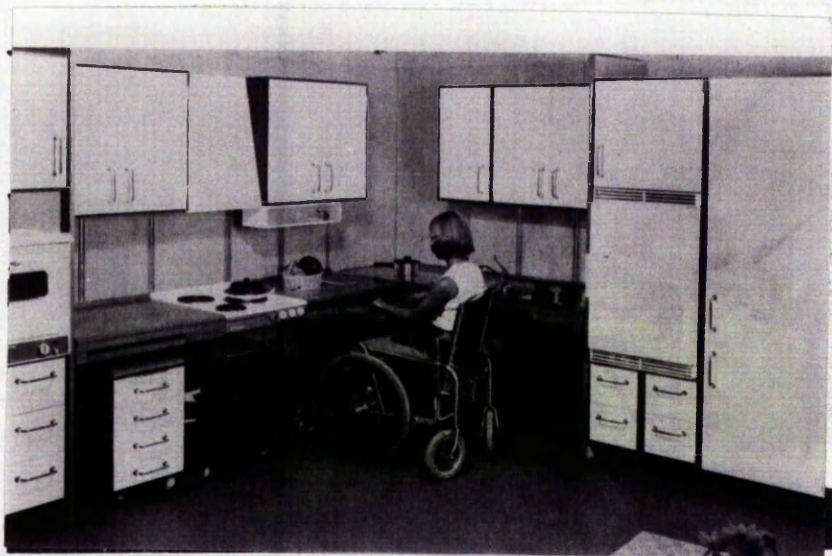
The interior layout and fittings for the flats had to be carefully considered. The design team studied the way that a handicapped person functions in his home, and from these surveys they were able to design equipment to suit the special needs. Emphasis was given to adjustability. For instance, kitchen work surfaces had to be raised and lowered to suit the user, and cupboards had to be within easy reach. Personal hygiene was another important consideration for the Focus Flats are fitted with alternative positions for shower, toilet and washbasin.

- 2.6.4 During the early research work Sven Brattgård developed a method of observing and recording an object from different directions from a single observation point. This is called "the Mirror Reflection Method". For the Focus Flats project a full size mock-up of a typical room layout was build. The floor was divided into 10 cm squares and large mirrors fixed at 45° , one above and one to the side of the floor area. A camera was used to record the movements of a wheelchair in this space and was fixed so that both the experiment area and the mirrors fall within its range. The resulting film records three planes simultaneously, and data can be taken from the actual film by measuring the scale picked up from the floor. This technique can also be used to record functions with smaller objects and equipment by reducing the experimental area.

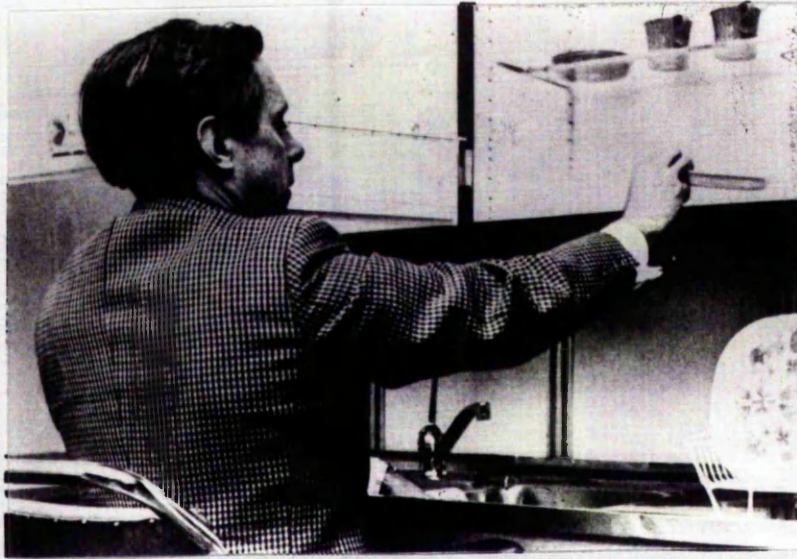
- 2.6.5 Many of the projects undertaken by the team are concerned with modifications and minor changes to the urban environment to make it more accessible to the handicapped person.



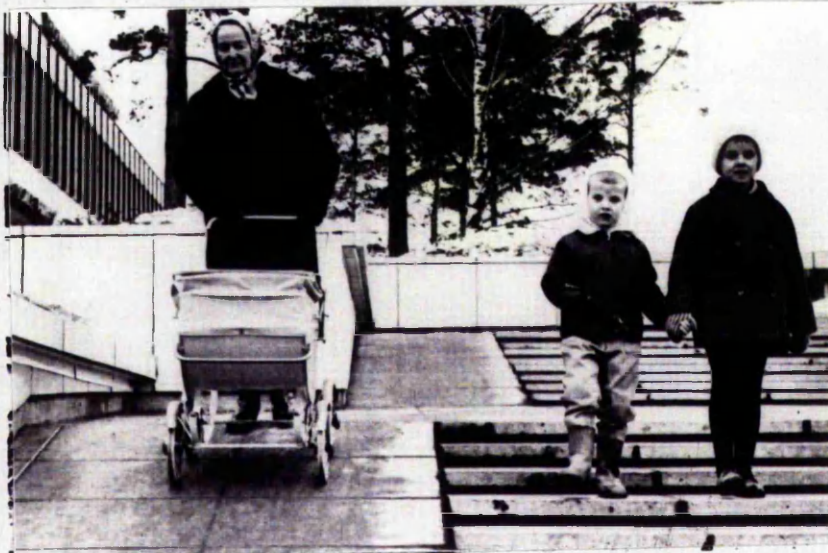
The "Fokus" concept of handicapped people living and working within the urban centres.



A typical "Fokus" kitchen layout.



Sven-Olof Brattgård using a "Fokus" kitchen.



Other citizens, who fall outside the architects "norm", and who are in need of special consideration.

However, as shown in a film produced by the team, the reference to "handicapped people in the urban environment" includes many people not normally associated in this group. The film shows the view down a pedestrian street with four steps down at the end near to the camera. People encountering difficulties with the steps included wheelchair users, old people, mothers with prams, people with shopping trollies, blind people and expectant mothers.

2.6.6 Brattgård's attitude towards design for the handicapped can possibly be best summed up by the Danish Designer, Falle Horn, who also designs and produces kitchens with sufficient flexibility of use to cope with the requirements of the handicapped:

"Products should be designed so that they can be used even by the handicapped".

2.7.0 INSTITUTION: Folke Bernadottehemmet, Uppsala, Sweden

TYPE: Centre for the Care of Cerebral Palsied Children

SPONSOR: University Hospital, Uppsala

CONTACT: Pediatrician

GENERAL DESCRIPTION:

2.7.1 The centre is about ten years old and situated just outside Uppsala, in pleasant countryside. It is part of the Department of Pediatrics at the University Hospital of Uppsala.

Children attend the centre for short periods of treatment of approximately 2 to 3 weeks duration, depending on the individual child. Only Cerebral Palsy is treated at Folke Bernadottehemmet and all of the children are referred to as having "motor deficiencies". Some of the children are very mild Cerebral Palsy sufferers who perhaps suffer from an inability to concentrate, due to slight hand and eye co-ordination problems discovered for the first time at school. However, the majority of the children were severely handicapped, and since it was the policy of the centre to begin training as early as possible, many were under 5 years old.

DESIGN OBSERVATIONS:

2.7.2 The accommodation was well planned and careful attention had been paid to providing a pleasant atmosphere for both staff and children.

2.7.3 A special support mattress had been developed for the Nursery Department by Bengt Carling, a designer from Stockholm. It consisted of a muslin bag approximately six feet by five feet



Folke Bemadottehemmet, Uppsala, Sweden.



An interior decorated with a real understanding of the users.

(see picture), filled with polystyrene beads, fitted into an outer PVC bag, to which a tube had been fixed which could be connected to a standard domestic vacuum cleaner. In use, the mattress was laid on the nursery floor and up to 5 children placed on it. The polystyrene beads allowed their bodies to be supported in comfortable positions and these could be controlled by the staff. When each child was comfortable, the air from the mattress was drawn out via the vacuum cleaner causing the bag to become rigid. This provided the children with support moulded to their own bodies and helped them maintain a good posture.

The staff found this a particularly successful way of holding the attention of a group of children who would otherwise be flopping and struggling to remain upright.

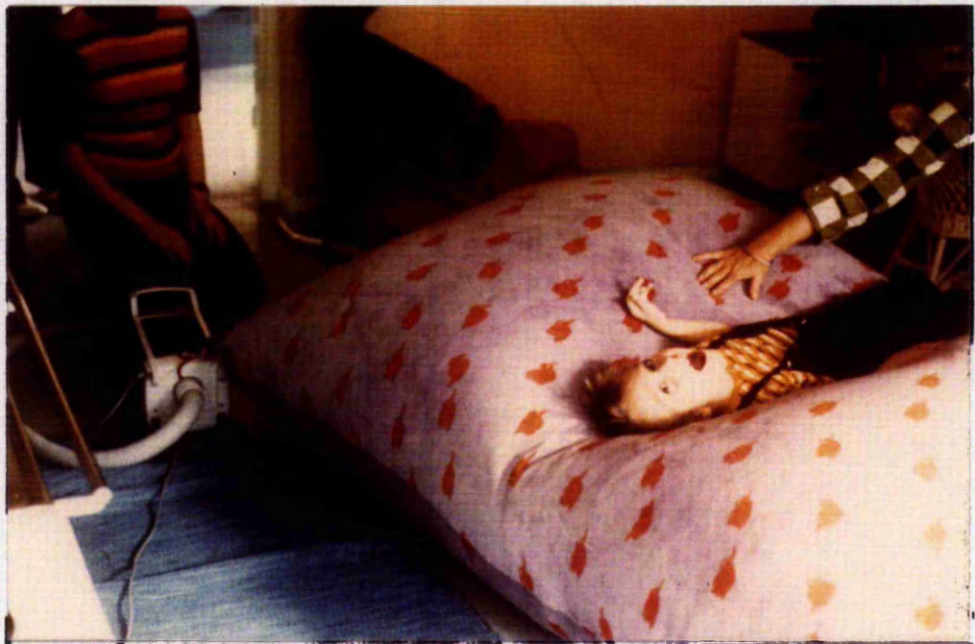
Since the outer bag was made from strong PVC, it was also possible to use the mattress as an inflatable support. The action of the vacuum cleaner is reversed to blow up the bag.

Inflatable mattresses are widely used by physiotherapists working with Cerebral Palsied children, since the child can experience total support while his ability to balance is assessed.

- 2.7.4 The staff at the centre were particularly imaginative in their use of the total environment as an aid to teaching through play. At the time of my visit, a situation was being acted out which necessitated the pursuit of clues by children dressed as policemen. Their police car, complete with cardboard blue light, was a trolley used by a severely handicapped boy, who was the car driver. Other children, not able to walk, sat on the trolley while others, more able bodied, pushed the trolley at speed along the corridors. It was exciting to see all of the children involved in such robust play no matter how severely handicapped they were, and in this situation the most handicapped boy had the most to offer - the police car.



Bengt Carling's support mattress, based on the air evacuation technique, effected with a standard domestic vacuum cleaner.



The vacuum cleaner can also blow air. I was assured that this child enjoyed this treatment.



The granular support mattress (in the back-ground) used in this "after lunch" rest period, at Folke Bernadottehemmet.

2.8.0 INSTITUTION: Geelsgard, Copenhagen

TYPE: School for Handicapped Children

SPONSOR: Local Authority

CONTACT: Occupational Therapist

GENERAL DESCRIPTION:

2.8.1 The school is in the suburbs of Copenhagen and children attend, either daily or as boarders. Children are streamed within the school according to the levels of their IQ than their degree of handicaps.

Accommodation and facilities were standard for the type of school, but many interesting additions had been made through an understanding of their special needs.

DESIGN OBSERVATIONS:

2.8.2 In the main entrance hall, which in this school was quite large, a number of wall-hung activity boards were installed. These all demanded a response from the children, either to create a picture on an empty landscape, by using magnetic cut-outs of buildings, cars, animals, trees etc or to match the various cut out figures with their correct shadow. The children wait in this area for transport to their homes, and these boards were very popular.

In the evening, the staff would wipe clean the landscape boards and mismatch the figures so that the whole activity would be eagerly resumed on the following day, rather like an incomplete jigsaw on a table which as you pass it demands that you make a further attempt to complete it.

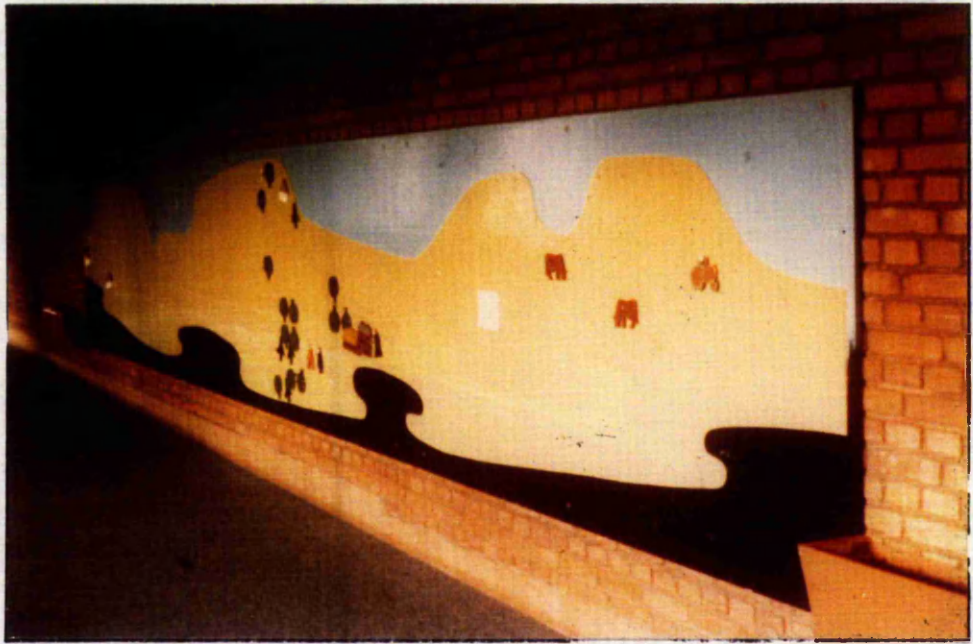
2.8.3 Other open areas in the school displayed the work of well known Danish artists. It was apparently an honour to be asked to exhibit work at the school. Each exhibition of work was chosen carefully and the children were asked to comment on the choice.

2.8.4 The school was fortunate that they could call upon the services of a local Detention Centre to provide them with specially made equipment. The Detention Centre had a range of workshop facilities and it contained skilled men who were able to make special equipment to a high standard.

One such piece was a special floor table for a child who used her feet to write, draw and type. It consisted of an angled work surface with an "angle poise" lamp and a clamp for paper. This surface could be tipped vertically to allow a typewriter beneath it to be used. Two of these units had been made so that the child could have one of them at home.

2.8.5 In the Physiotherapy Department special standing aids were to be seen which had also been made at the Detention Centre. These were of brightly painted plywood and allowed children to be supported in a prone position while working at normal height tables.

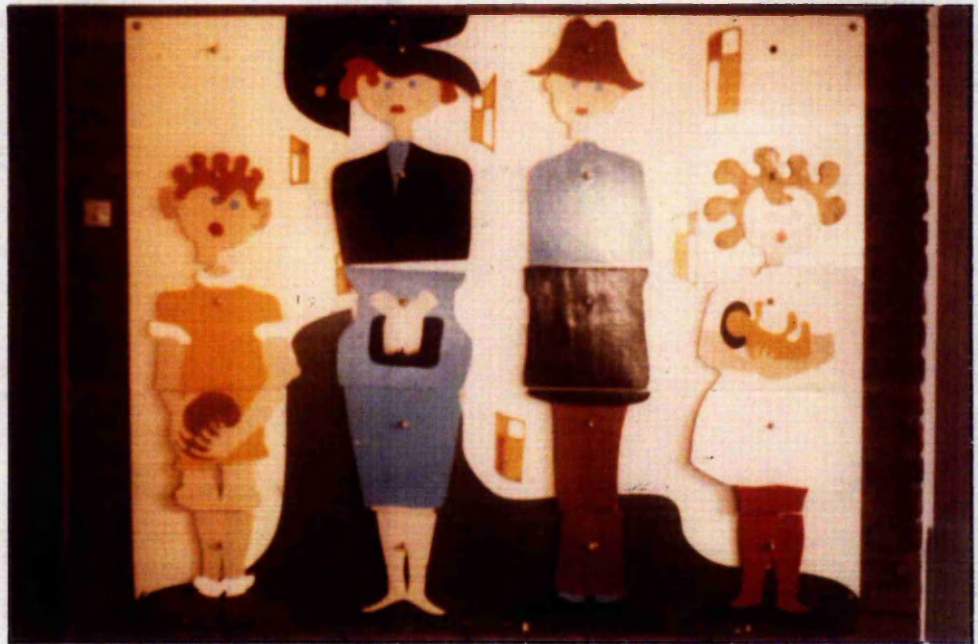
2.8.6 In all the activities practised at the school, Geelsgard showed genuine understanding of the handicapped child's needs. This rapport is epitomised by the treatment of the entrance hall. Handicapped children spend many hours a week waiting, just sitting and waiting. By providing so much communal activity in their own waiting areas Geelsgard has transformed tedium into one of the day's social highspots.



Magnetic landscapes at Gøelsgard: land ...



... and sea



More large scale "waiting games"
demanding attention



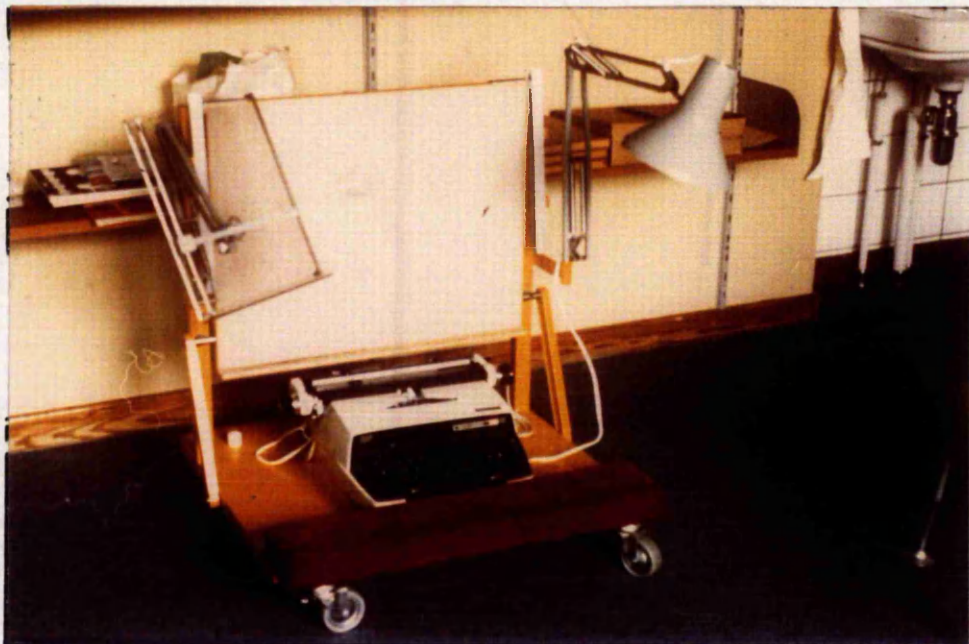


Artists displaying their work at Geelsgard can depend on an honest reaction from their public.



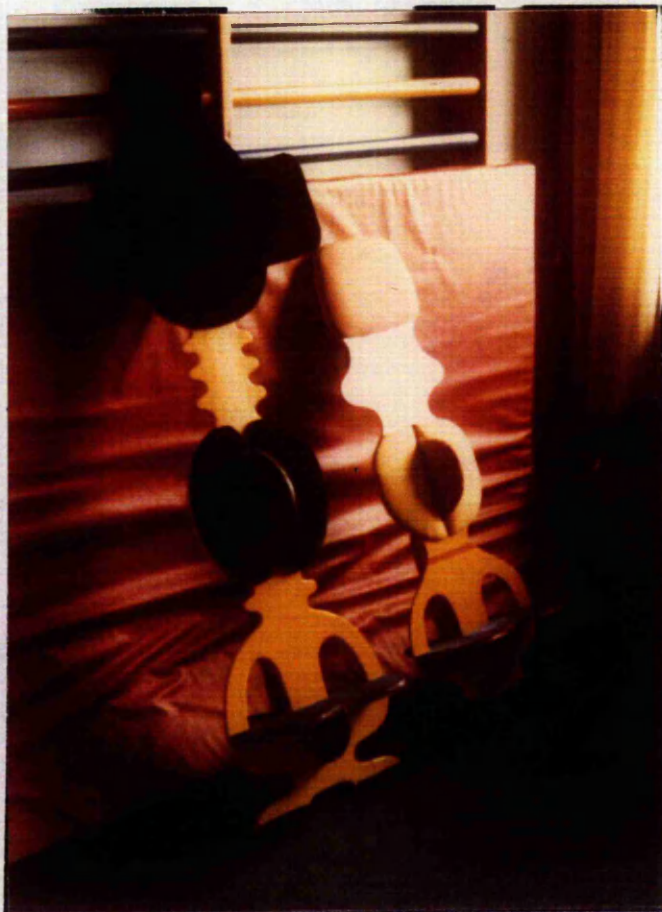


The purpose-built floor-table showing its dual function of a writing and drawing support,



which can be quickly transformed into a typewriter-stand.

Standing aids: a bold attempt to reduce the stigma of handicap by "humanising" the design of medical equipment.



2.9.0 INSTITUTION: Het Dorp, Holland

TYPE: Village for the Disabled

SPONSOR: Self financed

CONTACT: Administrator

GENERAL DESCRIPTION:

2.9.1 Het Dorp is a small village near Arnhem, Holland and serves 450 disabled people. The layout comprises individual ground floor apartments grouped around the central service facilities.

The inhabitants are physically handicapped:

"In selecting residents, Het Dorp strives, first of all to serve the interests of the candidate, with an eye to achieving the greatest possible degree of development for the handicapped person in question."

The above quotation is extracted from the Het Dorp Constitution and vividly illuminates its concern for the provision of an environment which encourages the handicapped to excel.

DESIGN OBSERVATIONS:

2.9.2 Each of the personal apartments have similar accommodation, this being: living room, bedroom, bathroom and kitchenette. However, any impression that these are standard "hospital" rooms is quickly lost since each unit of accommodation is presented in the manner of a private house, even down to details like a door bell and letter box on the front door.

Each front door overlooks a covered, centrally-heated, street (street and not corridor is the correct word since the pavement and walls are made in standard outdoor materials), and therefore, when the inhabitants leave home for work or shopping, there is a real feeling of being in the outside world. Independence is a premium in Het Dorp.

2.9.3 At the time of my visit a wheelchair was being prepared in the village workshops for a young man who was so severely handicapped that he could only control his tongue. A moisture-sensitive control had been fitted to his wheelchairs electronic drive which enabled him to direct his chair in all directions with his tongue. The wheelchair's design was also sophisticated enough to allow him to select alternative seating positions related to particular activities.

The production of this wheelchair is a prime example of the double benefits provided at Het Dorp. The young man achieved a freedom hitherto unknown, and the wheelchair producers, also handicapped, realised the satisfaction of giving, rather than constantly being obliged to receive.

2.9.4 Perhaps the essence of Het Dorp's activities is best summed up by the following criteria for residents listed in their Constitution:

- 1 Housing in individual quarters.
- 2 Care.
- 3 Work, or the most worthwhile activity.
- 4 Recreation.
- 5 A democratic voice in their own way of life and that of the community in which they live.
- 6 The opportunity, if desired, of fulfilling religious or cultural needs.



Het Dorp (the village): a new life for a few of the more fortunate handicapped people in Holland.

2.10.0 INSTITUTION: Karkulla Institution, Finland

TYPE: Institution for Handicapped Children

SPONSOR: Finnish Government

CONTACT: Director

GENERAL DESCRIPTION:

2.10.1 The Karkulla Institution is situated at Kirjala in a rural setting 160 Km south west of Helsinki. It is ten years old and caters for children who belong to the Swedish-speaking population in the south of Finland. Most of the children are brain-damaged to a lesser or greater extent and will remain at the Institution for as long as they need treatment. However, some of the children are so severely handicapped that their life expectancy is only about ten years. At Karkulla the term "child" is used for all the patients however old.

DESIGN OBSERVATIONS:

2.10.2 As in many institutions in Scandinavia, the rooms were cheerful and brightly decorated. Classrooms were provided for the older children and these were equipped with special combined chair and desk units. The chair was adjustable for height of seat and rake of back, while the desk provided easily accessible storage and a large vinyl covered working area.

2.10.3 Craft activities were encouraged and many examples of work were to be seen decorating every available space. The Institution was obviously caring very successfully for the majority of the children. However, the condition of severely handicapped children appeared to present problems which were understandably very hard to solve.

2.10.4. These children's responses were very limited indeed, and the facilities provided for them did little to encourage development. One such facility was a large tray some eight feet square with raised sides of approximately 12 inches. The inside of the tray had been lined with carpet. The whole structure was raised some 30 inches from the floor. Up to five severely handicapped children were placed in the tray with an assortment of toys. It was quickly apparent that the children were receiving little or no creative stimulation even though at odd moments an involuntary movement would cause a child to touch a neighbour or a toy. The nurse in charge explained that this method was used because of staff shortages. One nurse could attend to two or three groups of children in this way. She also pointed out that the trays were not heavy and could be pushed to the sunniest parts of the room.

2.10.5 In conclusion, it seems that the demands of the management of care had been too strongly emphasised to the detriment of the fulfilment of the children's needs.



Karkulla is pleasantly situated in the Finnish countryside, but is unable to encourage integration with the rest of the community because of its isolated location



Sensibly-designed desk and chair units.

2.11.0 INSTITUTION: Karolinska, Sjukhuset, Stockholm

TYPE: Hospital

SPONSOR: Swedish Health Authority

CONTACT: Doctor in Pediatrics

GENERAL DESCRIPTION:

2.11.1 Karolinska is the largest teaching hospital in Stockholm. The Children's Department provides treatment for physically handicapped children, either as out-patients or under short-term care. Most of the treatment is of a therapeutic nature although clinical treatment was also given in some cases.

DESIGN OBSERVATIONS:

2.11.2 The Children's Department is housed in a separate building to the main hospital, which dates back to 1813. Even today, the remaining traces of lettering above the main entrance reads: "The Cripples House". This small phrase at least illuminates Swedish societies changing attitudes and also suggests the enormity of the design task in making the environment acceptable to today's standards.

2.11.3 The wards were large and sombre, but attempts had been made to improve them. The students of the Konstfack Design School in Stockholm had redecorated the wards in a pleasant manner.

Apart from painting the walls and doors in the almost obligatory Scandinavian bright colours, attempts had been made to humanise the ward space by re-arranging the furniture into smaller groups, and by providing low partitions with sitting areas enclosed within.

The students' concern with creating a reasonable relationship between the scale of the building and the size of a child, was particularly successful in the corridor treatment where hand prints were painted on the floor to denote that children crawled up and down that space. This proved a constant reminder to adults of the presence of children.

2.11.4 The Therapy Department had also commissioned work from the students of the Konsfact School. This was for a structure offering the handicapped child alternative activities to exercise his skills and to serve as a useful piece of nursery equipment. The solution was a structure based on two box units, linked by side panels, to provide an internal play area. On the outside of the structure interesting activity panels had been designed. One provided the children with endless possibilities for creating noise, with bells, horns, rattles and drums. Another was covered in various fabric lengths and hanks of wool for small hands to investigate the different textures. The third had small coloured discs, of different colours with handles, which fitted into a larger outer circle. This gave the child the opportunity to test his skill at recognising colour change by placing the correct two colours together. The fourth side was fitted to a large wheel, and parallel friction brake. The brake could be adjusted to provide resistance to the free running of the wheel and by so doing exercise arm muscles as the resistance increased.

2.11.5 Karolinska Sjukhuset provided me with a further example of a successful and bold attempt to reduce the inhuman proportions of old hospital buildings and to create more civilised environments through an understanding of a child's relationship to his surroundings.



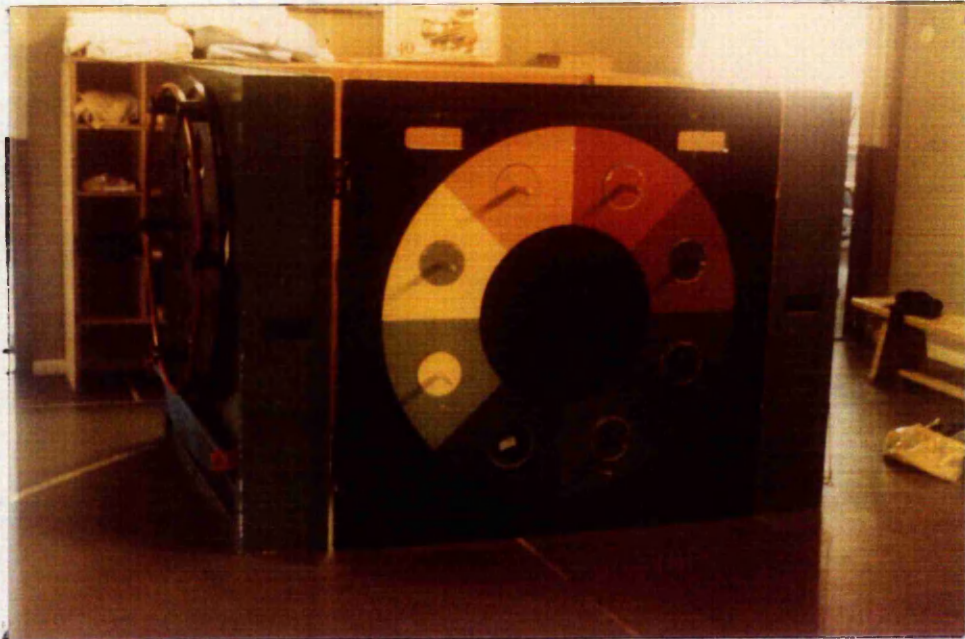
The Children's Department at Karolinska.
An example of the insensitive architecture
of our forefathers.



Students (from the Konsfact Design School in
Stockholm) attempt to redress the balance with
colour and fittings.



Large wards, painted and reduced in size to the scale of their occupants.



"Multi activity" structure, yet another example of the use of equipment in play situations to scale down the 'uncivilised' proportions of old hospital buildings.

2.12.0 INSTITUTION: Kirkby-in-Ashfield Special School

TYPE: Special School

SPONSOR: Local Authority

CONTACT: Deputy Head

GENERAL DESCRIPTION:

2.12.1 The school is situated in a new housing development on the east side of Kirkby-in-Ashfield, Nottinghamshire. It was opened in 1975 and provides schooling for children with a wide range of handicaps, from severe cerebral palsy to educational sub-normality. There are no boarding facilities and consequently the children are reasonably local and attend daily.

A nursery unit had been provided particularly for the younger handicapped children, but it was quickly found that this had to accommodate older, more severely handicapped cases who could not fit into other classes of the more able children. This obviously was an added problem to the nursery unit staff.

DESIGN OBSERVATIONS:

2.12.2 The school was designed to cater specifically for handicapped children. Consequently, all of the accommodation is at ground level making wheelchair access as easy as possible. This is helped further by the provision of wide corridors and spacious planning of entrance and exits, which comply to published recommendations. However, little information on special school equipment is readily available and it is not surprising that much unsuitable furniture was initially specified.

2.12.3 One of the school's physiotherapists told me that, when the school was opened, most of the furniture in the nursery unit had to be immediately removed, since the chairs provided were adult-size swivel/diving-chairs which hopelessly mismatched the low tables. Unfortunately, as in many new schools, furniture selection had been made without sufficient knowledge of childrens specific requirements, or of teaching staffs recommendations. Indeed, many of the children arrived for school with their own pieces of furniture to find that insufficient space had been made available for them.

2.12.4 It did appear that this lack of special equipment was not due to a shortage of funds, but rather to insufficient awareness of the special needs. For instance, at the time of my visit, highly sophisticated sound equipment was being installed in the main hall, and the small exhibition area near the entrance was being illuminated by a lighting system that would have done justice to a Bond Street Gallery. In stark contrast to this, a little girl in the nursery unit was strapped in a wheelchair in a contorted posture because no money was supposedly available to supply her with the equipment she so desperately needed, and which the staff had whole-heartedly recommended.

2.12.5 The schools facilities obviously show a willingness on the part of the Local Authority to improve the handicapped childs lot. However, it is tragic that this concern should eventually manifest itself in adult sophistication, rather than a genuine fulfillment of the basic design requirements of the children.

2.13.0 INSTITUTION: Kollektivhuset, Denmark

TYPE: Residential Centre

SPONSOR: Local Authority

CONTACT: Centre Administrator

GENERAL DESCRIPTION:

2.13.1 Killektivhuset is at Herning, on the island of Jutland, Denmark. It is a modern development on the outskirts of the town providing permanent accommodation for both handicapped and non-handicapped people, in a variety of ways. A central six storey building is divided into small self-contained apartments for handicapped people requiring daily help.

Some of the people living in these apartments had previously been in institutions receiving full care, but since arriving at Kollektivhuset they have found a new independence, through the provision of correct facilities.

A ground floor nursery building provides care for severely handicapped children and young people. A number of small bungalows accommodate married couples in which one or both partners are handicapped. Other bungalows are provided for non-handicapped residents who work in the nearby town.

DESIGN OBSERVATIONS:

2.13.2 The idea behind Killektivhuset is that handicapped people should be given the opportunity to live in normal accommodation while still being able to obtain special care if required. Some of the

able-bodied residents are involved with the handicapped, usually by giving up free time to help with social and recreational activities. But it is not a condition that they should, and indeed, many lead their lives unaffected by their handicapped neighbours.

The same is also true in reverse, and it has been found at Kollektivhuset that many of the handicapped residents are far more independant than they were when they first arrived.



Kollektivhuset: integrated dwellings for a variety of people, some of whom are handicapped.



One of the Centres' restaurants; a meeting place for residents and visitors from nearby Herning.

2.14.0 INSTITUTION: Lapsi, Invalidien, Koulusaatio, Helsinki,
Finland.

TYPE: Boarding school for Handicapped Children

SPONSOR: Finnish Government

CONTACT: Director

GENERAL DESCRIPTION:

2.14.1 The school is situated on the west side of Helsinki, on the edge of the suburbs. Originally, it was built as a four-storey fever hospital in the mid 19th Century, and new accommodation has recently been added on the same site.

The children were of school age and were suffering from multiple disabilities. Due to their handicaps (motor disability in particular), they were not able to attend school in their home communities. Lapsi operates a nine year school, offering every feature of basic education, as given in primary and secondary schools.

210 children attend the school, and several of the older children were able to attend the upper classes of the local secondary school. The younger children lived in new two-storey accommodation and went to the old building for classes, whilst the older children both lived and worked in the original 19th Century premises.

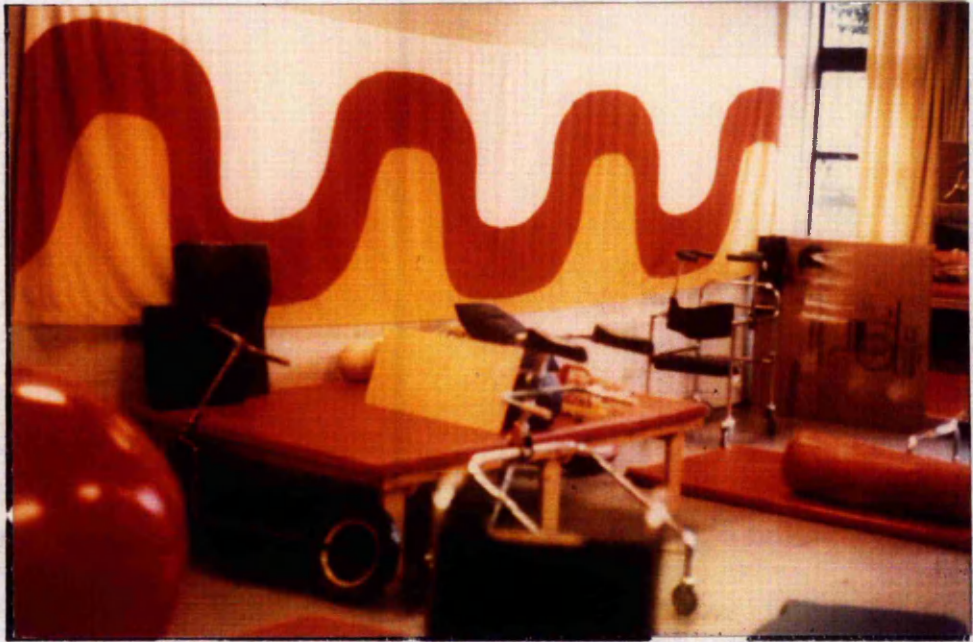
DESIGN OBSERVATIONS:

2.14.2 This school proved an interesting case study because it comprised both old and new premises. The old premises displayed all the typical problems, such as difficult wheelchair mobility and rather worn-out and depressing interiors. In theory, combinations of

such factors should low morale result in the children but, in fact, they produced the opposite. The awkward corners found on entering and leaving the old service lift provided a challenge to the wheelchair users skill, and certainly my appearance in the school initiated a display of balance and cornering ability far in excess of the situations demand. My obvious amazement at their prowess caused great pleasure, presumably because the handicapped child, like everyone else, enjoys performing well in public.

2.14.3 The depressing nature of the rooms was also taken as a spur to action, rather than a cause for self-pity. Each room displayed a decor of stunning and vigorous personal commitment. In contrast, the new buildings had been decorated under the auspices of a scientific psychological study, which seemed to suggest that green was a suitable colour, because of its calming influence on children. It is not clear who made the decision that handicapped children need wallpaper as a sedative, or for that matter, that they need a sedative at all. However, the study was taken at face-value and the interior was decorated throughout in various shades of green.

Now, several years after this decision was made, both staff and students find the monotony and lack of scope depressing, and have made requests to have it altered.



Dramatic decor to cover worn-out interiors.



The calming effect of built-in sedation!

2.15.0 INSTITUTION: Lowes Wong School, Southwell, Nottinghamshire

TYPE: Infants School

SPONSOR: Local Authority

CONTACT: Headmistress

GENERAL DESCRIPTION:

2.15.1 Lowes Wong was one of the first schools in the county to integrate physically handicapped children with their normal infant intake.

The school is sited on the west side of Southwell. It is a single storey building on a site which borders on open countryside which rises steeply from the school boundary. No special facilities were available at Lowes Wong for handicapped children and the staff were concerned that they would find it difficult to integrate the children. The classrooms were of open plan design allowing a degree of flexibility. However, the classes were large and accommodation difficulties had been experienced.

Initially, the school had been asked to take two Spina Bifida children aged 5 and 6. Spina Bifida is a condition which restricts their physical capabilities but which need not affect their mental development if given normal educational opportunities.

DESIGN OBSERVATIONS:

2.15.2 The main problem of this situation was to integrate the two handicapped children with a class of 30, as opposed to integrating a class of 30 with two handicapped children. Normal class routine was to be disrupted as little as possible, and indeed, for the two newcomers, living this normal routine was to be the reward for effort

2.15.3 Specific problems were caused by the 5 year old child's need to use a wheelchair for most of the day. This was awkward in the classroom space since the teaching area was quite small and had to function in a variety of ways, but attempts had been made to solve some of the problems as they occurred.

Her table had been raised to accommodate her knees when sitting in her wheelchair, though this somewhat isolated her from the other children using lower tables. Many of the activities were performed as a group around a table, and careful attention had to be paid to the organisation of this, so that further isolation was not felt.

2.15.4 Further problems were experienced in the PE sessions. The teachers found that standard equipment was unsuitable, and again, special attachments had been fitted to the standard range to provide apparatus for simple exercises. This proved one of many extra jobs for the teachers, who had to assemble the special equipment before each lesson. It would appear that at present there is little equipment available for use in schools by both handicapped and non handicapped children. If it were available it would surely ease the difficulties of integration.

This would be particularly desirable in the cases of many Cerebral Palsied children whose IQ's are often normal but whose development is restricted by their physical handicap and a lack of the stimulating learning atmosphere found in most schools.

2.16.0 INSTITUTION: The Mount, Nottingham

TYPE: Family Help Unit

SPONSOR: The Spastics Society

CONTACT: The Head Teacher

GENERAL DESCRIPTION:

2.16.1 The Mount is a large Victorian house which has been converted to provide short-term residential care for handicapped children. A nursery day-school in a new building on the same site is provided for cerebral palsied children from 3 to 6 years of age. There was an average attendance of ten children each day with a staff of two teachers and two helpers.

The school building is on one level and joined to the residential unit. School accommodation consists of: play area, rest room, large covered patio, dining room, toilets and changing facilities, and a room for teaching in the old building.

DESIGN OBSERVATIONS:

2.16.2 The change in character from old to new interiors provides an exciting variety of surroundings rather similar to those experienced in a large private house rather than a school or hospital. This feeling has been enhanced by the constant change of pictures and displays, both by staff and children. The atmosphere is, without a doubt, optimistic.

