Report of the Executive Policy Committee dated December 5, 2001

Universal Design Policy
File CR-3 (Vol. 5)

85 - 4. The Executive Policy Committee has been advised that the Access Advisory Committee (AAC) has been requested by the Mayor's office to research and provide feedback on a Draft Universal Design Policy written by a community group, the Inter-organizational Access Committee (IOAC). The AAC has worked in cooperation with the community, the Chief Administrative Officer's office and key departments to further develop the existing report and consider the implications to the city. The AAC and administration have developed revised recommendations towards a strong overall policy for Universal Design. If Winnipeg's City Council accepts Universal Design as a proactive approach to doing city business, this policy would be the first of its kind in Canada.

Many civic facilities were built in the 1960's and 1970's, prior to barrier free building code. It has been expensive for the city to retrofit all its buildings to bring them up to current barrier free standards. The Public Works and the Planning, Property and Development Departments have established a plan to prioritize remaining identified structures that require access issues be addressed. The City of Winnipeg receives numerous requests from the community to ensure not only buildings and landscaping are safe and accessible, but also information, communications and services. Recognizing the proactive approach the city is taking in the area of barrier free design, but being cognisant of the expense, the AAC along side the Inter-organizational Access Committee has determined future major renovations and new projects should be viewed using a perspective of Universal Design.

In 1998, Winnipeg Development Agreement Program 5C funded a project which allowed an outside organization to audit the civic properties defined by the Centre Plan boarders for accessibility. This was done under the supervision and guidance of the AAC. One recommendation from this audit was that the City of Winnipeg adopt a policy on Universal Design.

The citizens of Winnipeg have a variety of different abilities, strengths, heights, etc. and this should not exclude or segregate anyone from participating in community life and accessing and using municipal services. Since 1999, significant effort by a number of people and organizations has gone into the development of a Universal Design Policy ranging from the formulation of a proposed Universal Design by-law by the Inter-Organizational Access Committee, through to input from the Mayor and Chief Administrative Officer. Over the past year, the Access Advisory Committee has been working with a Technical Steering Committee comprised of: the Directors of Public Works, Planning, Property and Development, Winnipeg Transit and the Corporate Services Equity and Diversity Coordinator. Its purpose has been to balance the needs of the community with the realities of civic government not only with respect to available resources but also as to how the city conducts business. Following this we consulted with divisional management and their response has been favourable. All input from the administration and the community has been considered and built into the Access Advisory Committee's recommendations. The goal of this policy is to have a city that is inclusive, comfortable and attractive for everyone.

Participation provides a vehicle to define the population, collect relevant information, open lines of communication and to share decision-making. Through the consultation and development process of the Universal Design Policy, the AAC has recognized the value of a cross disciplinary approach including participation by all stakeholders. With that in mind, the Access Advisory Committee seeks to continue the momentum of systems collaboration. The Universal Design interdepartmental implementation team established by the Chief Administrative Officer would preserve the proactive, inclusive approach to design and decision making which is inherent in the concept of Universal Design. Because Universal Design can be applied not only to environments and buildings, but also to systems, information, products and services, a comprehensive plan will be necessary. This team will continue to enhance strategies for moving this document from policy into practice in a timely and cost effective manner.

By December 2002, a completed progress report should be submitted to the Executive Policy Committee by the Universal Design interdepartmental implementation team. This will assist the

Report of the Executive Policy Committee dated December 5, 2001

Access Advisory Committee under their mandate to keep Council informed on the progress of accessibility issues within The City of Winnipeg through the Universal Design Policy.

On November 14, 2001, the Executive Policy Committee laid the matter over for 30 days.

The Executive Policy Committee recommends:

I. That City Council adopt the Universal Design Policy for The City of Winnipeg as recommended by the Access Advisory Committee and outlined on Appendix “B”.

II. That the Chief Administrative Officer establish an Interdepartmental Implementation Team to manage the implementation of this policy.

III. That the Interdepartmental Implementation Team provide a Universal Design progress report to Executive Policy Committee by December 2002.

IV. That the Proper Officers of the City be authorized to do all things necessary to effect the intent of the foregoing.

Copy of attachments referred to in the above clause are on file in the office of the City Clerk.

Moved by His Worship Mayor Murray,
Adoption of the clause.

Carried.

Appendix "A" referred to in Clause 4 of the Report of the Executive Policy Committee dated December 5, 2001

Universal Design Policy – Executive Summary

The following is a summary of the intent, methodology and implementation of the Universal Design Policy as approved by the Access Advisory Committee October 16, 2001.

1. That the City of Winnipeg will ensure all new construction and/or major renovations to buildings, exterior environments, as well as purchases and new developments in services, products, or systems that are funded in whole or part by The City will follow Universal Design criteria.

2. That the Chief Administrative Officer will establish an interdepartmental implementation team to steer this policy. This team would consist of representatives from the Access Advisory Committee and the following civic departments: Public Works, Planning, Property and Development, Winnipeg Transit, Corporate Finance – Materials Management, Corporate Services – Human Resources – Information Technology, the Equity and Diversity Co-ordinator, and any others deemed necessary. (Appendix B – Part 2, Statement of Intent: Interdepartmental Implementation Team)

3. That Corporate Education works with the interdepartmental implementation team to assist in the development of education programs to meet the diverse needs of each department. This will range from developing new programs and training tools to utilizing existing ones. (Appendix B - Part 3, Section 1: Education)

4. That the "Universal Design Checklist" be used as an assessment tool to evaluate how well the design of a building or product or service meets the criteria of Universal Design. (Appendix B - Part 3 Section 2 and Part 5)

5. That the city use "Access, A Guide to Accessible Design for Designers, Builders, Facility Owners and Managers" published by the Universal Design Institute, University of Manitoba, as a reference when implementing Universal Design. Alternate resource materials may be utilized subject to approval by the Access Advisory Committee. (Appendix B – Part 3, Section 2)

6. That all new construction or major renovations of civic buildings and/or exterior environments, as well as transportation systems, will be reviewed to identify compatibility with Universal Design criteria as outlined in Appendix B - Part 3, Section 3.1 and 3.2.

7. That Corporate Finance, Materials Management Division review Appendix B - Part 3, Section 3.3 "Products" and work with the Universal Design implementation team to provide recommendations for an implementation plan.

8. Effective January 1, 2002, all new services and programs financed by any department in The City of Winnipeg will be reviewed for compliance with Universal Design criteria using the written Checklist. (Appendix B - Part 3, Section 3.4)

9. Information, such as written documents and announcements, website design, interactive communication processes, and oral and visual presentations, prepared by any department in The City of Winnipeg will take into consideration compliance with Universal Design criteria using the Checklist. (Appendix B - Part 3, Section 3.5)

10. The City of Winnipeg will institute a Universal Design review process as part of budget planning. This will be the responsibility of each department and will be done on a project-by-project basis. (Appendix B - Part 3, Section 4)

11. The City of Winnipeg will include Universal Design criteria when developing the program of requirements for its contracting and tender processes. (Appendix B - Part 3, Section 5)

12. All public meetings and community consultations will take place in accordance with universal design principles. (Appendix B - Part 3, Section 6)

Submitted by:
The Access Advisory Committee
Oct. 16, 2001

Appendix "B" referred to in Clause # of the Report of the Executive Policy Committee dated December 5, 2001



Universal Design Policy

Submitted By: The City of Winnipeg
Mayor's Access Advisory Committee

Date: October 16, 2001

Acknowledgements

To Gail Finkel for researching, formulating and writing the original Universal Design Policy, thank you for your extensive contribution.

To the members of The Inter-Organizational Access Committee (IOAC) who participated in developing this document, thank you. IOAC is a Winnipeg-based community committee comprised of organizational representatives and individuals that are interested in achieving environmental design that includes the functional range of our population.

Thank you to the members of the Access Advisory Committee and the civic administration for their efforts in adapting the policy to balance the needs of the community with the realities of civic government not only with respect to available resources but also as to how the city conducts business.

Table of Contents

PART 1: INTRODUCTION 8

GOALS: 8
BACKGROUND: 8
ADVANTAGES: 10
STAKEHOLDERS: 10

PART 2: STATEMENT OF INTENT 11

POLICY: 11
IMPLEMENTATION TEAM: 11

PART 3: METHODOLOGY 12

SECTION 1. EDUCATION 12
SECTION 2. CHECKLIST 12
SECTION 3. REVIEW PROCESS 14
3.1. BUILDINGS 14
3.2. EXTERIOR ENVIRONMENTS AND TRANSPORTATION SYSTEMS 14
3.3. PRODUCTS 15
3.4. SERVICES AND PROGRAMS 15
3.5. INFORMATION 15
SECTION 4. BUDGET SCREEN 15
SECTION 5. CONTRACTING AND TENDERING PROCESSES 15
SECTION 6. COMMUNITY CONSULTATIONS AND PUBLIC MEETINGS 17

PART 4: IMPLEMENTATION 17

PART 5: UNIVERSAL DESIGN CRITERIA 18

INTRODUCTION 18
RANGE OF HUMAN FUNCTIONING 18
STATEMENTS OF GOOD DESIGN 21
THE CHECKLIST 26
DEFINITIONS 29

PART 6: APPENDICES 30

A. ARTICLES ON UNIVERSAL DESIGN 30
B. CASE STUDIES 43
C. PROGRAMS 48
D. SOURCES FOR MORE INFORMATION 47
E. LETTERS OF SUPPORT 58

PART 1: INTRODUCTION

As we move into the new millennium, The City of Winnipeg will conscientiously provide leadership in thought and action by institutionalizing a commitment to creating a city that is truly inclusive of all citizens through endorsing and incorporating the concept of universal design.

