ROCHESTER INSTITUTE OF TECHNOLOGY

A Thesis Submitted to the Faculty of

The College of Fine and Applied Arts

in Candidacy for the Degree of

MASTER OF FINE ARTS

LIBERATION: DESIGN THAT LIBERATES RATHER THAN HANDICAPS US

By

M. Amelia Kennedy

Date: 10 July 1989

Adviser: Craig McArt

Date: Sept. 10, 1989

Associate Adviser: Jim Sias

Date: Sept 9, 1989

Associate Adviser: Judy Lynd

Date: Sept 11, 1989

Special Assistant to the Dean of Graduate Affairs: Philip Bornarth

Date: Sept 12, 1989

Dean, College of Fine and Applied Arts: Dr. Robert Johnston

Date: 9/13/89

I, ______________________________ , hereby grant permission to the Wallace Memorial Library of RIT, to reproduce my thesis in whole or in part. Any reproduction will not be for commercial use or profit.

M. Amelia Kennedy
400 East 71 St Apt 17B
New York NY 10021-4816

Date: 11 Sept 1989

TABLE OF CONTENTS

PREMISE

In my studies to become an industrial designer I have placed the strongest emphasis on two specific concerns: the design of products that support safe human activity (ergonomics), and the design of products that are accessible to physically impaired people. During this time I have been struck by the fact that these two concerns are always discussed separately, as if they had distinct applications in design that never related. The underlying assumption is that the general population and the the physically impaired are mutually exclusive groups. For this thesis project I set out to challenge that assumption by finding design solutions common to both of these groups and to illustrate my solutions by redesigning a product to satisfy their needs.

RESEARCH

Psychological Aspects of Impairment

I began my research by considering how the psychological aspects of physical impairment would impact on design. The major psychological characteristic identified through my readings and interviews was the feeling of alienation. The mistaken attitude that able-bodied people are more capable than physically impaired people greatly contributes to the feeling that an impaired person is inferior to everyone else. Along with that attitude is the belief that people who look or act differently are automatically assumed to be more different than similar to ourselves. Seeing a person who is different from ourselves often causes us to look away and avoid exchanges. This of course, contributes to alienation. This same avoidance of the impaired population by designers and manufacturers has alienated this group from most of the products produced today, particularly household appliances. Products are targeted only for the able-bodied, assuming that any person with an impairment will have access to products designed specifically for their needs by a specialist. The fact is that very few products are so designed—to do so would be cost prohibitive.[1] Thus, people with impairments are faced with three unsavory choices: using existing products in their inconvenient and unsafe condition, modifying the products, or depending on others to perform the task for them.

The results: a product that causes unsafe, sometimes dangerous movements to the user, a user-modified product that reinforces alienation by constantly reminding the user of their differences, or the circumstance of being dependent on others, particularly for the simplest of tasks, resulting in frustration, anger and depression. Loss of independence, and the constant reminder that you will never be seen as equal to an able-bodied person, eats away at one's sense of self-esteem. We all should respect the variations in people, and our product oriented society must show it.

Physical Aspects of Impairment

While the psychological aspects were the motivation for my research, the physical needs were the core of the project. Physically impaired people are those who have some degree of loss in ability—usually not a total loss. Such people may not be able to support the weight of their bodies for ambulation, but might be able to get in or out of a wheelchair unaided. Also, the effect of aging on the body, among other conditions and diseases, causes changes in the body's functions that are gradual and progressive.[2] The net effect is that one has diminishing physical abilities. By simply incorporating variable controls that are user-adjustable to suit individual levels of need, the designer can make a product safe and functional to a broader range of users.

Product Choice

The first stage of my research was undertaken without identifying the product I would later re-design. I felt it was important to begin by learning about many groups of physically impaired people and how they interact with various products in their homes. My intention was to resist imposing my ideas of what products needed improvement and determining who would benefit from my design. Instead, I anticipated that people or groups would emerge based on their functional abilities and they would identify the products needing improvement. I was sure that designing for people's abilities would result in a broader user group than designing for their inabilities. In fact, the user group grew and included people I would never have considered otherwise. For example, while studying people who use a wheelchair for mobility, I discovered that people of short stature operate at the same height and have a similar limited range of motion.[3] In many other ways they have similar functional abilities, although the causes are completely different. This suggested that the causes of a physical impairment should only be considered as a reference tool to determine functional ability.

The next step was to poll a sample group of users to identify the product I would design to illustrate my thesis. To aid my selection, I surveyed a group of twenty people (10 physically impaired and 10 able-bodied), asking them to identify a product that they both a) use regularly, and b) find difficult to use. The vacuum cleaner was identified by more than half of the group—a wide variety of other products were named by the rest. In the second round of discussion, when the vacuum cleaner was mentioned to those who first chose a different product, half again shared anecdotes about their difficulties. Vacuum cleaners seemed to be an appropriate example because they were identified so often and because they are in use in almost every home in America.