2.16.3 Even though the average daily attendance was only ten children, the Mount had to cope with a very large range of handicap. The results of this were immediately noticeable on entering the

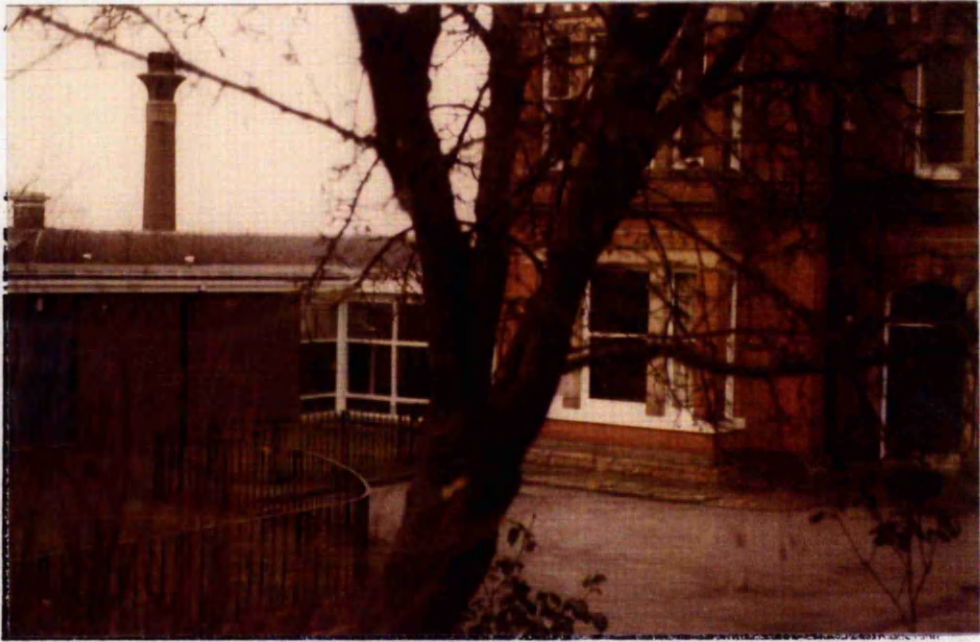
premises since two large rooms were almost completely given-over to the storage of aids and equipment, in order to cope with the many and different needs of the children. Some of the large play equipment had only one function, such as sliding, and surprisingly it could not be easily taken apart for storage.

2.16.4 The Mount was obliged, in many cases, to buy standard school equipment. The lack of specially-designed, multifunctional, readily storable play facilities for the handicapped was a constant source of frustration to the teachers. The store room also contained a couple of play items which had proved too troublesome to use correctly.

One of these was a large inflatable mattress which had been purchased by the school for the children to exercise upon. However, it had been difficult to maintain the correct air-pressure and consequently, it had lain idle for some time. It may well have been that only small but nevertheless tedious, adjustment would have corrected the fault, but the responsibility for only ten handicapped children gave no time whatsoever to cope with additional nuisances. It was felt that from the efficient management of care viewpoint the equipment should have been absolutely foolproof.

2.16.5 The remainder of the storeroom was taken up with "home made" chairs that previous children had brought and grown out of. All of these had been originally made to provide the correct postural-support for their particular stage of development, and since there are so few suitable postural-support chairs commercially available, the Mount was obliged to retain the outgrown chairs in case a future child required similar specialised support.

2.16.6 In the light of the importance which therapists place upon correct postural-support to assist in a child's physical and mental development, it is tragic that the already hard-pressed teachers receive little real help in this area. Imagine the public outcry if a visit to an optician resulted in a rummage through discarded spectacles. The situation is not dissimilar.



Victorian and modern accomodation at the Mount.

2.17.0 INSTITUTION: Nottingham Childrens Hospital

TYPE: Childrens Hospital

SPONSOR: Trent Regional Health Authority

CONTACT: Physiotherapist

GENERAL DESCRIPTION:

2.17.1 The hospital is situated in the Mapperley district of the City, and is the main medical centre for children in Nottingham. It is a large Victorian building. There is a physiotherapy and occupational-therapy unit attached to the hospital, which gives treatment to cerebral palsied children on an out-patient basis.

DESIGN OBSERVATIONS:

2.17.2 The accommodation consists of four large treatment rooms linked in pairs by interconnecting doors. Unfortunately, this causes the rooms to be used as corridors and treatment is often momentarily halted while people pass through.

The rooms have high ceilings and walls that are drably painted in a speckle finish, evocative of public toilets. Attempts have been made to brighten up the rooms with posters and paintings.

The floors throughout are tiled and these are a dark green colour typical of old hospitals. Areas used for treatment are covered with rubber mats.

2.17.3 Since there is little storage space, equipment remains in the rooms in which it is used. This causes difficulties to the staff when changing from one activity to another, and often results in delays which cause the children to lose interest. Some storage space has been provided in the form of wide shelves cantilevered from the wall, high up, near to the ceiling. These are difficult to reach and are therefore used for things rarely needed.

Since there is no office space provided for staff, work has to be done in the treatment areas, which not only causes disruption on both sides but can mean that confidential reports are often left unattended.

2.17.4 A wide range of equipment was available for the children to use; both standard manufactured items and "one off" pieces designed by the therapists and made by parents, or local school workshops. Even though there was a large number of home-made items in the hospital, many of these were repeats which earlier children had needed to take and use at home. Good examples of these were potty-chairs and corner seats. It did seem surprising that neither the National Health Service nor individual parents could find the required, though not particularly specialised, aids in high street shops.



The therapy area: the maximum amount of equipment in the minimum amount of space.

2.18.0 INSTITUTION: Old Hall School, Walsall

TYPE: Special School

SPONSOR: Walsall Education Committee

CONTACT: Headteacher

GENERAL DESCRIPTION:

2.18.1 The school is at Short Heath, to the north of Walsall. It was opened in 1975 and provides day care for school-age children who are both mentally and physically handicapped.

The school buildings are on ground level sited on four sides of an open inner area, which is visible from the classrooms, and is used as a play space and provides accommodation for pets.

DESIGN OBSERVATIONS:

2.18.2 The classrooms are of open-plan design, each area running into the next, without corridors which can often cause difficulties for children with mobility problems.

However, it was interesting to see that each teacher had found it necessary to divide the large open space into a smaller enclosed areas using screens, which had been constructed in "Dexion" by the school handyman, and decorated with examples of the childrens work. The staff commented that they found it difficult to maintain the childrens' concentration without some form of barrier to the constant traffic of other children and staff. They had also proved that the children were happier and more able to cope with a restricted amount of space.

2.18.3 One of the initially striking features of this school, to me was the amazing discrepancy between the quality of the building and the special equipment required by the children. The lack of suitable furniture available to the Local Authority was apparent. Much of the equipment had been made by either the school's handyman or parents. No matter how good the intention, the results gave an air of temporary existence. Hardly conducive to concentrating on learning skills for the future.

2.19.0 INSTITUTION: "Ostra Sjukhuset, Gothenburg

TYPE: Childrens Hospital

SPONSOR: Health Authority

CONTACT: Architect

GENERAL DESCRIPTION:

2.19.1 "Ostra Sjukhuset Hospital is a children's medical centre. It is included in this survey of relevant institutions because of its deliberate and positive approach to the relationship between child and hospital.

It was opened in 1973 and a subsidy for artistic decoration throughout the premises of one per cent of building costs was made. At the time this was approximately £45,000.

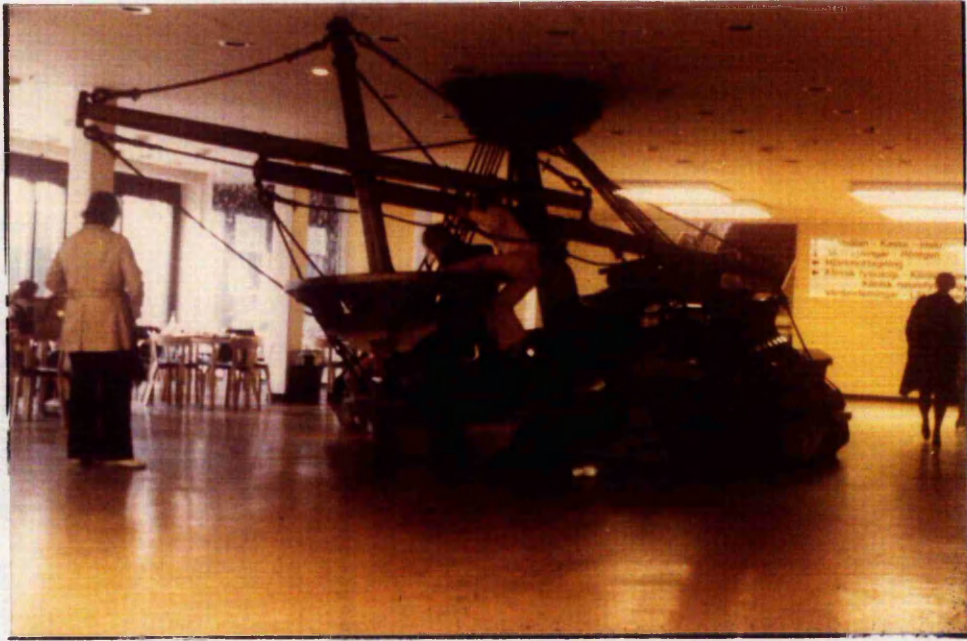
DESIGN OBSERVATIONS:

- 2.19.2 The results of the subsidy are immediately apparent on entering the main reception, which features a large enamel painting by Denice Zetterquist and an enormous sculptured gallion, large enough for children to play on, by Bengt Lundin. These set the pattern for the rest of the hospital interior. The main concern is to present the hospital to the child as an optimistic institution where good health and normal everyday living will be recovered.
- 2.19.3 General accommodation, such as the main reception and consultation rooms in the wards, are open areas with brightly painted fittings. Various areas of the hospital have strikingly different colour schemes to also help relative newcomers to find their way around.

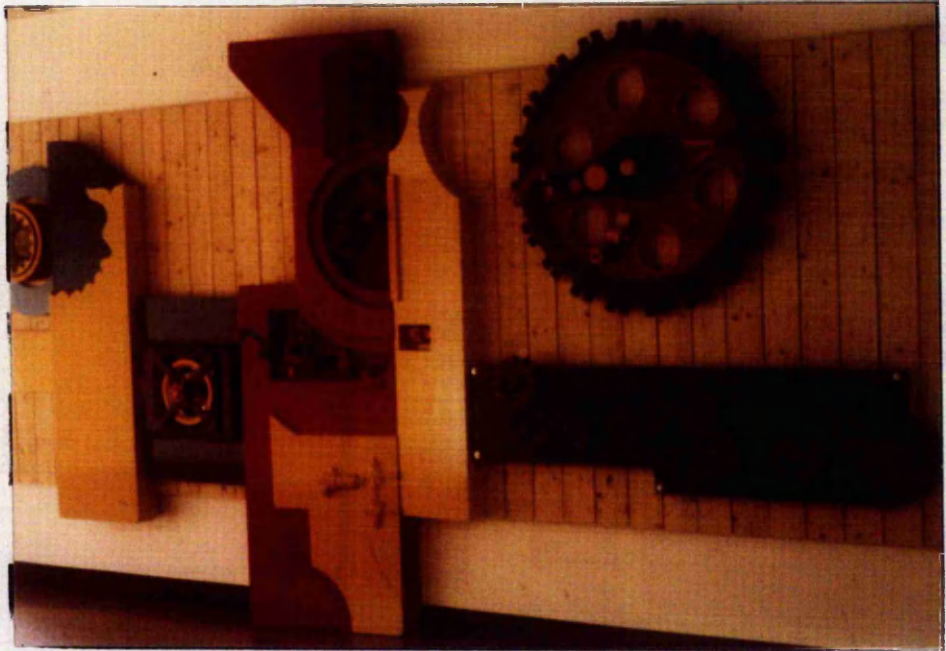
2.19.4 The smaller treatment rooms and wards are decorated with light, but not vibrant, colours, to create a feeling of calmness and harmony, in contrast with the vigour and bustle of the brightly coloured corridors.

There are also works of art by Roj Friberg, Lillemor Petterson, Carola Lind, Bengt Nordenborg and Lars Drougge. These take the form of large three-dimensional wall sculptures many offering opportunities for play.

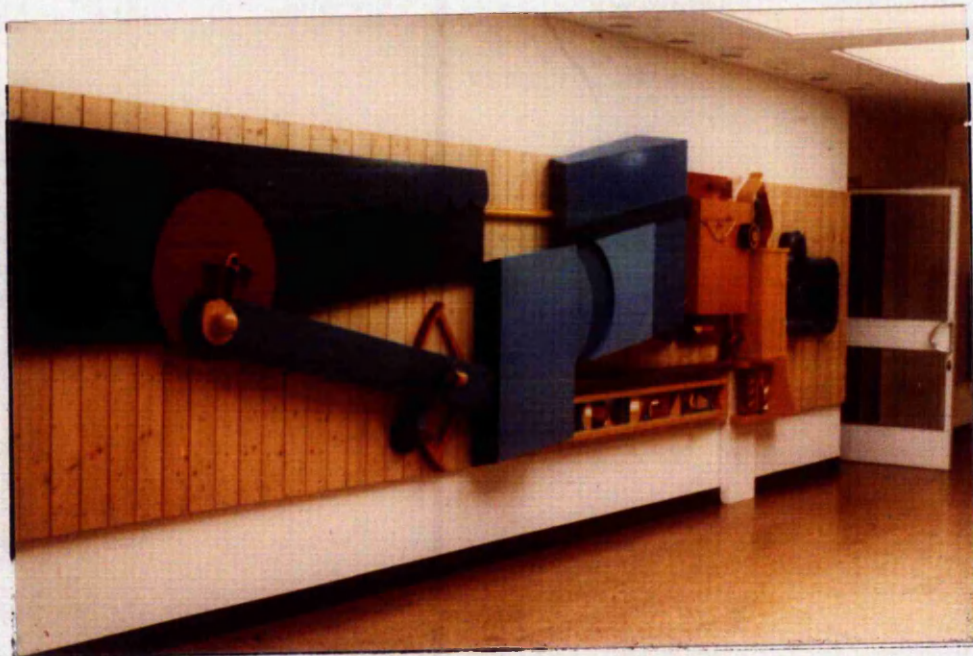
2.19.5 Conversation with the staff confirmed the impression that the money in this case had been well spent, and that the children did not totally view hospital visits as an ordeal to be endured.



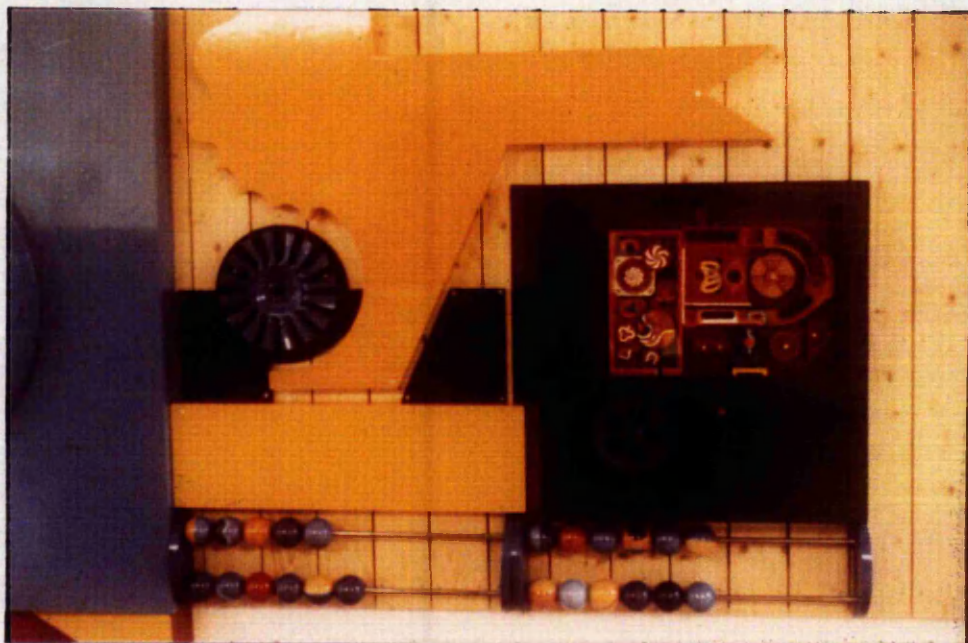
"
Östra Sjukhuset, where a visit to hospital
can be almost enjoyable.



Jumbo size kinetic art at Östra Sjukhuset



All of these structures provide opportunities for play.



2.20.0 INSTITUTION: Rembo, Rheneu, Holland

TYPE: Manufacturer of Institutional Equipment

SPONSOR: Private Company

CONTACT: Managing Director

GENERAL DESCRIPTION:

2.20.1 Rembo manufacture contract furniture using a range of materials; wood, metal and plastics. Most of their production is based on comprehensive ranges of furniture suitable for use in old peoples homes, hospitals and other institutions.

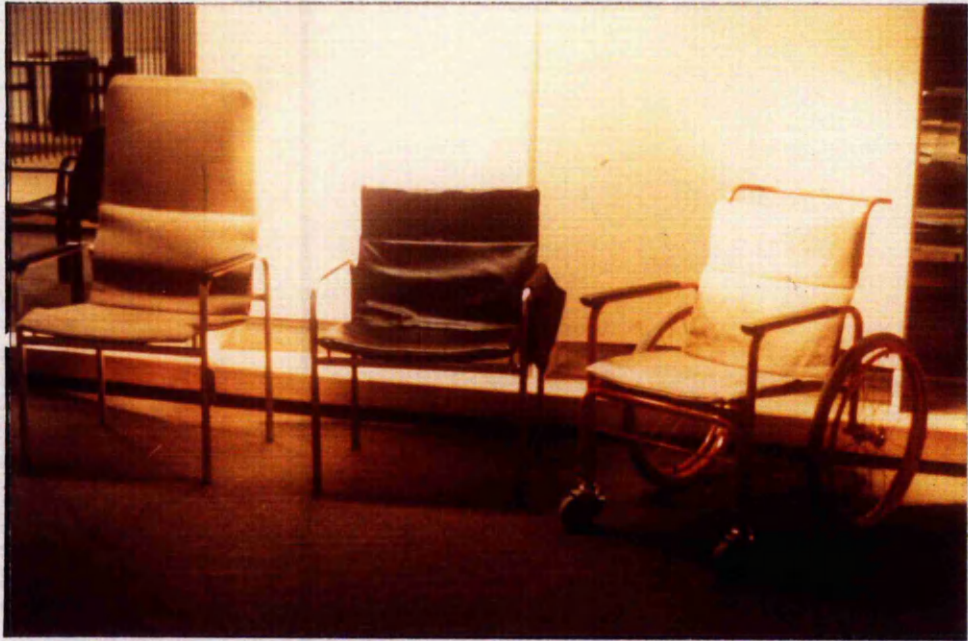
DESIGN OBSERVATIONS:

2.20.2 Many institutions caring for mentally retarded children found that standard contract chairs were easily destroyed. The children did this by jumping on the unsupported legs when the chairs were laid on the floor.

Since few chairs are designed to cope with this treatment, the company decided to develop a chair specifically for such children. The result was a design produced in two pre-fabricated fibreglass halves which were then bonded together. The chairs have no sharp corners and can be used in any position without danger to the child or damage to the chair. When laid on its back, the chair was designed to rock from side to side - a movement enjoyed by many mentally retarded children.

2.20.3 The benefits of specific production and consumer knowledge is further seen in their wheelchair design, which matches their own

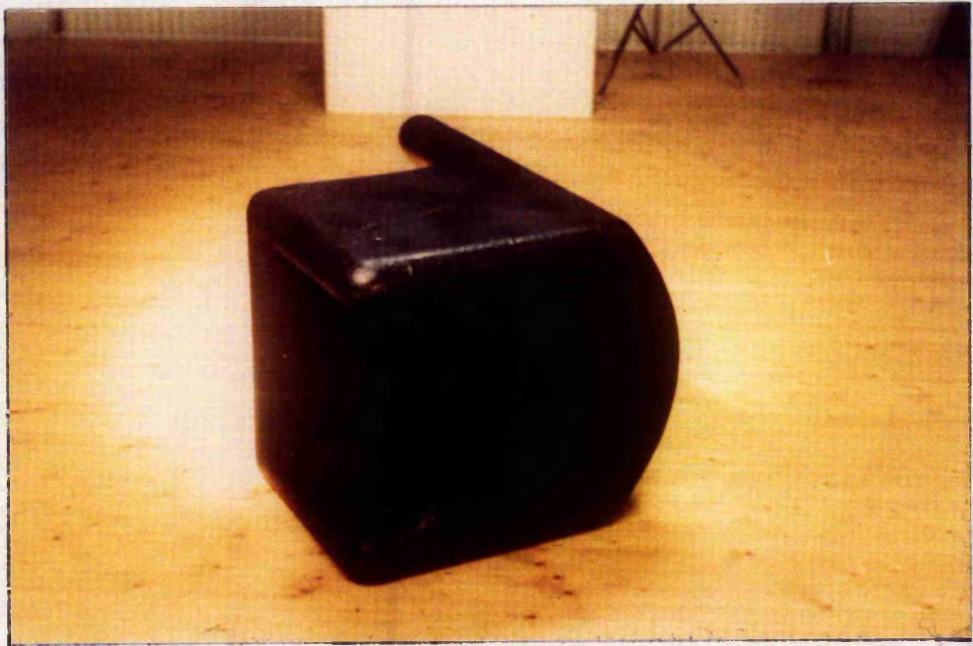
standard range of chairs. This makes it possible for people requiring a mobility aid rather than a sophisticated, over specialised wheelchair to use what, to all intents and purposes, is a standard domestic institutional chair.



Rembo demonstrate that a wheelchair is merely a further "option" to their standard range of chairs for the elderly.

A chair, designed and manufactured by
"Rembo" of Holland, for mentally
retarded children.





An unconventional chair designed for
unconventional use ...



... even encouraged

2.21.0 INSTITUTION: Rinnekoti, Saatio, Finland
TYPE: Institution for the Mentally Retarded
SPONSOR: Finnish Government
CONTACT: Resident Psychologist

GENERAL DESCRIPTION:

2.21.1 Rinnekoti is situated near Espoo, and has been built in the grounds of a large country estate, which was originally owned by a Religious Order.

The care of the handicapped was started by Nuns when they took two blind children into care. Gradually more children came until it was decided to establish the house as a hospital. Since that time, many more buildings have been erected, providing facilities for a wide range of specialist care.

The patients are drawn from all parts of South Finland, and their care is paid for partly by the state and partly by local taxes paid in the patients home localities.

Rinnekoti provides care for both children and adults who are mentally retarded and in many cases physically handicapped. Their care is either on a daily "out-patient" basis or for short or long term residential periods.

DESIGN OBSERVATIONS:

2.21.2. The staff's attitude towards the children's development very much influenced the type and design of facilities that were available. The hospital shows considerable evidence that the child, the staff and the designer are involved in a developing liaison.

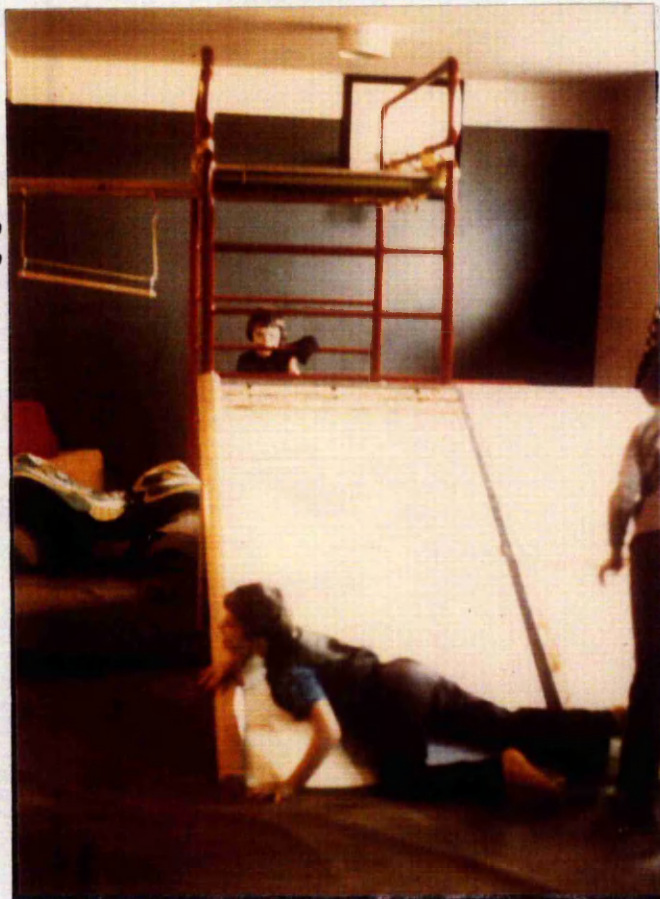
The children are encouraged to learn a wide variety of physical co-ordination skills. For instance, painting, drawing and clay modelling are popular activities, particularly when each child realises that in these areas making a mess was acceptable, or even desirable.

2.21.3 I was interested to learn from the teachers that mentally-retarded children had initial difficulty working with paint and clay since, for most of their lives, constant encouragement had been given to keeping clean. However, in contrast to the personal expression encouraged in the clay shop, an interesting exercise in developing the social graces and table manners was practised in the communal dining room. This was used by everyone, providing that nobody caused a disturbance or made a mess. Apparently children spent many extra hours developing sufficient physical control in order to be socially accepted through eating in the same room as the staff. The results were astounding and I saw severely mentally and physically handicapped children sharing the same dining facilities as the Director and guests of the Institution.

2.21.4 This attitude towards personal development inspired the Finnish Architect, Yrjo Sotamma to work with Aino Sassi, a psychologist, on the development of a total play-therapy environment for mentally retarded children. The work has been centred around the childrens responses when placed together in a purpose-built room fitted with play equipment, as shown in the photographs.

Yrjo calls it the "tumbling room". The rapport between the children and the equipment is constantly monitored, and it is hoped that the observations will form future specifications for more sophisticated play equipment.

The "tumbling room",
at Rinnekoti Saatio,
the work of
Yrjo Sotamma and
Aino Sassi.



2.22.0 INSTITUTION: Sagåsen, Kålleröd, Sweden

TYPE: Residential home for Handicapped Children

SPONSOR: Gothenburg County Borough Educational Board

CONTACT: Therapy Supervisor

GENERAL DESCRIPTION:

2.22.1 Sagåsen is a residential home for 248 children at Kålleröd, South of Gothenburg. It has seven units built between 1960 and 1965. This institution was the first purpose-built residential home in the country for severely and moderately handicapped children and young people.

Two of the units or houses as they are called, accommodate 96 children in eight sections, with 12 children in each. Most of the youngsters are moderately retarded and are aged between 8 and 20.

A small unit built in 1962 accommodates 16 severely retarded children aged from 1 to 16. A further house, also built in 1962, accommodates 27 infants. Twenty-seven pre-school children, who are only moderately handicapped, live in a two-section house. Two units, built in 1964 and 1965, accommodate the remainder of the children who have severe physical handicaps rather than mental retardation.

DESIGN OBSERVATIONS:

2.22.2 The accommodation is modern and colourful. Each house is self-contained, and is equipped with a small gymnasium and a workshop/hobbies room to encourage the children to be active after normal school hours.

2.22.3 Both staff and children thought the amount and scope of facilities excellent, though strangely enough, slightly restricting. Could it have been that the Architect had again provided too much too often since each of the houses was exactly identical to the others! As I left, one of the staff remarked:

"The architect has left nothing for us to do to our own houses but to fill them with children."

Could this be yet again another example of overcaring - being suffocating rather than stimulating?



Sagåsen, exterior ...



... and interior, typical of modern Swedish institutional design.

2.23.0 INSTITUTION: The Swedish Institute for the Handicapped,
Sweden

TYPE: Advisory

SPONSOR: Swedish Government

CONTACT: Institute Information Officer

GENERAL DESCRIPTION:

2.23.1 The Institute is situated at Blackeberg, north-west of Stockholm.

It is a central body for research, development, testing and information within the field of work for the handicapped, and is devoted mainly to aids. Established in 1968, the Institute is 70 per cent funded by Government grants; the remainder by industry.

A staff of approximately 80 people prepare information, develop and test new aids, and the Institute sponsors new research and development work.

DESIGN OBSERVATIONS:

2.23.2 Ergonomi Design, a private design consultancy in Stockholm, was commissioned by the Institute for the Handicapped to design and develop a knife suitable for use by people suffering from Rheumatoid Arthritis, which often results in an inability to grip. This project was principally undertaken by the designer Maria Benktzon.

The initial research very quickly indicated that the traditional knife format had remained almost static from the stone age to the present. This being, simply, one end sharp for cutting, the other blunt for holding.

However, when she examined which particular muscles were being used in the cutting action of the traditional knife she discovered that much of the force came from the hand to keep the knife under control - a fact which highlighted the arthritic sufferers' difficulty.

The traditional knife does not allow the natural weight of the arm to assist in the cutting motion. Having ascertained this phenomenon, prototypes were produced with the handle situated over the blade. The resulting trials proved very successful, and indeed, many people with varying degrees of hand control found the new format an improvement.

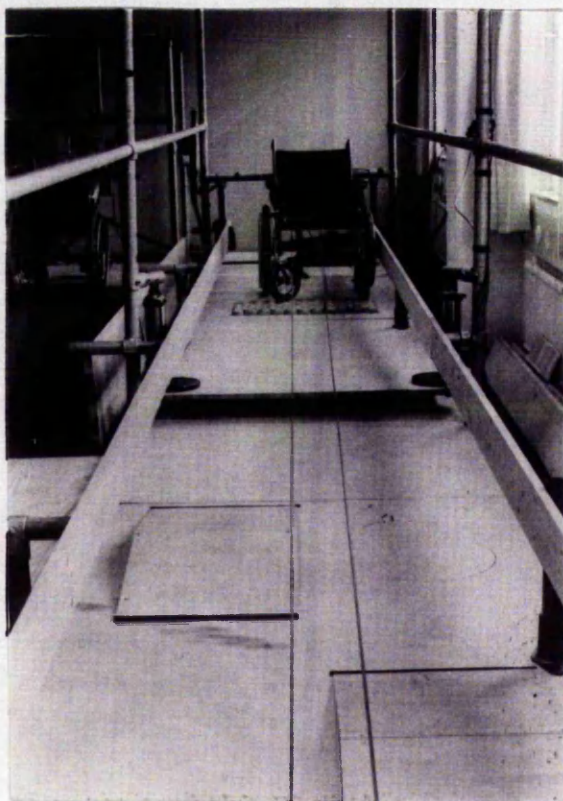
The final design is now in mass production and through thorough research the designer has created an attractive and desirable product, suitable for all; from a brief which originally asked for an aid for only the handicapped.

Therefore, by making the knife common property, the gulf between the handicapped and non-handicapped has been minimised.

2.23.3 A further development sponsored by the Institute was undertaken by designer Solbritt Lanquist. This called for a device to help train children supplied with artificial arms, particularly the victims of thalidomide. Most artificial arms, which are activated from the responses of nerve endings in the shoulder, on electronic sensors, have limited scope. Each arm and hand has two functions, up and down movement and grip; the other, side to side movements and grip. Co-ordinating these movements takes practice, more difficult still is the ability to know how much grip to exert on an object when there is no touch-feedback to the brain. Too tight a grip could crush a glass - too little and it would be dropped.

The solution, designed by Solbritt Lanquist, is based on a series of activity boards, fixed to a central column. The boards display a variety of games and puzzles which exercise the users powers of hand-coordination, or train him to be discerning with grip.

New equipment is rigorously tested and evaluated by the Handicap Institute.





The Institute have a department which provides technical service for the modification and adaptation of existing equipment.

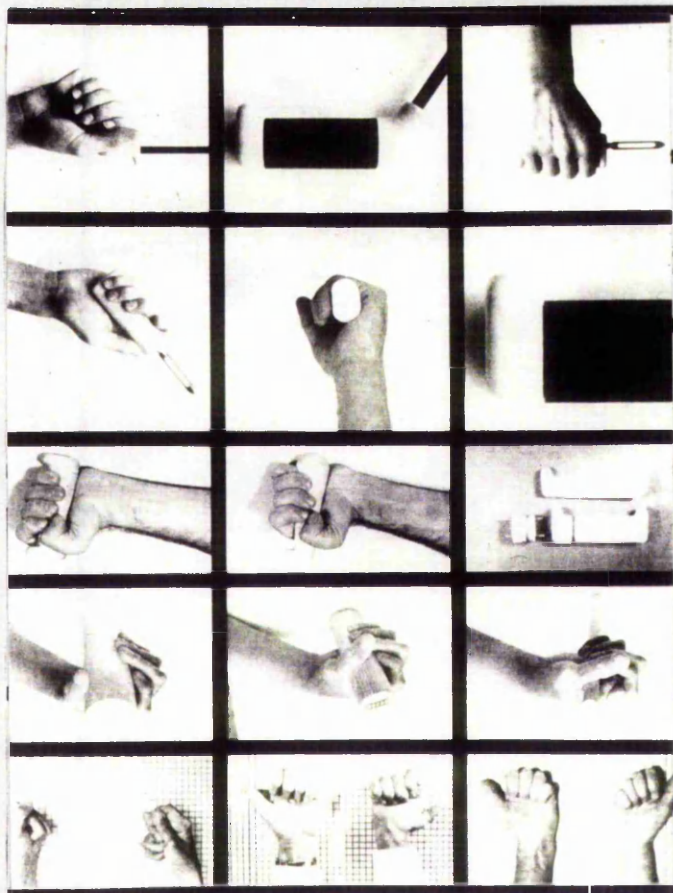


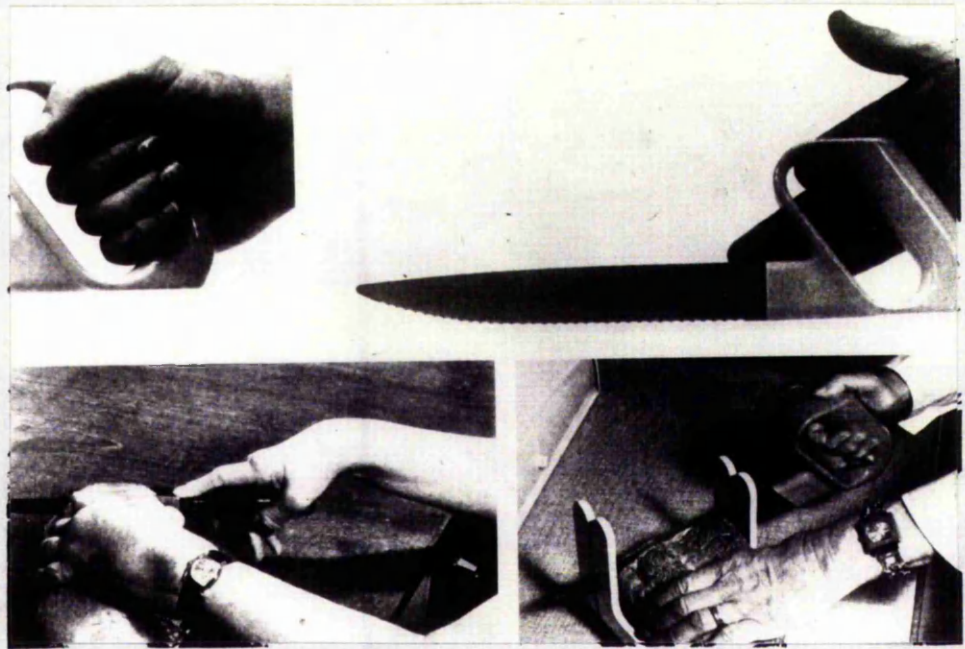


Knife handle for persons with difficulties in gripping. It has been developed by a group of designers at the request of the Swedish Institute for the Handicapped.

Design Research

- a) Observing and recording the problem.
- b) Discovering the optimum dimensions.
- c) Developing the most effective shape.
- d) Testing the non-slip properties of various finishes.
- e) Product application.

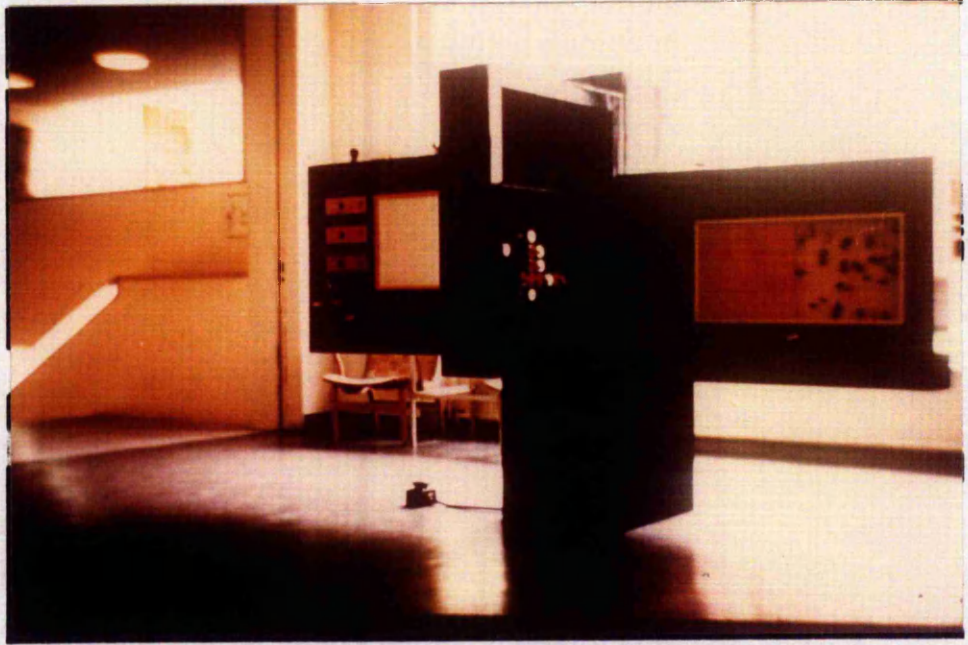




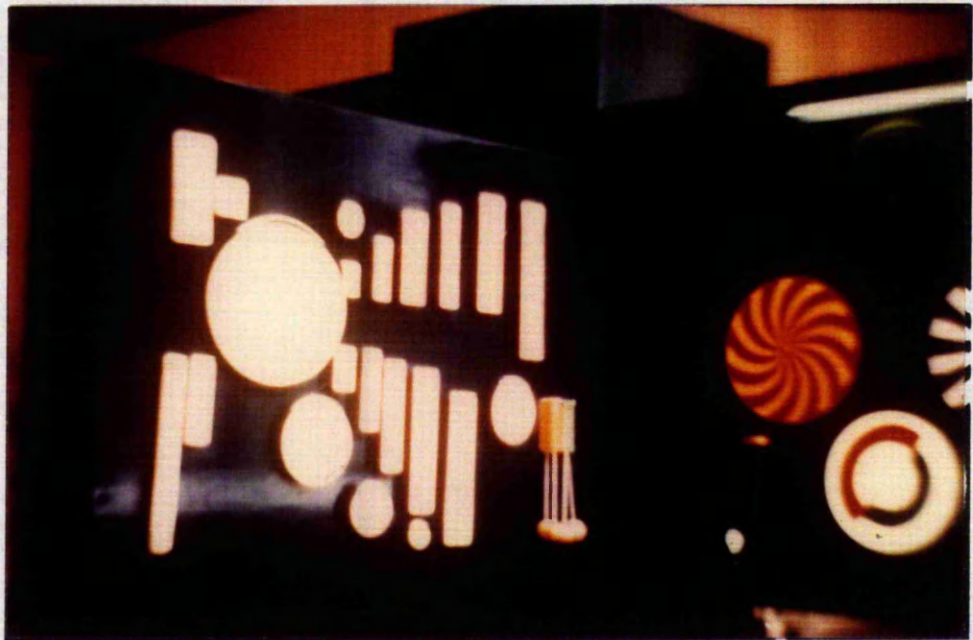
This knife is now produced commercially in Sweden and available from "high street" hardware shops.

Although the design was initially developed to fulfil a critical need of the handicapped, it is not sold as an "aid", merely as a more efficient product for anyone to use. This is "grass roots" integration at work.

Such has been the success of this piece of equipment that an Italian company are hoping to market it as a child's toy and make it available in the shops. It is therefore likely that sometime in the future the game will be played by both handicapped and non-handicapped children, thereby creating integration.



Play equipment, designed by Solbritt Lanquest, to develop the motor sensory skills in young children with artificial arms.



A sound board is included in the apparatus

2.24.0 INSTITUTION: Wilford View, Nottingham

TYPE: Residential Centre for the Handicapped

SPONSOR: Local Authority

CONTACT: Warden

GENERAL DESCRIPTION:

2.24.1 Situated in the West Bridgford area of Nottingham, Wilford View provides residential care for 20 to 30 handicapped people. There is also provision for other handicapped people to visit the centre on a daily basis.

The accommodation is on three floors, accessible to wheelchair users by lift. Each floor provides similar accommodation: single bedrooms (with individual working facilities), bathrooms, and communal areas for relaxation. Shared kitchens provide facilities for the preparation of light meals and drinks.

DESIGN OBSERVATIONS:

2.24.2 Two of the residents had similar mobility problems. They were unable to operate their wheelchairs in the normal way by hand-rotation of the large rear wheels, since they had no control of their jerky arm movements, which also prevented them using electric-powered chairs. Propulsion was achieved by pushing their feet against the ground causing them to move backwards.

2.24.3 One young man using this technique had developed serious spinal problems through the constant twisting of his body to enable him to see where he was going. Also, his wheelchair had to be regularly repaired as this awkward posture had overloaded the thin plastic-covered canvas back. Amazingly, this young man travels up to 7 miles each Sunday morning, enduring overwhelming discomfort and doing untold permanent damage to himself in order to maintain his freedom.



"Wilford View"



A resident demonstrates his method of mobility, pushing the chair backwards.

2.25.0 INSTITUTION: Westdale Hospital, Nottingham

TYPE: Special Care Hospital

SPONSOR: Area Health Authority

CONTACT: Matron

GENERAL DESCRIPTION:

2.25.1 Westdale is situated in the Mapperley district of Nottingham and provides long and short term care for children with both physical handicap and mental retardation.

The hospital was originally built as an emergency treatment unit during the last war. The buildings comprise three long narrow huts linked together at each end by corridors.

DESIGN OBSERVATIONS:

2.25.2 The buildings presented many problems to both planners and staff. Each of the long huts had been designed originally as open ward space. This is not acceptable as accommodation for handicapped children since many spaces are required to suit specific activities, providing for instance, quiet teaching rooms, physical activity rooms, television rooms and bedrooms etc.

The wards have therefore been divided into smaller rooms by lateral partitions with a central door. Unfortunately, each room is now a corridor and each corridor, a room.

