

Universal Design – Clarification and Development

A Report for the Ministry of the Environment, Government of Norway

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Universal Design – Clarification And Development

Preface

Universal design has been adopted by the Norwegian government as a strategy of importance in a number of political areas. These include transportation, planning, building, housing, information and communication technology, and health and social services. This significant emphasis on universal design has been approved by the Norwegian Parliament (Storting). Universal design is replacing the concepts of accessibility and usability in most areas of government and society. In addition, universal design is now being used in new areas where accessibility issues have formerly not been observed.

The Norwegian definition of universal design is a direct translation of the definition developed by The Center for Universal Design at North Carolina State University. Besides being used as a general policy instrument, universal design is being applied in laws and regulations. Universal design is already implemented in laws concerning the learning environment (buildings, equipment etc.) in universities, colleges, non-degree granting colleges, and in kindergartens. Additionally, the concept will be included in new laws on public procurement, planning and building and non-discrimination. The idea is being used in regulations for impact assessment in planning and may be considered for use in building regulations.

This extensive use of universal design has revealed a wide-ranging need for clarification and development of the concept of universal design to make it precise and operational. It is of particular importance at this stage to clarify the scope of the concept of universal design as an objective and as a practical policy. Likewise, practical methods to achieve universal design need to be presented.

To respond to these issues, the Ministry of the Environment commissioned this report to explain, detail, and extend key universal design concepts, and to explore the practical dimensions of applying universal design concepts in real world situations.

Ministry of the Environment
Government of Norway

Universell Utforming – Universal Design

It is generally agreed that the term *universal design* first entered into usage in the mid-1980's by United States (US) architect, Ronald L. Mace, FAIA [1] Since then the concept of universal design has spread worldwide and has influenced and joined related concepts such as Design for All, Life Span Design, and Inclusive Design. In its 20-year history in the US, universal design has slowly gained acceptance but has seen an uneven adoption. Universal design still remains a strategy that has been implemented by different sectors of the private and public domains, selectively and for fairly narrowly framed purposes. From the perspective of more usable and supportive environments, the US remains principally focused on accessibility: developing regulations, codes, standards, policies and procedures to provide societal inclusion to people with disabilities.

The emergence of universal design depended substantially on many years of work on accessibility and the lessons learned from those activities. Accessibility efforts and the fundamental values of the disability rights movement in large part formed the foundation on which universal design concepts were built. But, universal design came into being partly because of the nature of accessibility that existed in the US by 1985; it was neither commonly found nor was it creatively applied. However, the appearance of universal design did not herald the end of accessibility. Two of the most significant American federal laws requiring accessibility were yet to be enacted by the time universal design began to emerge: the Fair Housing Amendments Act was signed in 1988 and the Americans with Disabilities Act passed in 1990. Universal design and accessibility have continued to develop in a connected yet parallel manner, during the time of the *greatest* activity in the realm of accessibility code compliance. To be sure, the philosophical basis for the accessibility movement and universal design are quite similar: inclusion, full participation, and social equity. Universal design extends beyond the confines of accessibility to include all persons and creates that inclusion by promoting integrated and mainstreamed products, environmental features, and services.

The national expansion of accessibility provisions into private buildings, multifamily housing, and beyond, has continued the dominant role of accessible design. This has presented a challenge for advocates of universal design in their promotion of conceptual, policy and practical distinctions. While the great advantage of 50 years worth of work on accessible design has been the creation of a markedly accessible non-residential built environment, it has also carved a large space in the collective psychology of people in the US. For example, universal design as a distinct idea is often confused with, if not subsumed by, the more narrowly targeted concept of accessible design. Broadening the beneficiary group of more usable designing to include all of society is a significant practical and symbolic step that still requires much more effort.

Norway has adopted the universal design concept and applied it more broadly and from higher levels of the federal government than is the case in the United States. In making universal design and its philosophy an explicit part of broad national policy, [2] Norway has surpassed the status of universal design in the US. Regardless, this report will briefly document the origins, progress and vigorous activity in universal design as well as suggest useful lessons from the decades of accessibility successes.

I. Background

Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. –Ron Mace, 1988

User-focused design did not begin in the past century with accessibility and universal design. Examples of user-tailored or human-centric design [3] extend back thousands of years, and often focus on occupational issues such as tools adapted to certain tasks, and features that facilitate the loading and unloading of material and goods, such as ramps at loading docks. Umbach (2006) cites Roman chariots built to the scale of warriors and notes the historic use of the dimensional term “foot” as evidence of our attention to the human form.

The architectural trends of the late 19th and early 20th centuries toward modernist and functionalist design seemed to consider the day-to-day needs of individuals. Architects such as Klint, Corbusier, Aalto, Oud and those in the Bauhaus and De Stijl schools promoted an assortment of anthropometrics, affordability, efficient use of space, mass production, and housing for the general population. [4] [5] Nearly 70 years ago, Lewis Mumford was also promoting the concept of *social architecture* that was more responsive to society and to individuals. [5]. These movements never created a groundswell of adoption in architectural practice. Nor did architectural practice in most of the 20th century of the century become known for attention to lifespan issues and the ‘non-average’. [6] This was to be imposed on the field increasingly, beginning in the 1960’s. Early in the 20th century, the field of industrial design developed in tandem with the fields of ergonomics and human factors. One can trace the more effective response of the industrial design field to usability issues and considerations than was the case with architecture.

The accessibility field in the US has been part of the civil rights movement for people with disabilities that began after World War II, and was related to the larger worldwide human rights movement principally identified with the United Nations. [7], [8] The US disability activities paralleled other similar civil rights movements by disenfranchised groups in the US at that time, for example women, African Americans, and Native Americans. During the 1960’s and since then, the disability community in the US has vigorously advocated for the creation of civil rights legislation and building regulations that provided accessibility features, e.g., curb cuts, stepless entrances, and lever door hardware. The initial major push into accessible building design came after the publication of the American National Standards Institute’s (ANSI) I 17.1 standard in 1961 [9], the first US accessibility design standard.

When Universal Design arose 25 years later, the success of the accessibility work in the intervening years had made great progress by appearing in some federal and state policies with respect to programs and services, architecture, transportation, public rights of way, public spaces, and to a lesser extent, housing. Although not uniformly applied or consistently rendered, by the mid-1980’s accessible design was becoming

more of a reality for the design and construction industry across the US. Standards such as ANSI 117.1, and its many later revisions and other accessibility provisions that were based on it were a great steps forward in the field, yet had similar flaws. Those flaws revealed the limitations of a code-based approach. Later analysis by Lusher and Mace showed that the codes and standards "... have been developed by an approach of modifying the norm through the use of a few specially designed features and products to accommodate the 'few' who vary from the norm. "Page 754 [10] The authors point out that this approach led to an 'after-the-fact' implementation of access features (even in new construction) which resulted in "... facilities which have their own 'functional limitations' and aesthetic problems." Page 754 [10] Other code-based challenges were also noted. "As architects began to wrestle with the implementation of standards, it became apparent that segregated accessible features were 'special,' more expensive, and usually ugly." Page 10 [11]

Yet, by 1985 people with disabilities had begun to gain significant access to buildings, programs and services. Unfortunately the access was not always equal or appropriate. In many cases, this access was via separate building features and components. In those still-early days of this field, common occurrences were separate entrances, longer routes of travel, confusing wayfinding, and inconsistently rendered accessibility. At that time, these access features were found more commonly in newly constructed buildings. Renovated buildings often escaped requirements. The features were often stigmatizing and weren't integrated into the overall design scheme of a product or feature of a building or environment.