Range of Users

In defining the widest possible range of users based on their functional abilities, the limits of the range became clear. There were some people who would only be able to use a personally modified machine (e.g., a quadraplegic), and others for whom vacuuming was impractical because it required too much of their limited energy (e.g., a person who suffers from the fatigue of advanced Multiple Sclerosis). Since my objective was to expand the user group where possible without eliminating any present users, the "new" users' needs could not conflict with the "present" users' needs. The following are common characteristics of the "new" users, defined by their functional abilities, not by the causes of their impairments:

- Lessened muscle strength.
- Difficulty in motor control of major muscle groups (a reduced ability to walk or stand).
- Difficulty in motor control of minor muscle groups (i.e., dexterity of the hands).
- Lessened flexibility and range of motion (affecting the ability to bend, reach, or turn).
- Spasticity.
- Fatigue.

Design Criteria

After determining the functional abilities, these criteria for the design of a vacuum cleaner emerged:

- Safety.
- Weight (as light as possible).
- One-hand operation.
- Little or no need for complex fine muscle control.
- Variability of height (to accommodate the wide range of users' operational heights).

Shining Examples

Throughout my research I looked for existing products that could inspire me and help refine my ability to identify and avoid design shortcomings relevant to my thesis. I found products that solve for the needs of the physically impaired as well as the general population, some by intent, others by default.

A&E DESIGN, Stockholm, Sweden—a company specializing in design for physically impaired people—designed and marketed the Jordan dishwashing brush specifically for people who have difficulty in grasping. Their product has attained international mainstream success because the large ribbed handle was found to be beneficial not only for people who's functioning has physically changed, but for anyone with wet, soapy hands.[4]

The Backsaver snow shovel (and the series of garden tools that have followed), allows the lower back to be in a less stressful position to help people with back problems to continue these types of activities. The general population has begun to use it as a way to prevent strain on the back.[5]

Countertop microwave and convection ovens have been on the market as a supplement to standard ovens. Unanticipated by the designers, countertop ovens fill a need for people who use wheel chairs. When placed on a table, their height is safe and comfortable for the user and the side hinged door swings out of the way for clear access.[6] This provides a solution to conventional oven doors that open downward, making wheelchair, walker or crutch access very dangerous. The possibility of back strain and burn injury to any person while bending low from a standing position is also resolved.

Calculators can be purchased with a flat printed control pad or with buttons to press. The buttons allow for precise placement of fingers assuring accuracy for a user with dexterity or tremor problems. Some calculators have rubberized buttons that allow for even easier positioning of the fingers.

Subtle, essential differences in design have given a broader range of users safe access to these products.

PROPOSAL

There are two common types of vacuum cleaners: the upright and the canister. The upright is better able to clean carpeting but due to its size and weight is not easily maneuvered around furniture or on stairs. The canister type is lighter since only the wand and hose need to be lifted. Its small nozzle and thin wand make it more maneuverable than the upright.[7] In choosing the style of vacuum cleaner on which to concentrate, I took my cue from the physically impaired people and the rehabilitation specialist I interviewed. All of them used or recommended use of the canister style vacuum cleaner because weight and maneuverability were critical to a physically impaired person.

Existing vacuum cleaners require the user to bend and reach to operate or adjust the various parts of the machine. My first decision was to cluster the controls at the user's hands, thereby avoiding the safety problems inherent in bending and reaching. To accomplish this, I separated the dirt collection bag from the canister, leaving the motor and fan in the canister. I created a housing for the bag topped by the handle. The bag is positioned by sliding it over a tube and is then covered with an easy to open padded housing. This lightweight solution allows the operator to easily check the fullness of the bag to maintain efficiency of the machine, and is soft when rested on the lap of a seated user.

Turning the motor on and off is usually accomplished by pushing a button on the canister. This requires bending and reaching or, as some of my subjects reported, hitting the switch with the end of the wand—even throwing books at it! In my design the on/off device is located on the handle and is not a button: it is a touch sensitive pad on the underside of the handle. When the person grasps the handle the machine turns on. If they put it down or drop it, the machine automatically turns off. Only the strength required to hold the device is needed to operate it.

Existing canister vacuums use a handgrip area at the top of the wand—the thinnest of those I measured had a diameter of 1 1/4 inches. In HUMANSCALE 1/2/3, as well as other anthropometric research documents, a one-inch diameter is recommended for the handgrip because it allows the thumb and fingers to overlap, assuring a secure, comfortable hold. I incorporated this smaller size requirement in my design.