Goals:

- To accept that the population in Winnipeg has a variety of different abilities, strengths, heights, etc. and that this should not exclude or segregate anyone from participating in community life and accessing and using municipal services.
- To reduce the need and costs associated with providing disability specific solutions by providing a generalized approach to design that accommodates a wider range of people.
- To ensure that new civic buildings, environments, products, services and programs are designed to be useable by a wide range of citizens.
- To promote a city that is comfortable, attractive, and inclusive.

Background:

Universal Design is a concept, or way of thinking about design. It is also known as Design for Aging and Intergenerational Design. Simply put, Universal Design creates environments that respond to the needs of the range of the population to the greatest extent possible. It is an evolution from accessible or barrier-free design to be more inclusive. The key is Universal Design focuses on a range of needs, not averages. Average based thinking left out huge segments of our population, and so naturally, relied on special design features to include people with disabilities.

Universal Design acknowledges that people come in various sizes, have various strengths, etc. There is no value judgement on these differences. It is as important to include a tall twenty-year-old as a senior, or a child, or a person who uses a wheelchair or someone with a hearing disability.

Universal design solutions are functional and create better design. Some designs have come from barrier-free design. An example is lever handles. While first advocated by people with limited hand dexterity, they are simply easier to operate. They work for a wide range of users. Since they are no longer seen as a barrier-free item, they have become marketable, readily available, and used in many environments simply as a better alternative.

There are four key components in the definition of universal design that requires further clarification. That definition is; Universal Design creates environments that respond to the needs of the range of the population to the greatest extent possible.

First, the word "design" in the term universal design refers to more than the built environment. We design systems, services, and policies, as well as buildings and landscapes. Universal Design will apply equally well to the design of parks, buildings, transportation systems, information services, recreation and social services, policies and by-laws.

Second, to clarify the phrase "range of the population," basic human functioning issues must be defined. Human factors include:

- Vision: from easy to not possible seeing with or without aids
- Hearing: from easy to not possible hearing with or without aids
- Dexterity: from easy to not possible coordinating eye-hand movements
- Upper Body Strength and Mobility: from easy to not possible lifting, gripping, or grasping
- Lower Body Strength and Mobility: from easy to not possible walking, standing, or rising
- Cognition: from easy to not possible remembering or understanding
- Communication: from easy to not possible speaking, reading, hearing
- Balance: from easy to not possible remaining upright
- Stature: from tall to short, wide to thin

The above list is a way of describing the human condition and understanding that range is not a description of one special group, but rather a continuum within each of us.

Third, in order to be able to design in a way that takes into account this range of functioning, Universal Design criteria (or statements of good design) have been developed. These include:

- Designs should be marketable: the same for all, cost viable, and saleable
- Designs should be flexible: accommodate a wide range of preferences and capacities
- Designs should be uncomplicated and understandable: easy to understand regardless of the user's experience, knowledge, skills, or concentration level
- Designs should be safe: minimize hazards and provides fail-safe features
- Designs should require only reasonable effort: can be used efficiently and comfortably
- Designs should be easy to access and use: provide for easily getting to, getting at, reaching, using, and handling objects and spaces.
- Designs should be sustainable: provides an appropriate use of resources and consideration of environmental issues, as well as user's sensitivity to particular materials

Fourth, the phrase "to the greatest extent possible" is used because the goal of designing for all people is very difficult to achieve. This qualifier is not meant to limit, but rather to provide the motivation to constantly strive to improve our environments to be more inclusive to more people.

A safeguard, to ensure that this greatest extent is truly inclusive, is the participation of stakeholders. Participation provides a vehicle to define the population, collect relevant information, open lines of communication, and to share decision-making.

Because of the difficulty of designing for all people, Universal Design does not negate the need for barrier-free or accessible design features. Though significantly more people will be accommodated through implementing universal design, at times there will still be individual needs that are not addressed. The costs and instances for these will be much less by incorporating the concept of Universal Design.

Advantages:

By thinking of our population as a collection of people who have differences, we accept reality. The City of Winnipeg is a community made of children, adolescents, adults, and seniors. They are different heights, weights, and have different strengths and abilities. This is not good or bad, it just is.

Given this fact, design should allow our environments to respond without having to constantly develop exceptions for special circumstances. If we think about designing for our population as they are, we design for a range rather than an average. As such, universal design has been described as designing for people from 8 to 80. For a city with a diverse population, this approach not only makes environments more comfortable for people, it will also reduce the need for expensive renovations. Environments should adapt to the people, rather than requiring people to adapt to the environments.

If design is both a process and a result, we have the ability to create systems and environments that will allow people to be more active participants in their community. Universal Design, if done properly, can be aesthetically pleasing and no more expensive than conventional design. A cornerstone of universal design is that it is marketable. As a result, it is better design, allowing people to maximize their role in their family and in society.

Stakeholders:

Citizens of all ages, socio-economic groups, and neighbourhoods will benefit by having environments and programs incorporate universal design principles. The differences in our stature and strengths know no cultural or economic bounds.

Businesses also have a stake in Universal Design. Universal Design, which is instituted in the facility and as a way of doing business, opens up new markets. Industry magazines and newsletters are now acknowledging Universal Design as a growing and important trend. Often these publications tie the need for Universal Design with the aging population. This new aging population is active, has disposable income, and is recognized as a valuable market.

And finally, politicians have a stake in implementing universal design. By responding to the growing demand of citizens for easy access to services and facilities, elected officials can be more responsive in appropriate ways.

PART 2: STATEMENT OF INTENT

Policy:

That the City of Winnipeg will ensure all new construction and/or major renovations to buildings, exterior environments, as well as purchases and new developments in services, products, or systems that are funded in whole or part by The City will follow Universal Design criteria. (See page 18 "Statements of Good Design")

Implementation Team:

That the Chief Administrative Officer will establish an interdepartmental implementation team to steer this policy. This team would consist of representatives from the Access Advisory Committee and the following civic departments: Public Works, Planning, Property and Development, Winnipeg Transit, Corporate Finance – Materials Management, Corporate Services – Human Resources – Information Technology, the Equity and Diversity Co-ordinator, and any others deemed necessary. (Appendix B – Part 2, Statement of Intent: Interdepartmental Implementation Team)

In addition, each department will assign a departmental designate to be responsible for the implementation of Universal Design and provide an annual report to the Chief Administrative Officer and the Access Advisory Committee.

The City of Winnipeg Access Advisory Committee will provide an advisory role throughout the process.

PART 3: METHODOLOGY

Section 1: Education

It is vital that City of Winnipeg staff and elected officials become knowledgeable concerning universal design. As a result, there will be workshops on universal design and its implementation. Education sessions will be required at intervals specified by the inter-departmental implementation team. The Access Advisory Committee recommends the following:

a) That education programs and/or initiatives be developed to meet the various needs of civic personnel.

b) That departmental designates be responsible for ensuring staff training occurs.

c) That Corporate Education work with the interdepartmental implementation team to develop education programs and tools for City of Winnipeg staff in the concepts of Universal Design. This may include designing new programs and tools or enhancing existing training programs, new employee orientation programs, a train the trainer program, E-training, video production, etc.

d) That the Interdepartmental Implementation Team attends a one-day in-depth training session by March 2002.

e) That personnel responsible for planning, design, materials management, etc. as determined by departmental directors attend an extensive 1–3 d ay training session on Universal Design with a trainer approved by the Access Advisory Committee.

f) That designated departmental Universal Design personnel must attend a minimum of a one-day in-depth training on Universal Design with a trainer approved by the Access Advisory Committee.

Section 2: Checklist

That the Universal Design Checklist (see below) will become the worksheet for evaluations in the following Review Process. This form will be explained to staff in the educational sessions and will be used by the departments (See Part 5: Universal Design Criteria).

The Checklist provides a way to evaluate how well the design of a building or product or service meets the criteria of Universal Design. While it may be impossible to meet all criteria, the process of using the Checklist highlights areas that need further thought, ways to alter the design to be a better fit, and assist in making better decisions.

That the city use "Access, A Guide to Accessible Design for Designers, Builders, Facility Owners and Managers" published by the Universal Design Institute, University of Manitoba, as a reference when implementing Universal Design. Alternate resource materials may be utilized subject to approval by the Access Advisory Committee.

Section 3: Review Process

The City of Winnipeg will institute a Universal Design Review Process in each of the following areas.

3.1. Buildings

All new construction or major renovations of civic buildings will be reviewed to identify compatibility with Universal Design criteria. The designated departmental universal design staff person will be responsible to determine what changes are required using the written Checklist described in #2 above and then follow up as changes are made in the plans. A copy of the Checklist is to be maintained by the departmental designate and an annual update be provided to the Access Advisory Committee.

