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ABSTRACT

This paper explains what universal design is and is not and discusses slides of various products and environments that embody universal design principles. The paper explains that although the term "universal design" suggests a "one size fits all" approach to designing, quite the opposite is true. Rather, universal designers strive to create aesthetically beautiful and environmentally sensitive buildings, places and products that are equally comfortable, accessible, and suitable for a wide spectrum of diverse people. Even though advocates of universal design recognize that it is nearly impossible to design all things for all people, the ultimate objective is to be as inclusive as possible. After making several points about universal design, the paper offers principles for universal design with related guidelines and discusses the example slides. The principles are: (1) Equitable use: The design is useful and marketable to people with diverse abilities; (2) Flexibility in use: The design accommodates a wide range of individual preferences and abilities; (3) Simple and intuitive use: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level; (4) Perceptible information; (5) Tolerance for error: The design minimizes hazards and the adverse consequences of accidental or unintended actions; (6) Low physical effort; and (7) 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. (EV)

Integrating Public Schools Through Universal Design

Lecture for the Chicago Public Schools Design Competition Community Forums
Chicago, November 12 and 13, 2000

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I want to thank the sponsors and organizers of the Chicago Public Schools Design Competition for inviting me to your community forum to speak about universal design and its relevance to plans for a new elementary school in your neighborhood.

Never before in the history of our nation has there been a greater need to build more new schools and to modernize the huge inventory of dangerously unsafe, dilapidated, and overcrowded school buildings in our public school system. This need has created an unprecedented boom in school construction nationwide. But no place in the country has matched Chicago's investment in ensuring that every child - regardless of his or her race, income, or ability - will be treated fairly in their educational journey.

Many school districts are working to integrate children with disabilities into mainstream schools, but through this unique design competition, Chicago Public Schools is the first to both recognize and act upon the recognition that inclusive educational practice, to be fully successful, must "take place" in inclusively designed schools buildings. Because what and how children learn is deeply connected to where they learn.

The nature of my comments this afternoon will be twofold. First, I'll explain what universal design is and is not. And second, I'll show slides of various products and environments that embody universal design principles. Let me begin the first part by explaining that although the term universal design suggests a "one size fits all" approach to designing, quite the opposite is true. Succinctly put, universal designers strive to create aesthetically beautiful and environmentally sensitive buildings, places and products that are equally comfortable, accessible, and suitable for a wide spectrum of diverse people - from children to teenagers and elders, and those of very tall and very short stature, to left and right handed people, women and men, people who speak different languages,and people who are able bodied and disabled. Even though advocates of universal design recognize that it is nearly impossible to design all things for all people, the ultimate objective is to be as inclusive as possible.

With that general definition of universal design in mind, there are four important points that I want to elaborate upon and clarify. First, universal design is not a euphemism for accessible or "barrier free," design. Frequently, confusion arises regarding the difference between the terms. That confusion is understandable since the origins of the universal design movement reside in the pioneering actions and achievements of the disability rights movement in the United States, including the passage of the American's With Disabilities Act of 1990.

The ADA, as it is known, is a sweeping piece of civil rights legislation that prohibits discrimination against people with disabilities in employment, services, programs, public transportation, telecommunications and access to places of public accommodation. In the latter case, the ADA spells out legally enforceable minimal building code standards that allow many individuals with disabilities the opportunity to gain access to buildings, programs and activities.

Compliance by architects and interior designers to the minimum design standards set forth in the ADA has frequently meant the addition of ramps, widened doors, and

"handicapped" parking, approaches that have rarely produced visually inspiring architecture and public spaces, or equity for all users. The environmental design professions - architecture, landscape architecture, interior design and urban planning -pride themselves on placemaking that transforms, enhances, and enriches human experience. But it should not be surprising that aesthetically, spiritually and physically satisfying spatial settings are often illusive in the built environment when the motive for design is code compliance and reducing the risk of law suits. In other words, it is perfectly possible for a building to succeed in meeting the ADA regulations, but to fail in terms of the goals of universal design.

For example, while ADA standards do address some issues of disability, they not address the subtleties of sensory or cognitive differences in people, or the changes in physical or mental ability experienced by the human body over time. as a normal part of aging. These latter concerns are typically addressed by life span design or transgenerational design. However, these "age-centered" approaches to designing products and environments, have, to date, only focused on the needs of the aging population, while the needs of children and adolescents have been largely neglected.