The wands in existing canister models use clips or a friction fit to assemble wand sections. They require a surprising amount of finger strength and careful control of the hands to release. Many of the participants in the focus groups reported leaving their vacuum cleaner assembled all the time because it was impossible to disassemble. In addition, people of short stature and those vacuuming from a seated position found that using one wand section was too short and two was too long (providing a bad nozzle-to-floor angle). They would have to raise their hands above their shoulders to achieve the proper angle. To resolve these problems, I incorporated a telescoping wand in the design. The wand sections are adjustable from the length needed for a short or seated person to the length necessary for a tall male. The wands are held in place by a pneumatic cushion. There is a button located on the front side of the operator's hand grip to remove air from the cushion when a new adjustment is desired.

Existing machines operate on AC electricity, requiring bending or reaching necessary to plug in the cord. The cord also limits mobility and provides a dangerous environment for people using walking aids or wheelchairs. Many people reported getting the cord caught in their wheels or tripping over it. My design proposes a rechargeable battery housed in the canister to eliminate both dangers. The canister would be rolled into a seperate recharging unit at the storage location which would avoid lifting. Since the battery would increase the weight of the canister, the consumer would be provided with the options of a battery or cord version. Many people who vacuum from a wheelchair set the canister on the footrest between their legs. To aid this I designed the canister to swing toward the footrest when lifted.

Existing machines often use small wheels or rollers under the canister. They require substantial force to pull them across carpeting. Large six-inch wheels on the sides of this canister allows it to roll easily over carpeting.

CONCLUSION

It is assumed that safe, accessible design is always foremost in our minds when we begin a design project. Yet, because we cling to narrow, stereotypical definitions of the product's users, unsafe and inaccessible design solutions occur. In my exploration I have seen that it is a misconception to believe that our users are all physically able to the same degree. It is also a misconception that those with lessened abilities are "taken care of" with special products designed for them.

I propose that we approach design by first thoroughly learning about the users' abilities. Then we can develop designs that match the abilities instead of expecting the user to match the design. We must put aside our own preconceived ideas in favor of true, ergonomic design. These words don't sound earth shattering—in fact, we've heard them before. But with so many consumer products as evidence, we can see this approach has not been followed.

As a result of this thesis project I have been charged with a new sense of responsibility to seek out as much information as I can about my product's users. I take it as my responsibility to encourage more research be done in anthropometry of specialized groups. Then it can be disseminated and made as common in the libraries of designers as is HUMANSCALE 1/2/3.

This project has affected me personally as well as professionally. Meeting these people has opened my eyes to the stereotypes within myself. I have only begun to see how I and those people I used to refer to as disabled are really the same, and that the commonalities of mind and heart, will and desire are far more important than any physical differences. It has also reinforced my belief that the value of formal education is not what you learn—its value lies in the opportunity to develop attitudes that change the way you live.

APPENDIX

The following are summaries of the primary diseases and conditions affecting motor abilities.[8]

SPINAL CORD INJURY

25-30 new injuries per million population per year.

Impairments:

"The degree of disruption of the vertabral column determines how severe the injury to the spinal cord will be, and whether sensation and voluntary muscle movement below the level of the lesion will be completely or only partially lost." [9]

- partial or full loss of sensation.
- partial or full loss of voluntary muscle control.
- spasticity: uncontrolled reflex movements, ususally treated with medications.
- fatigue.

NEUROMUSCULAR DISEASES

Includes: Huntington's disease, Parkinson's disease, Spinocerebellar degeneration, Friedrich's ataxia, Amyotrophic Lateral Sclerosis, Spinal Muscular Atrophy, Poliomyelitis, Guillian-Barre' Syndrome, Myasthenia gravis, Muscular Dystrophy, and others, unnamed. Listed are the general symptoms of this catagory. Sensation is generally not affected, and pain is not a problem in these cases.

Impairments:

- chorea: jerky involuntary movements in the head, face, trunk, or limbs.
- balance while standing.
- muscle rigidity.
- slowness of movement.
- slow gait.
- tremor.
- difficulty in initiating movements.
- diminished aptitude for prolonged fine rapid movements of the hands or feet (fine finger dexterity, grasping).
- slow, laborious hand movements.
- ataxia: clumsiness and incoordination.
- muscle weakness and atrophy of limb(s): asymetrical or symmetrical.
- spasticity.
- fatigue.

PERIPHERAL NEUROPATHIES

Dieases of the nervous system outside of the brain and spinal column. 130,922,500 US citizens have problems which include lifting, reaching, handling, and fingering, and lower extremity inabilities. 1.5 million of these have paralysis. Impairments may be mostly sensory or mostly motor or both. They may involve one nerve, several or all (in asymmetrical manner).