For projects estimated at $250,000.00 or more, an outside consultant with expertise in design and universal design principles will be contracted by the City of Winnipeg to perform a detailed audit of the plans. The need for an outside consultant will be reviewed after the policy has been enforced for five years.

For projects ranging from $100,000.00 to $250,000.00 an external Universal Design audit is optional, however an internal Universal Design audit is required.

Universal Design considerations will be given to all projects less than $100,000.00 without a formal audit process.

3.2. Exterior Environments and Transportation Systems

All civic exterior environments with planned new construction or major renovation, as well as transportation systems, will be reviewed to identify potential compatibility with Universal Design criteria. The designated departmental universal design staff person will be responsible to determine what changes are required using the written Checklist described in #2 above and then follow up as changes are made in the plans. A copy of the Checklist is to be maintained by the departmental designate and an annual update be provided to the Access Advisory Committee.

For projects estimated at $250,000.00 or more, an outside consultant with expertise in design and universal design criteria will be contracted by the City of Winnipeg to perform a detailed audit of the plan. The need for an outside consultant will be reviewed after the policy has been enforced for five years.

For projects ranging from $100,000.00 to $250,000.00 an external Universal Design audit is optional, however an internal Universal Design audit is required.

Universal Design considerations will be given to all projects less than $100,000.00 without a formal audit process.

Universal Design Checklist©

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Design under consideration:

Facilitator/Reviewer:

1. Range of Functioning

	Rating	Comments
Vision		
Hearing		
Stature		
Balance		
Cognition		
Lower body strength and mobility		
Upper body strength and mobility		
Communication		
Dexterity		
Life span		

2. Statements of Good Design

	Rating	Comments
Marketable		
Flexible		
Uncomplicated & Understandable		
Safe		
Easy to Use and Access		
Reasonable Effort		
Environmentally Sensitive		

3. Appropriateness and Actions to be Taken:

3.3. Products

In cooperation with Corporate Finance, Materials Management Division, the interdepartmental implementation team will provide recommendations for the vetting of products ordered by any department in The City of Winnipeg for compliance with universal design criteria using the written Checklist described in #2 above. A copy of the Checklist is to be maintained by the departmental designate and an annual update be provided to the Access Advisory Committee. (See Section 5. Contracting and Tender Process)

When deemed necessary by the departmental universal design designate, the City of Winnipeg will contract a consultant with expertise in Universal Design and the field related to the product under consideration.

3.4. Services and Programs

Effective January 1, 2002, all new services and programs financed by any department of The City of Winnipeg will be reviewed for compliance with Universal Design criteria using the written Checklist described in #2 above. A copy of the Checklist is to be maintained by the departmental designate and an annual update be provided to the Access Advisory Committee. (See Section 5: Contracting and Tender Process)

When deemed necessary by the departmental universal design designate, the City of Winnipeg will contract a consultant with expertise in Universal Design in the field related to the service and/or program under consideration.

3.5. Information

Information, such as written documents and announcements, website design, interactive communication processes, and oral and visual presentations, prepared by any department in The City of Winnipeg will take into consideration compliance with Universal Design criteria using the Checklist described in #2 above. A copy of the Checklist is to be maintained by the departmental designate and an annual update be provided to the Access Advisory Committee. (See Section 5: Contracting and Tender Process)

When deemed necessary by the departmental universal design designate, the City of Winnipeg will contract a consultant with expertise in Universal Design and the field related to the product under consideration.

Section 4: Budget Screen

The City of Winnipeg will institute a Universal Design review process as part of budget planning. This will be the responsibility of each department and will be done on a project-by-project basis.

Section 5: Contracting and Tendering Processes

Services that the City of Winnipeg contracts with outside suppliers will comply with Universal Design criteria. The proposal call, application forms, and tender documents will include a statement from the

supplier as to how Universal Design criteria will be met. The City of Winnipeg will include the Universal Design materials in Part 5 of this document as supplementary materials in tender calls.

Section 6: Community Consultations and Public Meetings

The City will ensure that community consultations and public meetings are compatible with Universal Design criteria using the Checklist described in #2 above. This includes but is not limited to:

- ensuring the location is accessible to people whether they can manage steps or not;
- the advertisements informing citizens of the meeting and any other information are available in multiple formats; and
- meeting proceedings are accessible to people who may not be able to hear an oral discussion.

PART 4: IMPLEMENTATION

The Universal Design Inter-departmental Implementation Team will be responsible for developing timelines, costing, and an implementation plan. It shall provide a Universal Design progress report to the City of Winnipeg Executive Policy Committee by December 2002.

PART 5: UNIVERSAL DESIGN CRITERIA

The following are excerpts from Actualizing Universal Design, by Gail Finkel and Yhetta Gold.

Introduction

Universal design includes. It does not exclude. The definition of universal design states that **design solutions should respond to the needs of the widest possible range of the population**.

To implement universal design a conceptual framework is provided that allows for problem solving. Universal design does not focus on dimensional requirements, but rather on a way of thinking through design issues. The following three sections provide this framework. First, a description of the range of functioning and its design implications is provided. Second there is a listing of Statements of Good Design, or principles of universal design, with examples. It is the combination of understanding human functioning and statements of good design that result in universally designed environments, products, and services. Lastly, a Checklist is provided to test how well a design or service meets these two components.

Range of Human Functioning

All individuals are a collection of various abilities. Different aspects are easier for one person than another. No factor is more important and the range within each does not place a value judgment of better or worse, but rather easy to not possible.

How do we know the requirements of the people we are designing for? We need a new language that identifies the wide scope of functioning without segregating groups of people. This understanding of the range of human functioning of all people is essential to the implementation of universal design.

The following list provides a catalog of human factors that design must consider. There is no right or wrong, there is just variability. Also included is a brief list of the design implications when designing for a population with a range of functioning. This list is not all-inclusive.

1. Vision
    Range of Functioning:
        Seeing is very easy to not possible with or without corrective lenses.
    Design Implications:
        - Sufficient font size
        - Visual information provided in multiple formats
        - Colour contrast maximized
        - Sufficient lighting levels and glare is minimized
        - Website design allows for multiple forms of interaction and adaptable equipment

2. Hearing
    Range of Functioning:
        Hearing is very easy to not possible with or without assistive aids.
    Design Implications:
        - Sign language interpreters or other assistive technology is available
        - Audible information is provided visually

- Visual distractions are minimized
- Sufficient lighting levels

3. Stature

Range of Functioning:

A consideration of body types from tall to short, seated or standing, and thin to heavy.

Design Implications:

- Find common denominators for location of switches, handles, and mirrors where height is not an issue (i.e. no higher than 1200mm).
- Provide dimensional options for clear space, reach, and approach so that the space accommodates a person who is standing or seated or using an assistive aid.

4. Balance

Range of Functioning:

From high to low energy levels and from easy to not possible walking, remaining upright, or controlling of body movements, and one- and two- sidedness.

Design Implications:

- Limit amount of strength required
- Minimize distances
- Handrails are available
- Rest areas are available
- Space for walking aids
- Tasks can be performed with one hand

5. Cognition

Range of Functioning:

Very easy to not possible remembering, understanding, and making decisions.

Design Implications:

- Information is redundant and clear
- Visual or auditory distractions are minimized
- Appropriate acoustics
- Feedback is provided
- Assistance is available

6. Lower Body Strength and Mobility

Range of Functioning:

Very easy to not possible walking, sitting or rising, standing, stooping, kneeling, or climbing, with or without aids.

Design Implications:

- Mobility aids are accommodated
- Rest areas are available
- Handrails and grab bars are provided and reachable whether standing or seated
- Bending is not required

7. Upper Body Strength and Mobility

Range of Functioning:

Very easy to not possible reaching, lifting or holding, grasping or manipulating, and twisting or turning, with or without aids.

Design Implications:

- Reaching distances do not require stretching from a seated or standing position

- Devices are available to eliminate lifting and reaching
- Alternatives for grasping or twisting

8. Communication

Range of Functioning:

Speaking, understanding, or recognizing is very easy to not possible

Design Implications:

- Accomodations are available
- Size, colour, width, and height of font is appropriate
- Redundant cues are available
- Multiple cues are used

9. Dexterity

Range of Functioning:

Very easy to not possible performing manual tasks that requires hand-eye or two-hand coordination.

Design Implications:

- Alternatives for fine motor movement
- Alternatives for levels of co-ordination
- Space provided for assistive devices

10. Life Span

Range of Functioning:

A range of age and health factors evolving over time.

Design Implications:

- Provide physical and emotional comfort.
- Individual requirements concerning sensitivity and sustainability are considered.
- Flexible to changing needs.

Statements of Good Design

It is important to have a framework, a way of thinking about design. The combination of human functioning with the following Statements of Good Design (criteria of universal design) will result in better, more useable, and more comfortable designs.

1 - MARKETABLE

The design is saleable and available to a wide range of users.

Guidelines:

- The same for all or reasonable equivalent when not.
- Cost viability.
- Comfortable and pleasing features.

Example: Kathy

Kathy is a salesperson, who happens to be very short. She is tired of going into public washrooms and being unable to fix her hair, because the mirror is too high. A universal design feature is to place mirrors at a level that is just above the sink and be large enough that a standing taller person can use the mirror without bending.