Universal design encompasses but goes beyond both accessible and lifespan design by considering the comfort, accessibility and practical needs of as many people as possible throughout all phases of the design process. By increasing the number of users whose needs are being addressed in a single design solution, universal design encourages an integrated approach, rather than multiple separate solutions. It helps eliminate the need for special features and spaces, which for some people, are often stigmatizing, embarrassing, different looking and usually more expensive..

The Second point I want to make is that Universal design is not about "style." It does not suggest or determine a particular formal aesthetic result. When well implemented. universal design is virtually invisible, unnoticeable by most people, except that it is more convenient, safe, and physically and emotionally accessible.

Think about airport bathrooms. Many of us, especially people of large stature, head straight for the big stall designated for disabled people because we are unable to comfortably fit ourselves and our carry-on luggage into the small, cramped, so-called "regular" stalls.. Sometimes non-wheel chair users feel a little uncomfortable about using an accessible stall because it isn't supposed to be "for them." But what would happen if ALL bathroom stalls were accessible? All of us would benefit through enhanced comfort and convenience; and the need for a 'special" labeled stall that segregates wheelchair users from non-wheelchair users would be eliminated. In simple terms, universal design is human-centered, practical, "good design" that ultimately benefits most everyone. It is an approach to designing in which human needs and concerns are inseparable from aesthetic, environmental, and technological considerations.

The Third point is that universal design recognizes that there is no separation between human health, environmental health, and social justice. For example, extensive research has now fully documented that poor people and people of color, in urban and rural areas alike, have borne a disproportionate burden of environmental pollution and degradation - from living in neighborhoods near toxic waste sites, to living in substandard housing with lead based paint, poor sanitation and inadequate heat and hot water. Consequently, these populations have higher instances of blood lead levels in children, more respiratory diseases like asthma, and more occurances of certain cancers, than does the population as a whole.

In addition, public buildings that subject us to unhealthy air through inadequate ventilation systems and the off gassing of volatile organic compounds from furniture, carpeting, plastic countertops and household products,- make us less healthy and less productive than we are capable of being. According to the U.S. Environmental Protection Agency, the poor indoor air quality that causes sick building syndrome and environmental illness, costs American society tens of billions of dollars each year in medical bills, absenteeism and lost worker productivity. Healthy buildings, social justice and environmental protection are inseparable from each other. And they are also

inseparable from universal design's mandate to create products, buildings and communities that promote health and prevent illness.

Fourth and finally, universal design upholds the fundamental democratic principles of non-discrimination, equal opportunity, and personal empowerment. In a democracy like ours, when these ideals are not realized, social protest movements like those for Civil Rights, Women's Rights and Disability Rights, arise to oppose inequalities and injustices. And they usually begin by seeking to eliminate discriminatory practices through legal remedies that impose fines and penalties - for example desegregation laws -- like Brown vs. The Board of Education, the National Fair Housing Act, and the Americans with Disabilities Act.

As each of these late 20th century human rights movements matured, they began to look beyond the "letter of the law" that fosters social change through the threat of legal prosecution for non-compliance, to the "spirit of the law" which emphasizes ethics and values, and promulgates systemic changes in attitudes, behaviors, and institutional structures. It is within this spirit of the law and the imperatives of democracy that the Universal Design Movement emerged in the 1990's.

Universal designers realize that we must be proactive in what we design because policies and practices that are seemingly gender, race, and ability "neutral" have historically perpetuated separate and unequal housing, schools, neighborhoods, and workplaces. Universal design recognizes that all of us --irrespective of gender, race, class, age, size, or ability -- develop, grow, and change both physically and intellectually throughout our lives. And at any point in our lives, personal self-esteem, identity, and well being are deeply affected by our ability to function in our physical surroundings with a sense of belonging, comfort, independence, and control. In summary, I view universal design is a democratic, values-based framework for design decision making based on an ethic of inclusiveness that honors and celebrates human difference, and recognizes the interdependence among all of humanity, the natural world and the products of human design, including the built environment.

How then, does this definition manifest itself in universally designed artifacts? How do designers know when they have achieved universal design? o answer these questions, a team of experts gathered together in the mid 1990's at the Center for Universal Design at North Carolina State University, supported by a grant from the US Department of Education's National Institute on Disability and Rehabilitation Research (NIDRR). Their goal was to develop a set of principles that could guide the design process, allow the systematic evaluation of existing designs, and assist in educating both designers and consumers about the characteristics of more inclusively useable products and environments (members of the team included, in alphabetical order: Bettye Rose Connell, Mike Jones, Ron Mace, Jim Mueller, Abir Mullick, Elaine Ostroff, Jon Sanford, Molly Story, Ed Steinfeld, and Gregg Vanderheiden).