The creative process of design professionals often seemed limited when confronted by accessibility goals, as if minimum, replicated access features were all that were needed. Therefore, people with disabilities (and others who could take advantage of those features whether they identified themselves as 'disabled' or not) were still marginalized even though access to the world was improving.

This marginalized status was unintentionally perpetuated in the short term by expensive changes that were required in completed projects that did not comply with relevant accessibility requirements. These code compliance errors often cost designers and owners a great deal of time and money to correct. The fear of mistakes, combined with a general lack of understanding, foresight, and experience produced a conservative design result. There was a concern that any deviation from strict code adherence might expose those responsible for errors to significant liability. Only after many years of practical experience did the profession begin to move toward more creative and universal outcomes. However, those in the public and the private sectors are still trying to get basic accessibility implemented correctly, if not always embracing universal design.



Figure 1 illustrates how increasingly sophisticated approaches to accessibility compliance can result in universal outcomes. Providing appropriate sightlines and transaction counters for short or seated people is important in retail settings. This objective has been incorporated into a clever arrangement that also serves as the access and security gate for the staff of this information booth.

As early as the 1980's there were those who began to recognize that, even if imperfectly realized, many of the environmental features that were part of the accessibility provisions of that time, seemed to have a much broader beneficiary group than might have been expected. Story says of that time, "It ... became apparent that many of the environmental changes needed to accommodate people with disabilities actually benefited everyone." Page 10 [11]

The broad beneficiary group for accessibility, extending far beyond the presumably small and static group of people regarded as having a disability, began to change our notion of accessibility and our ideas of whom we are designing for.

Figure 1: Flexible gate/counter design
Photo by Leslie Young

<p>1. principle one: Equitable Use The design is useful and marketable to people with diverse abilities. GUIDELINES</p> <ul style="list-style-type: none"> • Provide the same means of use for all users: identical whenever possible; equivalent when not. • Avoid segregating or stigmatizing any users. • Provisions for privacy, security, and safety should be equally available to all users. • Make the design appealing to all users. <p>2 principle two: Flexibility in Use The design accommodates a wide range of individual preferences and abilities. GUIDELINES</p> <ul style="list-style-type: none"> • Provide choice in methods of use. • Accommodate right- or left-handed access and use. • Facilitate the user's accuracy and precision. • Provide adaptability to the user's pace. <p>3 principle three: Simple and Intuitive Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level. GUIDELINES</p> <ul style="list-style-type: none"> • Eliminate unnecessary complexity. • Be consistent with user expectations and intuition. • Accommodate a wide range of literacy and language skills. • Arrange information consistent with its importance. • Provide effective prompting and feedback during and after task completion. <p>4 principle four: Perceptible Information The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities. GUIDELINE</p> <ul style="list-style-type: none"> • Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information. 	<ul style="list-style-type: none"> • Provide adequate contrast between essential information and its surroundings. • Maximize "legibility" of essential information. • Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions). • Provide compatibility with a variety of techniques or devices used by people with sensory limitations. <p>5 principle five: Tolerance for Error The design minimizes hazards and the adverse consequences of accidental or unintended actions. GUIDELINES</p> <ul style="list-style-type: none"> • Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded. • Provide warnings of hazards and errors. • Provide fail-safe features. • Discourage unconscious action in tasks that require vigilance. <p>6 principle six: Low Physical Effort The design can be used efficiently and comfortably and with a minimum of fatigue. GUIDELINES</p> <ul style="list-style-type: none"> • Allow user to maintain a neutral body position. • Use reasonable operating forces. • Minimize repetitive actions. • Minimize sustained physical effort <p>7 principle seven: Size and Space for Approach and Use Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility. GUIDELINES</p> <ul style="list-style-type: none"> • Provide a clear line of sight to important elements for any seated or standing user. • Make reach to all components comfortable for any seated or standing user. • Accommodate variations in hand and grip size. • Provide adequate space for the use of assistive devices or personal assistance.
<p>Version 2.0 4/1/97. © Copyright 1997 NC State University, The Center for Universal Design, an initiative of the College of Design. Compiled by advocates of universal design, listed in alphabetical order: Bettye Rose Connell, Mike Jones, Ron Mace, Jim Mueller, Abir Mullick, Elaine Ostroff, Jon Sanford, Ed Steinfeld, Molly Story, & Gregg Vanderheiden</p>	

Figure 2. Universal Design Principles

Human Factors, Ergonomics and Social Equity

Inclusion and integration of everyone in family, work and community life are major goals of universal design. If applied, the ergonomics and human factors elements in Principles' 2-7 (See Figure 2) will drive a number of decisions that will help achieve those goals. However, the primary social equity instrument among the universal design principles is found in Principle 1: Equitable Use, The design is useful and marketable to people with diverse abilities. In fact, without Principle 1 being represented in combination with other principles, (and Guideline 1d. specifically: Make the design appealing to all users) a universal result is difficult to accomplish. The emphasis on design integration and mainstreaming of features found in Principle 1 helps leverage universal design into common usage and common acceptance.



Figure 3: Stairway with pool and seating **Photo Credit:** Leslie Young

The stairway images above (Figure 3) show a building element whose primary positive attributes relate to Principles 4 (Perceptible Information) and 5 (Tolerance for Error) because the pool and sitting wall prevent a blind or inattentive person from hitting their head on the underside of the stair. The fountain may offer audible cueing for people with vision impairments also. Secondary attributes that pertain to principles 3 (Simple and Intuitive) and 7 (Size and Space for Approach and Use) might apply because it presents a familiar and uncomplicated manner of use (3.b.) and that the handrails are properly placed and sized (7.c.). All of these might be considered to be adding functionality to the overall scheme, without including the mainstreaming effect of Principle 1 (Equitable Use). With this principle absent, it might have been built as a safe or ergonomically useful element rather than one that is inviting and appealing. It should be noted that this stair element, by itself, does not constitute a universal result for moving between floors of a building. It does not meet the needs of those who cannot use stairs, regardless of how well designed the stairs are. However the stairway, combined with a proximately located elevator, produces an acceptable UD solution.

The twenty-five years of work on accessible design in the US, from 1960 – 1985, formed the body of work from which universal design emerged. Continued progress in the

realm of accessibility since then has firmly established accessible design as a fundamental discipline and outcome that has benefited many. Done well and creatively, good accessible design can be truly universal. As was said nearly 10 years ago, “The demographic, legislative, economic, and social changes that brought us to this point are increasing the momentum that will propel us into the 21st century that will need to be more accommodating of individual differences. Universal design provides a blueprint for maximum inclusion of all people.” Page 13 [11]

2. Universal Design as a Practical Policy

The intent of universal design is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Universal design benefits people of all ages and abilities. Ron Mace, 1988

American and European commentators offer important insights into goals and beneficiaries commonly associated with Universal Design. The European Commission notes, “In most respects, *the integration of older people and people with disabilities into society* will only come about as a result of designing mainstream products and services to be accessible by as broad a range of users as possible” Page 10 [12] Story and Mace assert that universal design should “...*integrate people with disabilities into the mainstream...*” Page 11 [11] and that it will “...*reduce the physical and attitudinal barriers between people with and without disabilities.*” Page 11 *Italics added* [11] Danford states that universal design will “...yield advantages for everyone but will be of particular importance to people with disabilities.”[13] Commentators also mention what is regarded as the core constituencies of universal design: those with disabilities and older persons. The disability movement is properly credited with creating the context from which universal design could materialize in the 20th century. The aging phenomenon seems to be a prime driving force for universal design in the 21st century.