This way standing users, whether tall or short, and seated users all have access to the same mirror.
It does not stigmatize shorter or seated people.
It is an affordable solution and therefore provides equitable use.
It is tasteful and comfortable for all persons regardless of stature.

2 - *FLEXIBLE*

The design accommodates a wide range of capacities and preferences.

Guidelines:

- Provides choice.
- Adjusts to changing needs.

Example: Les

Les had a stroke that has affected his right arm. Since his kitchen was universally designed he has been able to continue preparing his own meals. The single lever control at the sink allows easy one-handed operation. The roll out shelving provides comfortable access to items. In his bathroom, reinforcement was placed between the studs to allow the placement of grab bars. This has now proven to be of great value.

3 - UNCOMPLICATED and UNDERSTANDABLE

The design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Guidelines:

- Arranges information consistent with its importance.
- Makes it easy to give and get instructions and offers timely feedback.
- Uses a variety of methods of presentation (pictorial, verbal, tactile).
- Provides adequate contrast.

Example: Juan

Juan is new to this country. His English is improving, but sometimes difficult. He bought a bookcase for his living room and has to assemble it. The directions are surprisingly easy, filled with simple, clear diagrams rather than words. The steps are clearly laid out and provide cues to ensure that each step was completed successfully before providing information on the next step. He was also able to get this information on a disc or tape if he so desired. He is able to have the bookcase finished and decorated quickly and with no hassles.

This is in contrast with his friend who speaks the language, but was given pages of directions that confused and frustrated every attempt to put a bicycle together. Each time he thought he had gotten it right, he would find that an error had been made four steps back and had to take the bike apart and start again.

4 - SAFE

The design provides security.

Guidelines:

- Arranges elements to minimize hazards and errors.
- Provides fail-safe features.
- Provides warnings of hazards.

Example: Daniel

Daniel's sight is not what it was a few years ago. Even with corrective lenses he has trouble reading any size print and distinguishing detail. He refuses to use a white cane as he walks through downtown.
Within the office building, there is a flight of stairs down to the lower level. Without a colour and texture contrasted warning strip he would not have noticed the stairs before being put in jeopardy.

5 - REASONABLE EFFORT

The design is used efficiently and comfortably.

Guidelines:

- Allows the user to maintain a comfortable body position.
- Minimizes repetitive actions.
- Minimizes sustained physical effort.

Example: Helen

Helen has had arthritis for a number of years. She has found many products to use that keep her involved in her daily routines. Examples include large tabs for medicine bottles, kitchen utensils designed with larger handles made of soft materials that adapt to her handgrip, and a telephone with speaker phone redial and memory.

6 - EASY TO USE AND ACCESS

The design provides for easily getting to, getting at, reaching, using, and handling objects and spaces.

Guidelines:

- Provides a clear line of access to important elements (sight, hearing, stance, etc.).
- Provides comfortable reach to all components for any seated or standing user.
- Accommodates variations in hand and grip size.
- Provides adequate space for the use of assistive devices or personal assistance.

Example: Simon

Simon uses a wheelchair. In a public washroom using universal design he finds the door is wide enough to easily enter and the lever door handle easy to operate. Instead of two doors in the entry to provide privacy for those inside the washroom, the wide path gently curves eliminating the need for a second door. The stalls are wide enough for him to enter, turn, and transfer onto the toilet. The accessories are logically arranged with the soap dispenser easily in reach of the sink with its one lever control and the paper towel dispenser at an approachable height with the disposal directly beneath it.
It is not just Simon who appreciates this layout, but many others.
Fred has just finished his Christmas shopping and can fit through the stall doors with the packages and has room to place his items.
Ken has limited vision and with the arrangement of the accessories can easily locate and use them.
Sam hates walking around with wet hands to the paper towel dispenser and appreciates it is adjacent to the sink.

7 - SUSTAINABLE

The design provides appropriate use of resources and consideration of environmental issues.

Guidelines:

- Controls energy expenditure.
- Promotes the use of local resources.
- Promotes consideration of user's sensitivity to particular materials.

Example: Vera

Vera is planning her home with the intention of remaining in it the rest of her life. By including universal design into the planning, she will eliminate major renovations or having to move as her functioning changes over time (sustainability). Where possible she is using materials recycled from demolished buildings, which will increase the character she wants in her home. Since her children have a number of allergies, she is also concerned about out-gassing of products and is careful not to use glues and carpets throughout the interior.

The Checklist

The following form has been developed to evaluate how well a design meets universal design criteria. The criterion incorporates the range of human functioning with the Statements of Good Design (discussed earlier in this paper).

While it may prove very difficult to fulfill all aspects of universal design, using this form will highlight the strengths and weaknesses of the proposed design. The process provokes discussion to clarify how the design accommodates the range of functioning in our population and identifies who is accommodated and who is not. Though the process designs may need no changes, minor modifications, or major alterations all of which lead to ways to better address our population needs.

Instructions

1. Measure the design against the range of functioning in our population. Shade in the box next to each of the areas of human functioning, starting from left to right. Fill in only as much of the box as indicates how well this solution meets the range of needs within this area.

    - For example, if the solution under discussion is adding a ramp to a building, under vision not all of the box will be filled in. With low or no vision, there will be difficulty finding the ramp and there is a risk of falling. The group/team should thoroughly discuss all aspects of the solution and then decide how much of the box is appropriate to fill in. In this case perhaps 60% of the box will be filled in.

1. Range of Functioning	Rating	Comments
Vision		Needs warning surface and colour contrast

    - Comments made in the discussion as to how we may mitigate any potential problems should be noted in the comment section. Use this exercise to discuss who is included and who is excluded in this solution and why. Continuing with the example of a ramp, the group noted that with a warning surface and colour contrasting materials the danger may mitigated.

2. Measure the proposed solution against the Statements of Good Design. Shade in the box next to each of the Statements of Good Design starting from left to right. Fill in only as much of the box as indicates how well this solution meets the concept.

    - Following the example given above, if a ramp addition is being considered it will be evaluated against the Statements of Good Design. The first issue is whether a ramp is marketable. Included in this statement is whether this design solution is saleable, viable in terms of cost, the same for all users, and comfortable and pleasing in appearance. In this case the group decides that it meets about 80% of those criteria.

2. Statements of Good Design	Rating	Comments

Marketability		Needs landscaping to integrate into design

- Comments made in the discussion as to how we may mitigate any potential problems should be noted in the comment section. Use this exercise to discuss what statements are included and which are excluded and why. Continuing with the same example, the group feels the marketability would be 100% if the area around the ramp is landscaped. This solution makes the design more attractive and integrated into the design of the site. The box would be filled in most of the way starting at the left and the comment about landscaping would be noted in the comment section.

3. Compare the results after all of questions #1 and #2 are done. From this information a decision can be made on the appropriateness of the solution and/or which comments must be incorporated to make the solution conform to maximizing the range of functioning and the statements of good design.

4. In large designs this process may need to focus on a number of individual issues and be repeated. For example in a large building, the entry, reception, offices, washrooms, lunchroom, etc. may need to be reviewed separately.

Universal Design Checklist©

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Design under consideration:

Facilitator:

1. Range of Functioning

	Rating	Comments
Vision		
Hearing		
Stature		
Balance		
Cognition		
Lower body strength and mobility		
Upper body strength and mobility		
Communication		
Dexterity		
Life span		

2. Statements of Good Design

	Rating	Comments
Marketable		
Flexible		
Uncomplicated & Understandable		
Safe		
Easy to Use and Access		
Reasonable Effort		
Environmentally Sensitive		

3. Appropriateness and Actions to be Taken:

Definitions

Universal Design: Design solutions that respond to the widest range of the population possible. Concerned with broad marketing by meeting the requirements for children through to seniors, people with or without disabilities, and without stigmatizing or identifiable aesthetics. Some special design features will still be required, but more limited in scope. Also known as Trans-generational Design, Life Span Design, and Design for All.

Design: Refers to a creative process that is used when developing something new. The scope goes beyond the term that is frequently understood as the purview of architects, and interior and industrial designers. Individuals design their lives, community groups design strategies and programs, governments design policies and laws, service providers design programs, etc.

Environment: Includes all those things that surround us; buildings, work places, recreational centres, products, services, transportation systems, etc.

People: The broad range of individuals who compose our population

To reduce confusion with other design terms the following is offered to clarify what universal design is and is not:

Accessible or Barrier-free Design: Unlike universal design these terms refer to specific solutions for specific disability types.

Adaptable or Flexible Design: Easily adjusted or renovated to meet individual needs, usually related to housing and disability related needs.

Part 6: Appendices

A. Articles on Universal Design
Excerpts from

The Concept of Universal Design

Copyright © E. Steinfeld 1994
By Edward Steinfeld Professor of Architecture, Director, Center for Inclusive Design & Environmental Access State University of New York at Buffalo

Universal Design is different than accessible design. Accessible design means products and buildings that are accessible and usable by people with disabilities. Universal design means products and buildings that are accessible and usable by everyone, including people with disabilities.

Although these different definitions appear to be simply semantic, they actually have significant differences in meaning. Accessible design has a tendency to lead to separate facilities for people with disabilities, for example, a ramp set off to the side of a stairway at an entrance or a wheelchair accessible toilet stall.