Impairments:

- muscle weakness in the legs, arms, and hands.
- sensory loss in the legs, arms, and hands.
- balance.
- fatigue.

MULTIPLE SCLEROSIS

500,000 cases in the US.

Impairments:

- vision: double or blurred.
- muscle weakness, loss of muscle control.
- spasticity.
- ataxia: loss of coordination.
- tremor.
- contractures: loss of range of motion.
- learning rate.

STROKE AND CEREBRAL TRAUMA

Second only to arthritis as a crippling disease.

Impairments:

- language, communication
- paralysis or muscle weakness on one side of the body.
- visual, spatial.
- sensory defecits: light touch, pain, temperature, deep pressure, vibratory, visual, positional, and the sense of verticality, balance.
- spasticity.
- shoulder joint may have tendency to dislocate or to cause hand swelling, pain, or contracture.
- fatigue.

CEREBRAL PALSY

Disorders of movement resulting from damage to the brain. 900,000 cases in the US.

Impairments:

- lack of control over muscles, not usually muscle weakness.
- dexterity.
- complex motor skills, when upper extremities are involved.
- speed of movement.
- ambulation, gait.
- bi-manual control.
- standing with both legs straight.
- balance, standing and sitting.
- spasticity.
- atheosis: involuntary occurrance of purposeless movement when attempting purposeful motion.
- dystonia: muscle tone occurring in muscles and their antagonists simultaneously.
- atonia: decrease in or absense of muscle tone.
- ataxia: difficulty in controlling specific movement that results in repetative overshooting.
- tremor.
- fatigue.

AMPUTATION

As of 1970, there were 311,000 amputees in the US. 90% involve the legs, 70% are male. The amputation may be unilateral or bilateral, and it may include the upper extremities, the lower extremities, or both.

Impairments:

- Loss of hands means loss of dexterity and ability for fine manipulation.
- ambulation.
- balance.

RHEUMATIC DISEASES

31.6 million persons in the US suffer from rheumatic disease. Below the age of 45: 48 per thousand population. Between 46 and 65: 333 per thousand population. 900,000 new cases per year. The diseases included here are: Rheumatoid Arthritis, Ankylosing Spondylitis, and Degenerative Joint Disease(DJD). Rheumatoid Arthritis affects the shoulder, elbow, wrist, hip, knee, ankle, and the small joints of the hands and feet. Ankylosing Spondylitis affects the spine, and DJD affects joints singly or in pairs and rarely involves more than one to three joints in an individual.

Impairments:

- loss of joint movement (dexterity and major motions).
- loss of muscle strength.
- pain is the major symptom.

SHORT STATURE/ACHONDROPLASIA

There are over 75 identified causes of short stature. Achondroplasia, a bone disorder resulting in disproportionate short stature, is the most common.

Impairments:

- small chest cage reduces cardio-pulmonary functioning and overheating when active.
- spinal disturbances which affect flexibility.
- hand flexibility and dexterity.
- limited range of motion at the elbow.
- gait differences due to bowed legs and short broad feet.
- balance problems.
- fatigue.

AGING

Although not a disease, the affects of aging on the senses and physical abilities can be extreme. The changes are usually gradual and often accommodated for by the individual.

Impairments:

- lessening of strength.
- lessening of endurance.
- reduced range of motion: large movements as well as fine dexterity of the hands or feet.
- gradual loss of clarity in sight.
- gradual loss of hearing.
- balance problems.
- fatigue.

All of the above conditions can cause mobility impairments. Depending on the severity, the use of a walker, canes, crutches (sometimes in addition to braces), or a wheelchair may be required or advisable. Mobility aids require use of the arms or hands at least occasionally, therefore it is advisable not to design a product that requires two handed operation.

ENDNOTES

[1] Interview with Kim Seroni, Northside Surgical Supply, Rochester, New York, September 1985.

[2] Howard W. Stoudt, "The Anthropometry of the Elderly," Human Factors, February 1981, p.29.

[3] Interview with Robert Van Etten, President of Little People of America, Rochester, New York, September 1985.

[4] Monica Bowman et al., Contemporary Swedish Design, Stockholm:Nationalmuseum, 1983, p. 49.

[5] Comfortably Yours, Aids for Easier Living, 1986, p. 14; and Ian Chong and Andrew McDonough, "Is a Tool Caused Backache A Designers Problem?" ID, September/October 1982, pp. 30,31.

[6] Interview with Judy Lynd, Rochester Rehabilitation Center, Rochester, New York, September 1985.

[7] "Vacuum Cleaners." Consumer Reports, August 1982, pp. 404-409.