Partially due to success of accessibility implementation and compliance in recent years, the term “accessibility” and the ideas about an “accessible” built environment are commonly known, if imperfectly understood. For example, to many people “fully accessible” means primarily usable by people who use wheelchairs, losing the inclusionary aspect of responding to the needs of people with other disabling conditions. One result of this pervasive consciousness about and misunderstandings of accessibility is confusion about the nature of universal design.

Common myths include:

- That universal design is really “just accessibility that is dressed up to look good”. If this were true, a new paint job might suffice.
- Or, that universal design is just *fully accessible* design but with the addition of characteristics that makes it usable by other people too. Well-engineered functionality is crucial to a universal outcome but will always fall short if the design is not integrated or mainstreamed. Often misused in this regard is the term *universal access*.
- That universal design is an umbrella term that now covers all things accessible and assistive. This lacks recognition of the broad beneficiary groups, the integrated and mainstreamed aspects of universal design, and the differences between accessibility, assistive technology, and universal design.

- A related idea is that universal design is the *new age* or current term for accessible design. It is “*what we are calling it*” now. This suggests the notion that universal design is merely the politically correct term that one must be careful to use in polite company. With this thinking, universal design is grouped together with code compliance and other efforts.

While originally developed at the Center for Universal Design, there is no restriction to an individual or organization adopting or adapting the basic universal design concepts. The Center has no control over these adaptations, hence the wide dispersion of many competing interpretations and similar innovative concepts. There is legitimate confusion between universal design and more similar concepts or concepts from other places such as visitability (an US-based approach, limited to housing, that promotes limited usability features), Design for All (a similar idea to universal design, principally in use in Europe), Life Span Design (used in the US, principally reflecting age sensitive design), Transgenerational Design (an idea formed in the US that good design now must accommodate people of all ages), Flex Housing (developed by Canadian Housing and Mortgage that includes features of accessibility as well as other innovative design ideas), and Lifetime Homes (developed in the UK, broadly applied standards with specific usability features) , among many others. The variety of concepts and common misunderstandings regarding universal design highlights the need for continued educational activities and suggests the need for international communication and collaboration.

An important component of a universal approach to design challenges focuses on the process of design. In this manner, an appropriate outcome can be assured through the process itself. Termed ‘universal designing’ page 188 [14], a broad and inclusive design process includes many perspectives and is mindful of the ergonomic, human factors, and social equity considerations.

A. The Application of Universal Design

Universal design is now being applied to numerous disciplines and domains. It is not clear that such broad applications were actively considered when universal design was first conceived. Early domains certainly included products, graphics, buildings, housing, and outdoor spaces. However, at the time of universal design's inception in the 1980's, a number of still-developing areas were untested or unknown. The Internet was not envisioned. Widespread personal computer use was new and untested. At the time of the creation of the principles and guidelines in 1997, the extent of future Internet and wireless use was not fully anticipated. In 2007, the list of domains and disciplines where one can find or imagine universal design taking a meaningful role is extensive: architecture, landscape architecture, parks and recreation areas, computing, product design, online resources, housing, education, urban planning, interiors, transportation, and graphics. It is regarded as being applicable at all scales of the built environment, information technology, and to systems and processes. Universal Design is considered so broadly now that few areas seem beyond its reach.

Application Challenges

An unfortunate response to the challenge of more accessible environments is to gravitate toward one of two extremes. One path is to mistakenly attempt to make everything “fully usable by everyone” by abandoning creative, interesting and challenging designs. The other path that is sometimes followed is an unfortunate refusal to meaningfully engage the issue by assuming that nothing can be done and that implementing an accessibility or universal design scheme will ruin the integrity of an existing building or proposed design. For example, a challenge is posed in large or complex environments, where it is sometimes not possible for each element to be universal in all respects. The inclination to make all outdoor play spaces fully accessible to children and adults with serious mobility problems is probably misplaced. It is important to be creative about making as much as accessible as possible, keeping in mind all users – parents, grandparents, other family members - within the constraints of a particular project. Where physical access is not always possible, alternate means should be employed to provide comparable meaningful experiences. So a playground or recreation area might be quite universal while not having every place or every experience fully usable by all.

In other cases, it may be feasible to solve a universal design challenge at a larger scale. For example, fixed seating or benches such as those found in parks are typically installed at an average height, pitch, and seat depth. Because users need widely varied seat types to accommodate variations in height, leg length, balance and postural requirements, many people are poorly served by single-style seating. Many modern office chairs today offer options, choices, adjustments, and flexibility to respond to these personal variations. One solution might be to offer different sitting opportunities in the same seating area, whether with benches or other sitting opportunities. Although, fixed seats designed to address one person's needs may be uncomfortable for others to use, providing different dimensioned fixed height seats in an array of seating might accommodate a wider range of users and produce a universal result in aggregate.

Taking the second path with minimal engagement can produce cursory results. For instance, some believe that single story homes are the only option for universal housing, ignoring the many opportunities for traveling between floor levels that are possible in a universal multi-level home. This effect is also encountered in the realms of historic preservation and renovations where a presumption may exist that nothing can meaningfully be achieved. In less developed outdoor environments such as parks and wilderness areas a related fear is that of nature being paved over. In each case, a thoughtful and creative approach can produce surprisingly effective results that balance several competing interests.

Still, we know that universal solutions aren't possible for all situations. This is why it is promoted as a goal toward which to strive. More narrowly framed and targeted solutions (accessible and assistive technology) will always be required in cases where a particular feature does not meet an individual's needs. But the growth in the application of universal design will mean that those instances where additional, custom features are required will be fewer, less frequent, more limited, and less costly.

Education

An important area of application of universal design is educational pedagogy and methodology. Extending beyond teaching *about* universal design, this stream of inquiry and practice is working on *how* to teach universally. Educational approaches have increasingly reflected different learning styles, accommodating varying individual needs within an overall structure. [15] Organizations such as the Center for Applied Special Technologies (CAST)[16], have helped research, promote and extend these ideas and have adapted and adopted a universal design philosophy and applied it to diverse student populations. Learning goals, instructional methods, instructional materials, and assessments are increasingly designed to be inclusive of as many students as possible.

New Applications

Recent connections have been made in the areas of community and urban design, particularly in efforts from *Livable Communities*, *Smart Growth*, *Transit Oriented Design*, and *New Urbanism*, among others. From a universal perspective these planning initiatives promote a number of positive elements such as sidewalks, slower street traffic, transit options, neighborhood connectivity, higher densities, and closer community origins and destinations. These neighborhood characteristics work well for a broad audience, provide choice, and are particularly appropriate for those who don't have regular or safe access to cars: children and teenagers, older people, low wealth households, as well as those with temporary or chronic disabling conditions. As reviewed in Kochtitzky and Duncan, "New urbanist and traditional neighborhood design are most often transit-oriented, pedestrian friendly, and senior friendly." Page 62 [17] They note that *Livable Communities*, *Healthy Communities* as well as *Smart Growth* directly or indirectly address, "... the transportation problems facing large populations of aging Americans in suburban and rural areas."63 [17] The areas of vision, cognition, and wayfinding are clearly issues with broad beneficiary groups that include those with vision problems and for people unfamiliar with a locale. There is a lack of agreement on means and methods and a lack of consistent application of the ideas that are accepted. Finding and implementing consistent ground surfaces that can help in this regard may be a crucial component in this area. Research on this topic is currently being conducted at

the College of Design, NC State University. Providing these key community characteristics leads to greater participation in family and community life, which lies at the heart of universal design.