Universal design, on the other hand, provides one solution that can accommodate people with disabilities as well as the rest of the population. Moreover, universal design means giving attention to the needs of older people as well as young, women as well as men, left handed persons as well as right handed persons.

An entrance that is designed to be "universal" would not have stairs at all. Instead of only one toilet stall designed for people who use wheelchairs, a toilet room with a universal design might include more than one stall with larger space clearances and perhaps additional facilities such as a changing table for babies. Instead of providing accessibility to only a men's and a women's toilet room there might also be a "family" toilet room, one in which men can take their young daughters or older mother and women can take their young sons or older father without embarrassment. This bathroom could also accommodate people with a wide range of physical limitations.

Over the last several years there has been a growing interest in universal design as an alternative to accessible design. Why has this occurred? In the highly developed countries there are several reasons:

- An increase in the number of survivors of disability
- Increasing life spans
- Increasing purchasing power among the population with disabilities
- Development of a "grey market"
- Recognition of the inadequacies of assistive technologies
- Products and environments that were not designed with old people in mind.

Data from the United States illustrates these trends. Between 1970 and 1980, the number of people with disabilities increased by 50%. This can be attributed to improvements in medical technology and health care practice. People with disabilities themselves are living longer and the growth of the older population, particularly the "older old" has been rapid. It is estimated that, by the year 2030, 20% of the population in the U.S. will be over 65.

The purchasing power of people with disabilities is significant. It is estimated that 36 million disabled people in the U.S. spend 40 billion dollars on special products. As they become integrated into general community life, hold jobs and earn more money, they are beginning to exert influence on design of mass marketed products. One of the most significant social trends has been the development of the "grey market." Consumers over 65 have the highest discretionary income in the U.S. It is estimated that the population over 50 years of age, which includes most middle age people as well as the aged, amounts to an $800 billion market. This group controls 56% of all discretionary income. For example, they purchase 60% of all domestic cars and own 50% of all homes.

Despite the increasing economic power of the older population and people with disabilities, there are many gaps in the market place. Many special products, i.e. assistive technology, are Band-Aid approaches to deficiencies in general consumer product design. The same can be said about accessibility features in public buildings or "adapted" housing. Research on consumer acceptance of assistive technology has demonstrated that people do not like the medical/technical appearance of these products. They are also too expensive, hard to find, unreliable and difficult to repair. Perhaps one of the most significant limitations is that consumers see them as stigmatizing; "special" products and environments promote a negative self-concept.

Increasingly, the proponents of disability rights and design professionals have come to realize that the concept of accessible design has to be rethought. Consumer products and environments have been designed for Peter Pan and his friends, people who never grow old and live in Never-Never-Land. The challenge now is to change the way we think about design of all products and environments.

It is important to note that the term universal design does not imply that everything in this world be fully usable by everybody. As we shall see, the term refers more to a goal to be reached and an attitude rather than a strict absolute. The less developed countries share some of the same trends as the highly developed countries. They also are experiencing an increase in survivors of disabilities and, in some cases, increasing life spans. However, in these countries, assistive technology is much more costly and hard to find. In some countries it is simply outside the reach of most people in the population. These countries have a need to control public welfare costs as well; moreover, the stigma of disability can be much greater. For these reasons, universal design makes a great deal of sense as an alternative to accessible design because it can be more generally available at lower costs than assistive technology or specialized settings.

With the advent of an independent living movement in the less developed countries, there is an opportunity to avoid the trap of special products and special places. Universal design also presents an opportunity for economic development. The creation and production of consumer products that are easier to use for everybody can improve competitiveness in the world export market. Moreover, the development of a public infrastructure, cultural and recreational sites that are usable by all can improve tourism and contribute to general economic welfare.

The first step in operationalizing the universal design philosophy is designing for a broader range of people. Whereas accessible design is often focused on the needs of people who use wheelchairs or have visual impairments, universal design should consider other differences as well. This may include differences in strength, intellectual abilities, perceptions and values. For example, universal design of signs at an airport terminal would include response to travelers who do not speak the native language of a country.

Broadening the target population for design can be achieved in two ways. First, individual designs can "forgive" limitations and abilities. For example, a door handle should be designed for ease of use by a variety of different grips. Second, products and environments should be designed to adapt to a range of abilities. So, for example, the walls surrounding a bathtub can be designed to support grab bars wherever they are needed. In this way individuals can install grab bars in places that are best for them. The first approach requires building in certain design features from the start.

The second approach, however, allows for a range of adaptation depending on individual and household needs. The initial level of usability might actually be lower than "accessible design" but the range of adaptation would be greater. An important implication of universal design is that it has mass appeal. Accessible design often has a medical or institutional appearance. The lack of good aesthetics often leads to "technology abandonment" on the part of the consumer or negative attitudes towards accessibility on the part of building owners or designers.

To ensure that universal design will be accepted, it must have a high standard of aesthetics. In fact the most successful universal designs often express the usability features of the product or environment as strong aesthetics qualities and are successful precisely because they are beautiful as well as useful. Of course, universal design must be usable and accessible by people who have disabilities.

Four principles can help to assure that this goal will be achieved:

- insuring a wide range of anthropometric fit
- reducing energy expenditure
- clarifying the environment
- using the systems approach

Products and environments should be usable within the comfortable reach of the intended users, including those who are seated and those who are standing. Circulation clearances and environments should be large enough to accommodate wheelchair and walking aide users. Grip sizes and clearances should be within the range abilities of people who have limited grip or have to use alternatives to the standard grips.

Often we think that accessibility can be achieved best through larger spaces; however, reducing energy expenditure is often just as important as providing enough clearance for wheelchair movements. In particular, older people need an environment that eliminates unnecessary expenditure of effort. This can be achieved by organizing space and designing devices to simplify the tasks of using them and may mean keeping spaces from getting too large. Useless movements should be eliminated.

Hands-free operation can be an excellent way to reduce energy expenditure. Operating forces on controls and hardware should be kept to a minimum. Finally, products and environments should be designed to reduce bending and stretching.

The legibility of the environment and products are critical to their successful use. Clarifying the environment includes the use of color and texture contrasts to identify different controls or improve the perception of spaces. Enough light should be provided to see things easily and glare should be kept to a minimum. Clarifying the environment also involves simplifying cognitive tasks associated

with perception and operation of devices. This can be achieved by making the way things work visible, providing "information in the world" instead of requiring people to memorize operations. Natural mapping should be used to make the relationship between controls and their effects more understandable.

Providing redundant queuing, for example visual signals as well as audible signals, reinforces communication about the operation of devices. In general, the level of technology should be kept as simple as possible and good feedback for the effects of one actions should be provided.

Universal design does not necessarily mean that the product or environment is designed to be usable by all people from the beginning. The systems approach can be used to provide an adaptable environment, one that can be easily adjusted to meet the need of any person. There are many ways to accomplish this.

Interchangeable parts allow for substitution of features to accommodate different levels of ability or different ways to use a device or place. For example, most computer systems allow the interchangeable use of several input devices, e.g. track ball, mouse keyboard, joy stick or laser pointer. Another approach to adaptability is the use of add-on options. For example, a bathtub that could have fittings that allow the installation of grab bars or seats. A consumer could purchase the basic bathtub first. As they got older, they could buy additional options that easily attach to the tub. The design of a system with uniform aesthetics would reduce the negative connotations associated with typical bars and seats.

Another important aspect of the systems approach is the interface of mass market products with assistive technology. A good example is the design of a telephone headset that can be usable with a TDD. There are many good examples of universal design.

Though we do not endorse the language used in this article, many important points are raised.

Excerpts from
Thirty-Something (Million): Should They Be Exceptions?

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There are over thirty million people in the U.S. with disabilities or functional limitations (of which a major cause is aging), and this number is increasing. An examination of the role of human factors in addressing this population is presented which would include both special designs for disability/aging and the incorporation of disability/aging into mainstream human factors research and education.

Statistics regarding the size and characteristics of this population are presented, including the costs of disability. Examples demonstrating the economic and commercial feasibility of incorporating disability/aging considerations in mass market designs are provided along with a discussion of the benefits to non-disabled users.

Introduction

Many nations are becoming more aware of the large numbers of persons with disabilities and the problems they face. This group includes those born with disabilities and those whose abilities diminish during their lifetime through disease, accident or aging. Recent Federal legislation in the United States, primarily Section 508 of Public Law 99-506 and the Americans with Disabilities Act, addresses accessibility problems faced by persons with disabilities in the workplace and community. In addition, the demographic trend toward a growing elderly population (particularly as the "baby boom" generation ages) is raising the prospect of a large number of consumers with decreasing abilities. The serious impact this will have on mass market products is beginning to be recognized by manufacturers.

These developments have sparked increased discussion within the human factors community. There is little question that human factors research and principles can be a benefit to those who are designing special devices for persons with functional limitations. However, the open question is, "Should the mainstream design of products include consideration of people who have disabilities or are elderly?" (In other words, should mass market products be made more accessible via their initial design?)

It is easy to answer this question in the affirmative from a humanitarian standpoint, yet this is likely to represent a major change in scope for the human factors field. The specific role of human factors with regard to design for disability/aging is yet to be determined. Such a change must also be well considered in terms of effects on personnel, curricula and economic perspectives.