- 2.25.3 These are typical problems found when changing the basic function of buildings. However, the human spirit thrives on adversity and the response by staff and children alike is to make the rooms as personable and homely as possible. The staff and residents have achieved this by decorating their own spaces as they wish. The result is a jamboree of colour and interests, which conquers any impression of a struggling Health Service where the handicapped appear low on the list of priorities.
- 2.25.4 Is it possible that there are areas of design like this where the Architect or Designer should hand over the decision-making to the user?
- 2.25.5 This represents a conflict of interests and was further highlighted by the differing opinions on the choice of bathroom facilities which were being planned for a replacement building for Westdale. These opinions were discussed in planning meetings to which the Matron was invited. She explained that most of the children were incontinent and required regular toileting. This presents acute problems first thing each day when most of the children require a complete sluicing down. It is an enormously difficult task when no special facilities are provided.

The provision of suitable facilities for this activity was to her the most important item of the bathroom design-requirements. Contrary to popular opinion, the planning committee felt that the provision of a humane and standard domestic bathroom was the more important factor. This conflict between the efficient management of care and a homely atmosphere was only resolved when a prominent member of the planning committee attended the 6.30 am to 8.00 am bathing sessions at Westdale for a week. As a result of his first-hand knowledge, priority has been given for the inclusion of sluicing facilities in special care units at the initial planning stage.

If sluicing equipment was available in "Wedgewood Blue" or "Rose Pink" this argument would not have occurred. Design is often a rationalisation of conflicting factors. The lesson to be learned from Westdale is that the everyday user has the most profound awareness of the design equation and ought to be consulted before any answers are provided.

2.26.0 INSTITUTION: Westbrook School, Long Eaton, Derbyshire

TYPE: Special School

SPONSOR: Local Authority

CONTACT: Headmaster

GENERAL DESCRIPTION:

2.26.1 Westbrook was built in 1972 in West Park, Long Eaton, which is also the site for part of the local Comprehensive School. The close proximity of the two schools has been exploited to some advantage by encouraging the Comprehensive School children to visit Westbrook in their lunch hour. Many friendships have developed, although it is interesting to note that the girls found mixing easier than the boys.

Westbrook caters for approximately 80 children between the ages of 2 and 16, and 35 of these are boarders, who live in family units of approximately 9 children. Each unit has a lounge/dining area, kitchen, bathroom and three bedrooms.

Although each unit provides the same accommodation, attempts have been made to give them individual identities through a choice of colours and layouts.

DESIGN OBSERVATIONS:

2.26.2 Physiotherapy policy had considerable effect on equipment design, despite the fact that many of the aids were of a crude "home made" nature. This came about as a result of the Senior Therapist's concern for the special needs of the individual child, and in particular, each individual's need for independent mobility, however crippling the handicap.

Special aids had therefore to be provided for several children. These aids were not available on the established market and so considerable modification of standard equipment was necessary. Discussions with the staff illuminated an aspect of design requirements concerned with the management of care of which I had hitherto been unaware. Much equipment for the handicapped will be adapted, and if provision is not made for this in the initial design, it will be adapted pretty crudely, by a handyman whose expertise is mainly woodwork. The staff therefore favoured wooden equipment and furniture rather than metal and plastic, so that this can take place.

- 2.26.3 This willingness to adapt also enabled the physiotherapist to specify the suitable equipment for each child's differing activities. For instance, it was considered that if a particular chair was suitable for a child's transportation, it did not follow that it would be good for working or feeding. The physiotherapists were of the opinion that their constant monitoring of activities pointed to the need for furniture which would provide adequate physical support to achieve the maximum potential from those activities.

2.27.0 INSTITUTION: Wehe Den Hoorn Centre, Holland

TYPE: Residential Accommodation for the Handicapped

SPONSOR: Dutch Government

CONTACT: Director

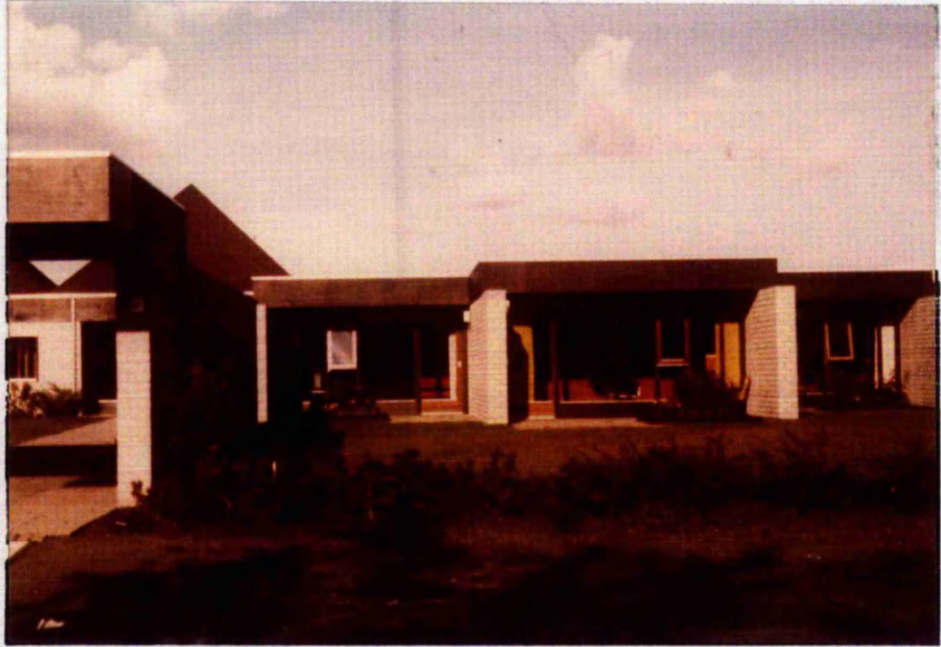
GENERAL OBSERVATIONS:

2.27.1 Wehe Den Hoorn is situated near Groningen, north Holland. The centre is so far the only one of its kind in Holland, providing what is called by its Director; "supporting living conditions", which is accommodation for the handicapped integrated within the community.

DESIGN OBSERVATIONS:

2.27.2 The layout of the centre emphasises, indeed encourages, both the handicapped individual's personal privacy and his social environment. The central facilities (shops, restaurant and sporting amenities) are used by both the handicapped residents and the villagers of Wehe Den Hoorn. The self-contained ground floor flats for the handicapped surround the amenities which are reached by covered streets.

2.27.3 The effect of placing the handicapped community right in the middle of an ordinary village has been remarkable. Many of the handicapped people spoke about their change of attitude through living there. They were no longer satisfied for this handicap to be a reason, or excuse, for living a less fulfilling life. The sight of other people's freedom had, in the main, sponsored a real determination to share such a life rather than induced depression and self pity.



The modern apartments at Wehe Den Hoorn for
handicapped residents.



The restaurant, and other amenities, are open to
the general public.

2.28.0 INSTITUTION: The Aids Centre, London

TYPE: Advisory

SPONSOR: Disabled Living Foundation

CONTACT: Information Officer and Assistant Director

GENERAL DESCRIPTION:

2.28.1 The Aids Centre is at 346 Kensington High Street, London. It provides facilities for the display and demonstration of equipment and maintains a comprehensive reference to information on selected equipment from the general market.

This information is also available to those concerned with the care of the handicapped in the form of bi-monthly information bulletins. Subscriptions are paid annually for this service.

The Centre displays aids in group settings related to their use. A small kitchen has been built to exhibit and demonstrate kitchen aids and a bathroom and toilet for hygiene equipment.

Therapy staff are available to demonstrate aids but normally ask for advance notice of a visit if their services are required.

The Centre offers a handicapped person the opportunity to try equipment prior to purchase.

2.28.2 The Assistant Director made the following comments on factors affecting the design of aids, based on her experience and that of the demonstrators at the centre. In light of the institutional surveys, I found that many of her comments showed a great understanding of the general use of equipment for the handicapped and these are substantiated by examples from my own research.

2.28.3

"An important consideration is the small size of the market; manufacturers are just not prepared to invest large sums of money in development work in such a specialised area."

This would appear to be very much the case in the UK, and to some extent reflects the still slightly patronising approach to the handicapped. Even at a national level there seems to be no genuinely optimistic policy towards the handicapped. Witness for example, the criminally tentative Government approach to the problems of the invalid car. It is hardly surprising that industry in today's 'uncertain economy' does not become involved in such projects. Dutch and Swedish firms recognised the potential commercial market and designed accordingly.

2.28.4

"If you can design something which is especially for handicapped children, but can also be used by normal children, then this is an advantage for pure economic reasons, but has the added advantage of being similar to things other children use, which makes them feel better."

These two critical points came to light at almost every institution I visited. The comment about the toys being similar to other children's also has two advantages. The first being that the handicapped child can physically engage in play with the non-handicapped. For example; the activity boards designed by Solbritt Lanquist to train children using artificial arms. Secondly, the handicapped child who is concentrating and playing on his own, knowing that the toy is desirable to other children, is therefore reassured.

2.28.5

"Don't aim for one disability, better to design for one functional problem, eg mobility, play, feeding. It doesn't matter why a child cannot walk; if he needs a wheelchair the chances are it will be used the same way. It is important to define your problem and to widen it to embrace as many as possible; although this can go too far as to be of no use to anyone - so research your ideas."

I would have expected this sort of advice from a designer rather than a therapist. Unexpectedly, the latter had seen disability problems in terms of general physical requirements rather than specific medical conditions. A good example of this approach is the way that a special knife was designed by Ergonomi Design in Stockholm. The problems associated with a specific rheumatoid-arthritis condition were treated as a general inability to grip, and this in turn covered many ranges of physical problem.

- 2.28.6 "Often a pure adaptation job is all that is required to keep the child as near normal as possible. It may be a conversion to make a tricycle capable of being operated by hands rather than feet etc. Therefore, the child feels better in a more normal situation."

In many cases, and particularly those children with a slight handicap, the above point is very valid. This was particularly noticeable in the institutions which adapted a fair amount of the basic facilities for special needs. However "a more normal situation" can also be brought about by the designer if he accepts the challenge of a child's handicap, and makes a desirable product for all children from the specific conditions.

- 2.28.7 "Must be marketable; charge the right price. It's wrong to think that because it's for the handicapped then it's got to be cheap. It's a business and should be treated as such to guarantee quality and availability."

In our society freedom of choice is one of our greatest assets, and while goods for the handicapped are seen as a charitable facility rather than a commercial venture, this freedom will never be forthcoming.

- 2.28.8 If products for handicapped people could be seen in the same light as those sold in specialist sports shops, outside clothing shops, and delicatessen or health-food shops, then the "back-street" handicap stigma could be removed.



The Aids Centre displays and deomonstrates aids and equipment for the handicapped.



3.0.0. INDIVIDUAL CASE STUDIES

The following children were selected from Centres, visited during the survey of Institutional Care, by their Therapists and Teachers, as children in most danger of delayed physical and personal development due to their lack of adequate facilities.

3.1.0 CASE STUDY NO: 1

SUBJECT: 13 year old girl, an only child

CONDITION/NATURE OF HANDICAP Spastic Quadraplegia. Athetoid Physical Involvement

TYPE OF INSTITUTION: Special School

REPORT BASED ON INFORMATION GIVEN BY: Physiotherapist, Teacher and Parents

3.1.1 This child lives sufficiently near her school to travel to it every day. Unfortunately the only transport available is the ambulance service which, because of its varied and irregular work-load, cannot guarantee to pick up children at the same times every day. This has a disrupting effect on both the school-day and the child's progress. It is also difficult for this child's mother to have a regular job since she has to stay with her daughter until the ambulance arrives.

At school it has been difficult to find a chair suitable for her to use, since any feeling of insecurity causes her to have quite a violent extensor spasm. She is most relaxed in a 'Major Buggy' although extra straps have had to be fitted for her safety.

Further problems are experienced at meal times where lack of suitable equipment to support her posture whilst feeding has resulted in her being fed whilst sitting on her mother's lap.

GENERAL DESIGN OBSERVATIONS:

3.1.2 This case emphasised the increasing problems that occur if a child's postural support is not catered for at an early age. It is quite possible, and even easy, to feed a very young spastic

child on the lap, but to feed a 13 year old in this way is a very different proposition. The demands on her mother at meal times are enormous but it would appear that these could be readily alleviated by the provision of a suitable chair. This would not only help the child feel more independent but it would also be more acceptable and 'civilised' when she and her family were 'eating out' with friends and relations. Her mother would also be infinitely less tired and could therefore give more appropriate care to her daughter. She might even gain periods of relaxation for herself.

3.2.0 CASE STUDY NO: 2

SUBJECT: 7 year old boy, an only child

CONDITION/NATURE OF HANDICAP: Spastic Quadraplegia and Athetoid.
No Speech.

TYPE OF INSTITUTION: Special School

REPORT BASED ON INFORMATION GIVEN BY: Physiotherapist and teacher

3.2.1 This boy is an extremely lively and popular child at school, which he enjoys enormously. His parents are very caring and try to lessen the impression of handicap by taking him out in a 'Major Buggy', and by keeping his wheelchair for home use. In spite of the obvious pleasure he derives from life, he becomes very frustrated when he is unable to realise his inner aspirations because of his physical limitations. This results in violent thrashing movements of both arms and legs.

His athetoid condition disrupts his speech, although he can be understood by his parents. A lack of muscle co-ordination causes serious eating problems for him: he is unable to chew food and finds meal times frustrating. He shows signs of wanting to feed himself but a lack of hand and eye co-ordination prevents this.

At school a wheelchair had been provided for his use but he disliked it. He found it uncomfortable when constantly shifting his position during spasms, and had, on one occasion, tipped the chair over after a violent extensor movement. Staff feel that the 'Major Buggy' has overtones of baby equipment, and find that other children and adults treat him as a baby as a result.

He uses a Cell Barnes chair at meal times, but he tends to droop sideways even though he is strapped in. If he gets excited he can easily tip it over since the legs of the chair have to be fully extended to cope with his size, and this makes the chair less stable.

At home he spends a great deal of time watching television, supported with cushions on the sofa or floor. He particularly enjoys watching Wrestling and his father has taken him to see live performances which he enacts for days afterwards. It is possible that he sees Wrestling as the one adult activity which his unco-ordinated physical struggles most resembles.

GENERAL DESIGN OBSERVATIONS:

- 3.2.2 It would appear that there is no item of mobile postural support which is suitable for the child's needs. The wheelchair is unsatisfactory on two grounds. The first being that it provides insufficient support for the trunk, which is frustrating for him and causes him to constantly lose concentration. The second reason is that hard-to-define and yet extraordinarily easy-to-understand, adult reaction to wheelchairs.

In this particular case, the mother feels that the wheelchair unduly emphasises her sons handicap, thereby setting him apart from society. However, the alternative 'Major Buggy' has connotations which are in no way healthy to the child's development because people respond to him as if he were an infant. He is by no means infantile, and his intelligence and imagination demand a response from society that is far more sophisticated than a two year old would require.

3.3.0 CASE STUDY NO: 3

SUBJECT: 6 year old girl, one of a family of three children.

CONDITION/NATURE OF HANDICAP:

TYPE OF INSTITUTION: Special School

REPORT BASED ON INFORMATION GIVEN BY: Physiotherapist and Teacher

3.3.1 This child is micro-caphalic (small headed) and any slight pressure on the back of her head causes her to arch her back and draw up her knees. She has severe contractures in her legs and arms and a spinal curve is developing.

At the age of six there is still no voluntary grasp in her hands and she has very little visual response. Although she has no speech she makes a babbling noise to attract attention. At home she is fed on her mothers lap, but at shcool, where staff are limited in numbers, she sits in a baby buggy. Since she has a very small mouth, feeding is difficult; her jaws however are strong and her gums often bleed when being fed with a small spoon.

Despite her small delicate physique she enjoys rough play, although her teacher commented that little in the way of play equipment suitably sized was available for her to use.

At home, she has no special seating and spends most of her time propped up with cushions on the settee. A small Amesbury Avon wheelchair was provided for her, but she is so small that she can easily slip out between the chair arm and centre pommel, which is intended to go between her legs.

She is transported to school lying in a pram body in the back of the car, and even for short journeys, the car is used. Unfortunately, she is unable to see out of the car from this position.

GENERAL DESIGN OBSERVATIONS:

- 3.3.2 The staff experience particular problems feeding this child. One of the main reasons is that her head must be treated with great care and since no physical postural support system is by any means as sensitive to pressure as a human hand, the physiotherapist thought it wise that there should be no contact between any of the equipment and her head.

However, the child's head could not be allowed to droop forward since this would make feeding, swallowing and digestion difficult. The postural support therefore, would have to be designed in order to present her head at an angle suitable for feeding.

3.4.0 CASE STUDY NO: 4

SUBJECT: 4 year old boy, youngest in a family of four

CONDITION/NATURE OF HANDICAP: Severe Spastic Quadraplegia

TYPE OF INSTITUTION: Special Nursery School

REPORT BASED ON INFORMATION GIVEN BY: Teacher and Physiotherapist

3.4.1 This child is one of a caring family and his two brothers and sister are very affectionate towards him. However, it is arguable that the loving care has to some extent smothered the child's personal development and independence.

He has only recently started to take solid food, having been fed mainly from a bottle at home. His limited head control makes the taking of adult food, as opposed to baby food, particularly difficult.

At school meal times, he sits in a corner seat close to the ground which is a tiring position for the person feeding him.

At home he sits in a baby's high-chair, which has its own tray, but he has to be kept away from the dining table because of the mess that he makes. A 'baby-buggy' is used for transport and he has little incentive for achieving independent mobility since his brothers and sisters push him wherever he goes, although the physiotherapist said that there was no reason why, with training, he could not move independently given the opportunity.

GENERAL DESIGN OBSERVATIONS:

3.4.2 This case highlights a conflict between, on the one hand, the management of his care requirements, and on the other, personal development through the acquisition of skills. This is particularly noticeable at meal times when the use of a bottle obviously eases the helpers task but hardly encourages the child.

Would it be possible to design for this child, and many others like him, a method of presenting food which has the ease of maintenance of a bottle, and yet provides the challenge that the child needs to acquire eating skills which are so critical to his development?

Much of the table equipment specifically designed for the Cerebral Palsied child is in the form of a traditional open-topped plate or dish. Perhaps a partly enclosed food container, which could be held close to the mouth to enable the child to spoon food directly from container, could be developed to encourage intermediary hand-to-mouth co-ordination.

Unfortunately, this particular child has not achieved any reasonable control and he consequently is not part of the family group at meal times because of the mess that he makes. This emphasises the profound links that may be drawn between personal development and eventual social integration.

3.5.0 CASE STUDY NO: 5

SUBJECT: 5 year old girl, the youngest in a family of four children

CONDITION/NATURE OF HANDICAP: Mildly Spastic - late developer

TYPE OF INSTITUTION: Special Care Nursery School

REPORT BASED ON INFORMATION GIVEN BY: Nursery School Staff

3.5.1 The parents of this child are very caring and deal confidently with their handicapped daughter. They are both illiterate, and notes from school have to be written so that the oldest child can read them to the parents.

When she was younger, a special chair was designed for her to use based on a "Shasbah" trolley without wheels, and used with a low table. From this she has progressed to a small "Windsor" chair which provides her with good lower trunk support. She uses this at meal times and for working. She wears calipers to aid walking and can stand quite well without them when using the special standing box-cum-table at school, although this isolates her to some extent since it is designed to be used by only one child at a time.

She is a happy child at school, who has come to terms with her handicap and who has developed her potential well. Her teacher felt that this success was due in part to the provision of correct equipment used at the right time to suit her handicap, and at each appropriate stage in her development.

GENERAL DESIGN OBSERVATIONS:

- 3.5.2 The teacher's comments mentioned above are quite significant. At the time of writing, this particular child is fortunate, in that, much of the equipment provided has suited her and has extended her capabilities. No design brief therefore resulted from this study. I was content and optimistic with the proof of the value of well designed equipment which matched the child's needs.

3.6.0 CASE STUDY NO: 6

SUBJECT: 5 year old girl, an only child

CONDITION/NATURE OF HANDICAP: Spastic Quadraplegia, mildly epileptic

TYPE OF INSTITUTION: Special School

REPORT BASED ON INFORMATION GIVEN BY: Therapist and Teacher

3.6.1 This child is happiest when playing and learning with other children, and is obviously stimulated by the school environment. Staff at the school find her to be one of their brighter children, always willing to co-operate and contribute fully in school activities.

She has difficulty in accurately controlling her actions, and her movements are very inexact. She tends to kick and push herself backwards when sitting. This is due to her strong extensor spasms and has to be controlled with drugs, which quieten her and help her to concentrate.

A trunk brace has been provided to improve her balance when sitting since she finds it difficult to sit, work, and remain upright. Although her teacher had seen an improvement in her work since using the brace, it was only used within the confines of school because of its ugly appearance: "flesh pink" plastazote held in place with bandages make it socially unsatisfactory for anywhere else.

GENERAL DESIGN OBSERVATIONS:

3.6.2 Quite often the terms, "aid" or "equipment" hinder a designer in fully understanding a child's comprehensive needs. In this case

the trunk brace manufactured in "flesh pink" plastazote is undoubtedly physically successful, but unfortunately, the child is not happy wearing it. Would it clarify the situation to re-determine the design needs as, a trunk support garment suitable for an afternoons shopping, a seaside holiday or maybe even a birthday party? Is it not possible to allow the child, through interchangeable covers, the feeling of being attractive and fashionable?

3.7.0 CASE STUDY NO: 7

SUBJECT: 17 year old boy, youngest of a family of three children

CONDITION/NATURE OF HANDICAP: Severe Spastic Quadraplegia. Athetoid

TYPE OF INSTITUTION: At Home

REPORT BASED ON INFORMATION GIVEN BY: Parents' and Physiotherapist

3.7.1 Since this boy is now 17, there is nowhere he can go to school, and his parents do not wish him to go into permanent care. They are very caring, understanding parents devoted to the welfare of their handicapped son. They have made a number of alterations to their house to help cope with his handicap.

He spends most of his day listening to records or watching TV. He sits, propped up with cushions, in the middle of the sofa - a situation which requires constant supervision, since his involuntary movements tend to force him downwards and onto the floor.

His spine has developed a curve due to the lack of adequate support. His drooping posture affects his natural body functions and weakens his respiration. He enjoys visits from his sisters' children and they like to watch TV sitting either side of him on the sofa.

GENERAL DESIGN OBSERVATIONS:

3.7.2 It is quite likely that this boy will live for the rest of his life at home. His parents wish it, and indeed, on the face of it,

cope very well with the situation, and yet still retain their own friends and social life. However, it was impossible for the parents to buy a postural support chair which the boy's medical condition demanded. The boy would spend most days sitting continuously. Therefore a support, if to be successful, would have to be very correct indeed.

Since no hospital equipment was suitable, the parents investigated chairs on the domestic market, such as the 'Parker Knoll Recliner', but again nothing was suitable. They were further surprised to find that no postural support chair was designed with the home environment in mind, and since it was their intention for their child to live as part of the family, it would have been distressing to always see him surrounded by obvious medical equipment.

- 3.7.3 This would have been one more social barrier because such equipment would emphasise the handicap rather than encouraging normal human relationships.

3.8.0 CASE STUDY NO: 8

SUBJECT: 4 year old girl, youngest in a family of six children

CONDITION/NATURE OF HANDICAP Spastic Quadraplegia

TYPE OF INSTITUTION: Special Care Nursery School

REPORT BASED ON INFORMATION GIVEN BY: Physiotherapist and Nursery School Teacher

3.8.1 Both parents of this child have jobs. The father is on shift-work and the mother works in the evenings, which means that the older children are often left in charge of their handicapped sister. Unfortunately, they sometimes treat her as a baby.

She is unable to co-ordinate her movements, and has very poor head control. She finds it difficult to straighten her spine because of ineffective back muscles. Her body requires total support to encourage the slightest signs of spontaneous movement or activity, but the 'Cell Barnes' chair, which was provided for her, restricts her movements since she has to use shoulder straps for safety, and her unsupported head droops, and falls sideways.

The problems associated with her poor head control are increased at meal times when she experiences extreme discomfort trying to chew and swallow food in a cramped posture. The physiotherapist explained that there is a tendency for these children to be "bird fed": a primitive action, which although easier and quicker, delays development and discourages self-control, and is therefore to be discouraged.

At school she uses a low table and a corner seat for creative work, but she requires constant repositioning and her progress is slow due to a lack of adequate postural support. However, she is keen to work and is delighted by the smallest amount of self-achievement.

GENERAL DESIGN OBSERVATIONS:

- 3.8.2 This child shows few signs of spontaneous activity and therefore any well-designed postural support must not only support her body, but must also encourage her to respond to the world around her. An all-protecting cocoon would, no doubt, be physically suitable, although it would encourage her to accept her immobility.
- 3.8.3 The most critical element in the design of specialised equipment for the handicapped is not to protect them from the world, but rather to help them to face the world on reasonable terms.

3.9.0 CASE STUDY NO: 9

SUBJECT: 5 year old boy, second youngest in a family of four children

CONDITION/NATURE OF HANDICAP: Mildly Spastic Hemiplegia Epileptic

TYPE OF INSTITUTION: Special Care Nursery School

REPORT BASED ON INFORMATION GIVEN BY: Head of School

3.9.1 The parents of this child are loving and considerate. Unfortunately, their circumstances deny them many household comforts and their house is cold and damp. As a result this boy is very prone to colds and chest infections.

His mother has difficulty coping with her young family and often the lack of adequate facilities at home means that the school has to be responsible for his personal hygiene, which causes extra problems for overworked staff.

He is a lively, active child at school, but inclined to tantrums when the pace of school activities are slowed to cater for the more severely handicapped children.

He is fascinated by anything on wheels and sometimes pushes other children in wheelchairs around the school, although this has to be supervised since he could easily tip a child over in his enthusiasm to be of help.

He enjoys climbing - an activity that is encouraged since it helps to develop his leg muscles, which are weak and prevent him from walking unaided.

He has no problems with eating and enjoys meal times. However, he has to be strapped into his chair, not to provide support, but to prevent him from taking food from other children.

When he first came to the school, he had not been 'potty-trained', however, he has since mastered this, although he requires constant supervision to see that he doesn't move off while staff attend to other less able children.

GENERAL DESIGN OBSERVATIONS:

- 3.9.2 This child was one of the more mildly handicapped of all of the case studies. In one sense his requirements demand less specialised design emphasis, but because of the nature of the special schools, he was being taught in conjunction with other quite severely handicapped children, and therefore, their equipment would come under more rough treatment from him than they themselves would normally give.
- 3.9.3 A postural support chair could well be completely stable for its user in isolation, but it could easily be knocked over by the well-meaning but unco-ordinated movements of a less handicapped friend.

3.10.0 CASE STUDY NO: 10

SUBJECT: 5 year old girl, an only child

CONDITION/NATURE OF HANDICAP: Spastic, with developmental delay and no speech.

TYPE OF INSTITUTION: Special Care Nursery School

REPORT BASED ON INFORMATION GIVEN BY: Headmistress of school

3.10.1 This child has a very floppy physique which becomes particularly disturbing at mealtimes when her constant collapsing creates severe digestion problems and discomfort. Consequently, she has developed a total dislike for meal times.

She is a frustrated child inclined to fits of temper when unable to accept her physical limitations. However, she responds happily in group activities with other children.

Her teacher feels that she could learn to use a typewriter for the communication she so desperately wants to achieve. This will require special support to help increase her arm control and to reduce the jerky movements due to her poor head control.

At home she sits in a 'Baby Relax' chair for most of the time. This has its own tray and is mounted on a high frame. The mother finds it easier to supervise her daughter at this level during feeding, play and relaxation which includes watching television, since it has a calming effect on the child.

A 'Baby Buggy' is used for transportation, and at school the staff find that she is content to sit in this during quiet periods, such as story-time.

GENERAL DESIGN OBSERVATIONS:

- 3.10.2 In rather the same way that people appreciate success in response to effort, the handicapped child is particularly inclined to associate one particular activity with discomfort. In this case feeding is the problem, and because no adequate trunk support system is available for her, she has developed an intense dislike for meal times.

This is very disappointing for the teachers because the successful acquisition of self-feeding skills is one of the most stimulating rewards to the Cerebral Palsied child. Indeed, it is a gateway to social acceptance, and through no fault of her own, or her carers, the child may be denied this because she has lost the incentive to overcome her handicap.

- 3.10.3 By providing correct support, a designer could at least remove a negative influence that is hindering the child's development.

3.11.0 CASE STUDY NO: 11

SUBJECT: 6 year old boy, youngest of a family
of two children

CONDITION/NATURE OF HANDICAP: Spastic Quadraplegia, Blind

TYPE OF INSTITUTION: Special School

REPORT BASED ON
INFORMATION GIVEN BY: Teacher

3.11.1 Although this boy has pleasant, understanding parents, he is a very sad child, who seems to derive less pleasure from life than his school friends. His multi-handicap problems seriously limit his capabilities and he is easily frustrated.

At school mealtimes it requires two members of staff to feed him. He is unable to see his food, and this causes him to rock his head violently from side to side in desperation. At home he is bottle-fed.

A 'Cell Barnes' chair has been provided for him to use both at home and at school. However, the rocking movements of his body can loosen the safety straps and he has, on occasions, slipped out onto the floor.

He is able to move himself a little when sitting in a chair with wheels. He pushes his feet against the floor and moves backwards.

Toileting presents serious difficulties in that he is doubly incontinent, and at home no special facilities are available. His parents had told the teacher that looking after him at home often totally exhausted them.

GENERAL DESIGN OBSERVATIONS:

3.11.2 This child's handicaps are very severe, unlike some of the other children in the same school, communication with him at any level is extraordinarily difficult. It is therefore very hard to understand what the child needs, or indeed, what he is feeling at all. However, he does seem to enjoy combinations of very simple experiences such as being inside a clothes horse used "tend fashion", and waving his arms about to touch various items hanging from it. While these may seem quite primitive, any more sophisticated activity appears, at the present, to be beyond his understanding.

3.12.0 CASE STUDY NO: 12

SUBJECT: 6 year old girl, an only child

CONDITION/NATURE OF HANDICAP: Severe spastic, epeleptic and blind

TYPE OF INSTITUTION: Special Nursery School

REPORT BASED ON INFORMATION GIVEN BY: Teacher and Physiotherapist

3.12.1 The mother of this child is devoted to her severely handicapped daughter, who requires constant care. The father, who works irregular hours, finds it difficult to sleep during the day, since the child cries for long periods and cannot be comforted.

This extremely demanding situation is never-ending since the mother does not wish the child to be put into care, so the parents have not taken a holiday, even for a day, since their daughter's birth.

The child is prone to fits which often hospitalises her for a short time. She is grossly overweight and since no suitable chair has been found for her to use at meal times, she is fed whilst sitting on her mothers lap.

The mother also has to support her on the lavatory since no aid has been found which could be used with safety. The child is able to support herself in a sitting position on the floor, by taking the weight on her hands, but this requires constant supervision in case she falls over.

A "Major Buggy", fitted with homemade straps for extra safety, is used for transportation, but she finds this uncomfortable during long periods.

The physiotherapist considered the child's home management the most serious problem since none of the available childrens aids were large enough for her to use.

GENERAL DESIGN OBSERVATIONS:

- 3.12.2 It is particularly difficult to provide aids for this child which suit her. Nearly all carers for handicapped children make some adjustments to equipment in order to achieve greater comfort for each individual child, or easier use for the carer.

However, this child has the added problem of being too large for all "standard" aids, and no amount of Government-subsidised mass-produced equipment would ever really be able to cope with her particular needs. She is genuinely a case for individual examination and "one off" production.

3.13.0 CASE STUDY NO: 13

SUBJECT: 7 year old boy, youngest in a family of six children

CONDITION/NATURE OF HANDICAP: Spastic Paraplegia

TYPE OF INSTITUTION: Special School

REPORT BASED ON INFORMATION GIVEN BY: Headmistress

3.13.1 This child is of West Indian origin, unable to understand English, which caused difficulties when the school first tried to assess his abilities. He is a bright child and responds eagerly to school work.

When he first started school, the staff found that he could move himself around the classroom by sitting astride a small tricycle and by pushing his feet against the ground. This helped to build up muscle tissue and to develop controlled responses in his legs from which he gained the ability to stand.

He has since been supplied with calipers which help to support him and encourage his walking. Unfortunately, his brothers and sisters are so amused by these that it upsets him to wear them at home, even though at school he is beginning to take a few steps without help from the staff. His teacher said that since the introduction of the calipers his general progress has deteriorated, and she is desperate to find something which will make his calipers more acceptable. The situation has got so bad that he now cries when he sees the ambulance arriving to take him home.

GENERAL DESIGN OBSERVATIONS:

- 3.13.2 It is regrettable that the often accurate observations of his brothers and sisters can be so cruel. However, it cannot be denied that this child's brothers and sisters are quite correct in that they are making an aesthetic decision that leg calipers look odd and ugly.
- 3.13.3 Adults may make this decision but, unlike the children, they usually try to ignore it. A conscientious designer cannot really afford himself this luxury and he must come to terms with the user's personal and social needs as much as his physical ones. Designers cannot redesign people but they can redesign leg calipers.

3.14.0 CASE STUDY NO: 14

SUBJECT: 5 year old girl, the younger child in a family of two

CONDITION/NATURE OF HANDICAP: Cerebral Palsy. Severe development daley

TYPE OF INSTITUTION: Special Nursery School

REPORT BASED ON INFORMATION GIVEN BY: Physiotherapist and Nursery School Staff

3.14.1 This case is particularly tragic for the parents since it is quite possible that their daughter's condition was due to whooping cough vaccination damage, and therefore, with foresight, may have been avoided. The girl developed normally for 16 months before the Cerebral Palsy symptoms began to show.

The parents' natural reaction has therefore been one of great concern for her welfare. At school the teachers found the child quite inactive and showed little self motivation although no physical reason could be found for her relative lack of development. She is unable to sit unsupported which causes her to sag forward. This position has given rise to respiratory and bronchial problems. A similar situation occurs at mealtimes when her head has to be held back by the person feeding her. Mealtimes are a long and slow process. In an attempt to provide reasonably correct postural support, the teachers strap her into a corner seat placed against a small low table. Although she finds this comfortable, the staff are conscious that this is further inhibiting her progress since she does not have close contact with the other children, and this is considered an essential part of school life.

GENERAL DESIGN OBSERVATIONS:

- 3.14.2 Corner seats were originally designed as introductory chairs for young spastic diplegic children.

The original use is particularly well explained in Nancie Finnie's book "Handling the Young Cerebral Palsied Child at Home". However, it so happens that for certain older children, and this is one such case the corner seat does offer some benefits. This is developed in Nancie Finnie's book which shows how a corner seat can be attached to dining chairs. However, the need for botching of this kind emphasises the real lack of specifically designed chairs which provide reasonable trunk support.

The problems that this child has in using the corner seat cause social rather than physical effects. The low chair and table isolate her from other children and this does not encourage her improvement. The already hard pressed teachers in a school would find it very difficult to be continually strapping corner seats to other pieces of furniture to suit many individual children and many situations.

- 3.14.3 Some sort of chair providing adequate postural support which could, in a matter of seconds, be changed in height or position, is urgently required.

3.15.0 CASE STUDY NO: 15

SUBJECT: 5 year old boy, an only child

CONDITION/NATURE OF HANDICAP: Spastic Paraplegia - developmental delay

TYPE OF INSTITUTION: Special School

REPORT BASED ON INFORMATION GIVEN BY: School Headteacher

3.15.1 Mother and child live together in a Council flat, and serious difficulties are experienced since the mother has to work on a full-time basis. An added problem is that the child is easily distressed by unfamiliar people and places, and he dislikes being left alone, even for only a few moments.

He is prone to temper tantrums which usually occur when he feels unsafe, and he dislikes sitting in chairs even though his physical condition does not prevent this. He prefers to lie on his back on the floor, a position he can move about from, and yet feel secure.

The school staff experience great difficulty at meal times since he spends most of the time worrying that he might fall out of his chair, rather than concentrating on eating his food.

Extreme difficulties are also experienced when pottyng, again for the reasons of insecurity, which means that a member of staff has to hold him the whole time.

GENERAL DESIGN OBSERVATIONS:

3.15.2 This child is extremely nervous and a really correct postural support is required for psychological reasons as much as for physical ones. He intensely dislikes perching on ordinary chairs and only feels happy when being nursed on somebody's lap. This is extremely time-consuming and frustrating both for his professional carers and for his mother. It is possible that a chair designed to cradle him might reduce his fears and gradually increase his independence, thereby freeing his carers for more profitable activities.

If such a chair could be further developed for use as a potty seat, the improvement could well be considerable. The problem is that, at the time of writing, no really suitable chair exists to test this theory.

3.16.0 CASE STUDY NO:

16

SUBJECT: 13 year old girl, an only child

CONDITION/NATURE OF HANDICAP: Severely Spastic - Quadraplegia

TYPE OF INSTITUTION: Special School

REPORT BASED ON INFORMATION GIVEN BY: Mother and Physiotherapist

3.16.1 This child lives with her mother and grandmother in a small terraced house. Since the mother has to work, her daughter is often left in the care of her grandmother, who is in her 70's.

An Amesbury Avon wheelchair is used for transporting the child to and from school, but in this her twisted spine is not fully supported and she experiences great discomfort.

At school she uses a trolley for work and transportation. This has been made by the school handyman from wheelchair parts. She finds this comfortable since, in the prone position, she feels totally supported. However, her posture is deteriorating through a lack of adequate support when sitting.

Her wheelchair has been fitted with a large head pad, also made by the school handyman, in an attempt to support her head in an upright position. Unfortunately, the remainder of the chair offers her such little comfort that short trips are more of an ordeal than a pleasure.

Although she has no speech, conversations are possible by asking her questions to which she replies by nodding her head. She can operate a typewriter by using a pointer fixed to a headband, and this she does from the prone position.

Her mother is very anxious about her daughters condition, and has done everything possible to find equipment and aids to help her.

GENERAL DESIGN OBSERVATIONS:

- 3.16.2 An Amesbury Aven wheelchair, which was provided for her, proved totally unsatisfactory on several points. The first being the result of an ordering system which relates age, length and weight of child to the size of chair needed. This particular child is indeed as tall as the "standard" thirteen year old, but considerably thinner and more fragile. Consequently, the chair provided is far too large, offering almost no support to her trunk and head. Her physical condition is therefore deteriorating and this causes an increase in spasms.

The wheelchair is still less suitable for her since several metal fittings protrude from the frame and she has frequently hurt herself on these.

Since they live in a small house, the chair's fittings, particularly the footrest, have caused considerable cuts and bruises to other people in the house. The chair is now kept outside.

3.17.0 CASE STUDY NO: 17

SUBJECT: 7 year old, only boy and youngest in a family of four children

CONDITION/NATURE OF HANDICAP: Spastic Quadraplegia and Athatoid

TYPE OF INSTITUTION: Special School

REPORT BASED ON INFORMATION GIVEN BY: Teacher and Occupational Therapist

3.17.1 This boy's parents are very understanding and co-operate eagerly with the school. His elder sisters tend to spoil him but he fights vigorously for his independence.

The Athatoid element in his handicap prevents him from accomplishing the things he so desperately attempts to do, and he becomes very frustrated particularly at meal times, since he wants to feed himself but is unable to do so. The school staff said that he disliked being fed as a baby in front of the other children.

He achieved mobility by doing a "rabbit jump" on all fours, which, although effective, can cause him injury.

The local hospital have provided him with a special chair for use at home. It is made in wood with a slatted back and is fitted with a work tray, which also prevents him from falling out. When sitting at a normal table he tends to bump his knees on the underside since violent spasm movements in his legs are produced as a result of excitement.

Furthermore, he finds it very difficult to keep his head upright and therefore his concentration is constantly broken.

The therapist felt that any aid to help support him whilst working could gradually be dispensed with as his control increases, through interest in his work.

He can use a typewriter, but finds it difficult to support himself for long periods without a great deal of determination.

GENERAL DESIGN OBSERVATIONS:

- 3.17.2 This child is obviously intelligent and communicates his intense frustrations more vividly than many of his school-friends. He reacts strongly against being treated as a baby, and therefore any activity designed for him must be genuinely challenging so that any success he may achieve will be the result of hard and concentrated effort. The design of aids and toys for him must be done with his handicap very much in mind, but a condescending approach will not be at all welcome.

3.18.0 CASE STUDY NO:

18

SUBJECT: 9 year old girl, an only child

CONDITION/NATURE OF HANDICAP: Severe Spastic Quadraplegia

TYPE OF INSTITUTION: Special School

REPORT BASED ON INFORMATION GIVEN BY: Mother, Teacher and Physiotherapist

3.18.1 This child has a severe spastic condition which has developed seriously producing a windblown hip condition, which will, if not adequately supported, almost certainly dislocate eventually. She has a wheelchair at school which she uses for most of the day, although whenever possible the physiotherapist places her on a floor mattress which allows her more freedom of movement.

The daily journeys to and from school present some of the greatest problems for this child, and those who care for her. She is transported from home to the bus stop in a wheelchair and is then transferred bodily into the bus. She is strapped into a seat by means of a pushchair harness which provides little support for the hour-long journey to school. Two attendants travel with the children to school but they are unable to constantly adjust her position, since there are some 30 other handicapped children also demanding their attention. No fixed support can be provided for her comfort since it is not always the same bus which picks her up.

It is unfortunate that if no solution can be found for this problem, it is likely that the child will have to be transported to school by ambulance, which, due to their varied commitments, are unreliable, or, at worst, she may no longer be able to travel daily to school, and a boarding situation would have to be found for her.

GENERAL DESIGN OBSERVATIONS:

3.18.2 This girl is an only child, which makes the need to go to school regularly, and in the manner of other children, even more critical. The journey by ambulance would isolate her and make her seem different from other children, who, although they are handicapped, travel in the bus without problems. This child's needs therefore are most definitely those of social integration.

The design of any fitting would not aim to improve her posture, but merely make her reasonably comfortable, and, most of all, safe on the journey. The solution should also take account of the great demand for attention the handicapped make on their carers, and therefore, it should be as efficient and easy to use as possible.

3.19.0 A collection of photographs taken during the surveys and case studies, which illustrate attempts to improve equipment for the handicapped through new products for mass production or "one offs" for individual problems.



The "stand up" wheelchair is designed to give chair-bound people the option of standing. This increases their personal freedom in an environment built to the requirements of middle aged, healthy male inhabitants.