Architectural design was at one time characterized by bifurcated practice: either mainstream design or “accessible design”. Design practice now seems to be headed toward more integration of usability features. Website design has had a similar, but more recent, pattern and may not have evolved quite so far. Efforts have largely been expended to design accessible websites rather than truly universal websites. These efforts typically produce two website styles. Some sites are largely graphics free, text-only and accessible for people with low vision or who are blind. Most sites are fully graphical. Some sites offer these two options. While the majority of websites don’t seem to make attempts to accommodate low vision users, the improvements to user software have made more of the web more accessible. These software improvements shouldn’t relieve the responsibility for web designers to address a broader audience.

B. Beneficiaries of Universal Design

The world's altered demographics have strengthened the relevance of accessible and universal design. The aging of many societies and the increased numbers of people with disabilities creates an undeniably larger number of people who are obvious, immediate and significant beneficiaries of a more supportive environment. Often cited as the reason for considering a universal design approach in recent years, the changing demographics instead offer the occasion for focusing on improved usability, safety and inclusion. Motives to include universal design features have been present for many years, as surely all human societies have included people with a wide range of human performance characteristics: tall, short, strong, weak, good and impaired hearing and vision, etc. The changing demographics provide an urgency to adapt design approaches and standards and to adopt universal design as policy and practice to catch up to the reality of the evolving international population.

As outlined earlier, the success of the accessibility movement in the US has created certain unintended challenges for universal design. The clear societal imperative to end discrimination against people with disabilities leaves a concept that is not particularly useful for the design process. The term disability is lumpy. It groups all those to whom the term is applied (even if subdivided) into broad categories of impairment that lose specificity. It is also not helpful to say that something is 'accessible to people with disabilities'. We know that people with disabilities have a vast range of abilities and impairments. A more useful way to consider the users of design is to understand the reality that we all exist along a continuum of human performance and other characteristics. We all vary widely in height, strength, visual ability, hearing acuity, mobility, balance, etc. Each person's characteristics can vary widely from each other and over time: Someone who has a strong torso may have vision that requires the use of assistive technology to see adequately, e.g., eyeglasses. Someone who uses a wheelchair to move from place to place may have acute hearing, and so on. In spite of the frequent associations with accessible design and consequently with the misunderstanding that universal design is solely about design for people with a disability, universal design lends a general focus on the needs of all users ("user needs design"). This is a key distinction of universal design when contrasted with accessibility and assistive technology. As Mace said, "Every individual is unique and as a group, the human species is quite diverse." Page 2[11] Designers need to appreciate the human diversity that exists within and outside of a disability construct.

Extending beyond disability and beyond natural diversity we can also examine personal circumstances and temporary health problems. Many people appreciate and directly benefit from accessible and universal features in the environment. "Families with baby carriages appreciate a transit system that makes it easy for them to get around. People with health problems that affect the spine—"bad backs"—are much better off in homes where they do not have to bend or reach so much. Many individuals—delivery people, bicyclists, and those with rolling luggage—use and appreciate curb cuts, stepless entries into buildings, and automatic opening doors. Together with family, friends, and colleagues (including those who may move with some difficulty), all people can enjoy the

pleasures of a park or recreation area with stairless and accessible walking paths and accessible amenities.” Page 56 [17] The consideration of friends, family, and colleagues greatly multiplies the impact of more or less supportive environments beyond individuals to the social groups in which we all exist. Not to be forgotten are those who we might term, ‘circumstantially disabled’. These are people who, in the course of every day life, find themselves operating differently because of their activities. Carrying a briefcase, coffee, or a child will force any of us alter the way we interact with the environment. In the broadest sense, perhaps it is more useful to think of everyone as possessing varying degrees of ability and disability instead of either fully-abled or disabled; or to use other terms that reflect the temporal nature of all our characteristics – temporarily able bodied, fully visual, etc. Perhaps a universal approach will help society move toward a more inclusive considerations of the users of design. Kochtitzky noted, “... the concept of “functional accessibility” for specific groups, few in number, has started a trend toward universally designed solutions that benefit a wide range of people throughout their daily and life-long transitions.” Page 56 [17]

So a universal outcome, even though the process requires that the needs of a wide audience be considered, does not, by definition, mean that every aspect of each item at all scales be universally usable to everyone. As similarly cited by many authors, including those from Norway, “...all products, buildings and surroundings shall be made to be used on equal terms by as many as possible.” Page 4 [2] author’s emphasis. Echoing the idea of “universal designing”, Danford asks, “How can every graphic, product, place, or system be usable by everyone? Universal design does not claim to accommodate everyone in every circumstance. Rather, it continuously moves toward this goal of universal usability. Consequently, a more appropriate term may be universal design, as a verb rather than a noun.” Page 2 [18]

Cognitive issues, addressed by the human factors component of the principles and guidelines (primarily in Principles 2-5) suggest broadly applicable concepts and interfaces that are appropriate for all ages, and literacies within a particular cultural context. The applicability of universal design in different cultural contexts is a matter for ongoing discussion. See *Section 4*.

Many consumers benefit from universal design through safer, more comfortable and usable products and environments, as well as the ability to confidently remain in place at times of temporary disability and as abilities change over time. Producers benefit from an expanded market for fewer products. Universal design improves independence, affordability, marketability, and user image and identity. It is a multidimensional and interdisciplinary issue that requires change in the knowledge, strategies and procedures of designers, manufacturers, builders and marketers in all industries.

The image below depicts the broad beneficiary groups of a universal circulation element. The following text provides a sample of how a space might reveal universal design principles.



Figure 4: Locating the elevator and escalators together avoids segregating group members with different modes of mobility. **Photo Credit:** Center for Universal Design

Primary Universal Design Principles/Guidelines:

Principle 1. Equitable Use

1a. Provide the same means of use for all users: identical whenever possible; equivalent when not.

1b. Avoid segregating or stigmatizing any users.

1c. Provisions for privacy, security, and safety should be equally available to all users.

1d. Make the design appealing to all users.

Principle 2. Flexibility in Use

2a. Provide choice in methods of use.

Principle 3. Simple and Intuitive

3a. Eliminate unnecessary complexity.

3b. Be consistent with user expectations and intuition.

3c. Accommodate a wide range of literacy and language skills.

Principle 6. Low Physical Effort

6b. Use reasonable operating forces.

6d. Minimize sustained physical effort.

Principle 7 Size and Space for Approach and Use

7d. Provide adequate space for the use of assistive devices or personal assistance.

C. The Boundaries of Universal Design

Universal design is gradually permeating the collective awareness and finding its way into design practice. However, practical universal design applications with long and tried histories are few. The dominance of accessibility in the US, and the federal and state level compliance mechanisms that have been developed, have created a number of specific means to balance accessibility and non discrimination goals against other governmental and private interests. Because some goals of accessibility and universal design are shared, lessons may be transferable from one to another.

It is generally agreed that universal design may not always be 100% achievable in a single product, feature, or element. This realization shouldn't be used to 'opt out' of grappling with the many challenges of achieving a universal outcome. Challenges are not hard to find: for example, establishing universal characteristics while still ensuring maximum affordability; achieving context sensitive solutions, providing greater usability in wilderness recreation areas, and finding appropriate solutions in historic structures or places. A key process-oriented step in this regard is to assure that designers and others are creatively engaged to think through challenges. Many roadblocks can be overcome with intentional thinking and creative design.