It is useful to break this complex question into the following component questions:

- Who is included in the category of "disabled and elderly persons"?
- How large is the disabled and elderly population?
- Can't the needs of disabled or elderly persons be handled separately or as exceptions?
- What can the human factors field do for this group?
- Is it economically and practically feasible to include disabled and elderly persons in the design process for mass market products?
- What are the "benefits" of incorporating disability and aging considerations into mainstream human factors activities?
- What are the "costs"?

Who Is Included in the Category of "Disabled and Elderly Persons"?

It is important to understand that there is no clear line between people who are categorized as "disabled" and those who are not. A performance or ability distribution for a given skill/ability is generally a continuous function, rather than bimodal with distinctive 'able' and 'disabled' groups. This distribution includes a small number of individuals who have exceptionally high ability, a larger number of individuals with mid-range ability, and another longer tail representing individuals with little or no ability in that particular area. In looking at such a distribution, it is impossible to simply draw a vertical line and separate able-bodied from disabled persons. It is also important to note that each aspect of ability has a separate distribution. Thus, a person who is poor along an ability distribution in one dimension (e.g., vision) may be at the other end of the distribution (i.e., excellent) with regard to another dimension (e.g., hearing or IQ). Thus, individuals do not fall at the lower or upper end of the distribution overall, but generally fall into different positions depending upon the particular ability being measured.

The 95th Percentile Illusion

It should be clear that even if elderly and disabled persons are included in the mainstream design process, it is not possible to design all products and devices so that they are usable by all individuals. There will always be a "tail" of individuals who are unable to use a given product.

In order to include a sizeable portion of the population in the category of "those who can use a product with little or no difficulty," the 95th percentile data are often used. The problem is that there are no "95th percentile" data for specific designs. Rather, there are only data with regard to individual physical or sensory characteristics. Thus there is 95th percentile data for height, a 95th percentile for vision, hearing, etc. As a result, it is not possible to determine when a product can be used by 95% of the people. It is only possible to estimate when a product can be used by 95% of the population along any one dimension. Since people in the 5% tail for any one dimension (e.g., height) are usually not the same people as the 5% tail along another dimension (e.g., vision) (Kroemer, 1987), it is possible to design a product using 95th percentile data and end up with a product that can be used by far less than 95% of the population.

To illustrate this phenomenon, imagine a mini-population of ten individuals. Ten percent of them (1 of 10) have one short leg, 10% have a visual impairment, 10% have a missing arm, 10% are short and 10% cannot hear.

Let's assume that we design a product that required 90th percentile ability along each of the dimensions of height, vision, leg use, arm use and hearing. In this instance we would end up with a product which was in fact only usable by 50% of this population. This occurs because, although only 10% of this mini-population is limited in any single dimension, different individuals fall into the 10% tail for each dimension and only 50% of the population is within the 90th percentile for all five areas.

In real life, the effect is not quite this dramatic, and its calculation is not so simple. First, the percentage of individual with disabilities is less than 10% along any one dimension. Secondly, there is often overlap where one individual would have more than one disability (elderly individuals, for example).

On the other hand, there is a much wider range of different individual types of disability. In addition, the data from which the 95th percentiles are calculated often exclude persons with disabilities (Kroemer, 1987), making the percentage who could use the design(s) smaller than one would first calculate.

How Large is the Disabled and Elderly Population?

Determining the exact number of individuals with disabilities or with limitations due to aging is difficult. Estimates vary depending upon the definitions of disability used and the sources of the data. There is also a substantial number of individuals with disabilities who have returned to the work force despite significant functional limitations and who therefore do not consider themselves disabled. Their functional limitations, however, must be taken into account when they are trying to perform within an environment of facilities and tools designed for "normal" or 95th percentile function.

To further confuse efforts to understand the makeup of this segment of our population, most of the data reported overlap. That is, the same individual may be counted in both the visually impaired and hearing impaired segments. Adding the two numbers together would give a false reading of the size of the "hearing or visually impaired" population. For example, in one study the incidence numbers

are reported as shown in Table 1 (based on data from National Center for Health Statistics, 1979, as reported in Czajka, 1984).

Table 1: Prevalence of Selected Impairments in the United States

	All Ages	Over 65
Impairments (vision, hearing, etc.)	20.3%	50.1%
Circulatory conditions	21.7%	63.8%
Respiratory conditions	26.2%	35.0%
Skin and musculoskeletal conditions	25.5%	57.4%
Other chronic conditions (diabetes, urinary, other)	27.8%	30.5%

Based on recompilation of data from Czajka (1984). Source: National Center for Health Statistics, 1979 and 1980 National Health Interview Survey

If you add the numbers in Column 1 of Table 1 together, you get 121% of the population (all ages). Adding the numbers in Column 2 gives you 236% (of the 65+ population). Clearly these numbers are not exclusive of each other. It is therefore important to differentiate incidence figures for single types of impairment from "total person" counts. In the latter case one must verify that the figures used are mutually exclusive before doing any adding. It is also important to note from this that many individuals will have multiple impairments, and solutions targeted at a single disability may not be useful to them. For example, 75% of people with speech impairments report other impairments, as do 73% of those who are blind, 71.4% of those with complete paralysis of the extremities, 70.4% of those with glaucoma, 55.4% of those who are deaf in both ears, and 38.6% of persons with hearing impairments other than deafness (National Health Interview Survey 1983-85; in LaPlante, 1988).

Finally, it is important to distinguish between the number of people that have an impairment and the number with a functional limitation. Impairment is a function of the basic capabilities (or lack thereof) of the individuals themselves. Functional limitation is a reflection of the interaction between these impairments and the design (physical, social, etc.) of the world around them. Safer designs might somewhat reduce the number of injuries and therefore the impairment figures. The greater potential for reducing these figures, however, is in reducing the number of people with functional limitations through better design of products, environments and systems. In this paper, both impairment and functional limitation figures are presented. In each case they are labelled as impairment or limitation as well as single dimensional (overlapping) or non-duplicative.

Though individual estimates vary, it appears that there are over thirty million people in the United States who are disabled or have functional limitations due to injury, illness or aging (Kraus & Stoddard, 1989). This is something between 12% and 20% of the population. Many of these individuals also have multiple disabilities....

Can't the Needs of Disabled and Elderly Persons Be Handled Separately or As Exceptions?

Although the total number of elderly or disabled persons is large, each individual disability or impairment area represents only a small portion of the population. We are therefore not dealing with one large group of people but with many small groups which together represent a major portion of our population. This raises a question as to the most effective means of addressing these problems. Is it

better to design everything so that it is accessible to most persons, including those with disabilities? Or is it more effective to design for the able bodied population and create special designs for persons with specific types of disability?

First we must start with the understanding that it is impractical, if not impossible, to design everything so that it is accessible by everyone regardless of their limitations. Some things have inherently limited usefulness to some populations (e.g., a stereo system for deaf individuals, or a kaleidoscope for blind persons), and accessibility for these products for those disabilities is less of an issue. There are also combinations of impairments which would make adaptation difficult to do on a standard basis (e.g., a deaf-blind-aphasic individual). However, for most types or degrees of impairment there are simple and low cost (or no cost) adaptations to product designs which can significantly increase their accessibility and usefulness to individuals with functional impairments. In these cases, inclusion of the design feature or approach in the standard product can be of substantial benefit to the individual and society as a whole (see further discussion in next section).

Another argument for incorporating accessibility directly into the design of mass market goods stems from the population distribution characteristics of elderly and disabled persons. As shown earlier, the number of persons with disabilities overall is large, but those with specific types of impairment represent a small portion of the total population. These small groups are further divided by the degree of limitation. People with mild hearing loss, for example, would use different techniques and aids from those with severe hearing loss. Thus, the target user groups are too small to be addressed individually. They are also geographically distributed across the U.S. As a result it is both economically impractical and a marketing and support nightmare to design individual appliances (stoves, microwave ovens, mixers, vacuum cleaners, cars, etc.) for each population. Finally, due to aging and other causes, we are all at risk of having to operate our appliances with diminishing functional capabilities over time.

We are therefore left with a balancing act. It is unreasonable to design everything so that it can be used by everyone. It is equally unreasonable to produce special designs for each major consumer product to accommodate the different disability groups. Some special aids and other devices will continue to be necessary to fulfill those needs that accessible mass market design cannot effectively meet. But where mass market goods can easily be made more accessible through careful and informed design, it appears to be the best and most economical approach....

Is It Economically and Practically Feasible to Include Disabled and Elderly Persons in the Design Process for Mass Market Products?

Experience so far has shown that consideration of disabilities and functional limitations in mainstream design is very definitely feasible from both an economic and practical standpoint. In the majority of cases, accessibility can be added to a product's design for little or no cost.

For example, Apple Computer has incorporated several special features directly into their standard operating system to accommodate individuals with various disabilities. One feature, called "Sticky Keys," allows individuals who only have one hand available or who use a head or mouth stick to operate the standard keyboard. Ordinarily, a person typing with a single finger or stick cannot use a keyboard, since it requires that you hold down two or more keys simultaneously for some operations (e.g., control-g or alt-h). The "Sticky Keys" feature allows the person to type the keys sequentially rather than concurrently. It is activated by tapping five times on the shift key and deactivates should

any two keys be depressed simultaneously (as a normal typist would). Thus, the feature is transparent to those users who don't need it.