[8] See Walter C. Stolov and Michael R. Clowers, Handbook of Severe Disabilities (Washington, DC: 1981) pp. 55-217; Statistical Abstracts of the United States, U.S. Bureau of the Census (Washington, DC: 1985) table # 184; N. Diffrient, A. Tilley, and J. Bardajy, Humanscale/3: Requirements for the Handicapped and Elderly (Cambridge : MIT Press, 1974) pp. 26-30; U.S., Department of Health and Human Services, National Health Interview Survey, National Center for Health Statistics, 1979-81, pp. 1-39; and Joseph Koncelik, Aging in the Product Environment (Stroudsburg: Hutchinson Ross Publishing, 1982).

[9] See Walter C. Stolov and Michael R. Clowers, Handbook of Severe Disabilities (Washington, DC: 1981) pp. 55-217.

BIBLIOGRAPHY

Alexander, A. "White Canes Go Electronic to Aid the Blind." Design. October 1984, p. 27.

Alexander, Harold H. Design - Criteria for Decisions. New York: Macmillan, 1976.

Anderson, Hoyt. The Disabled Homemaker. Springfield, Ill.: Charles C. Thomas Publishing Co., 1981.

Bayley, S. In Good Shape. New York: Van Nostrand Rheinhold, 1979.

Beer, E.H. Scandinavian Design: Objects of a Lifestyle. New York: Farrar, Straus and Giroux, 1975.

Bel Geddes, Norman. Horizons. Boston: Little, Brown and Co., 1932.

"Better Old Than New." Design. May 1984, pp. 48-50.

Boman, Monica, et al. Contemporary Swedish Design. Stockholm: Nationalmuseum, 1983.

Braidwood, S. "Design in a Low Choice Economy." Design. August 1984, p.14.

Breuer, Joseph. A Handbook of Assistive Devices for the Handicapped Elderly. New York: Haworth Press, 1982.

"Britex Brings Out a Child's Car Seat for the Handicapped." Design. June 1980, pp. 3+.

Bruck, Lilly. Access: The Guide to a Better Life for Disabled Americans. New York: Random House, 1978.

Caddel, Kay. "Anthropometry of Short Statured Persons." Ph.D. dissertation, Texas Tech University, 1985.

Canter, D. "From Knobs and Dials to Knowledge." Design. August 1984, pp. 31-33.

Chong, Ian and McDonough, Andrew. "Is a Tool Caused Backache a Designer's Problem?" ID. September/October 1982, pp.30-31.

Davis, Wendy. Aids to Make You Able. Don Mills, Ontario: General Publishing Co. Ltd., 1981.

Diffrient, N.; Tilley, A.; Bardajy, J. HUMANSCALE 1/2/3. Cambridge, MA: MIT Press, 1974.

Directory of Living Aids For the Disabled Person. Washington, D.C.: V.A. Office of Procurement and Supply, 1982.

"Disabled Ordinary People." Design. May 1981, pp. 32-35.

Doblin, Jay. One Hundred Great Product Designs. New York: Van Nostrand Reinhold Co., 1970.

Dormer, P. and Thackera, J. "Design and the Age of Quality." Design. July 1984, pp. 32-35.

Dreyfuss, Henry. Designing for People. New York: Simon and Schuster, 1955.

"For Those Who Are Not Independant." Abitare. September 1980, p. 169.

"Forget the Answers, It's the Questions that Count." Design. March 1981, p.59.

Hamilton, Nicola, ed. Svensk Form: A Conference about Swedish Design. London: The Design Council, 1981.

Heskett, John. Industrial Design. New York: Oxford University Press, 1980.

"Household Equipment." Abitare. October 1983, pp. 136-139.

"Information and Technology." Design. December 1982, pp. 41-43.

Koncelik, Joseph. Aging in the Product Environment. Stroudsburg, PA: Hutchinson Ross Publishing Co., 1982.

Kreisler, Nancy and Jack. Catalog of Aids for the Disabled. New York: McGraw-Hill, 1982.

Lynd, Judy. Rehabilitation Specialist, Rochester Rehabilitation Center, Rochester, New York. Interviews, September 1985 through March 1986.

Panero and Zelnick. Human Dimension and Interior Space: A Sourcebook of Design. New York: Whitney Library of Design, Watson-Guptill Publishing, 1979.

Revere, David, ed. Scandinavian Modern Design 1880-1980. New York: Abrams Publishing, 1982.

Sampson, P. "Standing up to Scrutiny." Design. July 1984, pp. 36-37.

Scheinberg, Labe C., ed. Multiple Sclerosis: A Guide for Patients and Their Families. New York: Raven Press, 1983.

Seroni, Kim. Northside Surgical Supply, Rochester, New York. Interview, September 1985.