Costs and Affordability

The most frequent trade-off encountered in universal design is that of affordability. This is the same concern heard over many years with respect to accessible and barrier free features as well. Many suggest that an otherwise universally designed product or feature that is quite expensive may, in practice, not be considered universal because of its lack of affordability to many people. A case can be made that if universal features are only available at high cost, the limited access for many would be discriminatory. This is one reason why universal design proponents work to confirm and communicate the actual low cost of most universal features (particularly in housing, see discussion below). Those who are skeptical of accessible and universal design may attempt to cite high cost, especially when it is just for a "few people's" advantage. The reality of broad beneficiary groups for universal design, discussed earlier, successfully counters this argument. It is becoming more difficult to assert that few are benefited by improvements to building usability.

It is the clear intent of accessibility provisions in the US is to provide full access to everyone and much effort has been expended to make that happen. However, many government units have attempted to balance the impact of accessibility requirements against the rights of individuals to an accessible environment. Because of the large number of older buildings, a good deal of attention is paid to the most challenging aspect of environmental accessibility: changing existing buildings, elements, and facilities. Adapting existing buildings for accessibility can be expensive as are virtually all renovation projects. Some mechanisms for determining appropriate levels of added accessibility involve assessing the financial exposure of a particular entity in order to achieve a particular level of accessibility. Factors may include the size of an organization, and the costs of accessibility, and the type of planned renovations, measuring the relative importance of an alteration compared to its financial impact on the entity that

will pay for the capital improvements. The US Department of Housing and Urban Development sorts out the obligations of local housing authorities by establishing the requirement to provide an accommodation to an individual with a disability, "...unless doing so would result in a fundamental alteration in the nature of the program or an undue financial or administrative burden." Page 5 [19]

One balancing mechanism provided by the ADA for private entities is the concept of "readily achievable" barrier removal in existing facilities. The regulations allow efforts commensurate with the resources that are available. On this topic Cronburg (1991) states "The law requires that architectural and communications barriers be removed in *existing facilities* when their removal is *readily achievable*, or easily accomplished and able to be carried out without much difficulty or expense. What is considered readily achievable will vary from organization to organization; a modification may be readily achievable for one place but not for another. Factors to be considered include the nature and cost of the remedial action; the organization's financial resources,...size...and type..." Page 5 [20] Cronburg (1991) gives additional decision-making guidance by pointing out the existence of a definite hierarchy of priorities to be considered. Access to the facility is considered most important, then access to goods and services, followed by access to restrooms. Similar prioritization might be created across a number of domains.

Full accessibility may also be hindered by structural impracticality or technical infeasibility. If the cost of providing a given level of accessibility is great, other mechanisms might be used. Other means to be considered include providing accessibility through alternative methods, the consideration of auxiliary aids, [20] alternate facilitation, and providing reasonable accommodations. Processes are suggested such as the creation of an access plan, planning in advance, and staff training. In many cases, it is essential for an organization to develop and document a plan for accessibility implementation in stages or phases. Universal design principle 1, Guideline a., strongly ties-in with this regulatory method regarding alternative means, "Provide the same means of use for all users: identical whenever possible; equivalent when not." It should be understood that even environments that are very universal might not meet everyone's needs. The use of assistive technology (purpose built, narrowly framed, specialty devices) or other technological solutions in these instances may be required.

The US federal government has also established incentives through the tax system to overcome financial challenges faced by small businesses in implementing accessibility improvements. Tax credits and tax deductions can be used in some circumstances by businesses to remove barriers, provide interpreters or to provide alternate materials or equipment to benefit employees or customers.[21]

Housing

Because of the decades-long implementation of accessible design in the non-residential built environment in the US there is increasing sophistication in how accessibility is rendered. It is possible to see universal results in many places. Over this time period, the costs for accessibility and universal design seem to have been accounted for in most non-housing new construction. That is, the increased usability is no longer considered a

strict add-on to “normal” design and construction practice as it was initially. Most single-family housing in the US has escaped accessibility requirements and consequently is still designed and built in a manner typical of homes of many years ago. It is this sector that is now experiencing some of these cost challenges.

A comprehensive assessment of affordability includes a balance between initial costs and building life cycle costs, household lifetime costs, and cost savings as well as the costs and benefits that are external to a particular circumscribed project. This becomes particularly relevant where project costs are immediately borne by one sector and benefits are accrued by another, or when those benefits are deferred until much later. For builders of private housing the market seems not to have priced the long-term value of universal design, not rewarding the initiative and effort of some builders (notwithstanding the modest cost add-ons for including basic universal features – See *Appendix*). The current lack of consumer demand for homes with universal features don’t easily allow for higher prices that builders would like to charge for them. The builder would prefer that this long-term housing quality be priced into the home at the time of initial sale. That would mean that the universal home, when compared to otherwise equivalent homes, would command a higher price to the consumer.

For owners and residents of universal housing, two of the key advantages are regarded as added value and cost savings. The value resides in current and future ease of use and convenience as well as the possible increased price of the home later. Cost savings will accrue because a resident household will spend fewer dollars on alternate care arrangements because moving to nursing, hospital, or assisted living settings may be delayed or minimized. The household living in a universal home can also realize savings by avoiding the costs of expensive remodeling (home access modifications) because the house has far fewer areas that might need customization for an individual. Financial savings can also accrue to insurers or government entities that fund or share funding for these health care and life care services. Builders are seen as making an effort to build better homes so that consumers, insurers, and the government can reap benefits over 5-40 years.

Scale

How far one needs to go to make an environment, especially a complex environment, universal may also depend on the unit and level of analysis that is used. To use a common example: must every toilet stall in each multi-stall restroom be universally designed? Current requirements call for one or more accessible stalls per restroom. Some question the adequacy of this standard. Given peoples’ great variations in size, strength, and needs for support getting on and off – “one (or two)-design-fits-all” doesn’t work. However, there is no consensus of what constitutes a universal toilet stall, much less a fully accessible toilet stall. An ideal universal multi-stall restroom might provide four or five very different stall types that might include a combination of right and left hand stalls, wide stalls and narrow stalls, and low, medium, and high toilet seat heights. Further research and development is needed to explore this issue further.

Information and Choice

Other approaches may involve including information and providing choices. In natural environments where terrain changes, weather, ground surfaces, climate and steep grades are a constant reality, difficult choices must be made about which and how many trails and routes of travel need to be accommodating. An analogy is that of the ski slope grading system that allows skiers to assess the appropriateness of a particular slope's challenges. In this way, an individual can match their skills to the slope's level of difficulty because they have been provided information about slope characteristics. So providing choices and options while allowing for "levels of challenge" is not inconsistent with a universal approach. Providing clear and usable information about what to expect is crucial to the success of this approach.

D. Accessibility, Assistive Technology and Adaptation

Universal design emerged out of a world of special accommodations for people with performance characteristics that varied from what was regarded, at that time, as average. Whether accessibility features in buildings or assistive technology equipment at home or in workplaces, *special* and *different* were primary characteristics of many accommodations through the 1980's and beyond. Universal design arose in part from the realization that many of the “specialty” design features characterized by accessible design turned out to improve life for others and have much broader beneficiaries than was presumed. It also arose because the specialty features were often rendered in a way that limited the availability of their broader benefits. For example, special ramps leading to side entrances were much less appealing and useful than a level entrance that was easily traversed and obviously available to everyone, without forcing people to hunt for it or to navigate a longer, out-of-the-way route.