The group developed seven general principles of universal design with related guidelines for each, that are in most cases, applicable at all scales - from the design of hand-held objects and signage systems, to architecture and community planning. However, to date they have been most helpful in industrial and graphic design where the "fit" between person and product is less complex and easier to visualize than the person to environment relationship. At the larger environmental scale, research into the development of modified and additional universal design principles and guidelines is being carried out by Professors Polly Welch and Stanton Jones at the University of Oregon, Susan Goltsman, a landscape architect, children's environmental design consultant, and founding principal of the interdisciplinary California-based design firm of Moore Iacofano Goltsman, and myself, among others.

I would like to introduce you to these seven principles by using slides of good examples to illustrate each. Before I do, two caveats are in order. First, a reminder that these principles and guidelines will NOT ALL be relevant to ALL designs. Some examples will demonstrate several principles, others perhaps only one. Second, these principles and examples address ONLY universally useable design, while the practice of design involves much more than consideration for usability. Designers must also incorporate

economic, aesthetic, technological, cultural, gender, and environmental concerns, among others, in their design work.

Principle 1: Equitable Use The design is useful and marketable to people with diverse abilities.

GUIDELINES
(1a) Provide the same means of use for all users: identical whenever possible; equivalent when not.
Power doors with sensors at entrances are convenient for all users.
Integrated, dispersed, and adaptable seating in assembly areas such as sports arenas and theaters permit people using wheelchairs to choose where to sit and with whom.
At Bradford Woods amphitheater, the design provides clear sight lines to the audience participants, whether they are in a seated or standing position.
The audience seating can be flipped up to allow wheelchairs, scooters, strollers, or wagons to be positioned where desired anywhere in the space.
At Ibach Park in Oregon, Susan Goltsman, of MIG has designed an historically themed play area that integrates children of varying abilities in an environment that encourages social and intellectual development as well. A stream - water in some places and a blue resilient safety surface in others symbolizes the Tualatin River, the city's most important geographical feature. Children touch an infrared pole to activate the water flow, which then trickles down from a large blue chute into a boulder lined channel in a retaining wall that is at grade on one side, allowing kids to wade into the stream, and at waist level on the other so that children in wheelchairs can reach into the water.
The stream meanders around a boulder representing a meteor that fell in Tualatin. The adjacent archeological dig is dominated by a large mastodon rib cage with one rib missing to allow wheelchair access. The digging area in the background, which contains a platform for wheelchair transfers, is bounded by a wall with embedded fossils that the children unearth as they delve into the sand.

Guideline 2 of principle 1 says that designed products and environments should
(1b) Avoid segregating or stigmatizing any users.
The four glass portal windows in this solid wood door allow standing and sitting children and adults to see in and out
This height adjustable drinking fountain was designed by Jason Billig and William Cheung, students at the State University of New York at Buffalo, under the tutelage of Professor Abir Mullick. It offers choice for children, adults, wheelchair users and people of very tall and short stature to individualize the drinking height and become part of the larger public. As opposed to "accessible" fountains that segregate users, the height adjustable drinking fountain is a democratic concept that offers the same opportunity to all people.

Guideline 3 of principle 1 states that
(1c) Provisions for privacy, security, and safety should be equally available to all users.
The Edmund D. Edelman Children's Courthouse in Monterey Park, California is the first courthouse in the U.S. exclusively dedicated to hearing child abuse cases. Moore Iacofano and Goltsman designed the children's waiting room so that walls create privacy for children to play alone or in groups while being inconspicuously watched over by an adult. In the background at the left is the science nook.
Here older children can read and study.
A chessboard dominates the MIG designed 10,000 square foot accessible playground. Resilient surfacing was used for safety in the event of falls.
At Flood Park in Menlo Park near San Francisco, also designed by MIG, the sandbox shelter contains both hot and cold sand for children who cant handle the heat. Toddlers can play in safety since the retaining wall (in the background) provides a barrier that prevents them from wandering away from the area, while a parent can sit on one of the 'plopping benches" with their packages (see the column on the left) and watch older children at play or converse with adults

The final guideline, number 4, is

(1d) Make the design appealing to all users.
In 1990 Oxo International introduced its Good Grips kitchen utensils for people who were limited by arthritis. These upscale, good looking products immediately found a large and enthusiastic audience. People found the large diameter nonslip rubber handles comfortable and easy to hold. The finned, flexible softspots guarantee a cushioned grip for everyone, regardless of age or functional ability. The extra plump oval handle is rounded at the end to nestle in the palm comfortably and securely. The tapered oversized hole guides the handle onto a hook without looking.