Few opportunities exist for wheelchair-bound people to indulge in activities above shoulder height. Apart from the obvious personal and social freedoms that this solution provides, there are physical advantages too, since many body functions perform far more satisfactorily in the standing position.



Permobil of Sweden have developed this electrically-driven wheelchair for rough exterior use.

Its rugged design and appearance make it popular with those children whose handicaps often deny them the pleasures of rough play. Instead, they become 'desirable' members of any gang!.

The designer of this chair was disabled in a road accident. A keen motorist, he decided to develop a chair using a car seat. Here the designer and client are one and the same, and no mistakes are made as to the real needs.

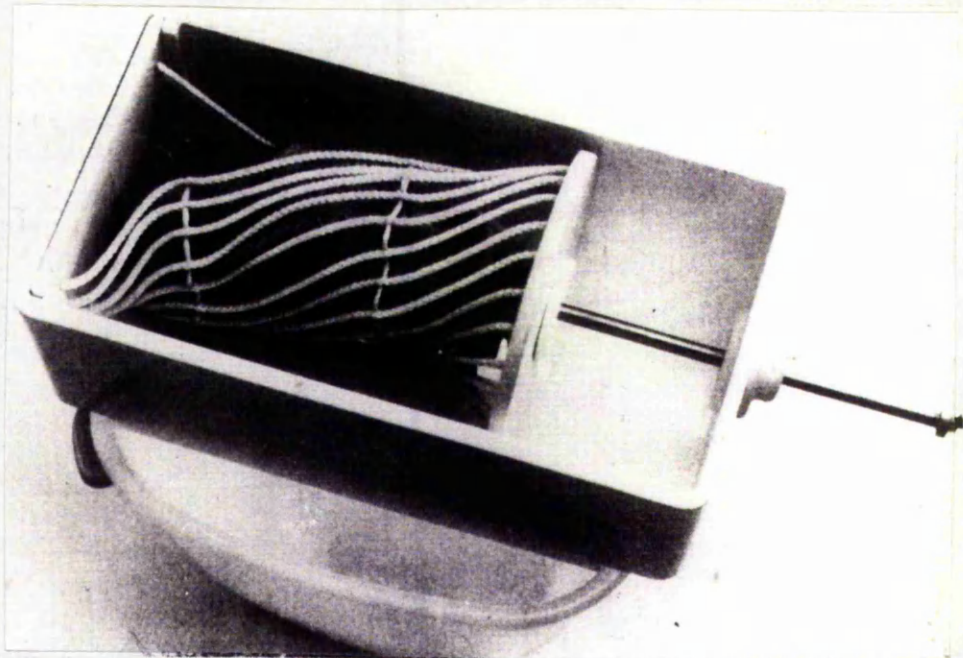


A fully adjustable frame provides this chair with a variety of uses. Developed in Germany it is used in schools throughout Scandinavia.





- Moving ramps, rather than escalators, in modern buildings can be used by both pedestrians and wheelchair users. They are also safer for mothers with prams, or when transporting wheeled shopping trolleys from one level to another.

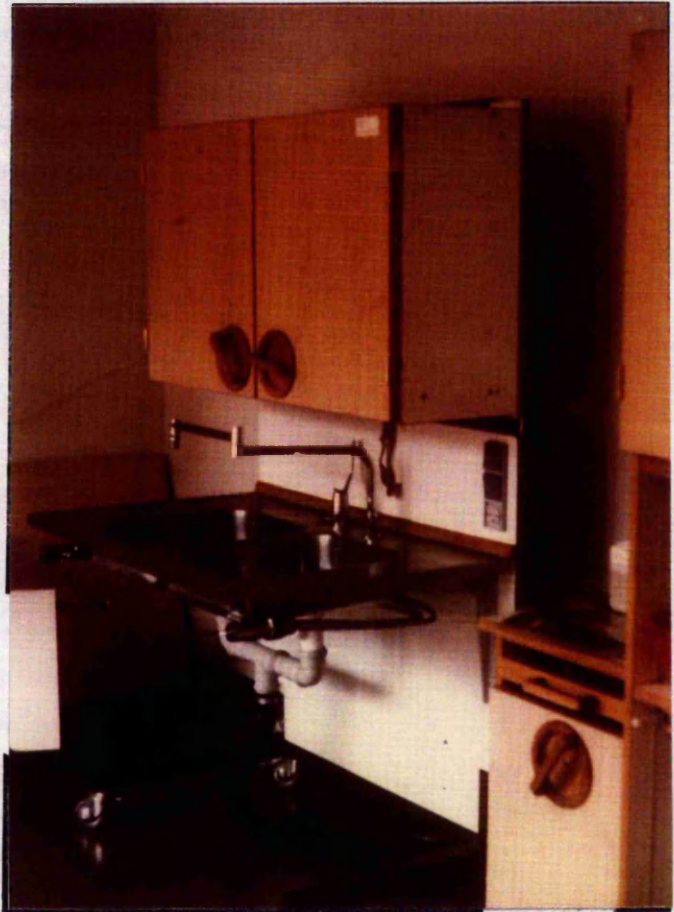


A device designed by an ergonomic -conscious designer in Stockholm to help people with badly reduced hand-grip to squeeze out dish cloths.

Kitchen units designed by
Palle Horn and produced by
Frederiksborg Køkkenet A/S
Hillerød Denmark.

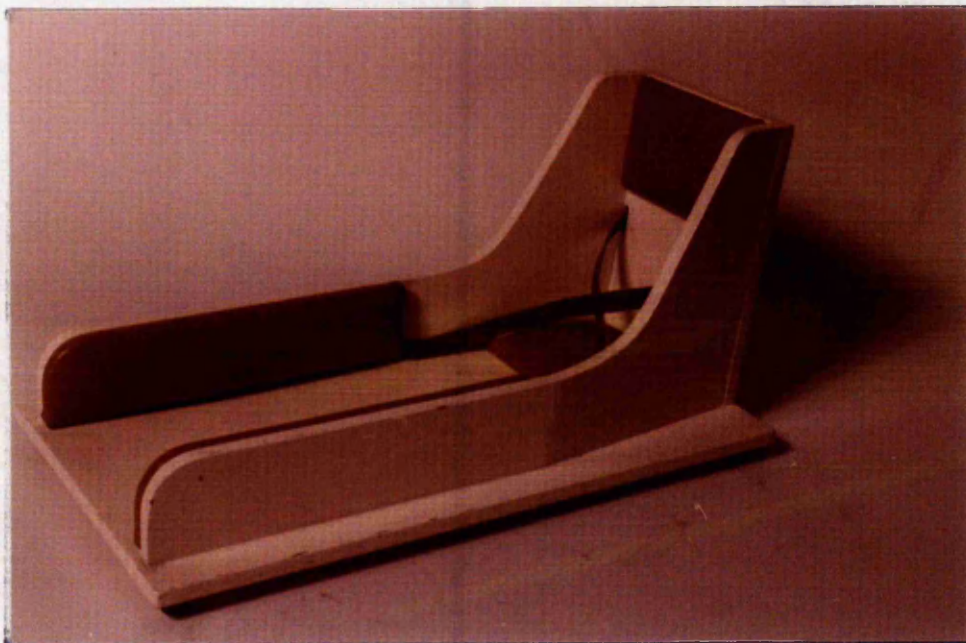
Fully manoeuvrable and
adjustable, they can be
easily adapted to suit a
change of user or layout.

The controls for water are
on the front edge of the
sink for safety, and the
water supply can be
directed to fill either
the right or the left-hand
sink, or fully extended
fill a bucket standing on
the floor.



The cupboard handles can be
turned through 360° until
an acceptable angle for
the user has been found.





Chair based on the SHASBAH trolley (see product report No 24 Appendix A). Designed for a paraplegic child and used with a low table. (See cast study report No 5).

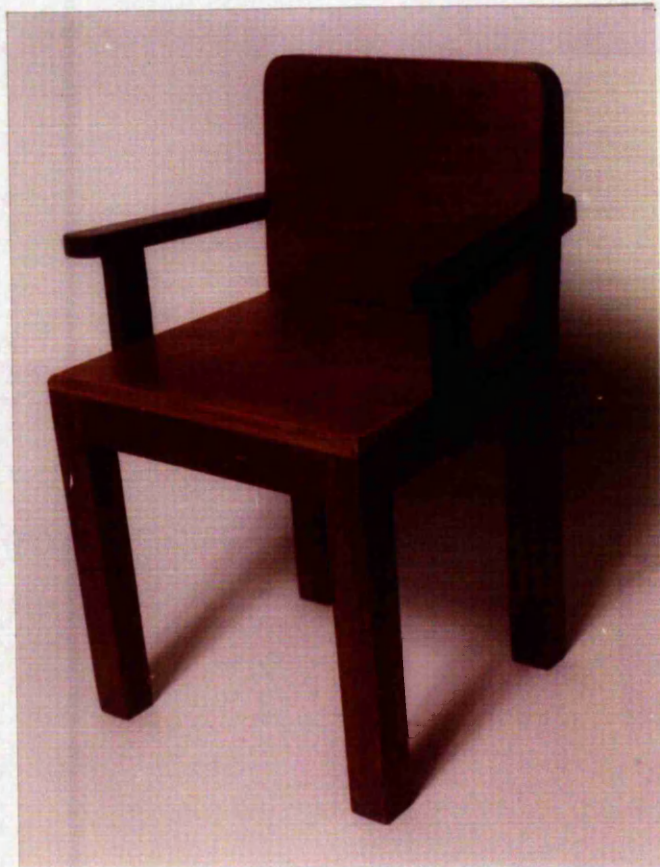


A desperate attempt to eliminate any association with hospital equipment.



Standard nursery chair modified with side supports. The shape of the sides are such that the child can sit securely without restriction to arm movements.

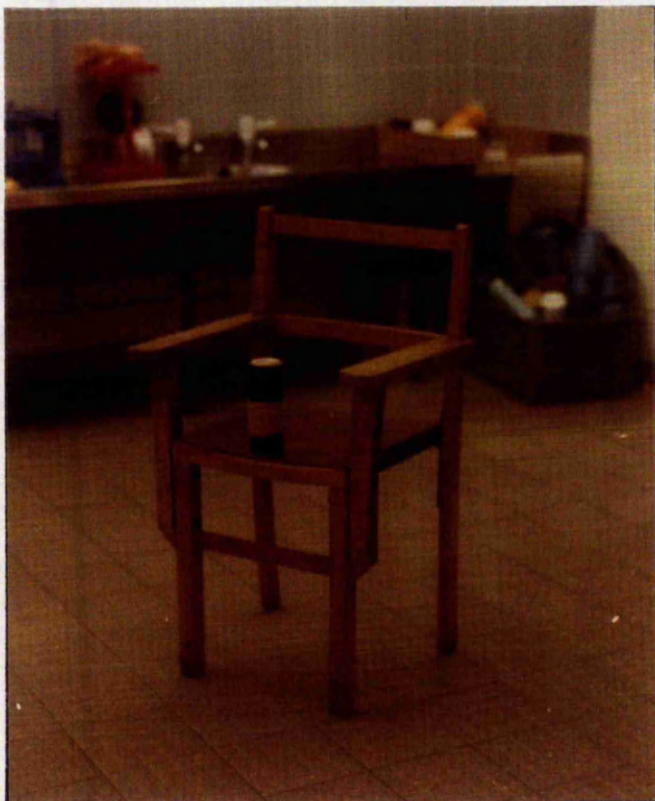
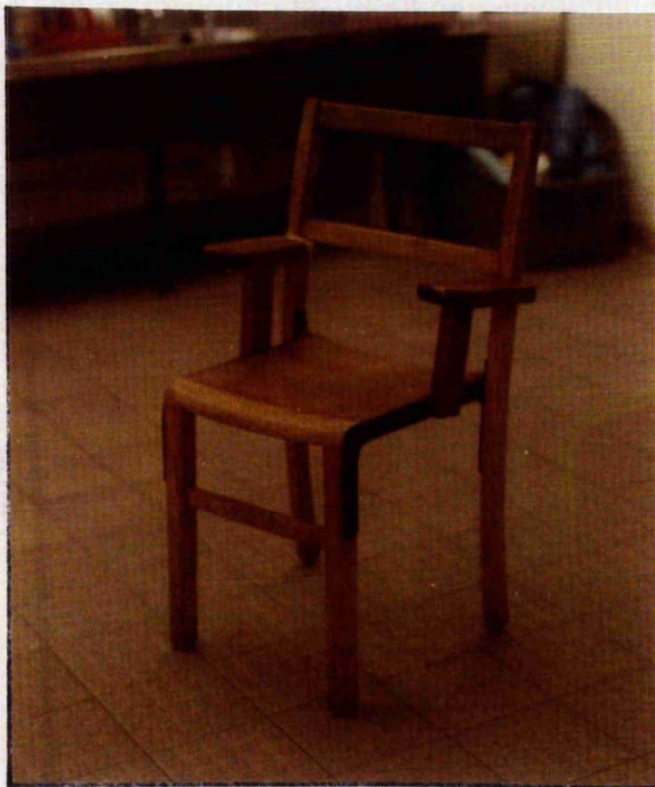
Narrow armchair with
full back support.



Armchair with groin-
straps fitted.



The addition of
D.I.Y. arms and
pommel to a
standard school
chair.



Adaptions to the
familiar school
chair provides
for extra support
when pottyng.



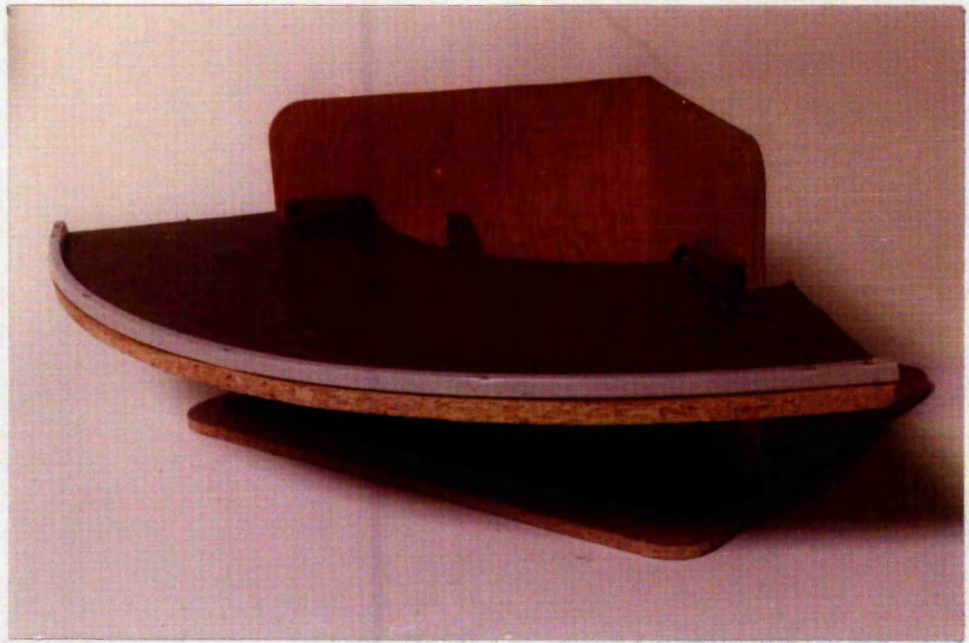


Further illustration showing the ease of adaptability of wooden furniture.

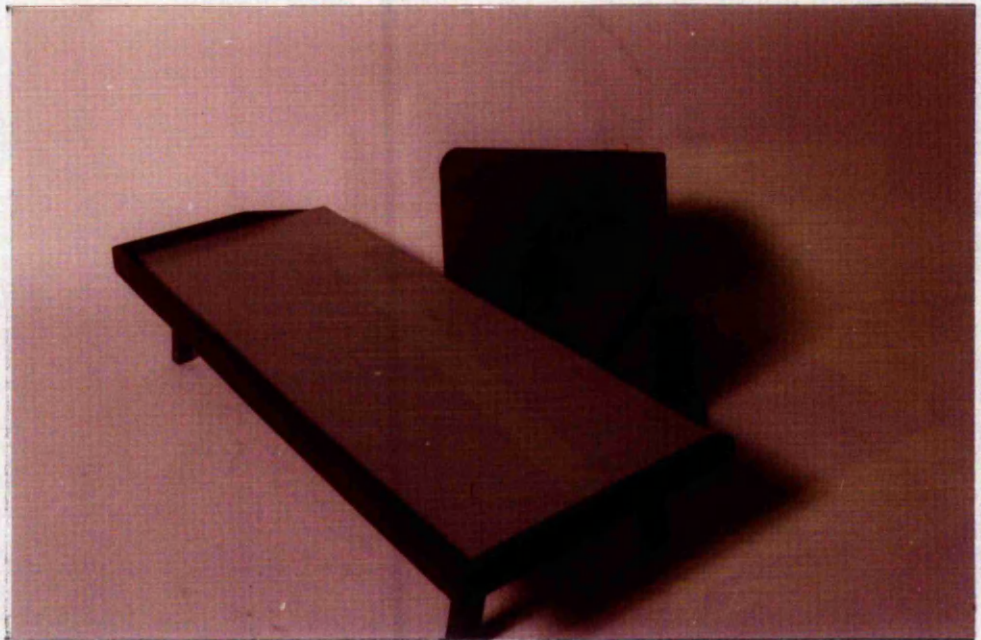
See Appendix A. 13.29.1



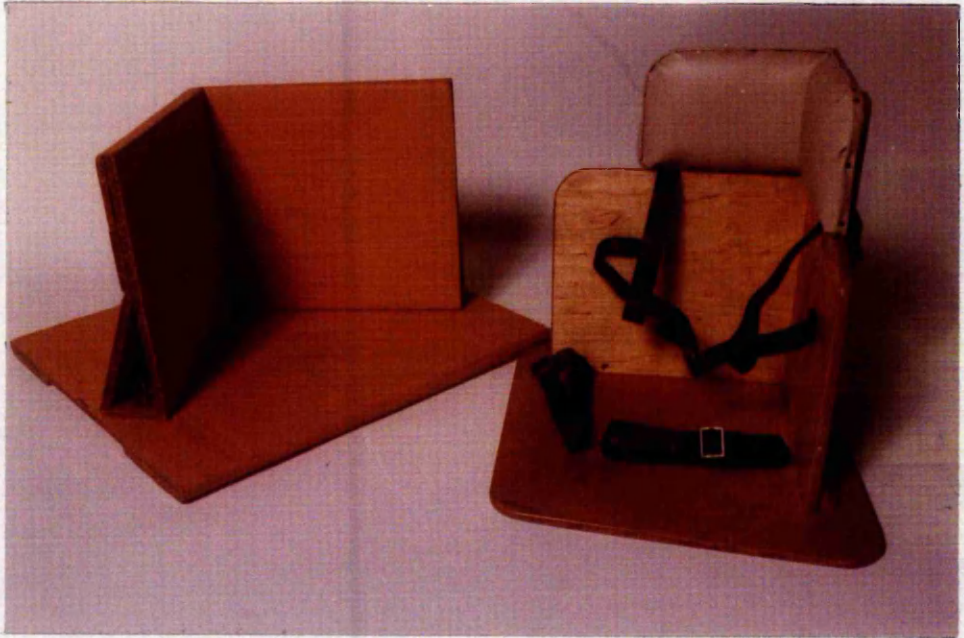
Standard corner seat, made from 12 mm plywood. The back is formed as a right angle fitted to a flat base. A wooden post is attached to the base to keep the children's legs apart. Straps are fitted as necessary.



Model with table attachment, providing the child with a play area matching his limits of reach.



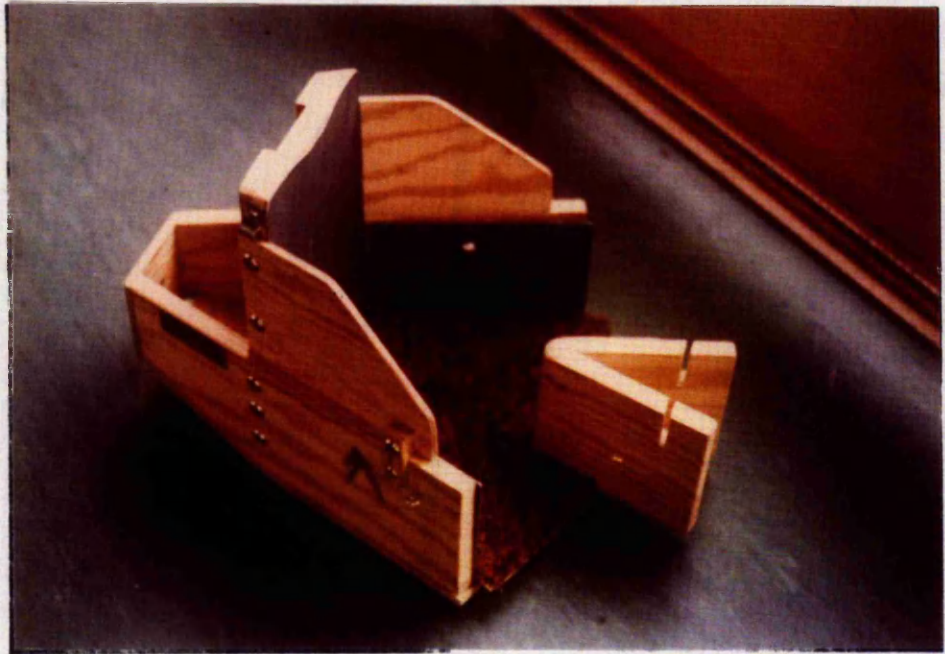
Free-standing table made to be used with a corner chair.



Prototype cardboard model, and additions to the standard chair, body harness, groin-straps and head support.



"Customised" corner seats.



A modified corner seat which can be fitted with a detachable tray and head support.

4.0.0 SURVEY CONCLUSIONS

The institution and individual case study investigations presented a broad cross-sectional, though by no means comprehensive or definitive, picture of the many people and situations concerned with the care of handicapped children. Eventhough these situations varied enormously, I was constantly impressed by the parents', teachers' and therapists' care and devotion.

4.1.0 Quality of Aids Available.

4.1.1 Unfortunately, the quality of this "grass roots" concern appeared in sharp contrast to the quality of aids available. The carers generally experienced enormous problems which knowledgeably-designed furniture could have radically alleviated. Their frustrations were further increased by a constant and often unsuccessful search for suitable aids.

I regret to report that this predicament was particularly noticeable in the UK, where I quickly concluded that little National policy had been formulated to provide the amount and variety of aids required. However, I was greatly encouraged by my experiences in Scandinavia and Holland, and I formed the opinion that sensitively-designed furniture could play a significant role in improving both the comfort and development of handicapped children, and the welfare of their carers.

4.1.2 After considerable analysis and discussion I concluded that the success of specifically-designed furniture for the handicapped child would depend upon the fulfillment of the following indispensable and interrelated needs.

4.2.0 Correct physical support.

4.2.1 The greatest area of concern was in the lack of suitable furniture which would correctly support the child whilst sitting. This is particularly critical because many of the childs learning and integrating opportunities are spent in the sitting position.

- 4.2.2 If insufficient postural support is provided at an early age, many children, with poor trunk and head control, degenerate rapidly into conditions of spinal deformity. With professional medical advice, therefore, suitable physical support plays a therapeutic role for younger children. Some cases, however, are so deteriorated that even the most controlled support can only succeed in preventing further degeneration. One of the most distressing effects suffered through poor posture is the child's inability to digest food easily, and many of the individual case studies highlighted this lack of correct physical support most vividly at meal times.
- 4.2.3 "The vital importance of the right kind of early therapeutic intervention was made abundantly clear".

The above is an extract from a report on a paper given by Mr David Scrutton, Chief Physiotherapist, Newcomen Centre, Guy's Hospital, London, at the London College of Furniture Seminar 1977 "Equipment for the Disabled".

- 4.3.0 Comfortable support.
- 4.3.1 Many handicapped children spend long periods of time sitting; much longer, in fact, than the normal individual. It is therefore important to ensure that any support is as comfortable as possible. This is particularly important to spastic children, because they react to physical discomfort with spontaneous and uncontrollable spasms, which disturb the learning process. They also cause distress in public and this often proves to be one of the barriers to social integration.
- 4.3.2 Uncomfortable support causes pressure sores which are extremely uncomfortable and may even require specialist medical attention.
- 4.3.3 Many parents respond to their child's discomfort by making additions to standard chairs, or in severe cases, by making completely new ones. These "last ditch" efforts illustrate the urgency of the situation.

4.4.0 Safety.

4.4.1 The handicapped child is often in the situation of having no control over his limbs, and consequently the stability requirements for his furniture are particularly critical. The stylistic notion of a three legged chair or stool is quite inappropriate. Three legs provide the most stable support for a static load, which the handicapped child is certainly not; indeed, he is constantly shifting, often quite violently.

4.4.2 Case study 3.16.3 illustrates the possibility of an injury that can happen when equipment has protruding mechanisms.

4.4.3 Strangely, the handicapped child is not only a danger to himself but also tends to keep company with other children he is least adapted to protect himself from. Therefore, the chair design must bear in mind not only the irregular treatment from within but also the probability of other handicapped but mobile children "driving without due care and attention". Please see case studies 3.9.2 and 2.2.1.

4.5.0 Care management.

4.5.1 The care of a handicapped child, either at home or in an institution, is both physically and mentally very demanding. It would be foolish to pretend that even the most superlative equipment could dispense with loving and sympathetic care. It became apparent to me that equipment for the handicapped child has two definite clients. The first obviously being the handicapped child himself, and the second, the person responsible for the care. Therefore, the equipment must be designed from the two users' points of view.

4.5.2 This situation is particularly apparent during meal and toileting times. In case study 3.1.1, the mother feeds her teenage daughter on her lap. This is particularly illuminating and highlights the carers waste of time, patience, and energy, which could be better spent in more positive playing and teaching activities.

Case study 3.11.1 emphasises the great demands made on parents, in particular is the final paragraph.

4.6.0 Visually acceptable support.

4.6.1 A design solution could quite easily fulfil the previous four conditions and yet remain completely ineffective. This is often due to a child's unwillingness to cooperate because of his intense dislike for the object. The individual studies depicted many cases where the usefulness of the equipment was considerably reduced because the child felt distaste for it.

Case study 3.6.1 vividly portrays an efficient and medically-desirable aid being severely restricted in use because of its unpleasant appearance.

4.6.2 In many cases the parents of the children are also offended by the visual aspects of equipment and are amazed by the lack of choice available. This is particularly apparent in the domestic situation as case study 3.7.1 described.

There is obviously a genuine case for hospital equipment whose sterility is essential in the ward, but this becomes incongruous in the home. It is in this out-of-context situation that the equipment's lack of humanity and personality looks intrusive.

4.6.3 There is a lingering stigma associated with the handicapped. People in Victorian times, used to lock handicapped children away. People, today, still associate wheelchairs with the stigma, but there is no direct link between the stigma and the dislike people have for the appearance of wheelchairs, ie that they look so mechanical and sterile.

4.7.0 Personal development.

4.7.1 It must be remembered at this stage that Cerebral Palsy does not necessarily imply mental retardation, or lack of intelligence. As

a result of the many problems of communication, it is often difficult to understand the mental ability of a spastic child. The learning process is often hampered by the child's discomfort and constant readjustment of posture. A large proportion of concentration and energy is channelled into merely remaining upright. Without correct support the pattern of concentration (never long in children) is being constantly disturbed by involuntary movement, and finally collapses completely.

This not only applies in the formal teaching situation, but in the child's general acquisition of physical skills. I found that, for the individual children studied, specific support systems had been made in order to channel their concentration into one part of the body in order to learn one specific activity.

- 4.7.2 Play activities are particularly successful in achieving coordination development. Many of the Scandinavian Institutions exploited this factor by providing suitable play equipment in waiting areas.
- 4.8.0 Reduction of isolation.
- 4.8.1 One of the most revealing insights into the life of a handicapped child concerned the amount of time spent waiting. Quite often the child has no personal freedom of movement, and could well spend long periods of time sitting on his own. In this situation, conversation with the non-handicapped is particularly difficult, since one is low down in a wheelchair, whilst passers-by are at standing-height. To go through life sitting down inevitably restricts many normally acceptable activities.
- 4.8.2 The limitations of personal mobility often demand that the handicapped person's facilities for specific jobs are designed to be close at hand. For example, the combined chair and tray unit gives the child short-term freedom to get on with the activity in hand without waiting for supervision. However, this independence can eventually lead to the child withdrawing completely from his immediate surroundings. In this case the equipment is providing the opportunity for busy but solitary, confinement. Therefore, equipment must acknowledge the need for other people's company and be designed accordingly.

4.8.3 Handicapped people can become isolated by a lack of social understanding. Social integration can only be genuinely achieved through willingness of society to accept handicapped people with equality and without patronisation. This is made more difficult as long as they are burdened with insensitively-designed aids which the world finds repulsive.

4.8.4 Fortunately, as the variety of designs generally increases, more products become suitable for both handicapped and non-handicapped people. These are beginning to play an important role in the reduction of stigma. Good examples are the bean bag chair, the "trip trap" chair, and the "major" and "minor baby-buggy".

4.8.5 It is hoped that more aids suitable for the social and domestic situation will become available, thereby reducing the tension that occurs for the handicapped in the outside world.

5.0.0. Introduction to new work based on the survey of Institutional Care and Individual Case Studies.

5.1.1. It was becoming increasingly apparent, that, if the study was to continue, furniture designed to analyse the requirements of Cerebral Palsied children would have to be developed and monitored in use.

5.1.2. To further our knowledge of the reactions which occur between the handicapped child, the carer and the furniture they use, it would be critical to monitor the furniture in use. Therefore several studies, both individual and institutional were investigated in greater depth. In all cases a detailed design brief was prepared based on information collected in the previous surveys and through meetings with all those most directly concerned with the welfare of each individual child.

Data recording techniques used included questionnaires prepared with parents, teachers and medical consultants, photography, and, wherever possible, video tape.

6.0.0 PROJECT : "FRAMEWORK"

Research and Design Development: Steve Walton (final year Furniture Design student, Trent Polytechnic), and Barry Wilson.

Research Location: "The Mount", Spastics Society Nursery School, Elm Bank, Nottingham and Therapy Department, Nottingham Childrens Hospital.

Professional Advisers: Heather Creadon, Headteacher at "The Mount".
Angela Kilbee, teacher at "The Mount"
Sally Huddleston, Senior Occupational Therapist, Nottingham Childrens Hospital.

Prototype Production: Colin Chapman, workshop technician, Furniture Design Section, Department of Three-dimensional Design, Trent Polytechnic, Nottingham.

Industrial Involvement: Sherwood Industries, Rainworth, Near Mansfield, Notts (developed Framework for commercial production).

- 6.1.1 Framework was initiated by the results of the institutional survey, and by exhaustive discussions held later with therapists and teachers. Eventhough the survey covered a wide range of handicaps, environments and equipment, support requirements of a primary nature were common to many of the situations.
- 6.1.2 I have listed below relevant extracts from the reports which epitomise the basic needs discussed in the previous conclusions.

Aspley Wood School, Nottingham 2.1.4

"Staff were aware of problems of isolation due to a lack of suitable equipment to cope with the range of handicaps, in the provision of facilities for integrated group work."

Broströmsgården, Gothenburg, Sweden 2.3.3

"The desire to give the children pleasant surroundings had meant denying them the joy and vigour of playing in the kitchen, in the potting shed or on the street corner."

" " Bracke Östergård, Gothenburg, Sweden 2.4.4

"Apparently, aids that could be easily dismantled or folded away were thought to be desirable."

Department of Handicap Research, Gothenburg University 2.6.3

"Emphasis was given to adjustability. For instance, kitchen work surfaces had to be raised or lowered to suit the user, and cupboards had to be within easy reach."

Geelsgård, Copenhagen, Denmark 2.8.5

"In the Physiotherapy Department special standing aids were to be seen which had also been made at the Detention Centre. These were of brightly painted plywood, and allowed children to be supported in a prone position while working at normal height tables."

Karolinska Sjukhuset, Stockholm 2.11.4

"Karolinska Sjukhuset provided me with a further example of a successful and bold attempt to reduce the inhuman proportions of old hospital buildings, and to create more civilised environments through the understanding of a child's relationship to his surroundings."

Kirkby-in-Ashfield Special School 2.11.3 and 2.11.5

"One of the schools' physiotherapists told me that, when the school was opened, most of the furniture in the nursery unit had to be removed, since the chairs provided were adult-size swivel/dining chairs which hopelessly mismatched the low tables."

"The schools facilities obviously show a willingness to improve the handicapped child's lot. However, it is tragic that this concern should eventually manifest itself in adult sophistication, rather than a genuine fulfillment of the basic design needs of the children."

Lowes Wong School, Southwell, Notts 2.15.2

"The main problem of this situation was to integrate the two handicapped children into a class of 30 as opposed to integrating a class of 30 with two handicapped children."

"Many of the activities were performed as a group around a table, and careful attention had to be paid to the organisation of this, so that further isolation was not felt."

"It would appear that at present there is little equipment available for use in schools by both handicapped and non-handicapped children. If it were available it would surely ease the difficulties of integration."

The Mount, Nottingham 2.16.3

"Eventhough the average daily attendance was only about ten children, the Mount had to cope with a very large range of handicap. The results of this were immediately noticeable on entering the premises since two large rooms were almost completely given over to the storage of aids and equipment in order to cope with the many and different needs of the children."

Nottingham Childrens Hospital 2.17.3

"Since there is little storage space, equipment remains in the rooms in which it is used. This causes difficulties to the staff when changing from one activity to another, and often results in delays which cause the children to lose interest."

Old Hall School, Walsall 2.18.3

"One of the initially striking features of this school, to me, was the amazing discrepancy between the quality of the building and the special equipment required by the children. The lack of suitable furniture available to the Local Authority was apparent."

"" " Rinnekoti Saatia, Finland 2.21.2

"The staff's attitude towards the children's development very much influenced the type and design of facilities available. The hospital shows considerable evidence that the child, the staff and the designer are in a developing liaison."

"The children are encouraged to learn a wide variety of physical co-ordination skills."

Sagåsen, Kallered, Sweden 2.22.2

"Each house is self contained, and is equipped with a small gymnasium and a workshop/hobbies room to encourage the children to be active after normal school hours."

The Swedish Institute for the Handicapped 2.23.4 - Ergonomic Knife-Design Project

"The final design is now in mass production and through thorough research, the designer has created an attractive desirable product suitable for all, from a brief which originally asked for an aid for only the handicapped."

Westdale Hospital, Nottingham 2.25.3 and 2.25.4

"The result is a jamboree of colour and interests, which conquers any impression of a struggling Health Service where the handicapped appear low on the list of priorities."

"Is it possible that there are areas of design decision making, where the Architect and Designer should be subordinate to the user?"

Westbrook School, Long Eaton 2.26.3

"Discussions with the staff illuminated an aspect of design requirements concerned with care management of which I had hitherto been unaware. Much equipment for the handicapped will be adapted, and if provision is not made for this in the initial design, it will be adapted pretty crudely, by a handyman whose expertise is mainly woodwork."

The Aids Centre, London 2.28.4, 2.28.5, 2.28.6, 2.28.7

Comments made by the Assistant Director:

"If you can design something which is especially for handicapped children, but can also be used by normal children, then this is an advantage for pure economic reasons, but has the added advantage of being similar to things other children use, which makes them feel better."

"Don't aim for one disability, better to design for one functional problem eg mobility, play, feeding."

"Often a pure adaptation job is all that is required to keep the child as near normal as possible."

"Must be marketable: charge the right price. Its wrong to think that because its for the handicapped then its got to be cheap. Its a business and should be treated as such, to guarantee quality and availability."

6.2.0 The design brief.

6.2.1 The key to any design solution to suit the above mentioned conditions is to provide basic and adaptable support.

6.2.2 At the Peto Institute, Budapest, Hungary a system of therapy has been formulated which includes a range of special equipment. The chair element from this range simply provides, on the one side seating support, whilst on the back a standing aid in the form of a vertical ladder.

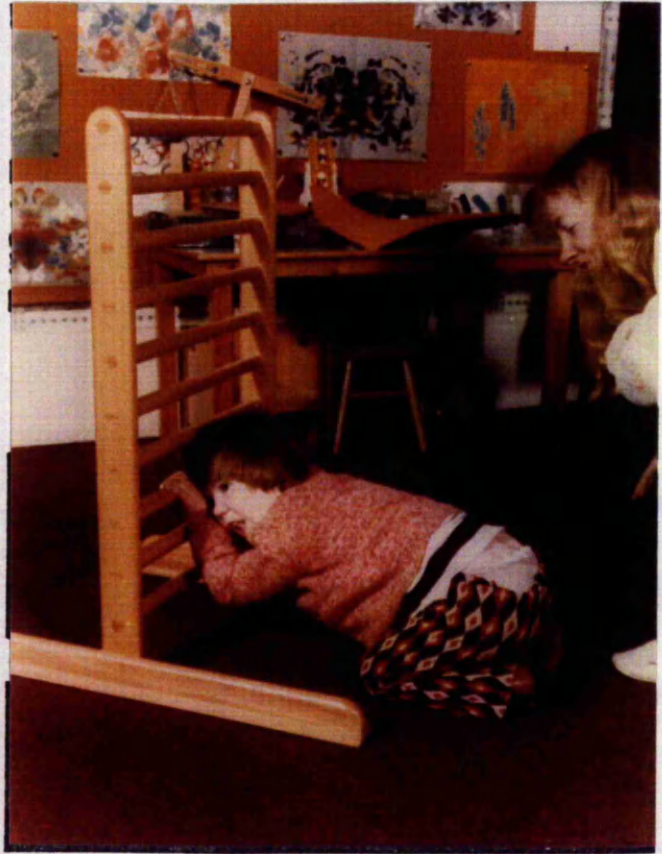
Physiotherapists frequently encourage children with poor standing ability to use wallbars in the gymnasium, and felt that a 'free standing' solution would allow this vital therapy to continue outside the gym. It seemed to me that this very basic and yet very effective concept could be developed to form one of the basic units to suit the design conditions.

- 6.2.3 Other units of the system such as chairs and prone boards could be designed to hook very simply over the rails. These initial proposals were discussed with therapists and teachers, who encouraged the production of prototypes for experiments in their institutions.
- 6.2.4 Preliminary design work began by establishing the desirable sizes for the unit, and after surveying a cross-section of children, the vertical unit was made 900 mm high. Mockups of rung diameters were also tested and although, of course, childrens' hand sizes varied, a diameter of 25 mm catered for most of the proposed range of nursery and primary age children.

Three components were built - the basic upright, a ladder and a seat platform and these were monitored in use.

- 6.2.5 The potential of "Framework" as it became named, was discussed at this stage, and with professional help a list of activities which could well be better performed with a more developed system, using the ladder units as a basis, was drawn up.

These developments are shown in the following photographs with captions describing their particular benefits.



The basic upright frame provides support in the vertical plane, not unlike wall bars found in physiotherapy departments and school gymnasiums.

Children attempting to stand for the first time use the evenly spaced rungs to pull themselves up from the floor, their uncoordinated movements being adequately supported by the particularly stable arrangement of the frame-structure.



Many handicapped children who are unable to maintain balance when sitting, are seriously delayed in potty-training.

The upright frame provides support in early toileting, and it is particularly useful in schools when a number of children are being 'pottied' at the same time, and staff-time is heavily committed.



- In schools where handicapped children are being integrated into non-handicapped classes many equipment problems remain unsolved (see survey report 2.15.1).

A child with poor standing balance can use the upright frame for support when involved in activities normally associated with the standing position. This eliminates the need to adapt standard equipment to suit the individual, and reduces the possibility of isolation in the classroom.



For children requiring total support when standing, a small range of additional fittings have been developed. These all clip onto the ladder rungs and comprise:

- a Upholstered pads in three sizes to provide comfort and adjustable support to the child's back.
- b An upholstered pommel for children who have difficulty in keeping their knees apart when standing.
- c Footrests which are adjustable for individual positioning of the feet in relation to the line of the body.
- d Safety harnesses which can be fitted as required and secured with 'Velcro' strip.

(Continued)



During trials, many of the children supported in this way were able to work, for the first time, in an upright position with complete freedom of arm movement, and at a height which allowed them to use standard equipment. The further addition of castors to the unit proved very successful with a number of children who rarely had the opportunity to stand alone, still less, to experience movement in this position, albeit with assistance.

(Continued)



One child found great pleasure in viewing the 'comings' and 'goings', in the school car park from his new vantage point, above the window cill.



A small detachable seat-platform provides adjustable seating positions for children with reasonable sitting balance, or for those attempting to achieve a degree of upper trunk control.

This fitting is also useful in its lowest position as a step for children who experience difficulties in orientating themselves to changes in level.



A small tub chair has been developed to fit onto the upright Framework unit based on information collected from both the individual case studies and the survey of existing equipment.

It was found that good support to the lower trunk encouraged children with floppy bodies to sit upright. The shape of this tub chair supports the lower back but does not restrict arm movement.



The chair can be used near to the floor, or raised to a standard working height, a feature particularly successful in the domestic environment, where parent/child activities can take place at normal working heights.

Although height adjustment is provided by the ladder rungs, no adjustment in width is available. However, three sizes of chair have been developed to overcome this problem to some degree.

When required, a standard "Mothercare"¹ harness can be fixed to the ladder rungs with the pram connectors supplied with the harness.



Staff at a number of institutions visited during the initial surveys, commented that a car seat can provide good all-round support for the young child with postural handicap particularly when feeding. These cannot normally be used anywhere other than the inside of a car.

The upright ladder unit forms an ideal support for a car seat, particularly the K L Jeeney model, which can be fitted to the Framework unit by means of a two-part support.

This is made to locate with the car restraint fixing points, which provide a flexible link between chair and frame. Feeding a young child in this way can be most effective. The carer has maximum control of the situation since the child and the food are at a convenient level. They are well-positioned for good eye contact and social interaction throughout the activity.



The seat can be adjusted to provide the more inclined angle required for feeding, and the lower-angle used for support during play at a normal table.

This is particularly useful in the Nursery School situation where a number of children share the same equipment. It offers opportunities for social integration, unlike chairs with attached trays which tend to isolate each child. See case study number 14, 3.14.2.