Soll, Robert W. and Gronoble, Penelope B. MS: Something Can Be Done and You Can Do It. Chicago: Contemporary Books, Inc., 1984.

Stavenow, Ake and Huldt, Ake H. Design in Sweden. New York: Bedminster Press, 1961.

Stolov, Walter C. and Clowers, Michael R., ed. Handbook of Severe Disabilities. Washington, DC: U. S. Government Printing Office, 1981.

Stoudt, Howard W. "The Anthropomotry of the Elderly." Human Factors. February 1981, pp.29-37.

Thomas, Joyce. Eureka Corporation. Interviews, September 1985 through March 1986.

U.S. Department of Health and Human Services. National Health Interview Survey, National Center for Health Statistics, 1979-81.

"Vacuum Cleaners." Consumer Reports. August 1982, pp.404-409.

Van Etten, Robert. Little People of America, Rochester, New York. Interview, September 1985.

Walley, John. Rochester, New York. Interview, September 1985.

Werbeant, Landesge. Design Center Stuttgart. Baden-Wurtenberg, 1984.

Wilcox, Donald. Finnish Design: Facts and Fantasy. New York: Van Nostrand Reinhold Co., 1973.

Wolf, John K., ed. Multiple Sclerosis, A Handbook for MSers and Their Families. Rutland, VT: Academy Books, 1984.

"Works Well, Doesn't Sell." Design. July 1982, pp.58-59.

Woudhuysen, J. "Form Follows Fluff." Design. August 1983, pp.48-50.

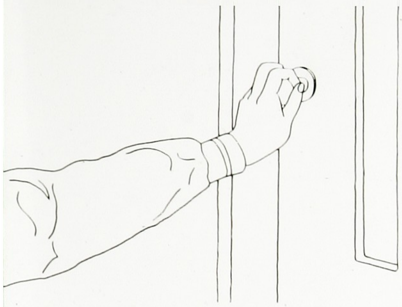
'hrough their product development, designers and manufacturers ıave reinforced the societal view that there are two distinct ategories of people with different levels of ability to perform veryday tasks: The physically able who can do for themselves nd the physically impaired who cannot.
}ecause service products have not been designed to fill our needs, ıe physically impaired have to tolerate the safety risks and/or liscomforts of standard products. Many times, we are forced to admit ıat we cannot operate the product ourselves, thereby also admitting ur dependency on others to perform often the simplest of chores. ıs a result, products that are intended to provide service, in reality ause alienation, reinforcing negative self-images and stereotypes.
'he products handicap rather than liberate us.

ıitially, I was told that if I designed to satisfy the needs f one group of people, the design would inconvenience or be ıaccessible to others. My plan was to **test this notion** by earching for common denominators among the wide variety of hysically impaired people. Upon finding common needs, I would **edesign a product to show how the physically impaired and the hysically able can be accommodated together.** This would result ı a product that breaks down artificial distinctions between people.

'o focus my research, I studied people who have physical impairments ıat affect **mobility:** Those used for balance, standing, walking and oordination. Lessened muscle **strength** and the lessened ability for ne **control** of movement are common to most but not all of the onditions. Reduced **flexibility** and **spasticity** are also factors. 'ommon to all is **fatigue.**

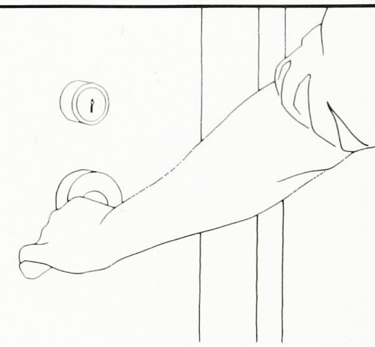
	major muscle control	fine muscle control	muscle strength	flexibility	spasticity	fatigue
Peripheral Neuromuscular Diseases	●		●			●
Neuromuscular Diseases	●	●	●	●	●	●
Rheumatic Diseases	●	●	●	●		●
Short Stature	●	●		●		●
Aging	●	●	●	●		●

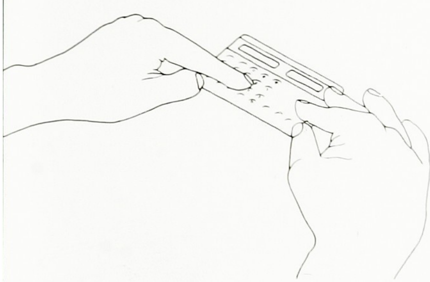
NEUROMUSCULAR DISEASES affect the motor system through damage to the nervous system at the brain or spinal cord. Included in this category are: Spinal coard injuries, Multiple sclerosis, Stroke, Cerebral trauma, Cerebral palsy, as well as other diseases of less frequent incidence.
PERIPHERAL NEUROMUSCULAR DISEASES affect the motor system through damage to the nervous system outside of the brain and spinal cord. The damage may be caused by an acquired disease (i.e., alcoholism, diabetes, cancer, etc.), exposure to toxins (heavy metals, organic compounds, or drugs), hereditary factors, or by nerve damage from a trauma.
RHEUMATIC DISEASES are those diseases and syndromes that involve joints and the soft tissue around them
SHORT STATURE, or dwarfism has over 75 isolated causes. Achondroplasia, a bone disorder, is the leading cause.
AGING, the natural process we all face, causes varying and progressive degrees of sensory and motor impairments.