Another feature now standard on Macintosh computers is called "Mouse Keys." Individuals who do not have the motor control necessary to operate a mouse can use the "Mouse Keys" feature to control the mouse cursor on the screen by using the keys on the numeric keypad. A third feature is "Close View," which allows individuals to enlarge the screen image up to 16 times its normal size. Thus visually impaired individuals may use the computer without special add-on devices.

All of the above features have been standard on all Macintosh computers for the past two years. Once the features were developed, the cost to include them in the product was essentially zero. The "Sticky Keys" and "Mouse Keys" features take up just 4k of space on the disk and are included in every system shipped. The "Close View" feature is just 20k and is included in the package of system disks shipped with each computer. Even when these same features had to be incorporated directly in the hardware (as they did for the Apple IIGS), the manufacturing cost was negligible (since it simply changed the code in the microcontrollers for the keyboard). Although Apple Computer has taken the early lead in this area, other major computer manufacturers and operating system developers have similar features under development.

Another example of no-cost accommodations can be found on some mass market mixing bowls. These bowls have small braille legends cast onto the underside of the bowl, listing the capacity in braille. Other than a few seconds to cut the dimples into the original mould, there is no additional cost involved in making the bowls. Some microwave manufacturers also offer braille/tactile overlays for their control panels to facilitate their use by blind or visually impaired users. US Sprint has a braille version of its FONE cards.

Accessible Design Can Sometimes Decrease Costs:

In some cases, creating a design which is more accessible can in fact decrease the costs involved in manufacture or maintenance/support of a product. One example is to be found in elevator design. Individuals in wheelchairs or on crutches had great difficulty with the large "banks" of elevators present in many buildings. Often the elevator door would open, but before the person in a wheelchair could get to the correct elevator, the door would close. An obvious solution would be for the elevators to stay open for a longer period of time. However, building codes required that a building's floors be visited by the elevators with a specified frequency. If the doors were made to stand open longer, additional elevators would need to be installed in the building to meet the level of service standards. In a building like the Sears Tower, this could result in a substantial portion of the building being consumed by elevators.

On examining the problem more carefully, however, it was noted that the problem was not that individuals in wheelchairs or on crutches were unable to enter an elevator within the time the door normally remained open. The problem was knowing which elevator was coming so they could position themselves in front of its door. By simply reprogramming the elevator's controlling computer it was possible to have the elevator activate the signal tone and light for the proper elevator in advance of its arrival at the floor.

Adopting this advance warning as a standard for elevators solves the accessibility problem without increasing costs. In addition it was found that both disabled and able-bodied persons were able to board the elevator much more rapidly when this advance warning was given. As a result, it was then

possible to either decrease the number of elevators and still provide the same level of service to the floors, or to increase the level of service, since the time the elevator is open on a floor could be reduced. Thus, the more accessible design turned out to be less expensive overall.

Disability Design Can Increase the Functionality for Able-Bodied Users:

It is very common for accessible designs also to prove beneficial for individuals who do not have limitations (Newell & Cairns, 1987). In the elevator example above, the advance warning not only increased the speed with which the elevators could service the floors, but also made it much easier for normal passengers to manoeuvre their luggage and board the elevator (i.e., without having to grab one bag and throw it into the elevator door while they retrieved their other bags from in front of the wrong elevator).

Probably the most common example of accessible design is the curb cut. Although the curb cuts are put in for persons in wheelchairs, it is estimated that for every individual in a wheelchair using a curb cut, somewhere between ten and one hundred bicycles, skateboards, shopping carts, baby carriages and delivery carts use the curb cut. It is also not uncommon to see individuals walk slightly out of their paths in order to walk up a curb cut rather than stepping up onto the curb, indicating a preference for the curb cut even when walking.

The "Mouse Keys" feature on the Macintosh computer provides another example. In addition to allowing the user to move the cursor across the screen, the "Mouse Keys" also have a "one pixel" feature. Tapping specific keys on the numeric keypad causes the mouse to move one pixel in the corresponding direction. As a result, it is possible to very precisely position the mouse on the screen. Since the normal mouse continues to be active at all times, it is possible for an able-bodied individual to use the regular mouse for general pointing movements and to move the mouse into the approximate area of interest. He/she can then reach over and tap on the numeric keypad keys (with"Mouse Keys" activated) in order to nudge the cursor the exact number of pixels required for precise positioning. Thus, the "Mouse Keys" feature adds functionality and a precision of movement which was not previously available to able-bodied users.

A real-time Palentype (similar to stenotype in the U.S.) translation aid was developed in England to allow a deaf member of Parliament to follow floor debates more easily and precisely. It later found its way into the courtroom or lawyers who could hear normally but wanted transcripts of the day's trial (Newell et al., 1984).

In general, when products, environments or systems are made more accessible to persons with limitations, they are usually easier for more able-bodied persons to use. Some of the potential benefits include lower fatigue, increased speed and lower error rates.

The Consequences of Not Providing Accessible Designs:

The benefits above are only half of the economic justification for more accessible design. A second and perhaps more significant economic benefit would be reduction of the costs to society which result from individuals being unable to effectively function independently in the world as it is currently designed. These costs take the form of benefits paid out of tax dollars for special assistance due to a disabled person's unemployment or non-independent living. In addition, there is the loss to society of

these individuals' productivity (meaning loss of tax revenues, creation of wealth, and contributions to society).

Overall disability expenditures in the U.S. rose approximately linearly from 50 billion dollars in 1975 to 170 billion dollars in 1986 (Berkowitz & Greene, 1989). Assuming this trend continues, the outlays for 1990 are estimated to exceed 200 billion dollars, as shown in Figure 6. Approximately half of the 1986 cost was for medical treatment, while the other half was for direct transfer payments. (Transfer payments are the actual funds allocated each year to people because of disabilities.) Other economic losses from disability (not including transfer payments) are estimated to have been in excess of 177 billion dollars in 1980 (Chirikos, 1989) (equivalent to 290 billion dollars in 1990 dollars).

Approximately one-third of the persons with disabilities who can and would like to work are unemployed. This amounts to approximately two million people (Kraus & Stoddard, 1989). Figuring an average annual salary of $15,000, that amounts to 30 billion dollars in lost productivity, as well as several billion dollars in lost tax revenues. This is in addition to the large costs in the form of transfer payments made to those individuals who cannot live independently.

What Are the "Benefits" of Incorporating Disability and Aging Considerations into Mainstream Human Factors Activities?

As we have seen, considering those with functional limitations in the overall design process is good for the design process overall. Design which is more accessible to persons with disabilities typically can benefit able-bodied users as well by reducing fatigue, increasing speed and decreasing the number of errors made. As in the elevator example, consideration of disability issues can also cause us to see design issues more clearly, leading to new insights and better overall design.

Creating more accessible designs can also increase the market for many consumer products. With increasing awareness of the accessibility issues, people are beginning to look for more accessible designs. The U.S. government, for example, has recently passed legislation (Section 508 of Public Law 99-506) requiring that the General Services Administration develop accessibility guidelines that should apply to all future electronic office equipment acquisitions (purchase or lease). Similar measures are being examined by other countries as well as many school systems and state governments in the U.S.

Accessibility features should begin to provide a market edge even in the home market. Although only one in five or six individuals in the United States has a significant functional limitation, a much higher percentage of households have individuals who have functional limitations. Products purchased for use in a household that has even one member with a disability may be more attractive if their design is more accessible. More accessible design will also increase the useful product life of many products purchased by or for individuals who are aging.

Finally, as noted above, there are tremendous potential economic benefits from making it easier for individuals with functional limitations to live more independently and become or remain employed.

What Are The Costs?

The most significant cost involved in considering functional limitations in mainstream design is that of building the necessary knowledge and skills in our human factors researchers, educators, and practitioners. Before we can include the disability aspects in mainstream research and teaching, we

must considerably expand our knowledge base and experience in these areas. This is difficult for most professionals, who already have difficulty keeping up with the literature.

In order to include design for persons with functional limitations in our college curricula, we will need to expand the already overcrowded content of our courses and/or add courses to the already difficult coursework requirements for our students. Since incorporating individuals with limitations in our standard design process does not eliminate the need for custom design of special aids, we must also somehow address custom design for disability to cover the needs that cannot be met through more accessible mass market design.

Conclusion

Incorporating disability considerations in our research and teaching will require substantial effort both as individuals and as a field. Before we can effectively incorporate disability and aging issues into our curriculum we will need to better define and refine this area. The basic principles involved in accessible design need to be explored and defined. More specific data regarding the different areas of impairment as they relate to design need to be gathered, condensed and made available to researchers and designers. Some design guidelines exist (Lifchez & Winslow, 1979; Sorenson, 1979; Newell, 1987; Newell & Cairns, 1987; Calkins, 1988; Vanderheiden, 1988; Enders & Hall, 1990; Mueller, 1990) but much more work is needed in the delineation and documentation of the basic principles of accessible design.

It seems apparent, however, from the demographics and trends in our population, that for an increasing number of the professionals and educational programs in human factors, design for disability and aging must merge with, and become a continuum of, the normal design process. Aside from the significant benefits to society, these efforts should also make our field more robust and lead it into new directions and to new insights.