The second major element in the Framework system is the straight ladder unit. This is 1200 mm long and slightly narrower than the upright frame, enabling it to fit between the uprights on the latter.

Children can be supported in the prone position using the upright frame and ladder as shown. The pads, used as in the standing application, form frontal support in this case.

Quite small children can be supported at working heights in this way. It not only provides the child with an alternative to prolonged sitting, but for children with an asymmetric body line, provides the necessary full-length symmetrical support that they require.



The staff at Lowes Wong Infants School, Southwell (see survey report 2.15.1) initiated the use of the Framework elements as PE equipment for the two Spina Bifida children attending their school.

The ladder can be set on an incline which provides the child sitting beneath it with the challenge of lifting his body off the ground by grasping the ladder rungs. This exercise can be extended by encouraging the child to work his way forward as he lifts, and this becomes more difficult the higher he has to reach.

6.2.15



The addition of a plywood infill panel to the ladder changes it into a working surface, which is adjustable to suit sitting or standing activities.



6.2.16 Often in nursery and infant schools, large-scale play equipment is used indoors. It therefore has to be light and easy to assemble.

The following photographs illustrate how "Framework" can be used as "scaffolding" to support a number of play activities for children whose needs and abilities vary.

Conventional climbing frame assembly.





The climbing frame format quickly becomes a 'den', 'hospital' or 'shop'.



Attractive materials and toys can be hung from the ladder rungs to provide a canopy of colour and movement for a severely handicapped child.



A slide attachment was developed for the Framework system, and this can be fixed to the upright ladder unit. Non-handicapped children have no problems in climbing the vertical ladder to use the slide. Children with physical handicaps are helped by using the ladder unit to form a gradient between the floor and the top of the slide. This is a particularly stable structure and in the schools used for its evaluation, quite severely handicapped children were able, albeit with extreme effort, to pull themselves to the top, then to have their efforts rewarded by a fast exhilarating descent.

. (Continued)



This has proved to be a very successful addition to the system, and would, in many schools where integration is being attempted, provide a very simple facility for children of vastly differing abilities to share the thrills of rough play.

6.3.0 Results

6.3.1 Three sets of "Framework" were monitored in the following institutions:

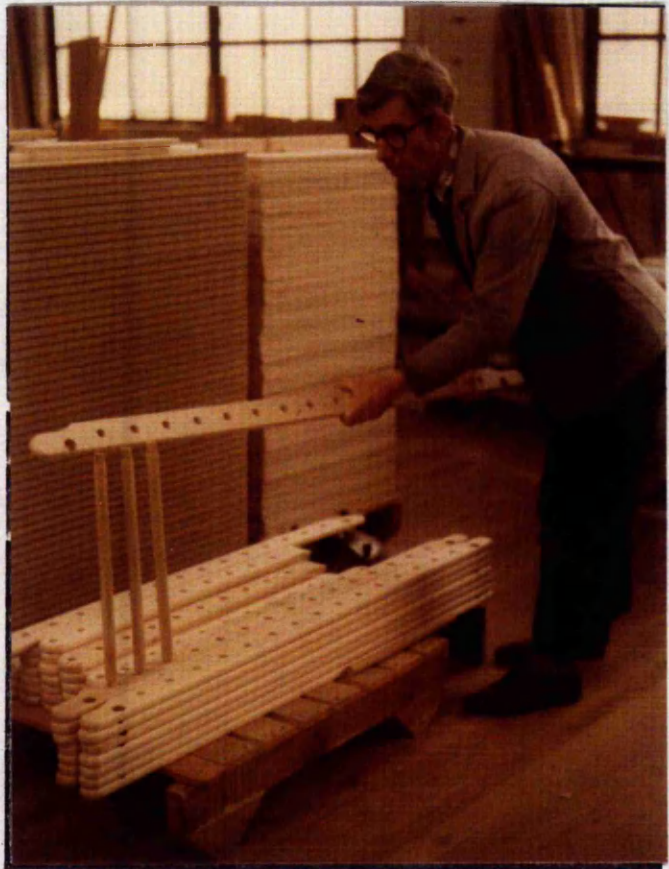
The Mount
Nottingham Childrens Hospital
Westdale Hospital
Old Hall School, Walsall
Lowes Wong School, Southwell
Park Hall School, Mansfield

The results were so encouraging that enquiries were soon received from these and other institutions regarding the purchase of "Framework".

Framework was brought to a larger audience at the International "Design for Need" exhibition held at the Royal College of Art, London in 1976. The interest shown in "Framework" has been such that it is now being produced commercially by Sherwood Industries, Nottingham.

6.3.2 Our ambition is to make Framework readily purchasable in a high street toy, or furniture shop, and it is being developed to cater for this domestic retail market as well as the initial instructional one.

6.3.3 It is hoped that eventually Framework will be used by both severely handicapped, mildly handicapped and non-handicapped children.



Framework in production
at Sherwood Industries,
Rainworth, nr Mansfield,
Nottinghamshire.



7.0.0 PROJECT : ADJUSTABLE FEEDING CHAIR

Research and Design Development: Stewart Waltham (final year Furniture Design student, Trent Polytechnic), and Barry Wilson.

Research Location: "The Mount" Spastics Society Nursery School, Elm Bank, Nottingham.

Education and Medical Advisers: Heather Creadon, Headteacher at "The Mount".
Angela Kilbee, teacher at "The Mount".
Sally Huddleston, Senior Occupational Therapist, Nottingham Children's Hospital.

Prototype Production: Stewart Waltham and Peter Rigley, workshop technician; Furniture Design Section, Department of Three-dimensional Design, Trent Polytechnic, Nottingham.

Industrial Involvement: Kelcoat Ltd, Nylon coating specialists, Barnsfield, Leek, Staffs, (nylon coating of the tubular frame).

7.1.1 When a car seat was used in conjunction with Framework, it proved a very successful support for some children at meal times. The staff of several institutions who had used Framework had considered that an adaptable "clip-on" seating support, to suit many and varied children, would be very useful for maintaining correct posture during feeding. Discussions with the staff formulated the following design requirements.

7.2.0 The Design Brief.

7.2.1 To design one postural support unit capable of being constantly adjusted to suit a wide variety of childrens' conditions.

7.2.2 The postural support should be comfortable for periods of up to one hour.

7.2.3 It must not isolate the child from his friends.

7.2.4 It must be capable of providing the child with enough freedom of movement in order that feeding skills can be acquired.

7.2.5 It must take little time to adjust when changing from one child to another.

7.2.6 It needs to be capable of being raised, or lowered, to suit the child, the carer, and the table used. One important requirement to be borne in mind is that it needs to be the correct height, so that the carer can spoon feed the child comfortably.

7.2.7 It must be desirable enough to encourage the child to want to use it.

7.2.8 It must cope with the distress of a child prone to spasms, in providing 'reassuring' support.

7.2.9 It must be easy to keep clean and maintain.

7.2.10 It must be easy to store and reasonably light to handle.

7.2.11 It must be suitable for economic quantity production.

7.3.0 Support Development

- 7.3.1 The design studies continued into a survey of the various methods of retaining a child in one particular position. Most methods used are based on a strap and harness technique. Discussions with therapists and teachers confirmed my belief that many of these were very time consuming to adjust, and offered little in the way of localised support.
- 7.3.2 It was obvious that another technique would have to be developed. Clues to this technique were found by watching the staff holding children at meal times. Their actions did not resemble those of restraining straps at all, but rather more, a combination of soft areas, the hands, applying gentle pressure where required.
- 7.3.3 A system of adjustable foam pads was designed for initial testing. This prototype was similar to the final solution, but originally had much larger pads. These proved too cumbersome, and in many cases restricted the child's movements. Alterations were constantly tried, until it was decided that the shape and size of pads shown were the most effective.
- 7.3.4 It was then necessary to construct a chair system capable of using the pads to their maximum potential. Since this chair was to be used by many children, the seat and back area had to provide good general support. It was evidently going to be unable to cater for severe cases of postural deformity. Indeed, of the children used for testing (and these were in the three to eight year old age group) few patterns of postural deterioration had, at that time, been detected.
- 7.3.5 Investigations showed that the "Baby Buggy", which had been designed for similar multi-user requirements, gave acceptable postural support for short term usage. The back and seat of this pushchair are slung on a light metal frame, and after testing proved acceptable for this application too.

7.4.0 Chair Construction

7.4.1 Attention was then paid to designing a system to combine the head pads, the torso pads, and the bottom and back support into a single chair.

7.4.2 The technical problem was to joint two pieces of light metal tube (the seat frame to the pad arms) in such a way as to enable them to be adjustable and to rotate through 360° . The final solution was inspired by the mechanical principles exploited on an adjustable guard on a routering machine, and an adjustable arm on a heat treatment lamp. Both of these fittings catered for a similar range of movements as that required by the chair pad attachments.

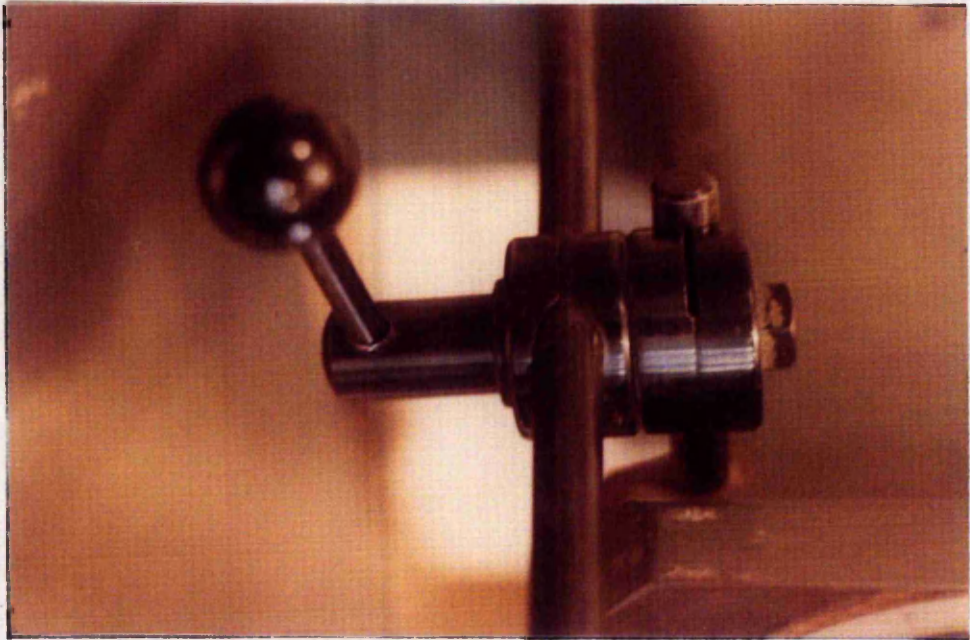
7.4.3 Brightly coloured canvas was chosen for the seat and back sling, and the arm pad covering. All of the covers are easily removable for washing.

7.4.4 The whole chair was designed to clip onto the basic upright framework element with heavy duty nylon hooks as used on other elements designed for use with the Framework system.

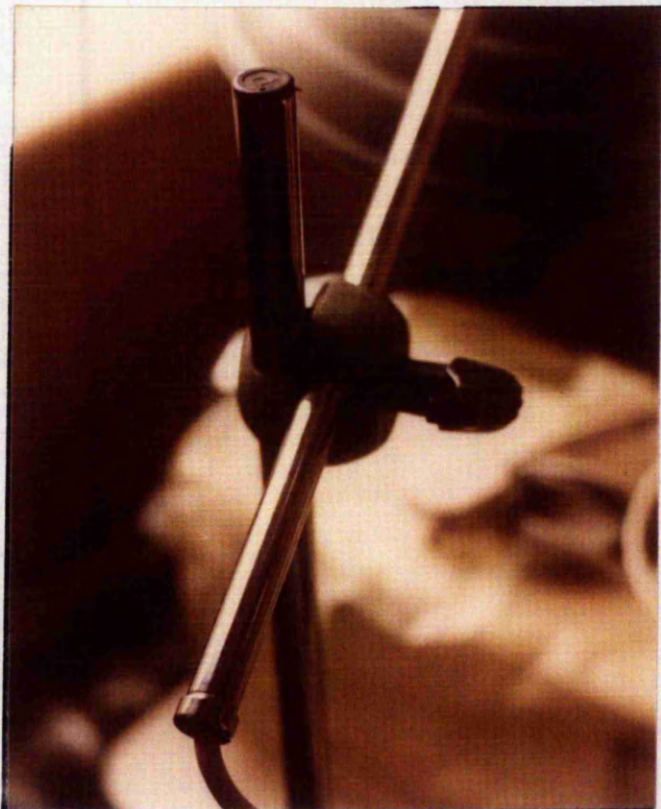
7.5.0 Design Evaluation

7.5.1 The chair has been used in feeding situations at two different institutions, and in both cases the staff commented on how easy it was to adjust the chair for different children. No mechanical teething problems have as yet been reported.

7.5.2 However, it has been suggested that the pad system could be developed to include support for the feet and legs. Physiotherapists considered that with this comprehensive, localised pressure technique, they could use the chair as a piece of positive postural improvement equipment.



The adjustment mechanism for a machine-guard above, and a heat treatment lamp below, provide a similar range of movements to those required by the chair pad attachments.





The completed chair, shown fixed to the upright "Framework" unit.

The chair in use.

Children with individual sitting requirements can be comfortably supported and restrained with the adjustable pads. It is not anticipated that children will spend long periods supported in this way: its use is more likely at times when an inability to maintain a desired posture seriously disrupts a particular activity,



7.5.3 It was also being successfully used in the period immediately after feeding to keep very floppy children in an upright position to aid their digestion.

7.6.0 Development Potential

7.6.1 This chair is now being used in the Nottingham Childrens Hospital, and it has attracted considerable interest by equipment manufacturers and representatives from the Spastics Society.

It is hoped that since Framework is in the process of being manufactured commercially, the feeding chair will also become available to supplement the range. This development is still in the early stages of discussions with various agencies for the handicapped, and industry.

8.0.0 PROJECT : "A CHAIR FOR CHARLOTTE"

(Case study No 8 in Section 3.0.0)

Research and Design Development: Barry Wilson

Research Location: "The Mount", Spastics Society
Nursery School, Elm Bank,
Nottingham and at Charlotte's home.

Advisers on Personal Care: Angela Kilbee, Charlotte's teacher.
Charlotte's mother.
Rose Dawson, Superintendent
Physiotherapist, Nottingham
Children's Hospital.

Prototype Production: Tony Kellett, Senior workshop
technician, Furniture Design Section,
Department of Three-dimensional
Design, Trent Polytechnic, Nottingham.

Industrial Involvement: Bowater Scott Paper Group, Disley,
Cheshire (supplied cardboard
cylinders).

- 8.1.1 Charlotte's teacher was concerned about the lack of progress that she was making. It was felt that she was in no way developing her true potential. At that time Charlotte was using a tub chair which was successful in providing the correct trunk support although it allowed her head to droop so far forward that she was unable to right herself. The teacher felt that these constant physical disturbances were seriously inhibiting Charlotte's learning.
- 8.1.2 I was requested by the teacher to investigate the situation. The discussions which followed strongly suggested that the semi circular profile of the tub chair could be a basis for the postural support required.
- 8.1.3 The design therefore developed as a tall circular tube, open at the front, which allowed Charlotte freedom of movement.
- 8.2.0 Prototype Development.
- 8.2.1 The construction of the tube presented intriguing problems. Plastic and metals would have been expensive, hard to obtain, and difficult to work. Laminated timber would have been easier to work but again would have been extraordinarily expensive, and probably far too heavy for the required use.
- 8.2.2 Finally, cardboard was chosen as the ideal material. The cardboard can be bought in the required circular drum form, since they are used as storage containers in many industries.
- 8.2.3 They are relatively cheap, indeed, Bowater Scott gave us a sample of the drums to work with.
- 8.2.4 A 300 mm diameter drum was selected, and by placing Charlotte inside the cylinder, the profiles were drawn and cut out with a "Stanley" knife. This was a very simple process and enabled us to make several alterations until we arrived at the optimum shape of cut-out which gave Charlotte sufficient support and maximum freedom of movement.

8.2.5 An upholstered seat was placed in the base of the drum and the cylinder was lined with a skin of foam and covered with vibrant red and yellow "ski suit" fabric. A safety strap, in the same fabric, was also fitted.

8.3.0 Mobility Opportunities.

8.3.1 The therapists were delighted with Charlotte's reaction to the chair. Apart from her obvious pleasure with its bright lively appearance, she was now able to maintain a good symmetrical posture for longer periods, and even when her concentration gave way, the wings of the chair prevented her head from drooping uncomfortably. At this stage of prototyping the possibilities of extending the chairs usefulness by the provision of wheels in the base was discussed. It was hoped that Charlotte would be able to propel herself over small distances by pushing her feet against the floor.

8.3.2 However, when this was tried, she was unable to co-ordinate her legs correctly, both feet turned outwards and her knees were pressed together. This was medically undesirable.

8.3.3 To counteract this phenomenon, and to ensure that her feet were placed flatly on the floor, a second prototype seat with a large central upholstered panel was developed. This proved successful since it forced her knees apart, and maintained her legs and feet in a position that would not hinder walking attempts in later stages of development.

8.3.4 The chair is much smaller than the conventional wheelchair, and is therefore much more suitable for use in confined indoor spaces. A rubber bumper - a cycle type - fitted around the base of the tube also reduced damage to furniture, decorations and other people's shin bones.

8.4.0 Design Evaluations.

8.4.1 This small self-propelled facility provided Charlotte, for the first time, with some manner of independence and choice. She particularly found this beneficial at home, where she was surrounded by five other, reasonably strong willed, children.

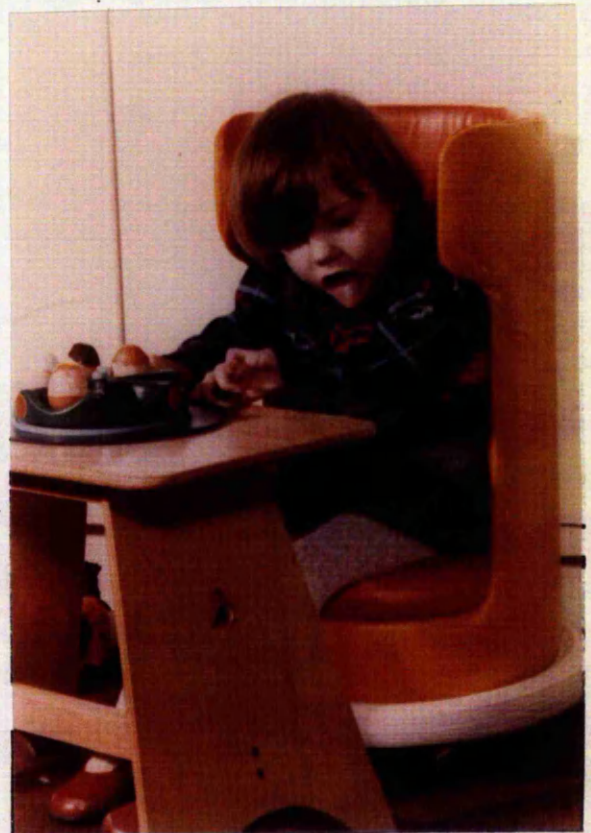


The final solution, with the revised seat design showing clearly the raised front which enabled Charlotte to position her feet correctly on the floor.

The 'winged' form of the chair provides Charlotte with sufficient head-support to maintain a reasonable posture without drastically restricting her freedom of movement.



Working and playing at standard-height nursery tables presented few problems apart from her tendency to push herself away from the table. However, as with other mobile chairs also used in static situations, a restraining hook seemed to be a solution to this problem, although Charlotte was always positioned near to a wall at these times.



- 8.4.2 At the time that this chair was initiated, Charlotte was too young to use a wheelchair, and physically unable to crawl. The chair therefore filled an intermediate gap in Charlotte's development which gave her the taste of independence and upon which therapists may well encourage her to walk.
- 8.4.3 The notion of creating objects which look lively and exciting for the handicapped produced interesting results. Charlotte's youngest brother was so taken with the chair, that he considered himself rather left out, and would regularly steal a 'quick go' in it. It would be interesting to discover how many times one of the botched or badly adapted chairs, or even a standard wheelchair, had caused envy and a fight for 'the next turn'. My observations of handicapped children at home lead me to believe that they have little their non-handicapped brothers and sisters would regard desirable.
- 8.4.4 If this policy of producing attractive aids was more widespread, social integration and the reduction of embarrassment for the handicapped child would surely improve, if only in the school playground.

9.0.0 PROJECT : "A CHAIR FOR ALISON"

(Case study No 1 in Section 3.0.0)

Research and Design Development: Barry Wilson

Research Location:

Therapy Department, Nottingham Children's Hospital, and at Alison's home.

Advisers on Personal Care:

Rose Dawson, Superintendent Physiotherapist, Nottingham Children's Hospital.
Alison's parents.

Prototype Production:

Tony Girdlestone, Technician, Furniture Design Section, Department of Three-dimensional Design, Trent Polytechnic, Nottingham.

Industrial Involvement:

Peninsular Products, Sheffield (manufactured tubular steel underframe).

9.1.1 Alison's mother was still feeding her daughter on her lap.

9.1.2 Ten years ago this would have been acceptable. However, the child is now a thirteen year old, and obviously, from the physical point of view, nursing whilst feeding somebody of this size is extremely tiring. This case highlights the care maintenance problems faced by a mother of a teenage spastic child, as opposed to a toddler.

It would be hoped that, by the age of thirteen, a change in relationship, as with any other parent and child, would have developed. However, in this case the lack of suitable equipment, and perhaps too much tender caring, had never obliged the child to sit in her own chair and attempt to feed herself.

At thirteen years old, her case had become critical.

9.2.0 Design Requirements.

9.2.1 The physiotherapist considered that a fully controlled, and comprehensive body support was required. This would maintain Alison in the correct position, which would enable her digestive system to work reasonably well.

9.2.2 A very close support would also provide psychological security, by imitating the support provided by her mother's lap.

9.3.0 Body Support Production.

9.3.1 Several techniques were discussed concerning a method of moulding such a support. Eventually a vacuum casting method, based on similar work, being developed on the Continent and in the United Kingdom, was used.

9.3.2 Detailed descriptions of these developments are presented in Appendix B.

9.3.3 Alison's close body mould shell was produced in the following way:

Alison was supported in a position recommended by the occupational therapist.

9.3.4 She was seated on a polythene bag approximately 900 mm x 1500 mm, half filled with polystyrene granules. A vacuum pump was connected to the bag and the air was slowly evacuated, during which time constant checks were made to ensure that the bag was conforming to Alison's shape correctly.

When maximum vacuum had been achieved, the granules became 'frozen' into a rigid shape formed by Alison's body.

9.3.5 When a satisfactory impression had been made, Alison was removed from the bag and a plaster bandage 'lay-up' was prepared inside the cast shape. When this had completely dried, after approximately one hour, it was removed by releasing the vacuum in the polystyrene filled bag.

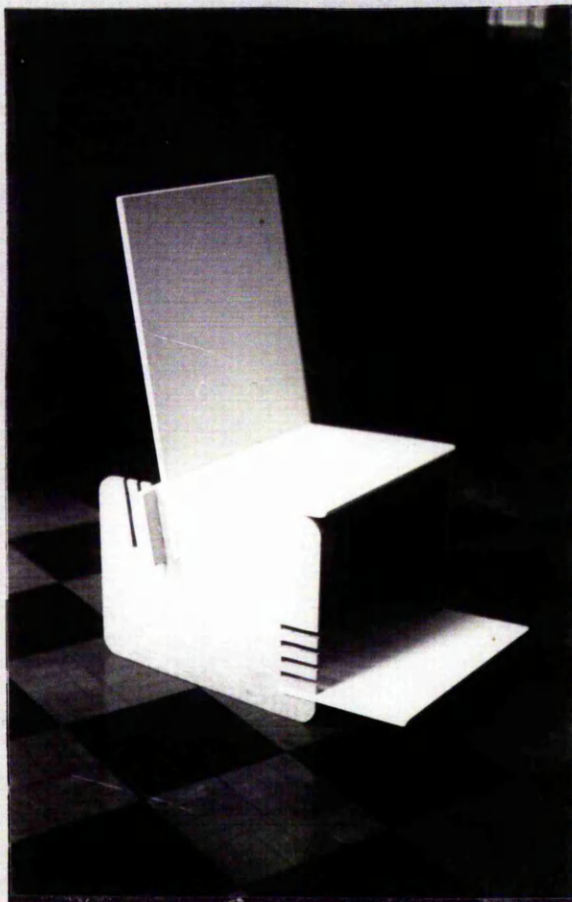
9.3.6 The resultant plaster bandage moulding was covered on the outside with a 25 mm layer of polyether foam which increased its overall size for final padding.

9.3.7 A second plaster bandage cast was taken from the outside of the first, and was used as the negative shape for a positive plaster plug.

9.3.8 Fibre glass matting and polyester resin was applied to the plaster plug, to a thickness of approximately 6 mm.

9.3.9 This fibre glass shell was then tested for correct fit, and a loose 25 mm layer of polyether foam was laid in the shell to represent the final upholstery padding. Alison found it to be a perfect fit and no corrections were necessary.

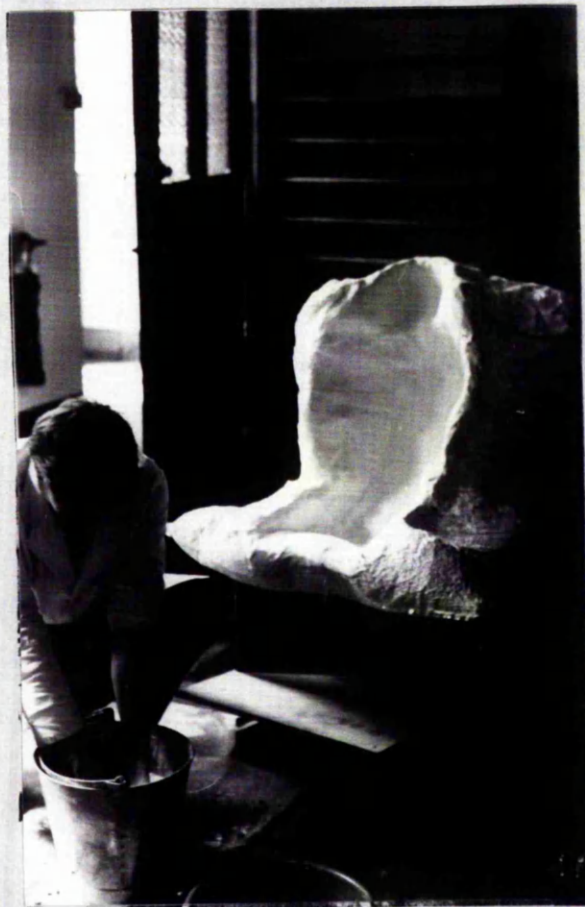
An adjustable platform
was built to support the
granule bag in a normal
sitting position.



The bag in place,
connected to the vacuum
pump, which can be seen
in the right hand corner
of the photograph.



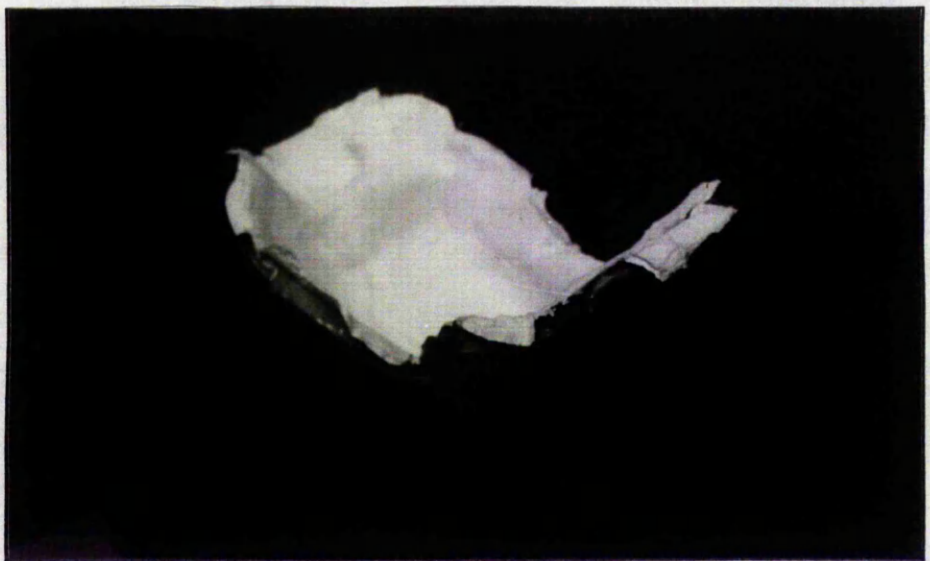
The air-evacuated bag showing Alison's body-form accurately 'frozen'. A thin plaster bandage 'lay-up' is prepared.



After drying, the plaster bandage cast was released from the bag by releasing the vacuum.



The resultant plaster bandage cast of approximately 5 mm thickness is surprisingly rigid.



A 25 mm layer of polyether foam is applied to the reverse side of the cast from which a second, larger plaster bandage cast can be taken.

9.3.10 To determine the correct height and inclination of the shell from the floor, a temporary wooden support was made and adjusted until Alison was sitting with both feet on the floor and in a position recommended by the therapist. The shell was then tailored to its final shape and the foam lining was fixed in place with adhesive.

Having produced the close body moulded shell, other factors had to be considered in the further development of the chair.

9.4.0 Chair Development.

9.4.1 These factors were concerned with successful care-management, and social integration. The chair needed to be easily transportable to allow Alison to 'eat out' with friends and relations.

9.4.2 A light, mild steel tube underframe was designed to fold over the chair to make a compact form; small enough to fit in the boot of a family car. This frame was produced by Peninsular Products of Sheffield, who specialise in tubular steel furniture, and was based on their standard production techniques.

9.4.3 A bonus advantage of the tubular underframe was its use as skid, which allowed Alison's mother to move the chair around a carpeted room, whilst Alison remained seated.

9.4.4 The initial prototype was offered to Alison without the front body support pad, as shown in the photograph. However, she appeared uneasy. It may well have been that she was missing her mother's reassuring left arm, which had previously given her that front support whilst sitting on her knee. The therapists were of the opinion that even without the pad, Alison was quite safe, and that the need was probably psychological.

Alison certainly relaxed immediately a wide softly upholstered pad was gently placed across her chest.

9.4.5 Despite the overall success of the support, feeding could still be rather messy, and if no provision was made for keeping the cover clean, the chair would quickly become soiled. To cope with this requirement, the chair was upholstered with a removable tailored cover, and after a year's use, it is still in reasonable order.

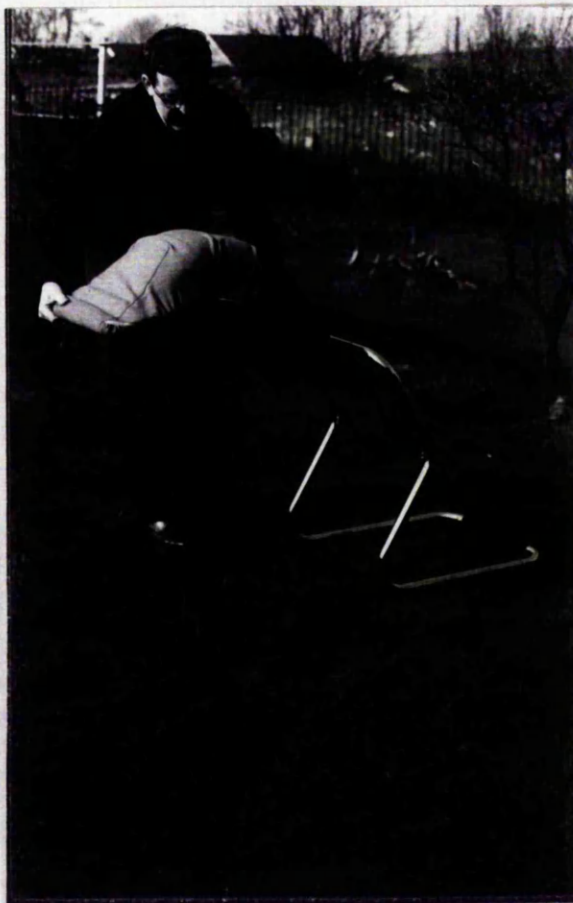
The solid plaster
'plug' from which the
GRP shell was produced.



In its tubular steel
frame the GRP shell was
fitted with removable
covers for ease of
cleaning.



For transportation, the shell can be folded inside its supporting frame. This reduces the overall volume of the unit allowing it to fit into the boot of the family car.





Alison in her "made
to measure" chair.



9.4.6 The provision of this cover also enabled her mother to choose a fabric which suited her furniture and decorations. This may seem only a small point, but it proved to be just one less barrier between Alison and visitors to the house.

9.5.0 Design Evaluation.

9.5.1 After several weeks use, Alison's mother raised the point that the fold-away mechanism could well be exploited to provide different seating angles suitable for different situations. Indeed, she had found it necessary to slightly increase the seating angle when feeding Alison to ensure that her head was correctly supported. She did this by adjusting the retaining bar at the back of the chair.

9.5.2 Alison has been using the chair for a year, and its success has been considerable. She now sits at the table, and is fed by her mother at family meal times. She is no longer distressed at meal times, and her digestion has improved.

9.5.3 The family's social life is much more pleasant. Alison can now go visiting and be sure of a comfortable chair. Her mother is considerably less tired and is able to enjoy life more.

9.5.4 Basic caring activities still leave her mother with enough time, energy and love to begin teaching Alison how to feed herself. This is an extremely long and arduous task, and would have been unthinkable a year ago.

10.0.0 PROJECT : "A CHAIR FOR NICKY"

(Case study No 7 in Section 3.0.0)

Research and Design Development: Barry Wilson

Research Location:

Therapy Department, Nottingham
Children's Hospital, and at
Nicky's home.

Advisers on Personal Care:

Rose Dawson, Superintendent Physio-
therapist, Nottingham Children's
Hospital.
Nicky's parents.

Prototype Production:

Tony Kellett, Senior technician,
Furniture Design Section, Depart-
ment of Three-dimensional Design,
Trent Polytechnic, Nottingham.

Industrial Involvement:

Hunting Industrial Plastics,
Wymeswold, Leics (manufactured
GRP shell).

- 10.1.1 The initial contact was made directly with me, as a result of a newspaper article which featured the work on Alison's chair. I discussed the case with Nicky's physiotherapist, and she confirmed that Nicky's physical situation was acute and that the body moulding process, used so successfully with Alison, could be applicable to Nicky.
- 10.1.2 Unlike Alison, Nicky would require a support chair that he would use all through the day. He is now too old for school, and since his parents do not wish him to go into care, he is at home every day.
- 10.1.3 At present, he spends most of this time "sitting" on the settee propped up with cushions. Unfortunately, these are neither firm, nor stable enough to support him for any reasonable length of time, Acute discomfort develops. As with many Cerebral Palsied cases, the discomfort eventually leads to spasms. In Nicky's case they are extensor spasms, which cause him to arch his back which shifts the cushions even further apart until he finally slides onto the floor. This state of affairs demands regular supervision, and indeed Nicky often falls on the floor to deliberately gain attention.
- 10.1.4 The settee and cushion solution also severely restricted Nicky's choice of things to look at. He is particularly fond of looking out of the picture window as there is a pleasant woodland outside. He also liked to watch a large illuminated tropical fish tank, the television and a record player, particularly when the records are going round. Changing his view is a major operation.
- 10.1.5 One successful activity which developed from the settee and cushion solution is that his nephew and niece could sit on either side of him. The cushions do not isolate him as many other pieces of postural support equipment appear to do. Having said that, only small children, such as his nephew and niece, who can dodge the spasms, are able to use the settee simultaneously with Nicky.
- 10.1.6 Breathing problems - as Nicky moves lower in his seat, his head is forced forward and breathing becomes more restricted, which builds up fluid on his chest. This causes him great discomfort.

10.2.0 Design Requirements

I spent considerable time with Nicky and his family at home, and formulated the following design requirements:

- 10.2.1 The chair must provide medically correct postural support, which will stop his further physical deterioration, and improve his breathing.
- 10.2.2 The chair must provide comfortable support to ensure that Nicky can use the chair for long enough periods to gain the medical advantages.
- 10.2.3 The chair must be safe, and remain stable, even when subjected to one of Nicky's violent spasms.
- 10.2.4 The whole chair must be easily moved by an adult, even when Nicky is sitting in it.
- 10.2.5 The chair must not be movable by Nicky. His uncontrollable leg movements could easily cause a chair on standard castors to collide with any one of the more fragile objects in the room.
- 10.2.6 Nicky must be able to swivel the chair, so that he can look in all directions.
- 10.2.7 The chair must not isolate him from the family, especially his nephew and niece whose company he enjoys so much.
- 10.2.8 His mother must be able to roll Nicky sideways, out of the chair and on to her lap to change him.
- 10.2.9 The chair must blend into the domestic environment. It must be a chair, first and foremost, rather than a hospital aid.

10.3.0 Body Support Production

- 10.3.1 Further research and clarification of the design brief endorsed our initial opinions that Nicky's physical condition required a close body moulded support.

The moulded support was produced in almost the same way as the one for Alison. However, it was decided to try to reduce some of the intermediate moulding processes in order to arrive at the final shell more quickly.

- 10.3.2 At the initial casting stage, a quilted blanket was prepared and laid over the polystyrene filled bag, prior to Nicky sitting on it. This was done to increase the shell size to allow for final upholstery. It therefore became unnecessary to take a second larger cast from the original, as in the case of Alison's support. This initial moulding stage was supervised by a physiotherapist to ensure that the posture adopted was medically correct, and comfortable enough for Nicky to use over long periods of time.
- 10.3.3 At this time, information published about Alison's chair had prompted Hunting Industrial Plastics, of Wymswold, near Loughborough, to contact me with a view to producing future close body moulded shells, in their factory. They already manufactured glass-fibre components for the motor, building and aircraft industries. It was agreed that they would make the glass fibre shell for Nicky's chair using the initial plaster bandage cast as a mould.
- 10.3.4 The resulting GRP shell was most satisfactory, even though it had been produced from the first plaster bandage 'lay-up' done by the physiotherapist and myself at Nottingham Children's Hospital.
- 10.3.5 The shell was then taken to Nicky's home where it was strapped to an easy-chair for Nicky to try over a period of a few days. He appeared to miss the volume of cushions that he had been used to on either side of him. The contours around the lumbar area also proved uncomfortable. This was adjusted with extra padding and when retried, appeared to be acceptable to Nicky.

10.3.6 The realisation that Nicky needed the actual reassurance of stability on either side of his body, inter-related with two factors mentioned previously. These were that the chair must provide for his nephew and niece to sit close to him, 10.2.7, and for his mother to roll him out of the chair 10.2.8. It was possible that Nicky's emotional need could be exploited in the design in a manner which would cater for the other two factors. A combination of these requirements resulted in a reasonably low, and wide, upholstered surround to be incorporated into the shell. This modified design was again tested and proved to be to Nicky's liking.

The shell now conformed to the factors 10.2.1, and 10.2.2 stated in the design brief.

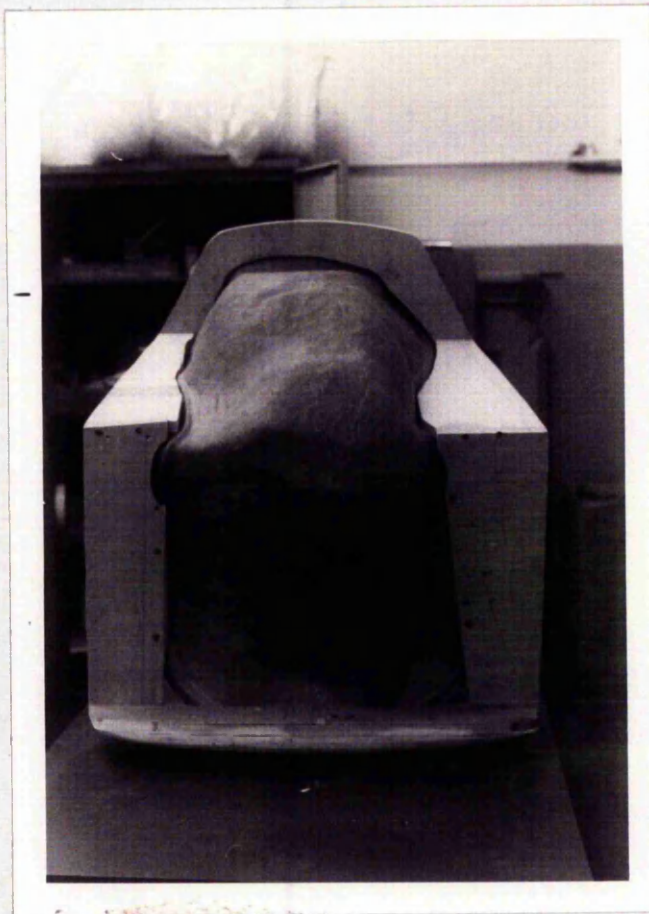
10.4.0 Chair Development

10.4.1 The support would have to be presented to both Nicky and his parents in a manner which would satisfy the remaining design requirements.