DOOR KNOB
Requires hand and wrist strength and flexibility at 36″ height.
A barrier for people with strength, flexibility and control impairments, children, people who use wheelchairs, people of short or tall stature and anyone carrying things.

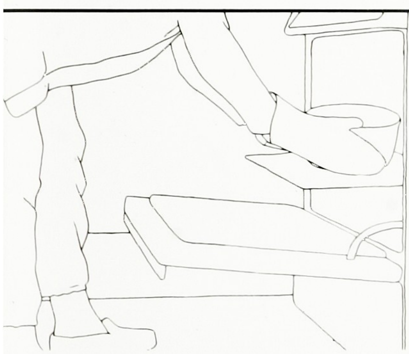
DOOR LEVER
Requires downward push, no specific grip, no optimum height.
Convenient to so many people, it has replaced the door knob in hospitals, schools and public buildings.





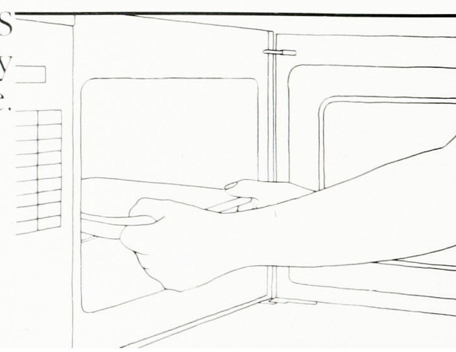
CONTROL PAD
Visual cues used to position fingers.
Difficult for people with vision or control impairments.

CONTROL BUTTONS
Visual and tactile cues aid in finger positioning which reduces errors.

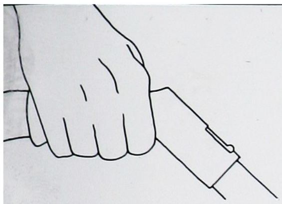


BOTTOM HINGED OVEN DOORS
Requires strength and balance while reaching over hot door.
Dangerous for people who use walking aids, wheelchairs, and people with strength or flexibility impairments.

SIDE HINGED DOORS
Door swings completely out of the way eliminating the danger of imbalance.

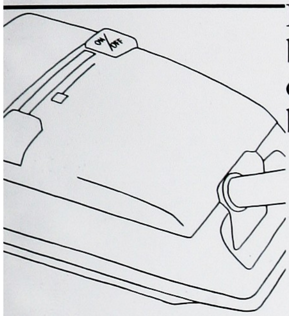


NOTE: ALL OF THE OPERATIONS CONTROLLED BY THE USER ARE AT YOUR HANDS, ELIMINATING THE NEED TO BEND AND STRETCH TO THE CANISTER.



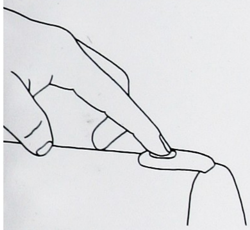
Existing machine uses 1¼″ diam. hand grip.

Proposal incorporates a 1″ diam. grip allowing fingers and thumb to overlap providing a secure comfortable hold.



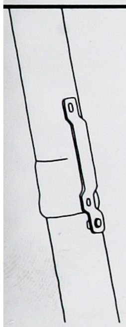
Existing machines use press buttons or toggle switches on the canister. You must reach and/or bend to operate.

Proposal incorporates a touch sensitive pad located on the handle. When your hand is on the grip, the machine turns on. Release your hand, it shuts off.