This idea of integrated design is represented in Principle 1: *Equitable Use* and more precisely in Guideline 1.d.: *Make the design appealing to all users*. This fundamental social equity component was intended to “raise all boats” in the rising tide of better, more useful, and more supportive environments. There was never the expectation that a more universal world would eliminate all need for customization of the environment to meet people’s particular functional needs.

Even in a very universal world, all need for purpose-built, custom and specialized features and devices will not disappear. Rather, as Steinfeld said, “...the idea is to improve the general environment in order to reduce the need for such settings and devices.” Page 1 [22] Universal design should become part of the standard process of getting to good design outcomes. As Steinfeld said, “Universal Design is a normative concept used as a goal in design of products, environments and communication systems.” Page 2 [23]



Figure 5: Adaptable Bathroom Cabinet. **Photo Credit;** Center for Universal Design

In considering the current definition of universal design, perhaps the term “adaptation” itself should be removed or fully explained. Adaptation is unacceptable as a means to universal design if common understandings of the term are used: reconstruction, renovation, or remodeling. This implies a good deal of effort and cost. However, designing for simple and low effort alterations (more like the idea of adjustability) may be an acceptable route to a universal outcome. The distinction is important because a

small-scale adaptation allows some design and user flexibility while maintaining user competency in his/her interaction with the environment. It will also help achieve a mainstreamed appeal and affordability as expensive changes can be avoided. Consider the challenge of modifying standard kitchen or bathroom cabinets for use by someone who operates from a seated position, e.g., someone who uses a wheelchair or who can only stand for short periods of time. This alteration is typically messy, and quite costly, and can't legitimately be included as part of a universal definition. Cabinets such as those developed at the Center for Universal Design that allow for quick, simple, and low effort changes would be an acceptable solution. (See figure 5)

E. Other Factors

There is much in common between universal design and most other progressive design and planning concepts. The evolution of building codes has also begun to reflect the more inclusive philosophy of universal design.

Code Compliance

Decades of experience with accessibility code compliance, has produced a slow movement towards improved accessibility. Accessibility has become accepted as normative practice while the industry is producing more buildings that even have universal qualities. Evidence of this progress can now be seen in a major US building code. In the 2006 International Building Code Commentary section, the authors note this shift in approach from accessibility being applied in selective areas only when specified, to the current position requiring an approach to accessibility from the perspective that, "...if it is not specifically exempted, it must be accessible." This section also specifically acknowledges the benefits to others of many accessibility features, for instance the prohibition of protrusions into paths of travel originally conceived to enable people who are blind; also benefiting those who may be distracted. Page 11-3 [24] The code council acknowledges the mainstreaming of accessibility and the benefits that accrue over all of our lives.

Sustainability

Universal design, as part of a supportive and enabling environment, can be seen as a component of social sustainability as it helps the full inclusion and participation in family and community life for all. Universal housing also connects well with the environmental sustainability movement. As Kochtitzky and Duncan said, (2006) in referencing Peterson and Dorsey, "A universal housing approach is consistent with sustainable design principles in that it prevents or reduces otherwise unnecessary (and often very expensive) renovations that might be needed to make a home functional and accessible for someone with disabilities." Page 62 [17] This also saves natural resources by avoiding the need to use more products and building materials.

Aesthetics

A critical aspect of universal design, aesthetics, is near the core of universal design and helps to differentiate it from design solutions that might be considered just accessible, assistive or ergonomic. Principle I (Equitable Use) clearly requires an appeal in the market place. This drives one fundamental aspect of universal design – characteristics are built in, integrated into the overall scheme, and therefore mainstreamed – not separate and distinct. A universal solution has to work well and look good. While this is true, universal design can also be described as 'astylistic' [25] in that the principles can be applied to, but don't require, any particular architectural or design style to be successful.

Public Health

A relatively new area of influence for universal design is in public health. Interest is growing in the US from federal agencies such as the Centers for Disease Control and Prevention, as indicated in their *Healthy People 2010* plan. [26] This plan cited issues of environmental design as important in promoting good health and preventing adverse health outcomes as measured by public health criteria. "To be truly healthy, an

individual must have a good quality of life as measured in a number of dimensions. Community designers, such as planners, engineers, and architects, can greatly influence and help fulfill many of these dimensions, as described in *Healthy People 2010*. The health and quality of life of all people is either promoted or degraded by community design choices made at the local, state, and federal levels.” Page 63 [17] Norway reinforces the important relationship to broader environmental and health concerns. “Heavily polluted air leads to immediate illness among people with asthma, but in the long run may also damage other people’s health.” Page 7 [2] It is important to emphasize individual and collective positive health outcomes from universal design, and to note the negative health outcomes from less supportive environments.

Planning

Current land use and planning initiatives such as traditional neighborhood design, new urbanism, smart growth, transit oriented design, livable communities and others provide superior land-use, infrastructure, public rights of way, and transportation advantages from a universal design perspective. The Congress of the New Urbanism’s Charter offers great hope. It states, “...neighborhoods should be diverse in use and population; communities should be designed for the pedestrian and transit as well as cars; cities and towns should be shaped by physically designed and universally accessible public spaces...” [27] While we can take comfort in the synergies between universal design and these other movements, gaps still exist. The positive attributes associated with these initiatives are not carried through to the housing that is produced. In some cases, “The streetscapes and building frontages often result in brownstones and row houses, both of which typically feature deep, narrow building forms set close to the street with first floors three to five feet above the sidewalk, reached by a set of stairs. In residential settings with wood frame homes—detached or attached—a similar scenario is created: small lots with porches set close to the front lot line and/or sidewalk.” Page 62 [17] As with so many other areas of challenge, the application of creative thinking should produce solutions to the seeming impasse. “With a little foresight, creativity, and design experimentation, new urbanist designers could achieve universal design outcomes.” Page 63 [17]



Figure 6: Mixed Use Project **Photo Credit:** Richard Duncan

This new mixed-use development brings residential, retail, and office uses into close proximity. The apartments over the stores are accessed via elevators.

Many other dwellings in the project, however, are impossible to enter if a person has difficulty walking.

3. Implementation Methods

While formal policy adoption of universal design in the US has been sporadic, several examples where universal design is at least nominally applied are worth citing:

- A small sector of the federal government, the Office on Accessibility of the National Endowment for the Arts (NEAR) has adopted Universal Design as their preferred strategy for increased access to the arts when they provide funding for that purpose. [28]
- The federal Department of Housing and Urban Development, a major federal department focusing on economic development, infrastructure and housing, suggests using universal design for some of the housing that it funds. Page 16 [29]
- The federal Department of Education funds a number of universal design-focused research centers, for example on the topics of telecommunications, medical instrumentation and workplaces. [30]
- The most far-reaching federal regulation is based on the Individuals with Disabilities Education Improvement Act of 2004 from the Department of Education. Its regulations direct educators to use universal design in assessment and curriculum development, and teaching modalities and methodologies.[31]
- Several state-level, public affordable housing developers (state housing finance agencies) require a universal approach with the housing that they fund, for example, the Kentucky Housing Corporation.[32]
- There is at least nominal interest in universal design from the society sectors that address the US's aging population. The National Association of Home Builders' 50+ Housing Council -the association that targets older households-nominally supports a universal approach. Their Certified Active Adult Specialist in Housing designation educational program (developed with help from the Center for Universal Design) includes useful universal design information.[33]
- The oldest and most successful national builder of housing targeted for older households, Del Web Inc., routinely includes basic universal features such as stepless entries, wider interior doors, and lever door handles.
- St Louis, Missouri. [34] and Howard County, Maryland page 276 [35] have both implemented a limited universal design housing strategy for certain types of housing built in their areas

In addition, related housing concepts such as visitability have been adopted at the state and local level in various places. [36] A Federal law referencing visitability, the Inclusive Home Design Act, has been proposed in Congress. Considered broadly, the Fair Housing Amendments Act guidelines incorporate a portion of the functionality of universal design. The list could be extended but the resulting picture would remain the same: universal design is sporadically used as a broad organizing strategy for service provision, planning, and policy in the US. Accessibility, grounded in non-discrimination towards and full inclusion of people with disabilities, through state and federal law and regulations, infuses public and private sector activities and policies.