Acknowledgements

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B. Case Studies

Winnipeg Airports Authority, Inc.
Winnipeg, Manitoba

The Winnipeg Airports Authority has had a Barrier Free Advisory Committee for a number of years. The members are comprised of community volunteers and Airport personnel. In 1999 WAA altered their mission statement to include promoting the principles of Universal Design. They are committed to developing a comfortable and useable airport for all travelers. As stated in their Strategic Directions, "Deliver state-of-the-art facilities which showcase universal design principles."

Within the last year the Committee has been reconstituted as the Universal Design Advisory Committee. A universal design specialist has been contracted with WAA to review all plans and projects to ensure they conform to the principles.

The Universal Design Advisory Committee provides input and is given feedback quarterly on projects and the work of the UD consultant. There is optimism that issues are and will be addressed through the cooperation of the facility personnel, the clear commitment to universal design, the expertise brought to projects and the volunteers from the community.

Excerpt from Adaptive Environments, Inc., Boston Mass. USA

South Boston Waterfront: A Neighborhood Fit for People

South Boston Waterfront

Boston is building its first new neighborhood in 150 years. This is the one opportunity in many lifetimes to define our city and ourselves through decisions we make about design. A record-breaking $20B public investment in infrastructure improvements has transformed the little-known district of warehouses, parking lots and working port into the largest development opportunity on the East Coast. Bordered by downtown, the interstate highway system, the airport, the deep-water port, and South Boston, the Waterfront is 1000 acres facing a pristine harbor.

A Neighborhood Fit for People.

We must seize the opportunity to create places in the South Boston Waterfront that are beautiful and accessible for the widest possible array of users. This is the place to demonstrate that we have the vision and the talent to go beyond minimal requirements for access under the law and create integrated solutions that reflect a community that welcomes all.

Universal design is a worldwide movement dedicated to designing products, environments and communications responsive to the spectrum of human needs. Sometimes called design for all, inclusive design, or lifespan design, universal design is not a design style but an orientation to design based on the following premises:

- Disability is not a special condition of a few;
- It is ordinary and effects most of us for some part of our lives;
- If a design works well for people with disabilities, it works better for everyone;
- Usability and aesthetics are mutually compatible.

The following standards have been developed to clarify and guide universal design:

1. Equitable design
2. Flexible design
3. Simple and intuitive use
4. Perceptible information
5. Tolerance for error
6. Low physical effort
7. Adequate space for approach, reach and comfort

The City of Boston's Commitment to Universal Design

The City of Boston has made a commitment to universal design in The Seaport Public Realm Plan: "Transportation, open space, access to the harbor, pedestrian facilities and residential, civic and commercial buildings should be usable by all people, to the greatest extent adaptation or specialized design."

How can we make it happen?

There is no question that government, the developers and the designers are committed to meeting the requirements for access under the law. But compliance does not invite the quality and scope of creative problem solving envisioned by universal design. Universal design focuses on the power of the

environment to shape human experience. Our self-esteem, identity, and well-being are deeply affected by how well we function in our physical surroundings. Providing individuals with a sense of comfort, independence and control contributes to making great, attractive places that people want to be.

Excerpts from Pacific Bell: EXECUTIVE SUMMARY

I. APPLYING UNIVERSAL DESIGN

Background

Universal design is a concept used in the process of making architectural environments accessible to people with disabilities. It is based on two simple but important lessons:

– It is much more cost effective to design access at the blueprint stage than to add access on later, through retrofits and reconstruction.

– The quality of access is far superior when it is incorporated into the structural design from the beginning.

Our recommendations below encourage Pacific Bell to apply the lessons of accessibility learned within the architectural realm to the design of its own telecommunications technologies and products. (This especially includes product design at Pacific Bell Information Systems, and also Pacific Bell Directory.)

We believe universal design is the best way for Pacific Bell to capture the smartest thinking about innovative uses for its products, and to meet customers' needs more effectively than is possible to expect from the current design process.

It also is the key for building new market awareness and penetration that translates directly to Pacific's bottom line.

Universal Design for Telecommunications

Example: Volume Amplification Control in Telephones. An example of the benefits of designing in access to accommodate the broadest range of users from the very beginning. When volume amplification is built into the original design or a telephone, the cost is inconsequential. As a specialized device, incorporated after the fact, it costs about $40--an additional expense for people who are hard of hearing.

Benefits: Useful for hard-of-hearing individuals, and also for anyone using a telephone in noisy environments like airports, hotels, offices, or public phone booths.

Electronic Curb Cuts

Those of us with disabilities think that universal design in telecommunications will serve the entire society as "electronic curb cuts." Here's what we mean: Curb cuts at cross walks designed for people unable to negotiate steps actually assist a wide range of people besides people in wheelchairs: parents with strollers, children and messengers on bikes, shoppers with grocery carts.

Universal design in telecommunications can provide opportunities for people who cannot use the telephone network as it is currently constituted or provisioned, as well as for many others with a wide range of abilities and needs.

A prime example of a universal design applications for telecommunications is the use of redundant visual and auditory information. Many of the recommendations in this report draw on that concept.

Useful precedents for universal design are worth studying. A few other industries besides the building trades have proven that designing a product for a group with disabilities usually turns out to be an opportunity for much broader market penetration with the general public as well.

Electronic Curb Cuts

Books on Tape: First developed for the blind, audio-cassette versions of books and other printed materials have developed into a multi-million dollar industry for a mass market that includes commuters, travelers, and many seniors.

Closed Captioning: Legislation passed in 1990 requires that all television screens 13 inches or larger, sold in the U.S. after July 1993, must have built-in decoder circuitry for current closed captioning. Captioning is an important service for deaf and hearing impaired consumers, but the service is useful and appreciated by others as well--kids learning to read, adults overcoming illiteracy who practice their reading, people who use English as a second language.

RECOMMENDATIONS

1) Incorporate universal design into the product development process from the beginning, and throughout the process.
2) Require product developers to use the resources and skills of Human Factors Engineering as a critical step in the design and development of all new products.
3) Add both staffing and training capabilities to Human Factors in order to provide the necessary expertise to product managers on functional design requirements for people with disabilities.
4) Develop practical, workable "filters" in Human Factors that can be applied at all critical phases of product development.
5) Require the appropriate leaders of product development to ensure that "filter questions" related to specific functional limitations be analyzed and answered for every new product.
6) Include people with disabilities in the beginning and test phases of all new product designs.
7) Direct vendors (CPE, network switches) to address specific issues of functional access for customers with disabilities as part of their contractual arrangements with Pacific Bell. 30)
8) Continue the market focus toward people with disabilities so the business and product teams can understand this segment adds revenue, in addition to helping the company improve its product designs.
9) Provide printed materials in a variety of media to better meet customer needs. Use audiotext services as a means of disseminating information. Research other formats that would serve the information needs of people with disabilities. Start with the phone bills.
10) Offer Directory Assistance, White Pages, and Yellow pages in different media, especially Baudot-accessible formats.
11) Promote video teleconferencing applications that create greater access for deaf, hard of hearing, and speech-impaired customers.
12) Test, develop, and promote ISDN's advanced sound quality to hard-of-hearing people.
13) Promote Priority Ringing to households with deaf and hearing customers.
14) Make the Message Center accessible to TDD users.
15) Make products for education accessible to expand the potential market to include special education.
16) Increase efforts to inform customers about the equipment lending program.
17) Include people with disabilities in advertising and marketing campaigns.
18) Assign top priority to implement Voice Dialling for PCS.
19) Pacific Bell should set vendor standards for PCS equipment and network services in order to address major concerns for specific categories of disability
20) Include people with disabilities in all PCS trials.

21) Develop and market PCS as a "wayfinding" tool to assist users in determining locations, and also as an environment control device.
22) Aggressively market PCS to people with disabilities, demonstrating its advantages both inside and outside the home.
23) Include people with disabilities in all phases of broadband trials.
24) Design redundancy in the use of interfaces for broadband products and services.
25) Allow customers to select a mode (text, audio) in which they give and receive information.
26) Establish partnerships or alliances with companies that provide (or plan to offer) information in forms accessible to people with disabilities.

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C. Programs

Adaptive Environments Inc.
Boston, Mass.
Universal Design Education Program

Universal Design Institute
University of Manitoba
Faculty of Architecture
Elective course

Special Program:
Manitoba League of Persons with Disabilities
Gail Finkel, M. Arch.

D. Sources for more information

Adaptive Environments Inc. Boston, MA, USA
www.adaptenv.org

Universal Design Institute
University of Manitoba
Winnipeg, Manitoba

Center for Inclusive Design and Environmental Access
School of Architecture and Planning, University of Buffalo, NY, USA
www.ap.buffalo.edu

Centre for Universal Design, North Carolina State University
www.ncsu.edu/nscu.design/cud

DesignAge, Royal College of Art, London, UK
www.designage.rcca.ac.uk

Gail Finkel, M. Arch.

Winnipeg, Manitoba

European Design for Ageing Network, DAN
www.valley.interact.nl/dan

Trace Centre, Wisconsin, USA
www.trace.wisc.edu

E. Letters of support

Attached please find a letter from the Inter-Organizational Access Committee supporting the Universal Design Policy as amended by the Access Advisory Committee. (Attach Letter).