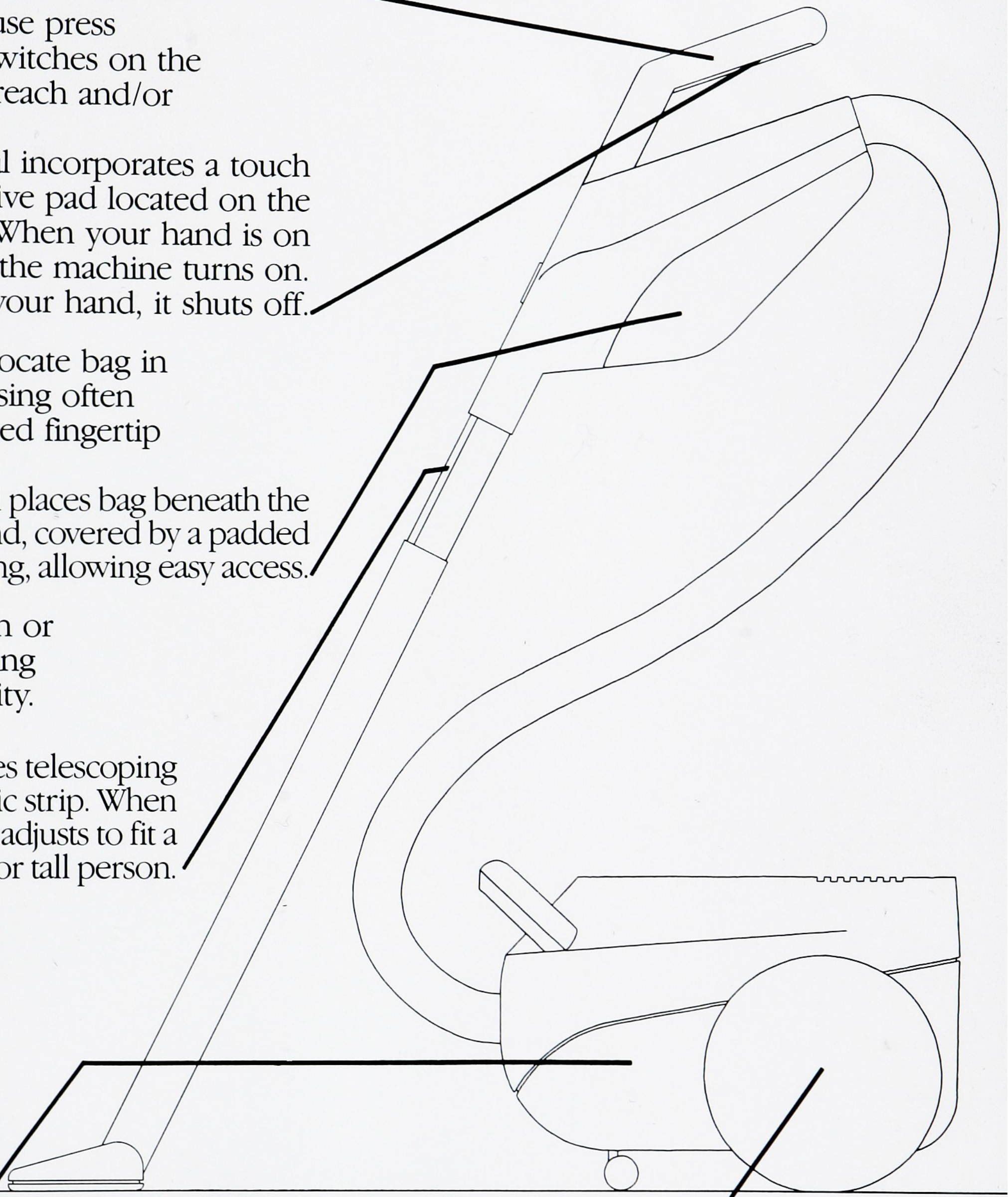
Existing machines locate bag in motor and fan housing often requiring two handed fingertip operation.

Proposal places bag beneath the hand, covered by a padded housing, allowing easy access.



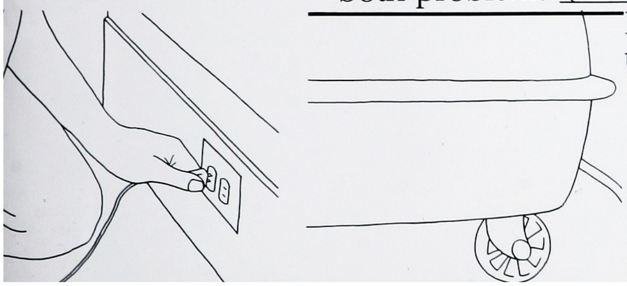
Existing machines use friction or clips to attach wands, requiring fingertip strength and dexterity. No adjustability in length.

Proposal provides telescoping wands with a pneumatic strip. When evacuated, the wand adjusts to fit a short, seated or tall person.



xisting machines operate on A/C ouse current requiring bending to tlets and movement limited to rd length.

Proposal incorporates a rechargeable battery eliminating both problems.



Existing machines, use small wheels under the canister.

Proposal has 6″ diam. wheels providing easier rolling.

Polypropene washing-up brush with nylon bristles. 1975. Jordan A/S