Housing

Single Family housing is the last major sector of the built environment in the US that remains principally unaffected by accessibility requirements. With the exception of one housing segment consumers are not demanding universal features, therefore builders are not responding. Because voluntary adoption of universal design by the building industry is uncommon, most existing and newly constructed homes in the US have a lot of ground to make up. “While home builders seem to willingly follow the home buying market, when market demand isn’t obvious, inclusion of universal features is uncommon.” When discussing this difficulty in England, Rob Imrie observes in *Disability and Society*, “...builders are unlikely to incorporate standards that are not part of a legal requirement.” Page 372 [37]

Interest in universal design comes from the housing sector focused on older households. Consumers seem to be responding favorably, and a number of builders are including some universal features. With this sector in mind, and with increased media and journalistic coverage, some see the US market close to a demand tipping point. Others see ground being lost each year and, once again, look to the actions of local, state, or federal government to influence the implementation of universally designed homes. Actions can include funding, zoning and development incentives, or design requirements as leveraged through state housing finance agencies, local and county level zoning boards, and local housing funders.

Evaluative Tools

Scores of assessment protocols and implementation methods have been developed to evaluate and ensure environmental accessibility, reaching a zenith in the 1990’s after the introduction of the ADA. Many compliance assessment protocols have been developed that are tied to the ADA Accessibility Guidelines or the Fair Housing Amendments Act Guidelines. One earlier approach on an urban scale for the City of Boston assisted development teams to focus on the specific accessibility issues that arise early in project. [38] This assures that appropriate attention will be paid, at the appropriate scale, at a time when an issue can be properly addressed, avoiding costly re-design. Two other early [39, 40] landmark efforts for the State of Massachusetts created a mechanism to assess accessibility in existing buildings, determine design solutions, price the alterations and establish priorities. Because universal design is only beginning to be implemented, numerous standard, and parallel methods have yet to be developed.

Universal design’s spread and growing recognition has created an interest in developing detailed regulations and standards. Performance standards are being considered in some venues. [41] However, some assert that universal design should be left as principles and guidelines, and allowed to remain as a goal. It has been suggested that to allow universal design to evolve into standards would risk them becoming another set of minimum requirements that must be followed. While there is merit in this argument, there exists the constant challenge of relevance, impact, evaluation and application if the principles remain as is. How can the “universality” of something be evaluated? How can one thing be said to be more universal than another? How many principles need to be represented (and how many guidelines within the principles need to be present) to be able to say that something is “universally designed”? If three principles are expressed in

one item and four in another, is the winner the one with four? Or is there a difference between and among the principles such that one must differently evaluate each principle and guideline to determine the level of universal success? These are all questions that are being addressed as different sectors grapple with the practical application of universal design, a process that may take years.

Some of the mechanisms that have adopted a universal design approach:

- The Center for Universal Design developed and uses a three-tiered approach (Gold, Silver and Bronze: Universal Design Features In Houses) [42] for implementing a universal housing strategy that has been widely distributed, adapted and adopted by individual builders and locales. It recognizes the gradations of usability that can be present in almost any product or environment. The approach also acknowledges the basic usability that must be present if one is to “clear the bar” and be able to authentically apply a “universal design” label.
- Universal product evaluations were developed by the Center to help teach about the principles and to guide the development of more universally usable products. [43] [44]
- Ostroff and Weisman (2004) proposed a dual evaluative scheme for assessing building and site usability considering both ADA compliance and universal design. [45] Developed with the recognition that accessibility features are being rendered in a more sophisticated way, it is hoped that improved outcomes might be encouraged by its use. While not addressing outdoor environments to any depth, it is believed to be the first attempt at integrating the detail and minimums of accessibility specifications with the breadth and design quality associated with universal design.

It is understood that universal design is a goal toward which one can strive but which may be difficult to achieve. Whatever evaluative systems are adopted to assess universal design, care should be taken to avoid an approach that yields a binary outcome: universal versus not universal. The challenge might be characterized as more vs. less universal or universal in certain ways rather than universal or not. A variety of principles and guidelines, to varying degrees, could characterize a feature. For example, it might be possible for something to be more or less ergonomic (Principle 6: Low Physical Effort) or that it might possess positive human factors characteristics (Principle 5: Tolerance for Error). It might be less easy to pursue a qualitative evaluation of the “degree to which something is integrated and broadly appealing” as found in Principle 1 (Equitable Use). While there is agreement on the overwhelming importance of the objective of mainstreamed features and the goal of social inclusion and maximum participation, how to measure the degree of wide appeal, specified in Principle 1, is another matter. How is one to decide what is appealing? It is surely a subjective evaluation, particularly when contrasted with quantitative assessments. The most innovative yet comprehensive assessment tool for determining universal design achievement was created from the Center for Universal Design’s, Universal Design Assessment Project (UDAP). While it is still under development and has not been refined into a workable scheme, it attempts to

match an array of human performance criteria with the principles and guidelines. This tool might grade how a space might work for certain mobility issues or for hearing, vision, cognition, etc. Its goal is to produce a fine-grained evaluation of environments as they function for diverse populations.

Process

An inclusive planning process is appropriate in all cases. When the ADA was first enacted in the US, there were few sure ways to assess, much less ensure, compliance. Evaluative tools were yet to be developed, expertise was rare, and enforcement was retroactive. This was particularly vexing for the private sector because “ADA” building plan approval was not possible. Years would pass before local building officials were able to render judgments on code compliance of features that were substantially the same as the ADA guidelines. Then and now part of the solution is to engage particularly affected groups such as people with disabilities and those who are older. “To achieve more universal solutions it is necessary that these groups genuinely participate throughout the whole process from an early stage” Page 5 [2] It was clear that an open and inclusive planning process was fundamental to an ADA compliant outcome. That lesson seems appropriate at this time for many instances where universal design is being applied. In any case, it is clear that universal design should join other design criteria as an important consideration in producing a superior result. As Alaskan (1997) said, “The principles of universal design could be regarded as one component of a *quality-assurance process of functionality*, from the start of a project to the final result. “ Page 5 [2] author’s emphasis.

4. Principles Re-Considered and Future Work

In spite of the progress that has been made in the field of universal design, it must be remembered that this field is still young: Accessibility itself has only been practiced for 50 years, seriously for only for 25 years. Universal design is just a bit over 20 years since its conceptualization and the principles and guidelines are only marking the 10 year anniversary in 2007. Areas of potential remain relatively un-examined, much research is needed, the principles themselves might evolve, and practical implementation needs to be developed.