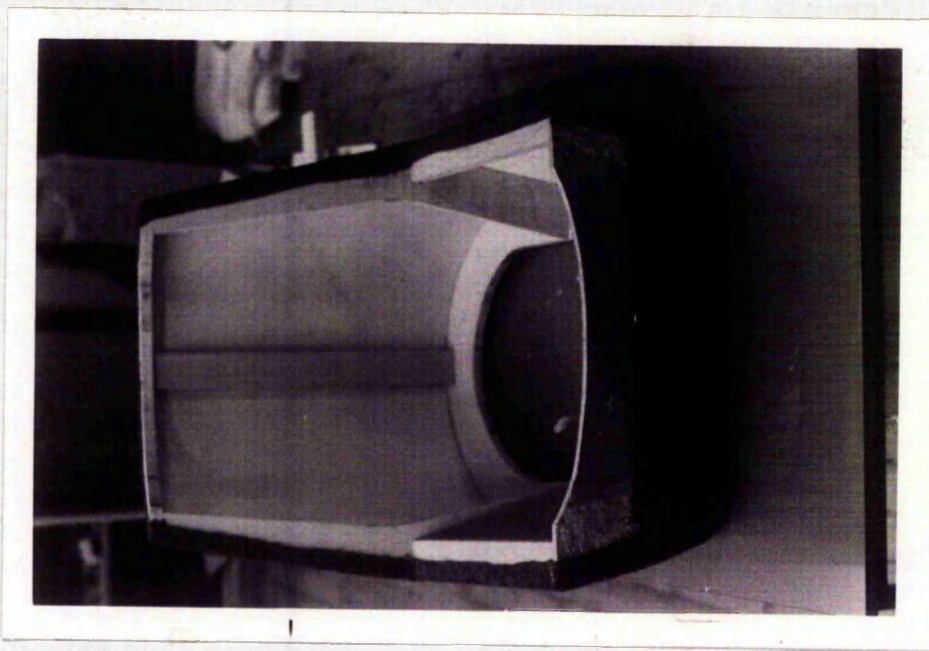
10.4.2 One of these had been the request that the chair should resemble, as much as possible, an ordinary domestic easy chair. The contorted moulding therefore ought to be hidden as much as possible. This was achieved at the back and sides by wrapping an outer plywood skin, fixed to a beech frame, around the shell.

The shell, with its integral wide arms, was fitted to the frame in such a way that it could be removed, for maintenance and adjustment, if required.

10.4.3 The apparently conflicting design requirements that an adult should be able to push the chair, but that Nicky should not, was resolved by fixing the chair onto a large and heavy 40 mm thick chipboard base. It was found that the weight of Nicky's body made the friction between this large area and the floor enough to make the chair static, even when subjected to Nicky's spasms. However, an adult applying a not unreasonable force to the outside of the chair could easily push it along the carpet.



A wooden arm unit is fitted to the GRP shell produced by Hunting Industrial Plastics. The grossly deformed shape of Nicky's body can be clearly seen.



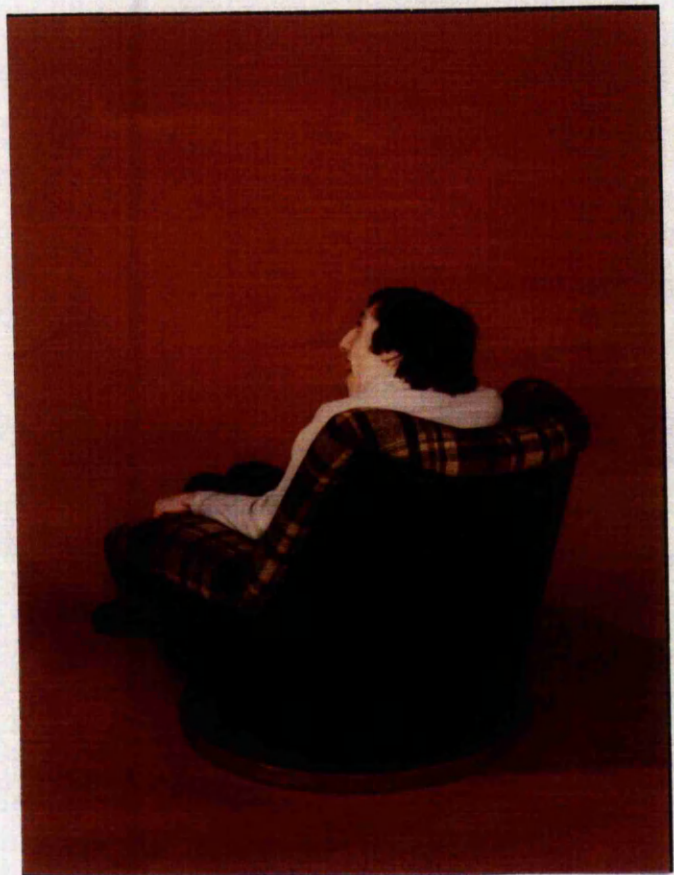
The plywood outer shell into which the above unit fits.

- 10.4.4 This stable base enabled a swivel mechanism to be incorporated between the shell and the base. The correct pressure of fit was determined so that Nicky would be able to swivel the shell around, without losing control.
- 10.4.5 The final decisions, relating to the choice of cover, were discussed with Nicky's parents. It could either have been made from an easy-to-clean material such as PVC or from a material which would have been more comfortable to use, such as a woven wool fabric. To some extent, this final decision epitomises one of the constantly recurring dilemmas that the study had revealed. This was the conflict between the handicapped child's personal needs and unreasonable demands made on their carers.

In this case the final choice was left to Nicky's mother, who chose a wool mix fabric in-keeping with the rest of the room's decoration. This choice was typical of many parents attitudes towards their handicapped children, that their comfort and happiness outweighed the cost of a little more housework.

10.5.0 Design Evaluations

- 10.5.1 At the time of writing, the chair has been used every day by Nicky. The postural support has been successful in that Nicky's spasms have become significantly less frequent, and that his respiration difficulties have become less acute.
- 10.5.2 It is too early at the present time to claim that his physical deterioration has been fully arrested. However, his physiotherapist is optimistic about the chair's long-term success, particularly as no sitting sores, which normally indicate poor areas of support, have as yet developed.
- 10.5.3 One of the most tangible improvements has been in the family's social life. Nicky's mother very strongly believes that guests, particularly new ones to the house, find it much easier to accept Nicky. This may well be because the chair visually appears to reduce his handicap, or because he now shows far fewer signs of distress.



Nicky in his new chair.

11.0.0 PROJECT : "A CHAIR FOR FIONA"

(Case study No 16 in Section 3.0.0)

Research and Design Development: Barry Wilson

Research Location: Chantrey Special School,
Sheffield, and at Fiona's home.

Advisers on Personal Care: Mrs Howe, Physiotherapist Chantrey
School, and Fiona's mother and
grandmother.

Prototype Production: Tony Kellett, and Paul Briggs,
Lecturer in the Furniture Design
Section, Department of Three-
dimensional Design, Trent Poly-
technic, Nottingham.

Industrial Involvement: Baxenden Chemical Co, Accrington,
Lancs (supplied and advised on the
use of polyurethane).
Raleigh Industries Ltd, Nottingham
(supplied wheels for the chair).

11.1.1 Fiona's mother was desperate to find a chair that would make her daughter comfortable.

She had heard of my work with Alison and Nicky, and had contacted me immediately. We discussed Fiona's case with her teacher and physiotherapist and it was quite obvious that for certain sitting activities, a moulded postural support chair was essential.

11.1.2 Despite her tragic appearance and acute physical deterioration, Fiona managed to display her feelings very vividly. She did this by vigorous facial and physical actions in response to questions and various other situations.

Even by the end of my first meeting with her, an understanding was quickly achieved. Her interests were similar to other thirteen year old girls and these included youth club visits, Starsky and Hutch and attention from the boys! In other circumstances she would have been a bouncy, happy, fashionable and extrovert girl.

11.1.3 Her wheelchair was not only physically unsuitable as mentioned in her case study 3.16.1, but quite completely contrasted her personality. She found using it as offensive as any other teenage girl would being forced to wear the wrong length of skirt.

11.1.4 Fiona worked in a prone position, supported on a trolley. However, it was difficult to transport her and almost impossible to feed her like this. Neither did the prone position make it easy for her to mix with company, when all she was seeing was the colour of their socks!

11.1.5 The wheelchair had proved totally unsatisfactory, and the staff had found it necessary to insert a large foam pad to support her head which leant over considerably due to the asymmetric line of her body.

11.1.6 Her right arm was wedged tightly down between her body and the chair arm to reduce the effects of extensor spasms.

11.2.0 Design Requirements

The physiotherapist was very concerned about Fiona's rapid deterioration and was quite sure that no support system presently available in this country could have controlled it.

Familiarity with the case eventually led me to note the following design requirements:

- 11.2.1 The chair had to provide close body moulded support to ensure that further postural deterioration was minimised.
- 11.2.2 It had to provide comfortable support so that Fiona could use the chair for long enough periods, to gain the maximum medical benefits.
- 11.2.3. The chair had to be mobile and was to replace the wheelchair in as many situations as possible.
- 11.2.4 The chair had to be easy to steer, because of the many confined spaces at home and school.
- 11.2.5 The chair had to be able to control Fiona's feet during a spasm.
- 11.2.6 The chair was to reflect Fiona's vibrant personality, so that she would enjoy using it. Hopefully it would be a boost to her morale and her learning capabilities.
- 11.2.7 The chair was to encourage as many people as possible to meet Fiona.

11.3.0 Body Support Production

This further and more detailed knowledge of the case emphasised the fact that the vacuum casting technique was particularly suitable to produce the initial body shell.

- 11.3.1 It was inconvenient to take the initial plaster bandage cast of Fiona at her school. This was therefore done at home, and illustrates that the technique requires little specialised equipment. Even the vacuum pump can be replaced adequately with a standard domestic vacuum cleaner. Her physiotherapist was present to ensure that the sitting position adopted correctly supported Fiona's severely deteriorated posture.
- 11.3.2 Experience gained from the production of close body mould shells for Alison and Nicky showed that there was a need for still further rationalisation of the secondary moulding processes.
- 11.3.3 In an attempt to make the system more commercially viable, an outer shell was produced in GRP which conformed in size to the plaster bandage mould but which was styled as a normal chair.
- 11.3.4 The plaster mould was then developed with extra bandage to fit the GRP shell and fixed on as a "lid".
- 11.3.5 Through the base of the chair cold cure polyurethane foam was then injected and allowed to fill the cavity between the plaster and the GRP outer shell. When this had been completed the plaster bandage mould was removed.
- 11.3.6 The shell now had the negative shape of Fiona's body, moulded into its polyurethane filling.

A 25 mm layer of flexible polyether foam was then fixed to the polyurethane with adhesive.

- 11.3.7 At this stage we sat Fiona in the shell and waited for her reactions. They were disappointing because she was immediately uneasy. A series of questions requiring yes or no answers were put to her.
- 11.3.8 The two distressing reactions she gave were indicative of the way she had been obliged to use her wheelchair previously. The extra padding that she had used to the right of her head caused her to feel insecure without it, even though her asymmetric posture was safely supported in the close fitting shell. The shell was therefore modified to accommodate her emotional needs on this point.

Her right arm, which had originally been wedged inside the wheelchair, and which was now completely free, also caused her concern. She has no control over this arm and was frightened that it might suddenly extend in a spasm and be injured. Several methods of retaining it within the perimeters of the chair-shape were tried, and the most successful of these was a looped bandage through which her hand could be slipped. This very simple device appeared to reassure her and she immediately began to show great pleasure at using the chair even at this unfinished stage.

11.4.0 Chair Development

11.4.1 A tubular steel underframe was built to support the chair-shell and to provide the necessary structure for wheels, handles and footrest.

11.4.2 A fibre glass moulding was made to cover and retain her feet, and this removed the need for unsightly restraining straps.

11.4.3 The opportunity was taken to enhance the already youthful appearance of the chair by styling the fibre glass foot retainer in a snappy sports-car fashion!

11.4.4 The outside shell and front footrest were sprayed in a vivid buttercup yellow, which contrasted sharply with the deep chocolate brown upholstery cover that was tailored to fit the seating area of the chair.

11.4.5 Throughout the design development, all the features were treated vigorously to give the final wheelchair a very definite "sporty" appearance. It is hoped that Fiona will respond positively to this, and will take great delight in swaggering (this must be the first time that anyone has swaggered in a wheelchair), about in the youth club and shops.

The finishing touch, which perhaps epitomises her need for other peoples recognition, is an ever-present introduction: "Fiona" - written diagonally in "Formula-One lettering across the footrest.



The "Sporty"
wheelchair.



11.5.0 Design Evaluations

11.5.1 As yet, we have no knowledge whether or not this true presentation of Fiona to society, will result in the reduction of some of the tensions that people feel when meeting the severely handicapped for the first time. This has been a positive attempt to demand a reaction, other than nervous sympathy, from the general public. It is hoped that the shock treatment will enable people to meet Fiona on genuine terms, and that she will, hopefully, feel happier - radiating her true character rather than shamefully admitting her handicap.

We look forward with great interest to receiving her mother's, her physiotherapist's and most of all, her own account of this social experiment.

12.0.0 CONCLUSIONS TO EXPERIMENTS

'The chair's lovely, but the foam inside seems to have collapsed' said Nicky's Mother, during my recent visit to their home.

It is now two year's since Nicky received his finished chair. He has apparently stopped growing and the chair continues to perform well, except that the soft foam layer has collapsed through constant use, and Nicky's parents have found that the use of a lambs skin adequately compensates for this.

I believe Nicky's chair may be fairly regarded as a successful project, and therefore used as an example. An analysis of the various stages of the project reveals that the design considerations are both complex and yet not untypical. By way of conclusion, these will now be included within a general discussion of design considerations, drawing upon information given in both the survey conclusions and the design evaluation. I think the value of the practical projects and physical experiments actually carried out may be demonstrated.

DESIGN CONSIDERATIONS

12.1.0 Correct Physical Support

Postural deformity, as in all patterns of human growth, is established at an early age. If gross physical deformity is to be avoided correct postural support is essential as early as the very first attempts are made to raise a child into a semi seated position instead of lying flat. In practice, posture is rarely considered until a child is first encouraged to sit upright in the conventional manner, by which time patterns of postural deformity may have already been established.

Close body mould systems such as those described in Appendix B (14.0.0), and used in the development of chairs for Alison (9.0.0), Nicky (10.0.0) and Fiona (11.0.0), use the existing form of the child's body to describe the form of the chair. The process accommodates the deteriorated posture, and whilst the signs are that the deterioration is arrested, it remains to be seen how much, if any, correction is possible by this means. If adequate support were to be available at an earlier age it is possible that much postural deterioration in children could be prevented.

- 12.1.1 The development of the adjustable feeding chair (7.0.0), highlighted the need for good frontal support when providing seating for young Cerebral Palsied children. Most chairs available for these children use straps and harnesses which tend more to restrain than to support.

The Physiotherapist involved with the adjustable chair suggested that such localised frontal support could be used to actually correct and maintain sitting postures (7.5.2)

- 12.1.2 A common problem experienced by children impaired by Cerebral Palsy is that they develop an imbalance between the left and right sides of their bodies. If one side is distinctly stronger than the other, inappropriate seating will usually cause the child to sit assymmetrically. This can result in undue pressure on the hip joints, and may eventually lead to hip dislocation. Prevention of this progressive deformity from an early age might be achieved by providing the child with padded support to the front of the knee on the strong side, allowing the weaker limb time to develop.

- 12.1.3 The physical well-being of children who sit for long periods can be seriously affected in a broader sense, by inadequate support: the digestion process can be disrupted, and the natural movement of body fluids can be impaired, causing pain and

discomfort. (7.5.3) In the case of Nicky (10.1.6) it was important that his chair reduced the build-up of fluid on his chest by preventing him from sliding forward. Incorrect posture had previously resulted in poor respiration. Ideally children like Nicky should be given the means to stand upright for periods each day, since the body functions more efficiently this way. However, this is not always possible or practical, but broadly speaking consideration should be given to this when designing body supports for chair-bound people. A new American wheelchair solves this problem quite effectively by supporting it's occupant in both the sitting and standing positions (p138-9)

12.2.0 Comfortable Support.

It is inevitable that Cerebral Palsied children will be physically handled and supported by their parents to a greater extent than will able-bodied children. The nursing of a cerebral palsied baby will extend well into infant years, and in some cases much longer (see 9.1.1). A physically closer-than-normal relationship may thus be established between the child and the nursing parent, and so the transition to a chair that is expected to provide the same support as the parent's lap may prove traumatic for the child. Discomfort and rejection are likely to result in uncontrollable spasms, making the transition more and more protracted. This is particularly disturbing at times of social interaction, eg. feeding.

12.2.1' It is commonly accepted that at such times even severley handicapped children are more condusive to learning. It is a time when a close relationship between feeder and child is established providing opportunities to develop basic patterns of hand-dexterity and eye-to-eye contact. This is vital for good body alignment, as the use of a car seat in conjunction with 'Framework' demonstrates (6.2.12). It seems most unfortunate that such valuable opportunities for learning and development are lost because the child is badly seated and uncomfortable.

12.3.0 Safe Support

The sensation of feeling safe in a chair like that of comfort, can encourage development. If a child feels unsafe, as Fiona did (11.3.8), it will often trigger off spasm's and stiffness: the child will become withdrawn and discouraged from attempting independence. In some instances safety is purely psychological, as was the case with Alison (9.4.4), and extra support might only be required to reassure the child.

12.3.1 In most schools and homes where there are handicapped children, abilities amongst them will inevitably vary considerably. Some will be confined to their chairs for most of the day, while others will be able to walk or crawl. There are obvious dangers to all concerned if chairs have dangerous protrusions, or can be easily tipped over if used as supports by a child unsteady on his feet. Furthermore, furniture in such places has to withstand a good deal of mistreatment : chairs not in use by those who normally occupy them can be seen, perhaps, as an extension to a climbing frame by more active children.

12.4.0 Care Management

The demands placed upon those caring for a handicapped child are extreme and yet it seems that they are often forgotten when equipment is designed for those in their care. It is therefore important that the design problem is seen from both user viewpoints : the child and the carer.

12.4.1 In many of the case studies (section 3.0.0), the child was totally dependent on its parents for all the normal daily activities, and, as in the case of Nicky (10.0.0), this situation becomes more difficult as the child grows older. The lifting and carrying done with ease when Nicky was a child have now become exhausting activities since both parties in this close relationship have become less able. A chair with low, wide arms enabled Nicky's mother to 'roll' him from the chair onto her lap to change him : a small design detail, but nevertheless a reduction of at least one lifting operation during the day.

12.4.2 Materials used for the covering of the chairs must be carefully considered. Alison's chair (9.4.5), had 'zip off' covers which are easy to launder and replace when worn. Unfortunately, at the time of writing no fabric has been developed which will adequately repel moisture and yet provide a soft, aired surface suitable for long periods of sitting. There is an urgent need for such a fabric to replace the PVC covers used extensively on furniture for chair-bound people. It is interesting that those of use with a choice of seating are quick to react when committed to one chair for long periods, eg. on long car journeys. Most car manufacturers offer cloth covered seats, as an alternative to PVC and treat them with a moisture repellant in an attempt to give the motorist maximum comfort even though they may, at any one time, only use that seat for two to three hours, with the opportunity to stop and stretch their legs if they wish. Not so for the chair bound, they may well sit in the same seat for the whole day with no alternative. There is an urgent need for improved seating materials for wheelchairs and other seating used by the handicapped.

12.5.0 Visually acceptable support.

Without exception, all of the design experiments carried out in this study demanded careful consideration of all aspects of the products appearance. Information collected from both the user and carer emphasised the general lack of attention that is given to the appearance of commercially available aids and equipment. It is clear that the requirements for chairs for Cerebral Palsied children are not likely to place the same competitive pressures upon manufacturers to provide attention to overall appearance as those for other products, with a wider appeal. However it would not seem unreasonable to expect a manufacturer of such chairs to choose orange or yellow paint in keeping with other nursery products, rather than the dull metallic grey or blue, which apparently matches only medical equipment.

12.5.1 In the case of Charlotte's chair (8.4.3), the results of such a sensitive approach were justly rewarded : the chair was found to be highly desirable by her non-handicapped brother. Seeing, at last, some equality, Charlotte was encouraged to use the chair, and in so doing improved her sitting balance.

12.5.2 The brief for 'Framework' (6.0.0), established the need for equipment to 'look normal', and it was interesting to see the results being used both by able bodied children and by severely handicapped children simultaneously. The use of natural beech for the construction of 'Framework' was found to be acceptable to all who use it. Children like the tactile qualities of the smooth, rounded sections and staff find it light and easy to move around in the classroom where it matches other pieces of school furniture.

'Framework' is now being purchased for both school and private use because visually it presents no barriers.

12.5.3 In some cases the requirements may demand that the appearance of a product is over emphasised in order to encourage a reaction to make people respond to its presence. Fiona's chair illustrates this point (11.0.0). Her vibrant personality was virtually lost to others while she was forced to use a wheelchair that she found totally unsuitable. Her new chair attracts the attention of others whose company she enjoys so much, particularly the boys! Perhaps with more sensitive and cheerful equipment the handicapped child could change the embarrassed and averted public eye to one of complete acceptance.

12.6.0 Personal Development

It is very difficult to measure accurately the mental ability of Cerebral Palsied children, since most of the normal accepted methods are not suited to children with serious physical limitations. However this does not necessarily mean that there is any mental retardation. Modern teaching methods can bypass the use of handwriting as a means of communication - using, for instance, electric typewriters with controls adapted to the child's needs.

12.6.1 Many of the children seen in schools during the surveys were in danger of delayed personal development due to bad postural support. It is almost impossible for a child to concentrate if he or she is constantly trying to maintain an upright position. Similarly, development of the social graces can be extremely difficult if at meal times the chair he sits in does not sufficiently support his posture, and prevent him drooping onto the table.

As previously stated, mealtimes are valuable opportunities in aspects of personal development. One centre visited in the survey of institutional care, Rinnekoti SMI-tio (2.21.3), strongly encouraged personal development by denying the children access to the main dining hall until an acceptable level of physical control at meal times had been achieved. At these times, a child's interest in the activity of feeding is normally intense, and, in the pursuit of food, he will generally respond more readily to suggestion. Hand control can therefore be practiced and self-feeding encouraged. It is also a time for social interaction, and relationships, particularly in a more relaxed manner than in the classroom. It is therefore essential that the child is adequately supported at such times, and it may be necessary for a chair to be designed solely for use at meal times, just as most non-handicapped people use different chairs for dining, relaxing and working. Unfortunately this is still something of a luxury for most chairbound people and one chair is normally used throughout the whole day.

12.7.0. Reduction of Isolation

Since the introduction of the Chronically Sick and Disabled Persons Act of 1970, the integration of handicapped people into the social environment has slowly taken place in very practical terms: for example, motorway services now provide facilities for people in wheelchairs; public buildings are now by law required to provide this kind of access. Architects and planners are slowly beginning to consider users more carefully - the classic human model (Male, 25, 5'9" tall and healthy) is used less than it used to be.

It is interesting to note that, since the introduction of the Act and the subsequent provision of these facilities, motorway services and other public buildings are now no less acceptable to non-handicapped people than previously. It is unlikely that any future Act of Parliament will require furniture to be usable by handicapped people, and yet, the crudely designed equipment which handicapped people have had to use for decades has caused a psychological isolation from society quite as negative in its effect as any lack of 'architectural' facilities.

- 12.7.1 One of the main considerations in the development of Framework (6.0.0.) was to reduce the isolation experienced by some handicapped children in mixed ability classes attempting integrated group work. The 'rung' system of attachment and adjustment on the ladder elements, enable a variety of standing, sitting and play formations to be achieved to suit the individual child, handicapped or non-handicapped.

In providing for individual needs, framework can be used as a support system in conjunction with standard tables, easels, and other equipment used in the classroom for group activities.

- 12.7.2. A requirement in the design of Nicky's chair was that it should not isolate him from the rest of his family (10.2.7.). It would have been easy to forget that in the pursuit of his physical comfort the design solution might have effectively removed all the personal contact that Nicky previously enjoyed when inadequately seated on the settee.

In the event, the wider design considerations became properly established, and these included his 'social' needs. This is an illustration of the importance of the reduction of isolation as a prime consideration in designing for handicapped children, or indeed for handicapped adults.

12.8.0 As indicated in the title and introduction of this thesis the conclusions I have drawn attempt to identify the most important aspects of an approach to designing furniture for Cerebral Palsied children which in my view, any other designer could use.

However, the practical problems still exist, and to some extent, they always will, but the more immediate need is to distinguish between genuine practical problems and mere obstacles. For example, the manufacture of individual close body moulded shells on an economic basis may be seen as a genuine practical problem, whereas the provision of a service facility to cater for such individual requirements may have its problems rooted in inflexible and stifling bureaucracy. The obstacles which seem to prevent a child from being provided with appropriate furniture are that neither information nor service is properly co-ordinated. The number of institutions and individuals that any one child may need to be in contact with is mind-boggling.

12.8.1. The following report was given to me by the mother of a Cerebral Palsied child when asked for details of chairs they had used, together with comments. This is reproduced unedited.

1. For two or three years to 1967 A wooden wheelchair with deckchair-type material seating, used for indoors only. Ordinary child's pushchair used for outdoors at this time.
2. During 1967 there was a change to an Everest & Jennings blue, fold together wheelchair with large wheels at back for both indoors and outdoors.
3. 1971 A small Buggy chair (the new type pushchair with striped deckchair-type material seating and aluminium frame). This was used for both indoors and outdoors and we were very "mobile" during the time we had this chair and the subsequent
4. larger Buggy Major, when the smaller one was outgrown.

5.6. From about 1973/4 to 1977 we had the smaller then the larger Amesbury Avon Red wheelchairs, with velcro-attached "wings" which Fiona pushed off very easily. Eventually we had to fit our own hardboard sidepiece to prevent her head falling sideways. The only way this chair could be transported was to take the chair from the chasis - see "Holiday" further on.

People involved:

In the case of the first six chairs it would seem that the people involved were mainly:

Paediatrician

Physiotherapists at the special C.P. Unit in Sheffield
Occupational Therapist - to do the measuring, i.e. length/
height of child only.

Ministry people and office staff at the Rehabilitation Centre who were our only contact with the actual makers of the chairs.

The manufacturers.

Approximate waiting period for delivery in each case: 6 months.

Problems after delivery: Second Amesbury Avon chair came with fixed wheels, so we had to order swing wheels for front of chasis and wait again, then fit them ourselves.

Lack of any sense of urgency on part of Rehabilitation Centre, our only contact with manufacturers apart from the hospital.

Frustrations involved in obtaining and using standard wheelchairs.

Its not so much the number of people involved in obtaining a suitable wheelchair for a badly handicapped child-cum-teenager as the frustrations which seem to be built into the system.

As if life is not difficult enough with a handicapped child - and I mean handicapped - in all four limbs and unable to speak properly, Mum is expected to turn up at the hospital or wherever on time for the appointment only to be kept waiting for hours in draughty, noisy corridors, on hard chairs to see a Doctor/Physiotherapist/Occupational Therapist, etc., who has very little time to spare. Therefore they rush at the child who promptly cries or goes into spasm and makes the whole interview a misery through no fault of its own. Or the Doctor etc., etc., may not turn up at all.

If you make your own way to the hospital you can at least catch the next bus home! But if your child is older and wheelchair large and ungainly its a case of waiting and waiting for your ambulance to fetch you and take you home again. It may not be a direct trip home but halfway round the city dropping other people off. It takes the whole day just for five or ten minutes with the specialist or doctor - but their time must not be wasted.

Yes, five or ten minutes with the doctor if you are lucky - on the other hand the worried Mum may be told to wait outside in the corridor whilst the examination takes place, as if your ideas/opinions are of no consequence at all.

Your child is to be measured for a new chair because the present one is too small - feet are trailing on the floor - so here you are, weary but still hoping you will be offered something comfortable for your child. Perhaps you will be able to see some wheelchairs and try them out - but no, all the Occupational Therapist does is ask age, weight and measure height/length but not waist or width. The fact that the present chair is padded out with cushions to fill the empty spaces around a very thin, long child because the chair is too wide does not enter into the measurements at all. You only

realise this omission later on - something like six months later when, after innumerable phone calls, the new chair arrives at last.

It looks great when unpacked and you've made head or tail of all the bits. The great moment arrives, your child can be put into the new chair. Adjust footrest for length of legs, tilt back for relaxed position, fit side wings to hold head - which child with push spasm promptly pushes off - and here we are again with enough space each side of the child for Mum to fit in the chair too. Yes, the old chair was too small lengthways and this one is fine, but its much too big from side to side.

Next visit to hospital you demonstrate this problem, but of course there is nothing to be done - they only make two sizes of chair and the sides are not adjustable. So, more cushions are required. And why, oh why are "Ministry chairs" always made with slippery plastic "leather"? Some children do not sit well and gradually slide forward. You can have a pommel fitted they say. But pommels hurt when all your weight is pressing against them for hours at a time. Another problem is all the nuts and bolts, and sharp edges these chairs seem to have - dangerous for child, Mum and passers-by.

Holiday

Another problem - try taking a handicapped child, a wheelchair (in this case an Amesbury Avon - non folding) and a suitcase on holiday. Its a major expedition.

Mum alone with child - impossible.

Mum, Dad, or Granny, with child - just about manageable, provided the driver of the car or taxi is willing to help.

It goes something like this: One person: push child in wheelchair to side of car. Second person: carry suitcase and other oddments, remembering to lock house door and put keys safe. Car driver offers to help: takes suitcase into boot. Meanwhile Granny sits in car. Mum: unfastens child from chair, lifts child onto granny's knee in car, then has to disconnect all the bits and pieces of the chair i.e. cushions, headrest etc., and put these in car. THEN: out comes special spanner for nuts and bolts which hold chair to chasis. WHEN this is achieved you have: 1 spanner, 2 nuts and bolts, 1 chair and 1 chasis to deal with. Woe betide you if you lose the spanner or nuts and bolts because you have to fit it all together again before you can move your child anywhere at the other end of your journey! And don't forget when holiday is over, this feat of engineering had to be accomplished all over again.

13.0.0 APPENDIX A

This is a survey of existing chairs and standing furniture available in the UK for Cerebral Palsied children. Such aids to daily living can often be issued by local Social Services Departments. This does not include wheelchairs which are issued on long term loans to disabled National Health patients with severely restricted mobility, and can be prescribed by a Consultant or a GP on form AOF 5G which is sent to the Local Appliance Centre (DHSS).

The detailed design observations on each of the following products are based on information collected from users, parents, teachers, physiotherapists and Occupational Therapists.

The selection of products for this survey was based on information for the disabled, children's aids and equipment lists No 15 and 15 appendix 1, published by the Disabled Living Foundation, 346 Kensington High Street, London W14.

13.1.1



Title:	Amesbury "Avon".		
Manufacturer:	Amesbury Surgical Appliances, Caerphilly, Mid Glamorgan.		
Overall dimensions (mm):	H1000.	W600.	D1000.
Cost (1977):	Small	£143.98	
	Medium	£144.55	
	Large	£176.00	

General Description of Product

A tilting push-chair used by both cerebral palsied and sub-normal children. Available with indoor and outdoor chassis this chair has a number of extra fittings: toilet facility, harness, tray, shoulder wings and weather-hood.

The main chair structure is constructed in chromium-plated tubular steel, and the upholstered plywood seat, back and arms etc are covered in vinyl.

13.1.2 Design observations:

This chair is most commonly supplied to severely handicapped children, since it can be supplied with a number of attachments. It is one of the few chairs available that is sufficiently adaptable for various sized children. Unfortunately, aspects of the adaptability of the chair seriously limit its acceptability. Open-ended tube which takes a removable tray and large protruding wing-nuts for adjustments, often caused injury to the child-occupant or helper. One parent commented that the sharp corners of the footrest often injured people in the house other than the child using the chair (see case study No 16, 13.16.2). Although the chair is available in three sizes it is often found to be too wide, even if the height and front-to-back dimensions are correct. The chair does not fold compactly, and is heavy for tilting and lifting.

Despite the fact that this chair is claimed to be one of the most versatile of its kind, in real terms, it provides little adequate support for individuals in spite of its numerous adjustments. Close body-moulding techniques have already shown that they can provide the greater degree of comfort and postural control required by young cerebral palsied children who are at the most critical stage in their physical development.

In visual terms the chair looks, and is, a contraption, and succeeds only in emphasising the degree of handicap and does little for the self-respect of its occupant.

13.2.1



Title: Amesbury "SU Chair".
Manufacturer: Amesbury Surgical Appliances,
Amesbury, Wiltshire.
Overall dimensions (mm): H1000. W450. D950.
Cost (1977): £134.87

General Description of Product

Constructed throughout in solid ash and birch plywood this chair is adjustable from an upright seating position to a 45° tilt, and is available in two seat widths:

SSU Model, 200 mm seat
SU Model, 250 mm seat.

The seat, back and head supports are upholstered with foam and covered in vinyl.

The head supports are removable as also is the tray. Both are fitted as standard. Extras include a sliding seat and a toilet chamber, hydrocephalic back harness and castors.

13.2.2 Design observations:

Similar in performance to the "Avon" this chair is used indoors only. Since it is constructed in wood, it is more suited to domestic interiors although its size restricts its use in small houses. The chair is fully adjustable and can be adapted to suit a wide range of children although, as with the Avon, parts of the chair protrude dangerously and extra padding has to be attached for protection.

A number of people most closely concerned with the care of handicapped children felt that, although complete adjustability was necessary for the wide range of support problems, there was an urgent need to develop a system which looked good and did not leave the occupant looking as if he had walked out of a shoe shop wearing the foot gauge and not the shoe. The chair does look as though this has happened, and like the Avon, fails dismally in visual terms.

13.3.1



Title: Amesbury "Wren Chair" (DHSS 8C).
Manufacturer: Amesbury Surgical Appliances.
Overall dimensions (mm): H1200. W460. D850.
Cost (1977): Only on prescription.

General Description of Product:

A standard general purpose chair designed for children up to 1.5m high and 5 stones in weight. Seat and back are in PVC coated canvas, and the back slopes 125 mm from the vertical. Extras include a winged backrest, a 50 mm thick cushion and a fixed footrest.

13.3.2 Design observations:

The general arrangement of this chair was found to be very practical, and children with the ability to propel the chair, found it sufficiently manoeuvrable to cope with domestic interiors.

When the winged back-rest was used some children found that it restricted their arm movements. The fixed footrest prevents the chair from folding and, as with the Avon, comments were made concerning the tendency for it to be injurious to furniture, fittings and people.

Although the chair folds compactly for transportation, to achieve this, comfortable, and correct sitting posture has been forefited by the provision of a slung seat and back-rest.

In appearance, the Wren chair is a marginal improvement upon the Avon and the SU chair.

13.4.1



Title: "Bec Bambino".
Manufacturer: Briddle Engineering Co Ltd,
Halesowen, West Midlands.
Overall dimensions (mm): H540. W460. D800.
Cost (1977): £260.

General Description of Product:

An electrically-powered chair for 2-7 year olds. The body of this chair is made in painted plywood, and the upholstery is removable. The footrest can be adjusted in height and the controls can be mounted on either the right or the left side.

13.4.2 Design observations:

The simplicity of this chair seemed to appeal to the people who had experience of it. Comments were made in praise of the simple adjustment technique used for the footrest, which, although removable, was safe in use.

The control unit was well-positioned and provided the child could cope with the simple movements required to operate it, no problems were experienced.

One teacher pointed out that the wooden sides of the chair allowed fixings to be made into them if required, and repairs were easier to carry out.

For its size the "Bambino" is a heavy chair and often had to be lifted, with great difficulty, to cope with changes in level, particularly out-of-doors.

The relatively uncomplicated exterior of the chair gives it a "fun-vehicle" appearance which is quite acceptable. However, it provides little in terms of postural support, indeed, without its mobility it would be little more than a very basic box chair.



Title: BEC "Fireball".
 Manufacturer: Briddle Engineering Co Ltd,
 Halesowen, West Midlands.
 Overall dimensions (mm): H840. W600. D820.
 Cost (1977): £400.

General Description of Product:

An electrically-powered chair of tubular steel construction. The two rear wheels are individually powered and the control box can be mounted either on the left or the right arm of the chair. The chair can be folded for transportation.

13.5.2 Design observations:

A system called "proportional control" is built into this chair which provides the operator with a slow build-up of speed. This has been found particularly useful for children with reduced eye-to-hand co-ordination, since jerky unwanted movements of the hand are not repeated in the movements of the chair.

Some electrically-powered chairs have been known to even exaggerate involuntary movements of the user, causing extreme difficulties when attempting to negotiate crowded spaces.

For transportation, the chair can be folded, and the batteries, contained in a carrying case, are removed and stored separately.

Although this chair is designed for outdoor use, its small wheels limit its range, since extreme difficulties are found with changes in level, and, loaded with batteries, the chair is heavy to lift.

The chair is purely a mobility-aid. It offers nothing with regard to correct postural support or to appearance.

13.6.1



Title: "Binchair".
Manufacturer: Rowen Conllyn Ltd,
Neath, Glamorgan
Overall dimensions (mm): H690. W530. D700.
Cost (1977): £27.54 (Tray £3.78).

General description of Product:

This chair was designed and developed by Penny Thrift whilst working at the Handicap Research Unit at Middlesex Polytechnic.

A plastic dustbin is used as a basis for the chair, which is shaped to the profile shown, upholstered and fitted with removable covers.

A detachable tray can also be supplied to fit at various distances from the seat, and a potty can be fitted beneath the seat.

13.6.2 Design observations

The "all round" shape of this chair is particularly good for children with poor sitting balance, in that whilst supporting the trunk there is no loss of free arm movement.

It was suggested that the stability of the chair could be improved with a wider base, since the dustbin-shell does not adequately support the sometimes violent movements of a hyperactive child.

One teacher had found that the tray, fixed only at the back, tended to be easily tipped by some athatoid children when excited play caused them to draw up their knees.

Like other chairs where trays are fitted, the Binchair is in danger of being provided for children who show little response to their immediate environment and are sometimes seated alone for long periods and provided with toys within their immediate grasp or sight. Unfortunately, it is too easy to forget a child isolated in this way and his chances of integration will be considerably reduced.

Despite the fact that a dustbin is used as the basic shell, it is one of the few chairs which is visually acceptable in a domestic environment.

13.7.1



Title: "Buggy Major"
Manufacturer: Andrews Maclaren Ltd,
Buckby, Northants.
Overall dimensions (mm): H1000. W450. D820.
Cost (1977): £28.49

General description of product:

This light-weight (12 lbs) folding chair is a large version of the popular "Baby Buggy" and is suitable for children of up to 9 stones in weight. The original Baby Buggy was designed as the result of a study made of existing push chairs by an engineer who wanted a light, compact chair for his own child.

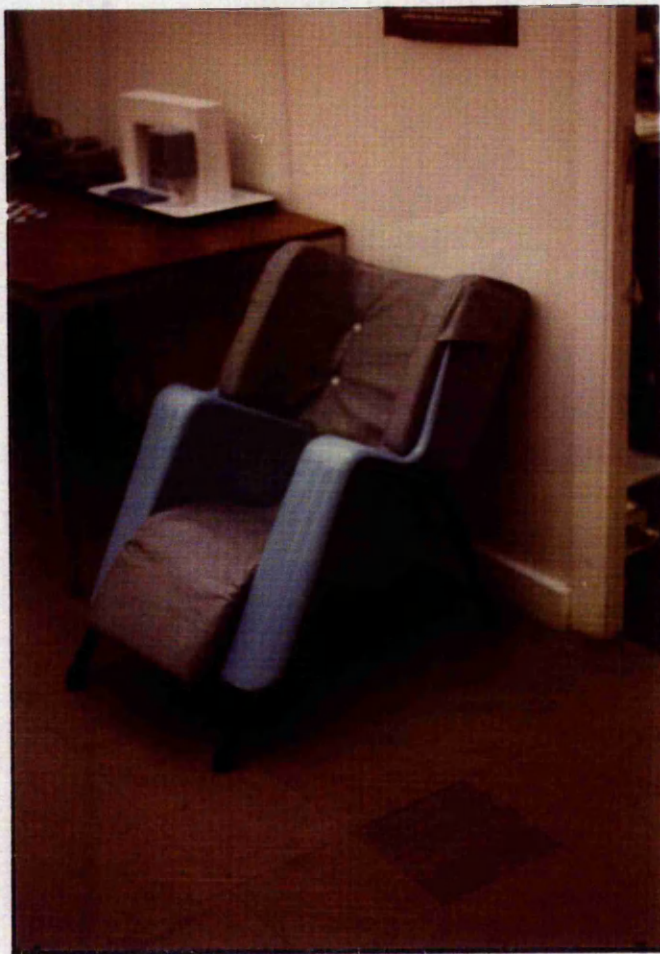
Many Baby Buggys have been supplied to handicapped children and the Major Buggy is designed for the older child with mobility problems. A separate seat insert is available for this model which gives extra side support, and fits into the existing seat. Ankle straps can also be fitted to prevent the backward displacement of the feet from the footrest.

13.7.2 Design observations

The main attraction of this pushchair is its lightness and ease of transportation. Many older handicapped children and adults use this chair for outdoor mobility and a wheelchair for indoor use.

Some therapists feel, however, that the 'scoop' design of the seat perpetuates unsatisfactory sitting posture and however comfortable the child may seem (or convenient for parents) the chair should not be used for long periods.

Problems related to the appearance of this chair have also been experienced (see case study No 2) since any extended use of a "baby" chair by an older child or adult will seriously limit their chances of being acceptable in company of their own age.



Title: The "Caistor" Chair.
Manufacturer: Fosrite Plastics Ltd,
Grimsby, Lincs.
Overall dimensions (mm): H750 W500. D700.
Cost (1977): £45.

General description of product:

This chair was developed by Fosrite Plastics in conjunction with Caistor Hospital, Lincoln. The shell is manufactured entirely in GRP with a fitted, padded cover, and stands on a tubular steel frame. The angle of the chair can be fixed by the manufacturer to suit the individual user.

13.8.2 Design observations:

The chair is softly padded and is particularly successful for periods of relaxation. Unfortunately, the choice of cover (PVC) is unsatisfactory for long periods since it quickly becomes hot and sticky. The impervious quality of the PVC quickly causes discomfort, particularly to incontinent users. The side wings, which provide extra support to a floppy child are too deep and reduce his field of vision.

Despite the fact that this chair is used for relaxation in a lounge situation, it is related in appearance to institutional/contract furniture and is not essentially domestic in character.



Title:	Cell Barnes "Mini" Chair.		
Manufacturer:	Modern Tubular Products Ltd, Egham, Surrey.		
Overall dimensions (mm):	Small:	H660.	W320. D500
	Large:	H790.	W370. D560
Cost (1977):	Small:	£27.50	
	Large:	£29.50	

General description of product:

This chair was originally designed for the Cerebral Palsied child in his first attempt to sit upright. The seat angle can be adjusted through 12° from the horizontal, and the back is adjustable over a range of 35° . The chair height can be adjusted by 75 mm by the individual adjustment of the telescopic legs. The optional headrest wings are available with two alternative fixing positions.

13.9.2 Design observations:

Although this chair is comparatively small it is not easy to move around when occupied.

Children with no sitting balance are provided with adequate all-round support, but this does not necessarily mean that good posture is adequately maintained.

Although the chair is adjustable in height, the method of adjustment is generally disliked. Staff found the individual adjustment of each leg time-consuming and frustrating, particularly when the child waiting to use it had to be supervised at the same time. Often after the child had been seated in the chair and firmly strapped in had it been found that one of the legs was shorter than the other three.

When the legs are fully extended it is less stable, and hyperactive children have been known to tip it over during particularly violent or excited movements.

The chair is a further example of the designers complete disregard for appearance.



Title:	Cell Barnes Wheelchair.		
Manufacturer:	Modern Tubular Productions Ltd, Egham, Surrey.		
Overall dimensions (mm):	H860.	W560.	D860.
Cost (1977):	£75.50	(330 mm seat)	
	£78.25	(400 mm seat)	

General description of product:

This chair, like the static Cell Barnes Mini Chair (13.9.1), was developed by Modern Rubular Productions in collaboration with the Cell Barnes Hospital. Manufactured in square-section stove-enamelled steel tube, the under frame supports the seat and back unit, which tilts through 30° from upright. The leg-rest is adjustable over a range of 110° . The footboard has 7 alternative slot-in positions at 40 mm intervals. Optional extras include, detachable feeding tray with sliding adjustment over 125 mm, nylon body-strap, thigh straps, body and shoulder harness and detachable lambswool seat cover.

13.10.2 Design observations:

It is unfortunate that the pitiful circumstances of a child with severe physical abnormalities are often unwittingly aggravated by the 'pesimistic' design of the products that the child is forced to use. Chairs like this offer no brightness or incentiveness to the user, neither are they optimistic in approach. In their over-attention to the physical problems, the designers have succeeded only in producing mechanical gadgetry, with little thought either to what it feels like to use it, or what it looks like in use. From a chair like this, the users expectations will reach little further than the prospect of a dull, tedious life, without hope, self-respect, vanity or achievement.

"Historically, the low expectations of society for the handicapped person had produced a reaction of low expectation in the disabled person himself. He responds to nil expectation with nil contribution."

Extract from a paper given by Mr Charles Pocock, Public Relations Officer for "Remploy" at the London College of Furniture seminar 1977 "Equipment for the Disabled".

This is indeed a chair for "the condemned".



Title: "Commodore Reclining Safety Seat".
Manufacturer: Swithin Continental,
Kilburn High Road, London NW6
Overall dimensions (mm): H600. W400. D800.
Cost (1977): £35.

General description of product:

A one-piece plastic moulded shell fitted to a light tubular steel underframe. The shell is padded and covered in a washable fabric. Safety harness and footrest are fitted as standard, and the chair is capable of adjustment from an upright to a fully reclining position.

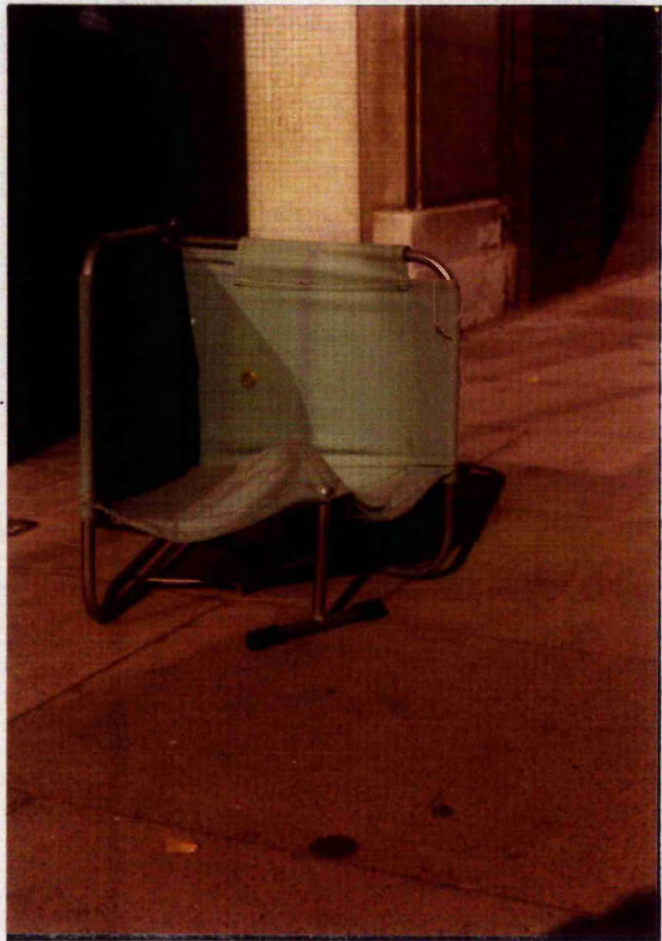
13.11.2 Design observations:

Although designed primarily as a car seat, it is an example of a type of chair which can also be used out of the car. The stringent safety considerations and requirements of a child's car seat, can coincidentally result in a chair ideally suited to young Cerebral Palsied children.

These considerations often include support to areas of the body most at risk, and in need for adequate support under impact. The unpredictable body movements set up by the motion of the car, are in some ways similar to the uncontrolled movements of a Cerebral Palsied child, prone to spasm when attempting coordination.

The full body-harness, commonly supplied with car seats, has distinct advantages for the handicapped child, since whilst providing comfortable support, the securing and releasing of a child is speedily done and this is an advantage to a busy carer.

The visual appeal of such chairs is always a vital consideration to manufacturers of "high street" merchandise, but rarely touched upon, it appears, in the development of new aids and equipment for the handicapped. In this case, the quality of the design of the framework that converts the chair for use by the handicapped falls far short of the quality of the design of the original "high street" product.



Title: Corner Seat.
Manufacturer: Nottingham Medical Equipment Co,
Melton Road, West Bridgford, Nottingham.
Overall dimensions (mm): H406. D610.
Cost (1977): £19.05.

General description of product:

This is a lightweight tubular steel version of the "home made" wooden corner seat often found in schools and therapy units, and is designed to be used by children from 2-8 years of age. The seat, which slopes backwards is approximately 130 mm high and like the back, made from canvas. An anti-tip device is built into this chair.

13.12.2 Design observations:

This type of chair is used by young Cerebral Palsied children who require trunk support to prevent extensor spasm, when lifting their arms to use their hands.

Since the chair folds it is easily transported and stored, although the rigidity lost in the folding mechanism can seriously delay its acceptance by a child who is attempting unaided sitting for the first time.

In appearance this chair resembles camping equipment of the past, but this is now a competitive market where colour and brightness sell the product. Yet there is nothing inherently attractive about this chair.



Title: Crossland Toilet Aid.
Manufacturer: Crosslands Plastics,
Ossett, West Yorks.
Overall dimensions (mm): H830. W550. D620
Cost (1977): £38.50.

General description of product:

Although this chair was initially designed as a toilet aid, it has proved to be a very acceptable chair for some Cerebral Palsied children at other times. Moulded in ABS this chair was a built-in headrest and pommel. It was designed for children within the age range 3-9 years by a research team from Newcastle Polytechnic.

13.13.2 Design observations:

As has been mentioned before, "one off" adaptations and modifications are difficult to carry out in plastics, and since no two handicapped children's seating requirements are exactly the same, adaptability should be an important consideration in any design solution. However, this chair, as primarily a toilet, uses plastic sensibly since it is easily cleaned and unaffected by disinfectants. The broad design of the base is to allow clearance for the toilet over which it is used, and in other situations provides vital stability.

The soft forms, typical of moulded plastic, prevent injury to the unsteady child, yet provide firm support and control where required.

Children with little or no trunk support, would require supervision when using this chair since no facility is available for the fixing of a harness.

13.14.1.



Title: "Growing Chair".
Manufacturer: Zimmer Orthopaedic Ltd,
Bridgend, Glamorgan.
Overall dimensions (mm): H840. W520. D900.
Cost (1977): £91.

General description of product:

Designed for children from 6 to 12 years, this chair can be enlarged as its occupants grow. The arms and footrests are detachable and the chair folds for transportation.

The frame is of tubular steel construction with a chromium plated finish, and the seat and back are in expanded vinyl.

13.14.2 Design observations:

The most favourable feature of this chair is that it can be extended to suit the growth of its user. This is done by purchasing a larger seat and back to fit the extended frame. The footrests can be re-positioned to accommodate longer legs.

No wheelchair has yet been commercially developed which can be readily increased in size to "grow" with the child. The "Easy-grow" wheelchair developed by David Hodge and Roy Fischer, post graduate students at the Royal College of Art, London, exploits the area of adaptation to suit growth most effectively. Although great interest has been shown by many organisations and by Government departments, at the time of writing, no decision has been made as to its future.



Title: HS2/A Chair
Manufacturer: R C Hayes (Leicester) Ltd,
Kirby Muxloe, Leicester.
Overall dimensions (mm): H 650. W400. D700.
Cost (1977): £63.95

General description of product

The K L Jeenay car seat forms the basis of this product: it has been mounted on a white, nylon-coated tubular-steel frame which also supports a removable plastic tray. The underframe, available with or without castors, allows the car seat to be fixed at three alternative positions from upright to an angle suitable for sleeping.

The tray has high sides for retaining toys and a metal plate laminated into its surface for use with magnetised toys.

This chair is designed for children from 1 to 8 years of age.

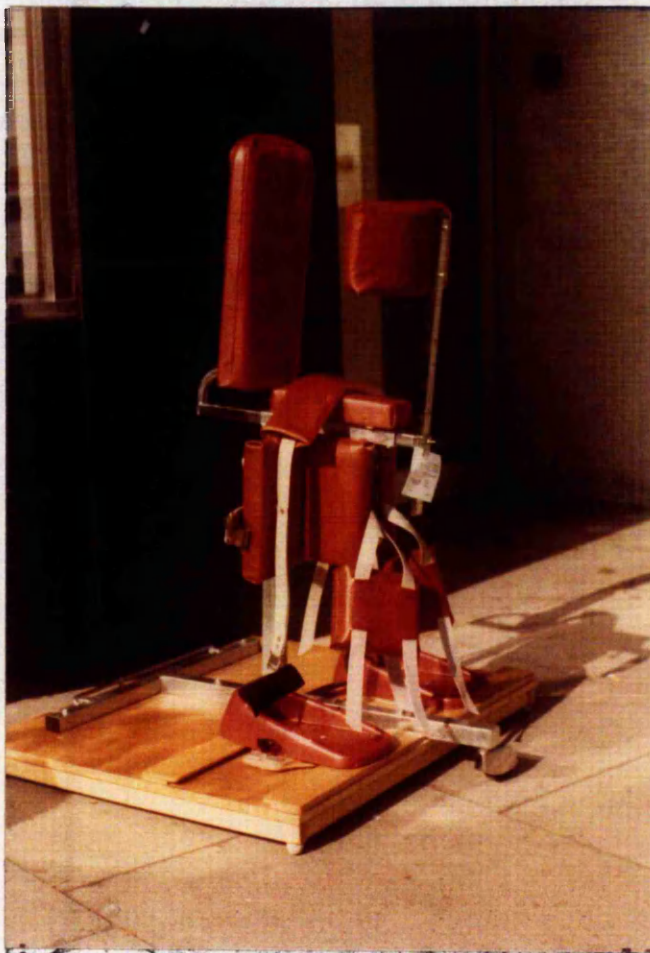
13.15.2 Design observations:

A further example of a car safety seat being used successfully in an 'out-of-car' situation. The K L Jeenay car is ideally suited to this application since the car fixing points can be easily adapted for use with other frames.

Small children can be safely supported in this chair and a number of people have found them particularly useful as a support for feeding. The tray is of a sensible design having a raised edge to retain toys, eliminating the frustrations of both child and carer. The design would be improved by the provision of a footrest.

Adverse comments on the product were few. However, as with all chairs which position the child near to the floor, it limits the opportunities for social interaction, particularly at meal times. Many of the daily household activities take place above the eye line of children sitting near the floor, and valuable opportunities for learning are lost as a result. The scope of this chair would be increased if an underframe which brought the child to domestic table and working heights could be developed.

The chair is generally simple and pleasing in appearance.



Title: "Hasi" Abduction Stand.
 Manufacturer: Western Medical Ltd,
 12 Nottingham Place, London W1.
 Overall dimensions (mm): H1120. W1000. D800.
 Cost (1977): £63.

General description of product:

This standing frame is typical of a number of similar products designed to support severely posturally-handicapped children in an upright position.

Constructed from square-section, chromium-plated metal tube, the stand is mounted on a large wooden base fitted with castors. The stand is fully adjustable and provides total body support with fixed pads for back, front and legs, together with loose pads for abdomen and knees. These are fixed to the main frame with straps. Children from 2 to 10 years can be supported in a standing position with this product.

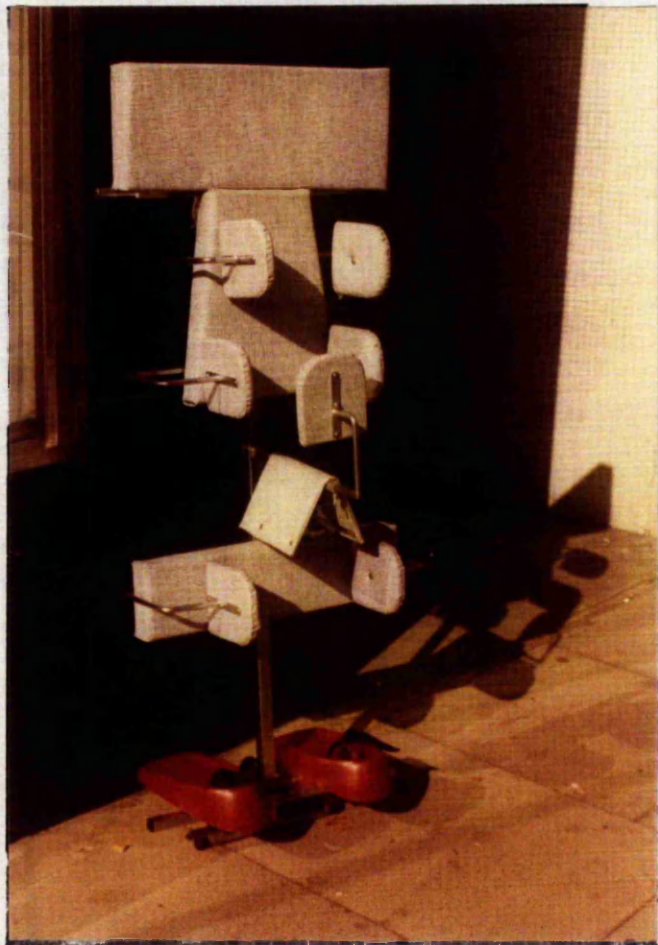
13.16.2 Design observations:

Since many posturally-handicapped children spend long periods of the day sitting, it is vitally important that facilities are available for them to stand, supported either by another person or by specially-designed standing equipment. This is particularly important for children whose overall pattern is one of flexion, and in these cases prolonged sitting can result in the development of contractures at the hips and knees.

Apart from the physical advantages that are gained from short periods of standing, social benefits can be achieved. As stated before, many daily activities take place at a standing level, and if the handicapped child is not to be denied this alternative view of his surroundings and an opportunity for involvement in table-height activities, equipment of this type will have to be available.

For the child with no stability of his own, the frame in which he stands must be particularly stable. This product was praised for its robust quality and stability, although one teacher commented that the large base caused difficulties for other children in the classroom particularly those with mobility problems.

This standing-aid seems to have evolved instead of being designed rationally. In consequence, it is over-engineered, cumbersome and grossly over complicated for the task that it performs. In appearance it has all the marks of hospital/institutional apparatus - almost to the point of resembling some sinister piece in a by-gone torture chamber. It is hardly appropriate for use in a childrens nursery school.



Title: "Hasi" Proning System.
Manufacturer: Western Medical Ltd,
12 Nottingham Place, London W1.
Overall dimensions (mm): H1300. W500. D400.
Cost (1977): £54

General description of product:

This product, like the abduction stand, is representative of a number of alternative products providing the same facilities.

The prone board is designed to be used against a table, and at an angle to the floor. The child uses the board for frontal support whilst working at table height. This design provides adjustable support on an extendable frame.

13.17.2 Design observations:

Children with asymmetrical sitting postures often have difficulty with hand-eye coordination. The advantages of the prone board for a child with a flexed, asymmetrical body is that it provides symmetry, and prevents the shoulder girdle from pressing down, so that the child can reach forward and use his hands. His hips and knees are kept extended and apart, his feet dorsi-flexed and any tendency of the feet to turn in or out can be controlled.

The Hasi system was found to be rather difficult to adjust and much larger than it needed to be, particularly for the age group 2 to 10 for which it is intended. Like the abduction stand it is over-engineered and unnecessarily complex. It compares unfavourably with some "home made" prone boards which are more decorative and much less formidable for small children to use.



Title: "Junior Sports" Chair.
Manufacturer: Meyra-Rehab (UK) Ltd,
Warminster, Wilts.
Overall dimensions (mm): H780. W400. D950.
Coat (1977): £119.73

General description of product:

The "Junior Sports" is a conventional wheelchair for self-propulsion and is available with either 600 mm or 710 mm diameter wheels. It is a small compact chair made in chromium-plated steel tube and fitted with a one-piece vinyl seat and back. The foot-rests are adjustable and are retained in an upright position when the chair is folded for transportation.

13.18.2 Design observations:

The chair is generally liked for its compact design and its economical use of space. Children using the chair found it to be particularly maneuverable, a distinct advantage in small, overcrowded classrooms.

Although the seat and back are thinly upholstered they achieve a degree of comfort not normally associated with slung seats. One of the yet-unsolved problems with wheelchairs seems to be to attain a comfortable, well-supporting seat unit which can be folded quickly and neatly for transportation and storage, but this chair is better than most.



Title: "Multi-variable" chair.
Manufacturer: Newton Aids Ltd,
22A Conway Street, London W1
Overall dimensions (mm): H700. W445. D445.
Cost (1977): £30.

General description of product:

Constructed in solid beech with upholstered plywood seat, back and arm rests, this chair can be adjusted in a number of ways. The seat can be raised and tilted at the front and back. The back-rest angle can be changed, and the removable arm-rests can also be used as head-supports when fitted to the back uprights. A potty is stowed away under the removable seat.

13.19.2 Design observations:

A number of schools that I visited, during the survey of Institutional Care, used this chair for children who had begun to develop a degree of sitting balance but who were unable to sit totally unsupported. Staff commented that although adjustment facilities were available in the design, they were difficult to carry out quickly and this was a disadvantage in a busy school or nursery situation. When necessary, the head supports proved effective for floppy children, and they were easy to fit.

A physiotherapist pointed out that although having potty facilities in a normal school chair might be convenient for busy staff, it did little to develop the child socially. Some children became accustomed to toileting in the chair they also sat in for feeding and work, and this made toilet training more difficult.

The chair is well-proportioned and blends naturally with other school furniture.



Title: "Newco Ladderback" Chair.
Manufacturer: Newham Municipal Industries,
Stratford, London E15 4PT.
Overall dimensions (mm): H800. W365. D660.
Cost (1977): £8.

General description of product:

The chair is constructed in solid beech and birch plywood with a natural finish. The seat is 350 mm square and 300 mm high, and forms the top of a plywood box-structure which provides the chair's rigidity. Skids are fixed to the base and these increase the chair's stability, while also providing ease of movement.

The ladder back can be used as a standing aid for children with poor standing-ability.

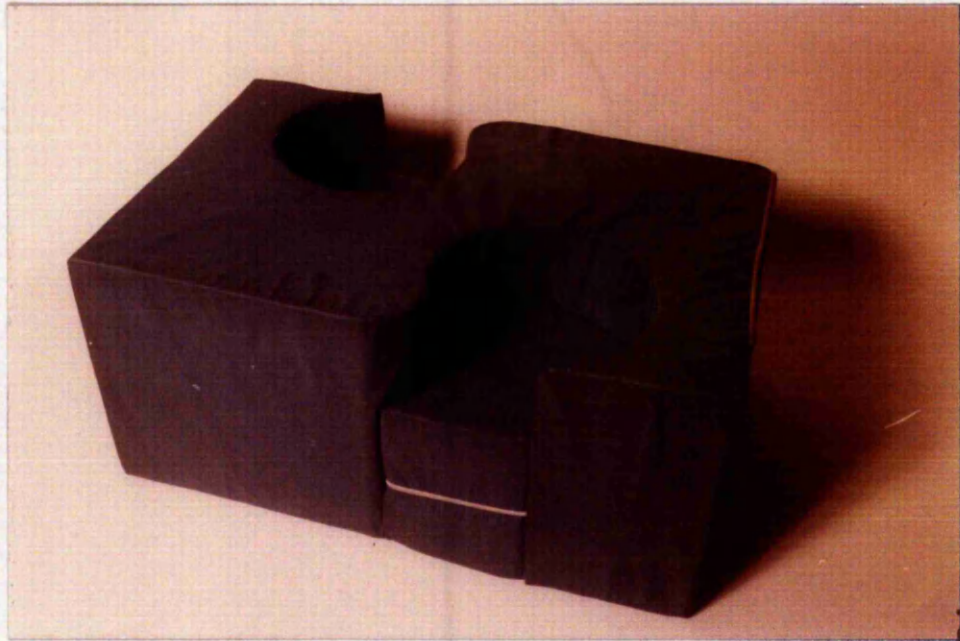
13.20.2 Design observations:

This chair is based on the "Peto" system, a physiotherapy technique developed at the Peto Institute, Budapest, Hungary, which uses a number of "ladder type" units as aids to a therapy programme (see chapter 6.0.0 of this study, "Framework" page 162).

Seen in a number of therapy units, this chair provides a child who is developing sitting balance with a "no nonsense" seat and a back with rungs he can grasp for re-assurance.

In one physiotherapy unit, a rewarding game had been developed. Children sitting on these chairs passed a rubber ring to each other. Each child hooked the rubber ring on the top of his neighbours chair who then removed it and passed it on. This required a good deal of dexterity in co-ordinating hand, eye and body in a series of twisting, turning and locating operations.

"Home made" versions of this chair are often seen since it can be made quite cheaply with a limited knowledge of woodwork. The chair can be adapted to suit individual children quite easily since it is constructed entirely in wood.



Title: "Playforms".
Manufacturer: Price Bros and Co Ltd,
Wellington, Somerset.
Overall dimensions (mm): H460. W900. D600 (layout illustrated)
Cost (1977): £25.95.

General description of product:

Manufactured in polyether foam, "playforms" are available in a number of shapes and sizes designed to assist in a variety of play, relaxation and exercise situations. The unit illustrated provides seating for two children, and is supplied with cushions of different thicknesses to give variable seat heights.

The units are covered in waterproof blue 'briflon' and can be wiped clean with soap and water.

13.21.2 Design observations:

"Playforms" are a popular addition to most nursery schools and therapy units, and they provide both staff and children with a number of alternative layouts for play and relaxation - a pleasant alternative to prolonged sitting in a wheelchair.

The material used to cover these all-foam units did appear to soil easily, and required constant attention, a problem with covering materials which come into contact with the floor.

The seating value of this product is only marginal compared to its usefulness as a large-scale 'toy'.

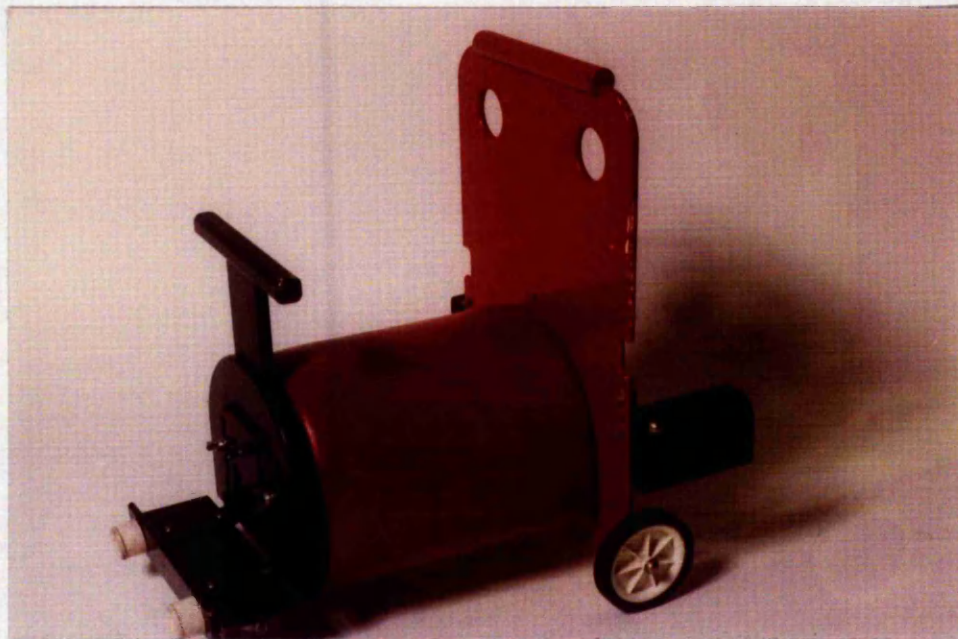
13.22.2 Design observations:

It has been found that this chair can effectively support severely handicapped children, although it was originally designed as "fun seating" for the non-handicapped.

The advantage of this type of support is that no extra straps are required. The child can be positioned in a number of postures with safety. Furthermore, other members of the family can use it and it does not become a "special aid" in the home environment.

The "bean-bag" chair is ideal for relaxation, and even sleep, and can be reshaped after use.

Therapists did point out, however, that the chair should only be used for short periods, since no postural development can be achieved from the support that it provides.



Title: "Saddle Seat Engine".
 Manufacturer: Toy and Furniture Workshop,
 Totland Bay, Isle-of-Wight.
 Overall dimensions (mm): Small H560. W400. D500.
 Large H760. W520. D700.
 Cost (1977): Small £40.83
 Large £61.61

General description of product:

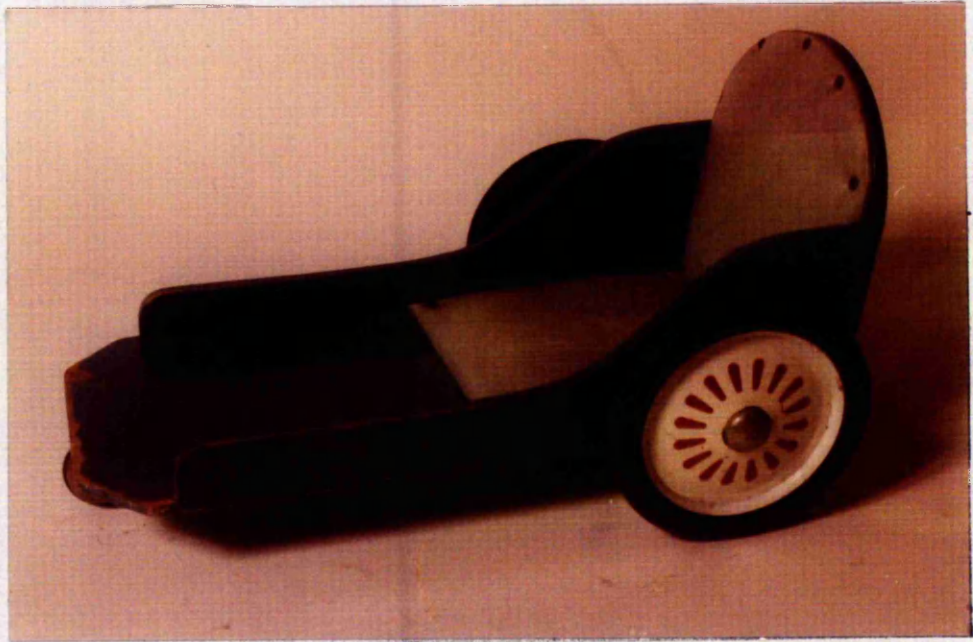
Designed specifically for cerebral palsied children who are unable to bend at the hips, the "Saddle Seat Engine" is adjustable to different heights. The small engine seat adjusts from 200 mm to 280 mm, and the large engine seat from 320 mm to 480 mm. "Forward only" action converts the rocking of the child's body into forward motion. This action on the back wheels can be changed to reverse. The handle retracts to go under a desk or table.

The design is based on the "roller chair" developed by Nanncie Finnie and described in her book "Handling the Young Cerebral Palsied Child at Home", see 16.0.0 Bibliography.

13.23.2 Design observations:

The chair is acceptable in any nursery, particularly for children attempting self-mobility. The roller shape separates the child's legs and makes it easier for him to bend his hips and knees, keeping his feet flat on the floor.

An added advantage of this design is that his first attempts at walking can be rewarded by pushing a friend seated as a passenger on the engine.



Title:	"Shasbah Trolley"		
Manufacturer:	Mrs M Charrett, S.H.A.S.B.H.A, Southampton.		
Overall dimensions (mm):	H360.	W300.	D650.
Cost (1977):	Small	£13	
	Large	£16.50	

General description of product:

The father of a child suffering from Spina Bifida designed this trolley, and it is manufactured by a non-profit-making unit linked to the Southampton and District Spina Bifida and Hydrocephalus Association (SHASBAH).

The trolley is made in two sizes and it is suitable for all paraplegic children between the ages of one and ten years. It is constructed in painted plywood and has a foam-filled seat and back covered in vinyl. The trolley is propelled by turning the rims of the large side wheels and the base platform is supported front and rear with 'Orbit' castors.

13.24.2 Design observations:

The 'Shasbah' trolley is a very successful mobility aid to paraplegic children because it is very manoeuvrable: it can be completely turned within its own length. Children with only a short period of practice find it easy to use and responsive to their control.

Unfortunately, as with any aid that a child is particularly happy with, there is a tendency not to try alternatives. Children are often fed in these chairs which can be supplied with low tables for feeding, work and play. This can become an almost too-convenient situation in which the children spend most of the day at floor level.

13.25.1



Title: Small standing box.
Manufacturer: Toy and Furniture Workshop,
Totland Bay, Isle-of-Wight.
Overall dimensions (mm): H800. W700. D900.
Cost (1977): £46.

General description of product:

Manufactured in solid beech and birch plywood this standing box is designed to support children of between the ages of 2 and 5 years.

The top and floor are adjustable giving three standing heights. A removable back allows the child access and also provides back support.

13.25.2 Design observations:

The physiotherapists that were consulted with regard to this product felt that the use of standing boxes by cerebral palsied children was satisfactory for only short periods since little external support is provided.

It is particularly unsatisfactory for a child to use a standing box unsupervised since he can easily sag into an extremely uncomfortable and physically damaging posture.

Providing that a child's physical condition is sufficiently well-developed, distinct advantages can be gained from short periods of standing as explained earlier in this survey. However, a number of teachers preferred supports that allow a child to stand and work at the same table as his friends, rather than a device which merely isolates him.

The physical requirements for this product are very different to those of 'normal' school furniture, so that a high degree of sensitivity in designing such an object is required. This product fails utterly in this respect and in no way attempts to break down the abnormality of being 'packaged' in this way.



Title: "Tripp Trapp" Chair.
 Manufacturer: Westnofa, Norway.
 Overall dimensions (mm): H780. W470. D490.
 Cost (1977): £19, baby rail £2.50.

General description of product:

This chair was initially developed to cope with normal growth in children and adults. Constructed mostly in solid beech the design allows for changes to be made in the relationship of the seat-height to the ground, and the seat-height to the footrest. It also provides support for young children, who are restrained by means of a laminated beech rail which "spring fits" into the two main frame members.

It was found that some children with poor postural control could also sit comfortably in this chair, and a sturdier restraining bar has been designed for their use.

13.26.2 Design observations:

It is interesting that this chair was not initially designed with the handicapped in mind. The early design work was centered around the notion of producing an adaptable seat unit that could be used by all members of the family, from the smallest to the largest. For handicapped children who are in need of the same support as a baby, but on a large scale, this chair suited ideally. However, when the chair has been fixed to suit a particular child, staff at some schools found it time-consuming to change it to suit another child, and this is due, to some extent to the fact that each of the cross bars has to be loosened to allow the seat, or footrest to be moved, which can mean the adjustment of up to 8 screws.

When used in the low position the footrest is particularly accessible for passing children to stand on, and if they do this, it makes the chair extremely unstable.

It was interesting however, to see a "Trip Trapp" chair being used successfully by each member of one family, enjoying a meal together: mother, father, grandfather, teenage son, 9 year old daughter and 6 year old physically handicapped daughter.

This design illustrates the basic faults that can be made by an over-attention to strong visual imagery - in this case the elevational inverted '7' shape, which pre-determines the geometry of the chair and uncompromisingly creates problems in use.

13.27.1



Title: Watford "Potty" Chair.
Manufacturer: Newton Aids Ltd,
2a Conway Street, London W1.
Overall dimensions (mm): H450. W280. D300.
Cost (1977): £6.60.

General description of product:

Although designed as a potty chair, it is converted into an ordinary chair or child's commode chair, by inserting an upholstered plywood seat. Constructed in plywood the chair has a solid wooden safety bar across the front which can be located in one of two positions.

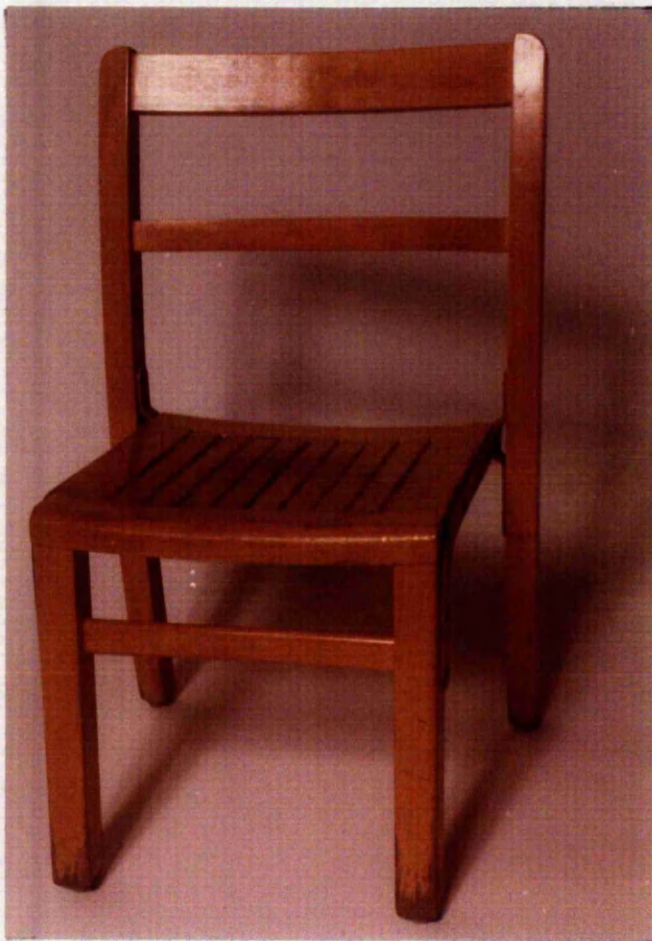
13.27.2 Design observations:

The high sides of this chair are particularly good for children who are unable to maintain an upright posture. However, small children found their arm movements restricted by it, and one teacher suggested that improvements could be made by reshaping the sides, making the front lower than the back.

The safety-rail caused discomfort for some children who, if left unattended could flop forward over the rail and remain 'hanging' there until noticed.

The advantage of this type of chair is that its simple construction and low price permit alterations and modifications to be made to suit individual children.

13.28.1



Title: Wooden stacking chair.
Manufacturer: ESA (Esavian),
Esavian Works, Stevenage, Herts.
Overall dimensions (mm): H650. W390. D360.
Cost (1977): £6.

General description of product:

Constructed entirely in solid beech, this chair is available in a range of sizes: nursery, infant, junior and senior.

The seat is slatted and narrower than the back frame to allow for stacking.

13.28.2 Design observations:

Although designed primarily for non-handicapped school children, this chair is also used by children in special schools, since it has been found particularly easy to modify to individual requirements. Examples are shown.

13.29.1



Title: Wooden tub chair.
Manufacturer: ESA (Esavian),
Esavian Works, Stevenage, Herts.
Overall dimensions (mm): Small H430. W320. D330
Large H480. W330. D330
Cost (1977): £7.26

General description of product:

Based on the 'Windsor' chair, construction is of a solid wooden seat into which round legs and rails are housed. This chair is particularly sturdy and is used in many nursery and infant schools by mildly handicapped children.

13.29.2 Design observations:

Staff who were familiar with this chair found it particularly successful for children who were attempting hand and eye co-ordination exercises, but who were unable to maintain an upright sitting position unaided.

13.29.2 (Continued)

The "all round" shape of the arms gave them good support and straps could be easily fitted to the upright spindles which join the arms to the seat.

In some schools, these chairs had been adapted to take a potty, and in one instance a front pommel had been fitted to prevent the occupant from slipping forward and on to the floor.



Title: "The Yorkhill" Chair.
 Manufacturer: Amesbury Surgical Appliances,
 Caephilly, Mid Glamorgan.
 Overall dimensions (mm): H700. W250. D600.
 Cost (1977): £65.93.

General description of product:

Developed primarily for Spina Bifida children this chair is often also used by Cerebral Palsied children. For 2 to 5 year olds the chair has a 250 mm wide seat and detachable tray.

A foot operated "prop" stand immobilises the chair by lifting the propelling wheels off the ground. The seat and back are in one padded unit covered in leather cloth.

Constructed in tubular steel, the frame supports a canvas sling into which the seat and back are fitted.

13.30.2 Design observations:

The chair is used most by young paraplegic children, who find it extremely manoeuvrable in confined spaces.

Unfortunately, the chair only partially folds and is not as easy to transport as the conventional sideways-folding chairs.

The brake can only be applied by an attendant and this restricts the users independence.

Of its type the chair has a neat and compact appearance.

The following photographs illustrate other work in the field of close body-mould systems for the production of custom-made seating for severely posturally-handicapped individuals. The techniques described represent a cross section of methods, and, although individuals and organisations are mentioned, it is understood that many others have developed similar techniques with similar results.

14.1.1 ORGANISATION

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WORK BY:

F W Germans, N W Koster, H H Kwee,
N Van Der Mey, R Soerjanto and D W Wijkmans

Occupational therapists made requests to the Institute of Medical Physics to produce solutions for patients with sitting problems.

14.1.2 A process known as Vacuum Formfixation Casting (VFC) had been used to take accurate impressions of leg stumps, in the production of prosthesis, and a patent has been granted to J W Mead through the United States Patent Office for this. Professor Germans and his team decided to develop the same technique in the production of part and whole close body moulds, in an attempt to relieve the discomfort experienced by people with postural deformities.

14.1.3 At present they are developing individual close body moulds for two main groups of patients:

- a) Patients suffering from skin breakdown through excessive sitting - the basic idea is to obtain an optimal pressure distribution over the seat of the patient, and thereby avoiding any excessive peak pressures which could cause sitting sores. For this purpose, they are experimenting with buttock seats shaped to the individual patient.
- b) Patients with sitting problems due to deteriorated postural conditions - for this group they are developing individually formed bucket seats, which include close support for the back, and, where necessary, the head of the patient.

14.1.4 Methods:

The patient is seated on one or more thin latex rubber bags partly filled with polystyrene granules. His correct sitting posture is determined by the medical team responsible for the patient.

His buttocks must sink into the bag to the proper depth in order to obtain a close contact and correct distribution of pressure. If necessary a light vibration of the bag can be used to facilitate the sinking into the bag. In this way it is also possible to control the depth to which the buttocks sink by stopping the vibration the sinking is also stopped.

Professor Germans is of the opinion that the above procedure is satisfactory to produce impressions for buttock seats. For the production of total body impressions, another bag, or part of the same bag, is placed around the patients back and pulled forward from under his arms. After checking that the correct posture has been maintained and that sufficient support has been provided, the air in the bag (or bags) is evacuated. Atmospheric pressure compresses the bag and its contents, solidifying the grain filled bag into the shape of the supported parts of the patients body. If the procedure has been successful then the patient is properly supported in this solidified structure.

The patient can now be removed from the bag, leaving his impression behind. The form of the impression is judged on its quality, and its functional success can be evaluated by placing the patient in it again for some time.

If it is acceptable, a plaster cast of the impression is taken, otherwise the procedure is repeated until it is successful.

A datum line is taken from one surface of the cast for future reference when preparing the final seat. The plaster cast obtained is finished by smoothing and represents an accurate copy of the patients shape in the desired posture and under normal loading conditions.

The thin latex rubber bag, filled with polystyrene granules, used to provide body impressions. The valves, used to evacuate the air can be clearly seen.



A plaster cast taken from the impression formed in the latex bag above.

The positive plaster cast is used as a mould for the vacuum forming of acrylonitrile - butadienestyrene (ABS) sheet, or the hand lay-up of glass reinforced polyester (GRP), to produce the chair shell.

The patient uses this shell as a close body support fixed in a wheelchair or secured to a normal domestic chair.

14.1.5 Results

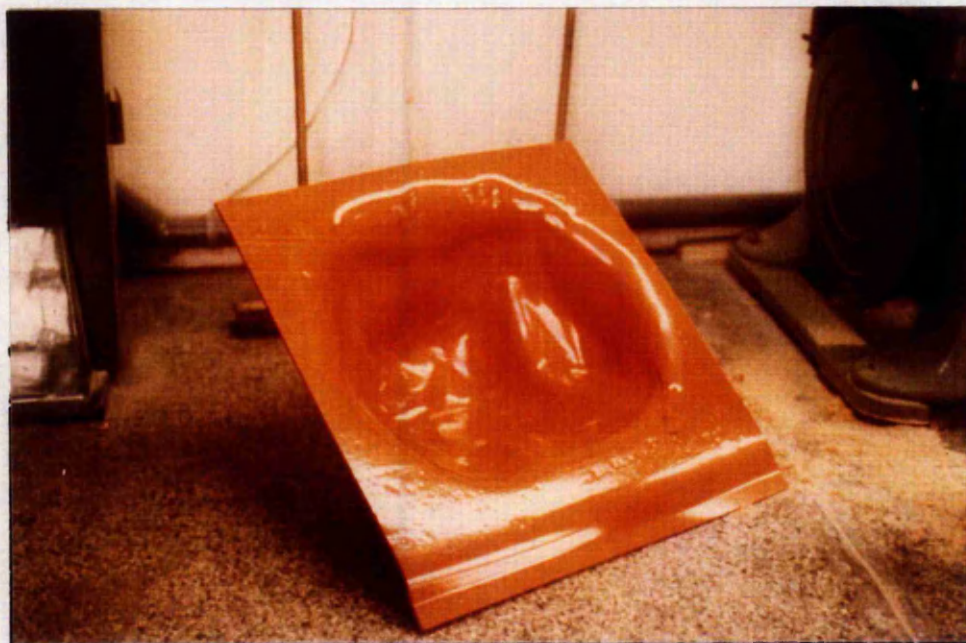
To date, fifteen such shells have been prepared by Prof Germans and his team, and although some of the seats have required minor corrections, none of them have been rejected by either the patient or medical staff so far, even in those cases where conventional methods had failed.