Areas of Study

Research is needed into:

- Common reach ranges for standing and seated adults and children,
- Understanding and improving wayfinding methods in general and ground surface types specifically, where great variations in theory and practice make consistency and true usability difficult,
- Costs and benefits of universal housing, including health benefits,
- The relationship between universal features, higher physical activity levels and increased community participation.

Connections and collaborations between public health, planning, and design professions are essential. Collaborations between disciplines must continue to “...identify critical intervention points and to educate and to empower each other in the specifics of their work...” Page 64 [17] Work must develop and disseminate:

- Validated, practical environmental assessment tools,
- Best practice designs.

Steinfeld and others are considering the inter-relationship between universal design and the International Classification of Functioning. “Both the ICF and the Principles are based on similar underlying theoretical constructs. Both recognize the environment as a major influence on human experience, and both recognize that people without impairments also experience limitations due to the influence of non-supportive environments.” Page 7 [23]

Universal Design Principles Reformulation

Enough time has passed since universal design and the principles were formulated for re-evaluation and reconsideration. All agree that the definition and principles should not remain static, but should be examined, altered and dynamically adapted. There are legitimate issues in several areas. Steinfeld notes, “The principles are internationally acknowledged as defining what UD is, but they are criticized by some for being vague, incomplete and difficult to understand. Others argue that they apply more to product and graphic design than to building design.” Page 4 [23] Many possible avenues for consideration exist, none of which question or undermine the essential philosophy of universal design to promote greater usability, mainstreaming and inclusion.

- Revise the definition by rewording, lengthening or shortening it. For example, one option would be to delete, replace or explain the word “adaptation”.

- Adding principles such as those related to affordability or sustainability.
- Articulate in any revised or expanded universal design definition and commentary the closely related concepts and generally agreed outcomes of a universal approach: comfort, safety, welcoming, competency, independence, participation, mainstreaming, integration, cultural and gender appropriateness, and inclusion. For example, safety is expressed in Principle 5: Tolerance for Error, in that the environment should be designed with the anticipation of people acting in predictable ways, which include distraction, lack of vigilance and attention, etc. all of which can lead to accidents and injury. Competency, understood as the ability to be successful or capable, is also implied but not called out in the principles. Rather it is an outcome of applying them. Competency is enhanced by an environment that meets expectations, and is easy to understand, allowing choice by providing alternate methods of use, related to Principle 3: Simple and Intuitive.
- Attendant to this is the question of the term's worldwide acceptance and appropriateness. It does not translate well into all languages. There is a current search for a universally usable term and logo that can help focus international efforts and promotion.
- Make the language of the principles and guidelines parallel and consistent in grammar and syntax.
- There is also the additional challenge with a lack of weighting of principles: does each of them need to be considered as important as the others? When questions of tradeoffs are inevitably encountered, which principles, if any, should take precedence?

This report has reviewed the philosophical and practical grounding of universal design in disability advocacy and accessibility and traced the evolution of universal design as a distinct concept. It considered the broad beneficiary groups for universal design, and in particular the idea that everyone can benefit from universal design. This was closely linked by the report to the paramount universal characteristics of greater usability tied to integrated design. The paper reviewed various strategies that have been used to balance different interests in achieving accessible outcomes and summarized several mechanisms to assess and apply a universal approach. The report outlined corollary and confusing concepts and considered the practical limits to a universal approach. Finally the paper discussed the several key areas for future work, in particular reviewing the principles themselves.

The fact that people increasingly have the chance to live long lives is a positive sign of a prosperous and healthy society. It is an indicator of good public health, good health care, nutrition and occupational safety. The demographic trends in the developed world will not level off until the middle of the 21st century. Until then the populations of these nations will be in transition, moving towards a stable status of more equal age cohorts with only small diminutions at each level until the later years. This is good. But during this worldwide transition, these societies will be coping with the demographic changes in several key areas. The viability of pension and retirement programs are being stressed, healthcare costs are being stretched, and caregiving systems are struggling to maintain services. All of these systems will have to adapt to the changing population. It should come as no surprise that the built environment would need to make adjustments as well. If the planet can avoid calamity, the developing world might join these ranks before the end of this century and perhaps benefit from the lessons that are now being learned. By embracing universal design, policies, and design and planning practices will be better able to handle those demands and ensure that quality of life values are included.

Appendix

Costs of Universal Housing

A major concern about universal design is that it adds substantial cost to otherwise equivalent homes, making them less affordable. There are perceived costs of universal home features, there are transition costs of a builder switching to a universal standard, and there are true costs of universal design.

Limited and dated research holds that the costs of essential universal housing features add 0%-5% to the otherwise equivalent typical home built without universal features. Costs can actually range considerably higher if many additional features or higher-cost products and fixtures are used. Anecdotal evidence points to added costs of universal design being marginal. Builders report that larger homes and market rate homes involve many configuration, fixture, and product and finish choices. The costs associated with these choices can be much more significant than the costs associated with universal features.

Basic universal design costs occurs in two categories: soft costs and construction costs. At the scale of the individual builder or developer, soft costs are incurred when transitioning from designing and building traditional homes to universal homes. Once the transition is accomplished, these costs will disappear. These include the costs of retraining staff and colleagues and subcontractors, and the costs of redrawing plans. To the extent that soft costs can be overcome, there may still remain particular costs associated with construction, installation and specifications in universal homes. However, many of these involve more detailed and optional aspects of universal home features.

Products

While less of an issue in more expensive homes, several more usable appliances or products are currently more expensive than standard products. Side by side refrigerators and front control ranges are typically more expensive than over/under refrigerators and rear control ranges. Front-loading clothes washers and front control clothes dryers cost 50%-100% more than ordinary top loading models. Other products such as lever door hardware, rocker panel light switches add marginal costs to the overall home pricing. Casement windows are more expensive than double hung windows, the usual specified product. Grab bars, which aren't currently part of basic universal features, are typically an added item to a home's costs.

Materials Expenses

One of the basic, hidden universal housing features is plywood sheathing in bathrooms. As indoor air quality has become more of an acknowledged health concern, universal design has embraced measures that improve indoor air. One of the basic new-home elements that can help assure better air quality in many parts of the country is sealed foundations. In areas of the south or west where crawlspace foundations are common, a sealed crawl space – that includes foundation wall waterproofing, and moisture barriers – can reduce the occurrence of moisture, mildew and mold related problems.

Entrances

The single biggest cost, design, engineering challenge in universal housing is the entrance. Experience shows that (with the exceptions noted above) many of the basic interior universal features can be accomplished easily. Entrance access can involve the close consideration of site selection, orientation, grading, and foundation styles. Additional costs can be incurred from subcontractors for careful grading, extra excavation, and additional drainage. A corollary advantage of sealed crawlspaces is that it can reduce the added costs listed above.

Affordable Housing

Anecdotal reports from work with affordable housing developers and market rate builders reveal that the smaller the size and the affordability of the home, the greater are the challenges associated with achieving a universal outcome. However, basic universal design features are absolutely achievable in homes of any size. Where space and funds are at a premium, fewer universal features are possible, particularly with respect to cabinetry, products, appliances, and fixtures.

Experience with affordable home builders such as Habitat for Humanity have shown that basic universal design can be achieved even in extremely modest sized homes (1,200 sf, three bedrooms) without altering the footprint of the home, one of the most expensive reasons for increased home costs.

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