Their first results have shown the following advantages of the VFC technique:

- a) The impression can be taken with the patient in his normal or corrected sitting posture.
- b) The impression can be made with the patient wearing normal clothing, and, where necessary, his orthopaedic appliances, thus producing the shape required under actual use.
- c) This technique is less disturbing to the patient than the one in which a plaster cast is made directly on his body. This aspect is of particular importance where children are concerned.
- d) The impression obtained is less dependent on the ability of the particular orthopaedic technician taking it.

14.1.6 Conclusions

Prof Germans emphasised that their work has so far been focused primarily on the problem of making a good body impression. The construction of the seat itself still presents them with many problems.



The ABS shell vacuum-formed, using the plaster cast as a mould. This particular shell was produced for a middle-aged man with an acute scoliosis. Professor Germans explained that, although this would be used in a domestic setting at meal times, it had not been produced to fit a specific chair, and would require a purpose-made underframe.

They have been using vacuum formed ABS with simulated sheepskin as a liner. The simulated skin (with uncoated back) is clamped around the plaster-of-paris mould without any wrinkles before the ABS sheet is formed on top of it.

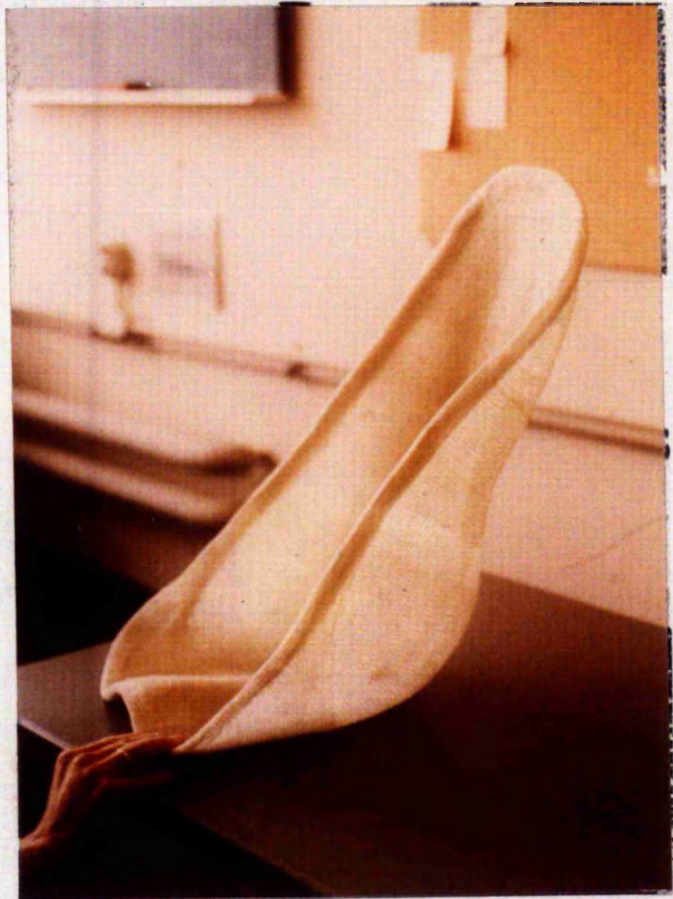
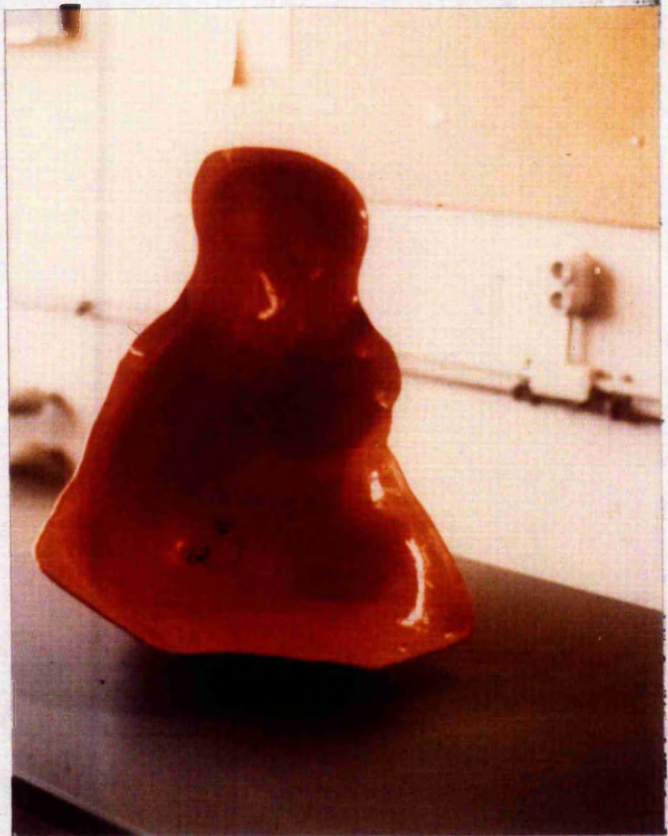
Perspiration problems sometimes occur, and a resilient liner which prevents excessive perspiration and even facilitates the ventilation of the patients skin would be desirable.

In an attempt to combat this problem they have made seats from Lightcast 11, an open-weave fibre glass impregnated with a photo-sensitive resin, which becomes rigid when exposed to the light generated by a special lamp emitting near ultra-violet light. The porosity of this material is very good. A disadvantage, however, is the impossibility of making local corrections afterwards and the difficulty of handling the material where there are sharp undercuts in the mould.

Prof Germans was most concerned with the cosmetic appearance of the seat. He felt that from the outside, the deformation of the body was clearly visible and even accentuated. He felt that a method of camouflaging this had to be found without increasing the perspiration problem. He was also anxious to see that the whole process of casting and manufacturing of seats was made as economical as possible.

An earlier shell produced at TNO. The close fitting nature of the mould often causes problems of perspiration.

Attempts have been made to solve this problem by producing shells in an open weave material "Lightcast" (opposite).



14.2.1 ORGANISATION: Mary Marlborough Lodge
Nuffield Orthopaedic Centre
Heddington, Oxford

WORK BY: Mr Terry Strange and Mr Derek Harris

Work on close body mould techniques began at Mary Marlborough Lodge some 10 years ago. At that time the system was based on a development used by the Royal Air Force Institute of Aviation Medicine for obtaining a rigid "vacuum splint" for use in orthopaedic operations.

Impressions of body contours were obtained using a flexible airtight container, partly filled with small spheres of expanded polystyrene. When the container was evacuated of air a rigid contoured cast was obtained.

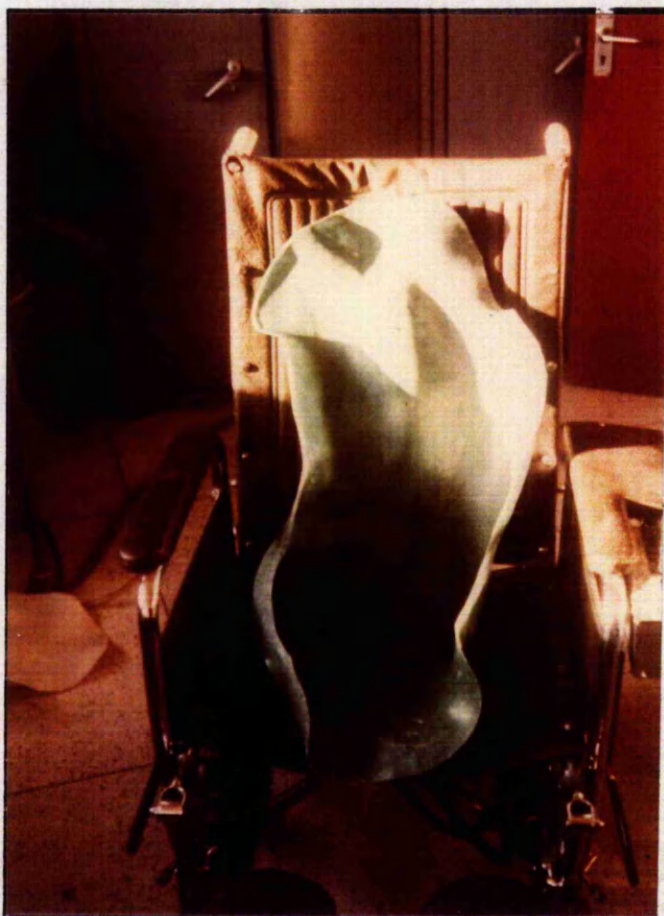
14.2.2 The Research Workshop at Mary Marlborough Lodge applied this technique to obtain full body impressions of a number of very disabled patients with severe physical deformity, using the cast to make fibreglass or polythene supports.

14.2.3 Methods

The casting cushion is made up as follows.

A PVC bag approximately 1500 mm x 90 mm is half-filled with polystyrene beads. A 25 mm tube, covered in gauze to act as a filter, is glued to the bag, and when a vacuum was applied to the bag by means of the tube, it becomes rigid. A vacuum pump is used for this purpose, and it is found that one with adjustable pressure facilities is the most successful.

The impression is taken with the patient sitting on the casting cushion in his wheelchair. The whole process is supervised by a physiotherapist to ensure that a good sitting position for the patient is maintained.



A GRP shell produced at Mary Marlborough Lodge, and fitted directly to the clients wheelchair.

The vacuum is released in the polystyrene negative and the solid, positive ceramic form removed. This is now used as a mould for producing a vacuum formed ABS shell. An integral layer of polyether foam is fixed to the ABS with adhesive at the moulding stage, to increase the comfort of the final shell.

14.2.6 Conclusions

The advantage of this process is the reduction in the time involved from the initial casting stage to the final shell. It is possible for a patient to be fitted up with a comfortable support in one day.

Corrections can be made by remoulding the thermo plastic ABS shell onto a new plug produced from a corrected position in the polystyrene cushion. These corrections can be made as required - even some months after the initial shape is produced.

The supports made at Mary Marlborough Lodge in this was are provided for use in wheelchairs, and Mr Strange felt that it was necessary to develop suitable sub-structures for the shells to enable them to have a wider use, particularly in the domestic environment.

14.3.1 ORGANISATION: Specialised Mouldings Ltd
Redwongs Way
Huntingdon, Cambridgeshire

WORK BY: Peter and David Jackson

Specialised Mouldings are manufacturers of glass reinforced plastic components for the motor and aircraft industries.

For many years they have produced complete body shells in GRP for racing car manufacturers, and in recent years have developed a technique for custom-moulding the seats to suit the individual drivers.

14.3.2 The system was shown on television and demonstrated by the late Graham Hill. After seeing this, Dr John Milligan, a Rheumatology and Rehabilitation Consultant at Poole Hospital, contacted Specialised Mouldings with the suggestion that it might be possible to use their custom moulding technique to produce wheelchair inserts for people with spinal deformities.

A successful moulding was subsequently produced for a 21 year old Bournemouth girl who had suffered with acute spinal deformity since birth. Following favourable results from this moulding, further inserts have been made for Muscular Dystrophy, Cerebral Palsy and Polio patients.

14.3.3 Methods

The following moulding procedure is monitored at all stages by the patients physiotherapist. The moulding is produced with the patient sitting in his wheelchair and so any apertures in the seat, back and arm area have to be filled to contain the mould. This is done with strips of hardboard taped in place, and any sharp protrusions are covered with pieces of soft foam.

A large polythene bag is then placed in the chair with its open end uppermost, at the top of the back rest. The patient then returns to the chair and assumes his normal sitting posture. Liquid polyurethane is then prepared in a quantity estimated by the operator by visual calculation of the spaces between the patient and the inside of his chair.

The polyurethane is poured into the open end of the polythene bag, and allowed to run freely down to the seat. After a few minutes the polyurethane foams in all directions, and as it reaches the open end of the bag it is retained either by folding the top over, or by holding piece of hardboard over it until the thermal reaction is complete and foaming has stopped.

Throughout the whole of the foaming cycle, the patient must remain perfectly still, otherwise incorrect support might result.

The patient is removed from the chair and the moulding allowed to cool and harden.

The polythene bag can now be separated from the rigid polyurethane cast and the patient resealed to ensure that there are no areas of his body unsupported, or incorrectly supported.

When a successful moulding has been achieved, it is coated with a thin layer of GRP and spray painted before final fitting to the wheelchair.

Since the moulding fits both the wheelchair and the patient, very little is needed to make the insert secure, usually this can be done with existing straps where necessary.

Specialised Mouldings now offer this custom-moulding service to hospitals and rehabilitation units. The inserts are made at the patients home, school or institution and are returned to Huntingdon for finishing work.

14.3.4 Conclusions

Although successful inserts have been produced using this technique, a number of factors prevent its widespread use:

- a) Polyurethane materials are difficult to work with outside controlled conditions, and can be harmful if used incorrectly.
- b) The fast foaming polyurethane leaves little time for adjustment of the patients posture.
- c) During the foaming cycle heat is generated which can be extremely uncomfortable.
- d) To date no accurate method of calculating the quantity of material required for each mould has been devised and the wastage factor is high.
- e) Wastage also occurs with incorrect moulds since there is no facility for trying and adjusting the insert prior to final fitting.

14.4.1 ORGANISATION: Chailey Heritage
(Craft School and Hospital)
North Chailey
Nr Lewes, Sussex

WORK BY: R L Nelham B Eng C Eng MIMech E

Personalised seats and inserts for wheelchairs are being made at Chailey Heritage for patients with gross spinal deformities.

14.4.2 In some cases the seat is manufactured so that it can be removed from the wheelchair for transfer to a vehicle. For one particular child the seat was fitted into the rear seat of the car using standard fittings which are commercially available for childrens safety seats.

A total of 17 seats have been made at Chailey Heritage to date.

14.4.3 Methods

The vacuum casting technique as described in 14.1.4 is used to produce the impression of the patients body and no changes to the process have been introduced. However, problems had been experienced with the polythene bags containing the polystyrene beads. They often became ruptured causing the beads to escape. To prevent this two bags are now used, one inside the other, the inner one being pierced with very small holes to prevent trapping air between the two.

At Chailey Heritage the seat shells are vacuum formed in thermoplastic materials. They have found that the comparatively high cost of a vacuum forming machine is soon recouped by the significant time saving which it allows as against the use of hand lay-up GRP techniques.

To prevent the collapse of the plaster mould under vacuum pressure in the machine, it is strengthened with internal wooden braces held in place with plaster.

The mould is positioned under the pre-heated thermoplastic sheet, which is drawn into the cast by vacuum creating a close fit between the two. This procedure is first carried out with a sheet of 'plastazote' or 'evazote' which forms the soft inner lining to the shell and is repeated with a sheet of ABS. The foam layer remains on the cast during the moulding of the ABS and the two are consequently heat bonded together.

After removal from the mould the shell is then roughly trimmed to shape and a trial fitting is carried out. Any corrections can be made by locally heating the shell with a hot air gun followed by hand forming which readily achieves the necessary corrections.

A second shell is produced which forms the base of the seat shell and provides it with a flat surface for fitting to a wheelchair or for fixing to a car seat, or for standing on the floor.

14.4.4 Conclusions

Since the plastazote or evazote liner is left uncovered, it is vulnerable to damage. It also causes the patient to be too warm in summer. An upholstery material is being sought that is sufficiently elastic to follow the contours of the seat shell, robust enough to resist damage, and which will provide ventilation between the patient and the close-moulded shell.

15.0.0 Glossary of terms often used in discussions and literature concerning physically handicapped children:

ABDUCT - to move away from the midline of the body.

ACTION TREMOR - Limb tremor.

ADDUCT - to move towards the midline of the body.

AGNOSIA - loss of ability to recognise experiences from the special senses (eg visual and auditory) and from other parts of the body (eg touch).

AKINESIS - loss of movement.

AMYOTONIA CONGENITA - a congenital defect causing loss of power in the muscles.

AMYOTROPHIC LATERAL SCLEROSIS - a gradual degeneration of the spinal cord producing progressive wasting and marked spasm of the muscles.

ANKYLOSIS - the fusion of limb joints by disease or by prolonged fixation in one position.

ANKYLOSING SPONDYLITIS - a disease of ligaments and cartilage affecting mainly the joints of the spine.

ANTERIOR POLIOMYELITIS (acute) - inflammation of the spinal cord, producing paralysis of the muscles.

APHASIA - inability to perform purposeful movements although there is no muscular or sensory loss or disturbance.

APOPLEXY - cerebral haemorrhage (bleeding into the brain).

ARTHODESIS - a fusion of a joint by operation.

ATAXIA - irregularity of movement.

ATAXIC GAIT - irregularity in walking.

ATHETOSIS (athetoid) - unco-ordination of movement, often combined with shaking in cases of Cerebral Palsy.

ATONIA - weakness of muscles producing lack of vitality and energy.

ATROPHY - wasting of muscles.

AXILLA - armpit.

BARREL CHEST - a large, rounded chest usually with a very diminished chest expansion.

CALIPER - a leg iron designed to support, in a corrected position a paralysed, deformed or broken limb.

CARPUS (Carpal Bones) - small bones of the wrist.

CEREBRAL PALSY - see 1.2.0

CLONUS - shaking movements of spastic muscles after the muscles have been suddenly stretched.

CONGENITAL - with the child from birth.

CONTRACTURES - shortening of the muscles due to the fixation of a limb, either on a splint or in a plaster case or as the result of a disease which prevents movement in a joint.

DEBILITY - weakness, loss of power.

DECUBITI - the plural of decubitus ulcers; bedsores.

DEFORMITY - a malformation of any part of the body, caused by abnormal developments, injury or diseases of bones, muscles, skin or nerves.

DEGENERATION - deterioration of an organ or tissue.

DIPLEGIA - paralysis affecting both corresponding limbs, eg both legs.

DISLOCATION - a condition in which the adjacent surfaces of two bones become displaced on one another, partially or completely. Partial dislocation is sometimes termed SUBLUXATION. Complete dislocation is sometimes termed LUXATION.

DORSI-FLEXION - the lifting of the foot up towards the body.

DROP-FOOT - an inability to bend the foot upwards at the ankle joint.

DYSTROPHY (see ATROPHY) - gradually increasing muscle wasting and weakness.

EPIPHYSIS - the ends of long bones which in childhood are connected to the shaft (Diaphysis) by thin discs of cartilage. In children they are liable to slip as the result of a fall and unless quickly and completely restored to their proper position may permanently interfere with growth.

EVERSION - turning out of the foot.

EXTENSION (extensor spasm) - straightening of any part of the body.

FEMUR - thigh bone.

FIBULA - outer bone of the lower leg, also called "brooch bone".

FLACCID PARALYSIS - paralysis seen in anterior poliomyelitis. Muscles are flabby and limbs sometimes fail.

FLEXION - the act of bending or condition of being bent. Muscles are sometimes described as extensors or flexors.

FRACTURES - injuries to bone due to accident. The bones may be merely cracked or completely broken into two or more fragments.

Comminuted fractures - those in which the bone is splintered into small pieces.

Compound fractures - those in which the skin is punctured.

Complicated fractures - those in which a blood vessel, nerve or joint is also involved.

Greenstick fractures - those in which the bone is split but not completely broken.

Spontaneous fractures - those which occur in diseases where the bones become very brittle (see OSSIUM FRAGILITAS).

FRIEDREICH'S DISEASE (Friedreich's Ataxia) - a disease of the nervous system of unknown origin, appearing usually in childhood, which is accompanied by deformities, lack of control of movement, and altered speech. The children, are however, of normal intelligence.

GENU VALGUM - knock-knees.

GENU VARUM - bow legs

HEMIPLEGIA - paralysis of one half of the body (eg arm and leg of the same side). The speech may also be affected and sometimes one half of the face.

HUMERUS - the bone of the upper arm.

HYPOTONIA - diminished power in the muscles, "floppiness".

HYSTERIA - an illness or fit without any apparent cause for the symptoms which occur. The condition is closely allied to mental excitement.

IMPACTED FRACTURE - a broken bone in which the two fragments are driven into one another.

INVERSION - turning in of the foot.

KINEMATICS - a study of motion.

KNOCK-KNEE (Genu Valgum) - an enlargement of the inner side of the knee seen in children, who, on examination, are found to be unable to put their heels together without placing one knee in front of the other.

KYPHOSIS - an increase of the normal curve of the upper half of the spine, often combined with a poking chin and round shoulders.

LORDOSIS - an increase in the normal curve of the spine in the lower half of the back (hollow back).

MICRO CAPHALIC - small headed.

MONOPLLEGIA - paralysis of one limb.

MORBID - diseased. Unnatural.

MUSCULAR DYSTROPHY - an increasing and progressive wasting and weakness of muscles.

MYOSITIS OSSIFICANS - a condition in which bone forms in a muscle or group of muscles resulting in loss of movement, and most commonly found in front of the elbow.

NEURITIS - inflammation of one or more nerves accompanied by pain and weakness of muscles. In severe cases there may be extensive paralysis.

OS CALCIS - heel bone.

OS INNOMINATUS - hip bone.

OSSIUM FRAGILITAS - brittleness of bone.

PARAPLEGIA - paralysis of both legs, and sometimes arms, which is due to spinal cord injury or disease.

PATELLA - knee cap.

PLANTA-FLEXION - the pointing of the foot downwards.

POSTURAL SUPPORT (as used in this study) - the provision of structures or surfaces to hold the body in a desired posture or position.

PRESSURE SORES - ulcers resulting from persistent friction of the skin (eg as the result of badly fitting splints).

PRONATION - turning of the arm with palm of hand down.

RADIUS - the outer bone of the forearm (thumb side)

SACRUM - the triangular bone at the base of the spine which, with the hip bones, forms the PELVIS.

SCAPULA - shoulder blade.

SCISSORS GAIT - a gait disturbance caused by the fact that spasticity of the muscles hold the thighs in adduction causing the legs to draw together.

SCOLIOSIS - a lateral or sideways curvature and twisting of the spine.

SENSORI-MOTOR EXPERIENCE - the feeling of one's own movements.

SPASM - the tension of muscles which may be temporary, (eg after an injury) or persistent as in certain diseases, eg Cerebral Palsy. The spasm may be sustained (TONIC) or may consist of a series of shaking movements (ATHETOID).

SPINA BIFIDA - a congenital deformity of the bones forming the spinal column in which part of the bony ring protecting the spinal cord may be absent. The cord is thus unprotected and may be injured causing paralysis of the legs and lack of control of the bladder and rectum.

SPLINTING - a method of fixing a limb to prevent movement in disease or injury. Splints are made from many materials (eg light metal, celluloid, plaster of paris, polythene).

STERNUM - breast bone.

STEREOGNOSIS - the ability to recognise shape, size and/or weight of objects.

SUPINATION - turning of the arm with palm of hand up.

TALIPES - an alteration in the normal shape of the foot due to injury or malformation at birth.

TENDON - the cord like part of some muscle (eg biceps).

TIBIA - the inner bone of the lower leg.

TONIC NECK REFLEX - when the turning of the head causes one arm to straighten and stiffen and the other to bend and stiffen.

TRAUMA - injury by accident.

TUMOUR - a growth

ULNA - the inner bone of the forearm (little finger side).

VALGUS FEET - flat feet.

VERTEBRA - a bone which forms part of the vertebral column (back bone)

WIND-BLOWN HIP - one hip and leg in adduction. A condition which can result in hip dislocation.

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17.0.0. APPENDIX E ACKNOWLEDGEMENTS

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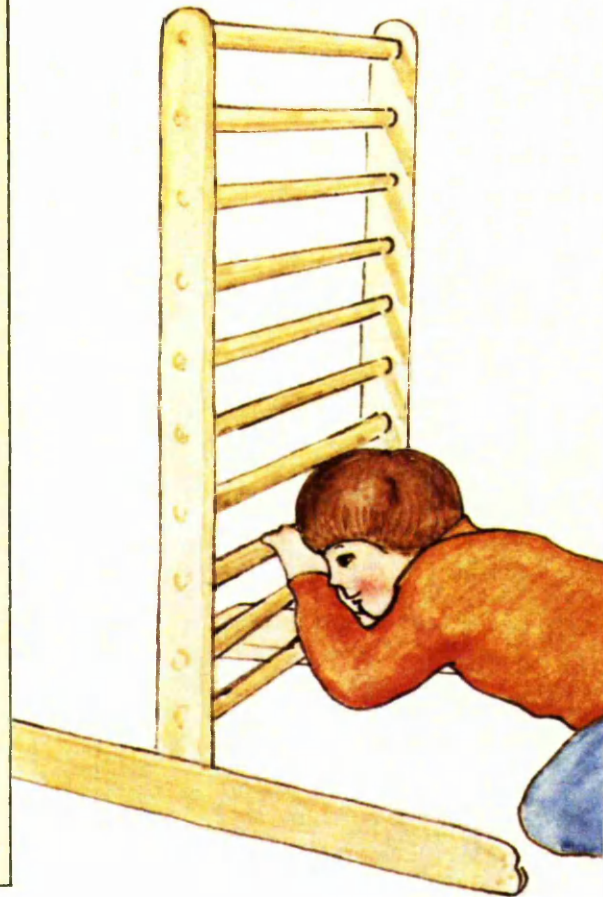


framework

Framework is a play support system designed for both handicapped and non-handicapped children, of nursery and infant age.



The upright frame unit supports first attempts at standing and walking.

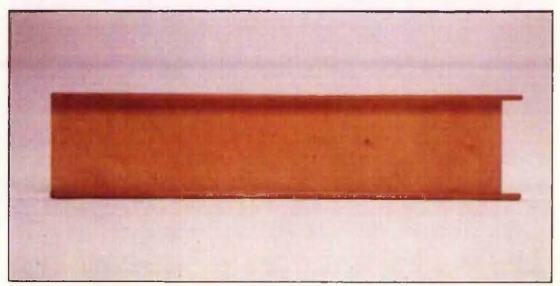
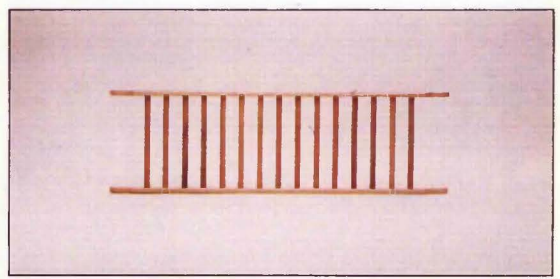


A small detachable box can be used at a variety of heights on the upright frame as a seat, or standing platform.

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Ladder

L	W
1370 mm	405 mm
54"	16"

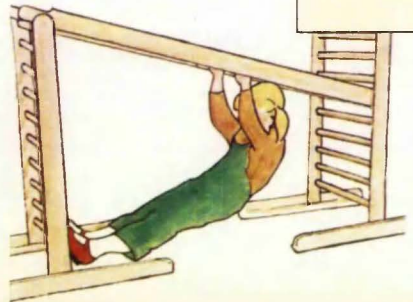


Slide

L	W
1905 mm	405 mm
75"	16"

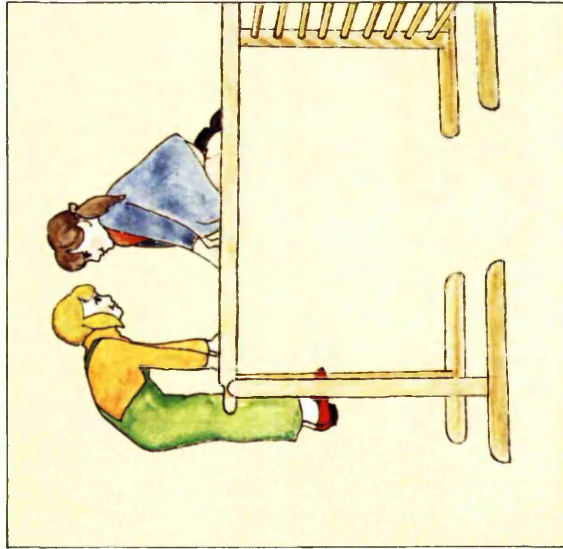
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Children unable to function below the waist can still take part in PE sessions; upper trunk and arms can be exercised using the ladder and two upright frames as a bridge over the child, who uses the rungs to lift and lower his body.



The tub chair, available in two sizes, can be secured to the upright frame in a number of positions to suit the individual child. A standard nursery restraining harness can be used with this chair, which is fixed to the ladder rungs with the "pram loops" supplied with the harness.

The ladder, used with two upright frames becomes a climbing frame for more able children.....



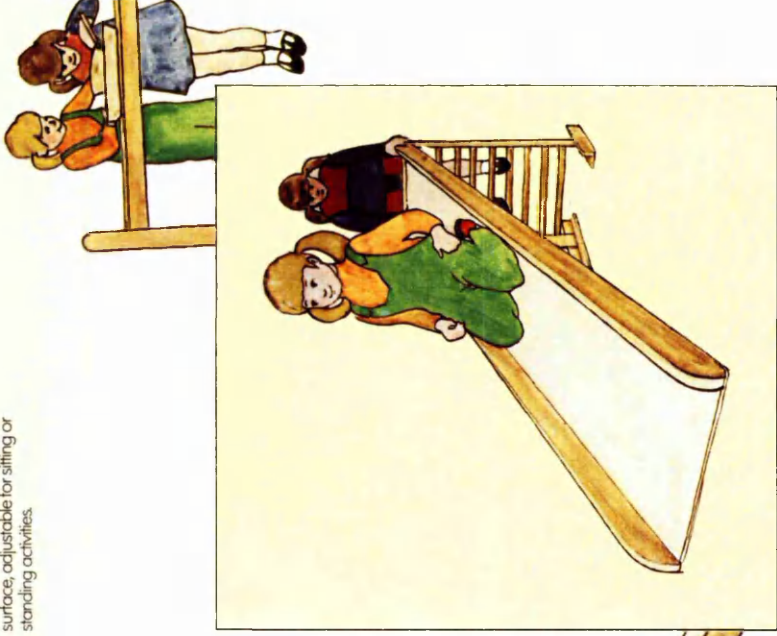
...or supports a canopy of shapes and colours to stimulate the less active



...and a framework to other play structures.



A plywood infill to the ladder transforms it into a useful work surface, adjustable for sitting or standing activities.



The slide attachment is secured to the top of the upright frame, and able bodied children use its rungs as a ladder.

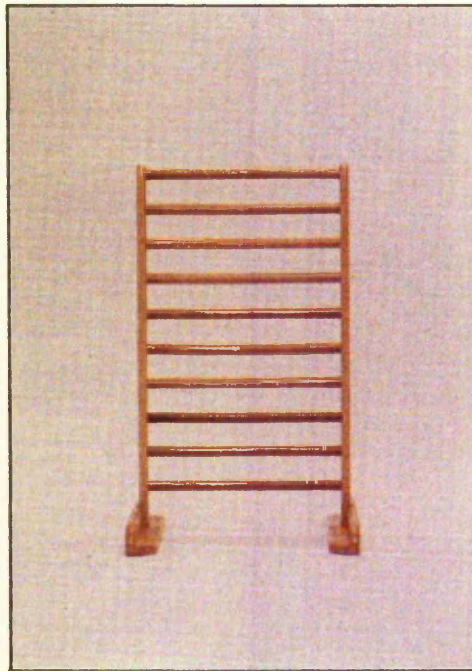
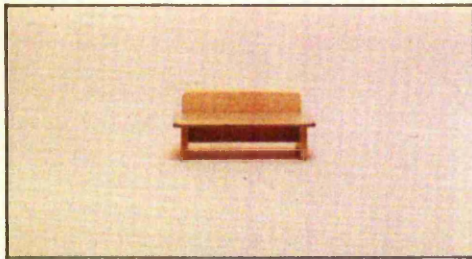


Even children with minimal physical ability can be encouraged to use the slide when assisted by the ladder fixed to the upright frame.



Seat/Platform

H	W	L
180 mm	400 mm	360 mm
7"	16"	14 1/4"

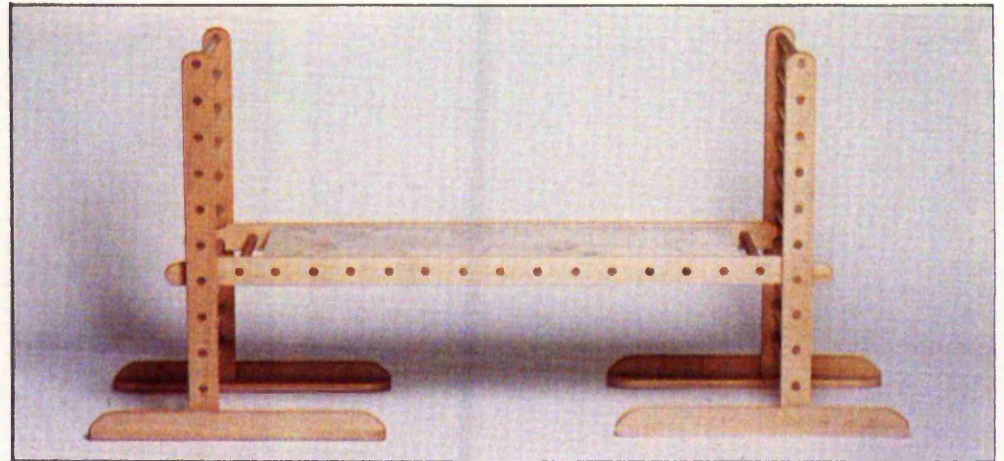


Upright Frame Unit

H	W	L
820 mm	455 mm	610 mm
32 1/4"	18"	24"

Plywood Work Top

L	W
1143 mm	362 mm
45"	14 1/4"



Shown above supported on ladder and two upright frame units.

Framework is constructed in solid beech timber and birch plywood, with a natural finish. The Tub Chair has a painted finish.

All enquiries regarding Framework should be addressed to the manufacturers:

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Comfort to the handicapped

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These examples are without doubt "one-offs" but do involve techniques which are common in the furniture industry, and the unit is constantly channelling its work towards solutions which will ultimately have a wider potential.

Barry Wilson feels that one of the most important lessons learned from this kind of work is the need for

designers and manufacturers to be intimately concerned with the rapport between people and products which are bought, used and misused daily. Such concern for a product's working life offers enormous scope to both manufacturer and designer alike for the creation of fresh and exciting products.

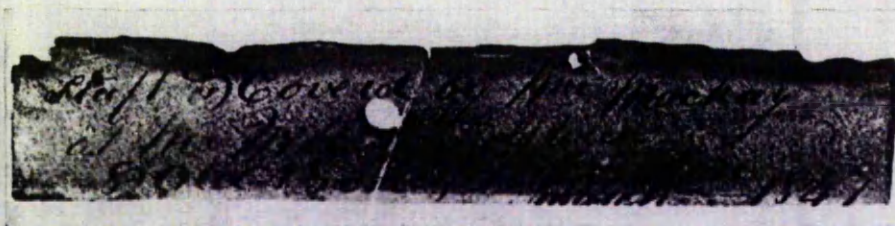
Alison and Nicky seated in the chairs specially designed for their disabilities at the Furniture Design Research Unit, Trent Polytechnic

Left: underframe supplied by Peninsular Products, Sheffield

Right: GRP shell made by Hunting Industrial Plastics, Wymswold



This small piece of parchment was found by craftsmen at Mill Brook, who were refurbishing a Victorian chair which has been in regular use. It reads: Stuft & Covered by Wm Mackay at Mr Wills Upholsterer, 80 Old Bond St, London. March—1847. Maybe in the year 2105 the latest message will be uncovered. It reads: Re-upholstered by Fred Walters at Mill Brook Furnishing Industries Ltd, Nuissey Lane, Totton, Southampton. November—1976



Visitor from Poland

A VISITOR to the Buckinghamshire College of Higher Education in High Wycombe is Dr Roman Rabije, a member of the staff of the Faculty of Wood Technology of the Warsaw Agricultural University.

His four-month visit is the second contact between the two premier institutions in the field of furniture and wood technology in the two countries. Herbert Berry, head of the School of Art & Design, Furniture & Timber at High Wycombe, visited the Polish university in June this year.

New moulding technique brings comfort to the handicapped

WITHIN the Furniture Design section of the Department of Three-Dimensional Design at Trent Polytechnic, Nottingham, designer Barry Wilson has been carrying out a research programme concerned with the design of furniture for the handicapped. He joined the Research Unit in 1973 having been previously employed on the design staff at G-Plan. Now in its fourth year, the unit has been responsible for the design and development of products which attempt to be positive in the evaluation of medical criteria and civilised in terms of human understanding.

The main area of investigation is comfort for the handicapped person in the domestic environment, which has led to the manufacture of seats moulded to suit the individual. In the past, these close body mould shells have been applied directly to the wheelchair, but had not been considered as a basis for domestic furniture.

The moulding technique is based on vacuum dilatancy casting, a system of obtaining a negative impression of the client's body in an air-evacuated bag of polystyrene beads, which forms the preparation for a final glass fibre moulding. The first chair produced in this way by Barry Wilson was for Alison, a girl of 13, a spastic quad-

ruplegic. Her condition caused problems with feeding and from a baby she had been fed sitting on her mother's lap. The new chair gives her stability and comfort, she now has her meals without fuss.

The design brief called for a light, easy to clean, transportable chair, therefore the GRP shell was ideal. It has an outer layer of 1in polyether and is fitted with zip-off covers for cleaning. The underframe was supplied by Peninsular Products, Sheffield, and is so designed to fold over the shell for easy transportation.

A further chair has been recently completed for an 18-year-old boy, Nicky, whose physical problems are similar to those of Alison but whose personal needs are very different.

Since he left school, Nicky spends most of his time at home. His main interests are pop music and TV. He found his wheelchair very uncomfortable for long periods and therefore spent much of his time padded up with cushions on a sofa, a situation which required constant attention. The brief for the new chair was carefully prepared from information given by those intimately concerned with his well-being.

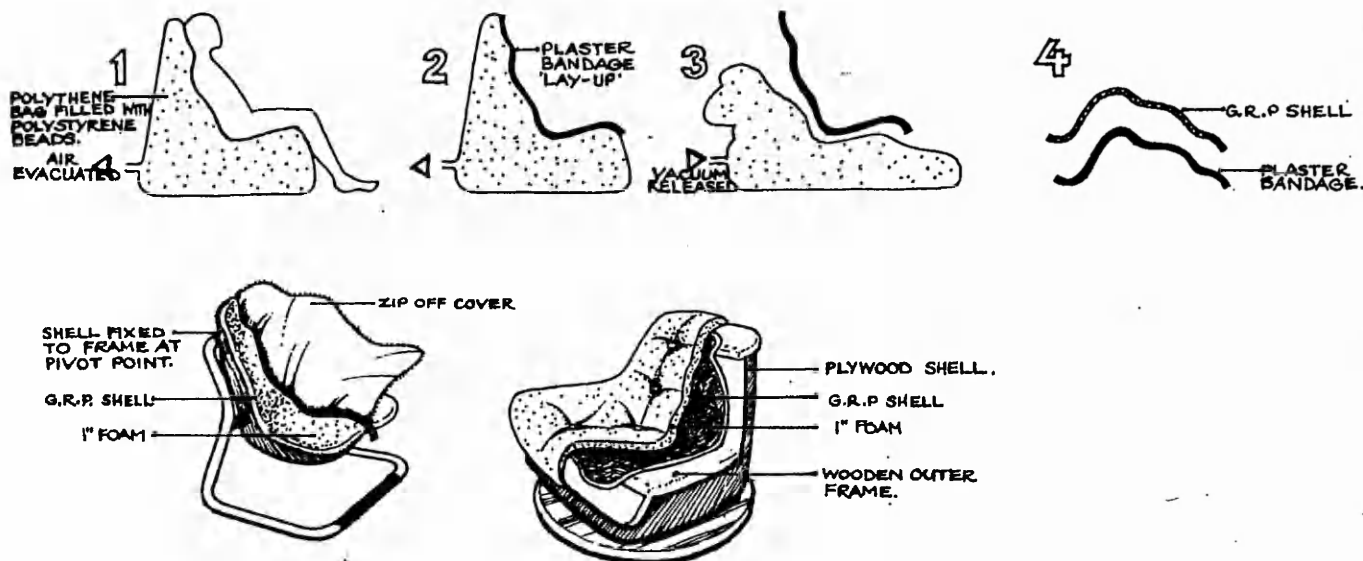
All his physical problems had to be considered in terms of postural support and comfort, with the correct

inclination of his body to help his weak respiration. For Nicky and his family to accept his new chair, other requirements had to be met. A revolving chair which could be turned to face parts of the room capturing his interest, but stable enough not to shake his confidence, and wide enough to take a nephew and niece on each arm when they visit.

The mould was prepared in the same way as Alison's, and the GRP shell was produced by Hunting Industrial Plastics of Wymswold, near Loughborough. A traditional wooded frame was tailored to the fibre glass seat, upholstered as a unit and fitted into an outer structure to give it the look of a normal chair and hide the reverse side of the moulded shell showing the physical deformity of Nicky's body. A swivel action designed with large interference fitting rings connect the chair to its base which is a 30in diameter teak veneered disc. Its smooth underside enables the chair to be slid easily about the room on a carpeted surface.

Both Nicky and his family are delighted with the new chair and its acceptance is being closely monitored. His respiration has improved dramatically and no sitting sores have so far been detected.

to next page



These diagrams illustrate the technique developed at Trent Polytechnic to mould chairs for the handicapped