Principle 2: Flexibility in Use The design accommodates a wide range of individual preferences and abilities.

While height adjustable sinks and toilets, like the modular Metaform Personal Hygiene System manufactured by Herman Miller Corporation, are designed to adjust quickly to the needs of individual users of all ages and abilities within a household.
The Metaform modular toilet adjusts easily to accommodate the height of a standing or sitting user, allowing access by a small child, a tall adult or a wheelchair user.
The arms can be separately flipped out to assist with a right or left handed wheelchair transfer, or to provide support for people who are unsteady.
Food preparation can be shared and enjoyed among family members of all ages when a kitchen is universally designed.
This model kitchen at the GE New Home Essentials/Living Center is designed to demonstrate how a kitchen can support a broad diversity of users and functions, increase safety, and make clean up an easier task.mThe raised dishwasher, for example, is easier for a seated user, but is also more comfortable for a standing person, a tall person, a pregnant woman, a person with a sports injury and may even serve as an "easy clean" work surface for a young child helping in the kitchen. In addition, clear floor spaces and knee spaces offer ease of movement and maneuverability for users in wheelchairs or scooters and allow others to sit while performing certain tasks of meal preparation.

GUIDELINES
I want to briefly illustrate 2 of the 4 related guidelines for principle 2:
(2a) Provide choice in methods of use.
A building entrance that offers both a ramp and stairs provides equitable use and a choice of entry method. While essential for a wheelchair or stroller user, a ramp may be too fatiguing for an ambulatory older person.
(2b) Accommodate right or left-handed access and use.
These Softouch scissors, manufactured by Fiskars, can be used by right or left handed people, and individuals who have low hand strength or arthritis. The scissors are used by grasping the non-slip rubber grip handles and pulling back the spring loaded orange switch.
(2c) Facilitate the user's accuracy and precision.
(2d) Provide adaptability to the user's pace.

Principle 3: Simple and Intuitive Use Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

GUIDELINES:
(3a) Eliminate unnecessary complexity
(3b) Be consistent with user expectations and intuition.
This Sony phone offers a number of sophisticated functions in a streamlined and uncomplicated looking package. All features, from the shape of the receiver, to the size, shape and positioning of the buttons, were carefully researched. Simple to use and offering both auditory and visual feedback through a built-in speakerphone and large display, this phone has broad market appeal.
MIG designed this children's game, which marks the entry to an elementary school, using squares and moveable spheres and pyramids to make up 28 different geometry lessons. (Embedded in the center of the checkerboard is a fossil of a prehistoric giant fish that was found on the site). Children develop their motor skills, spatial acuity, knowledge of geometry, and collaborative problem solving skills without writing or

reading, and have fun in the process. Guidelines
(3c) Accommodate a wide range of literacy and language skills.
(3d) Arrange information consistent with its importance.
(3e) Provide effective prompting and feedback during and after task completion.
The MAE ticket vending machine includes options for four languages, voice output, and easy navigation for blind users with simplified menus and controls. All functions require only four buttons.
The machine is designed with clear space at the base for wheelchair users to pull up close

Principle 4: Perceptible Information.

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
The four related guidelines basically involve using different and redundant modes of presenting information such as pictorial, verbal, and tactile, for people with diverse sensory abilities so that information and directions are legible, and easy to understand by everyone.
This conventional appearing handrail can be used to provide critical wayfinding information for people with low or no vision in complex environments like shopping malls, office buildings, medical complexes and museums. The Raynes Rail system incorporates Braille messages on its inner surface and audio information at strategic locations. Both the Braille and audio messages can be used to describe an entire floor plan and corridor patterns, announce specific areas, and give locations for other features. In this example, the rail system was used at the Museo Nacional de Columbia in Bogota, South America.
Museums that allow visitors to find their way about and experience exhibitions using Braille text, audio narration, raised-line drawings, and replicas where touching artifacts is prohibited, eliminate the need for two separate information systems, one for sighted and one for non-sighted visitors, and enrich the sensory experiences, comprehension, and enjoyment of all visitors.
At Flood Park, MIG designed this tactile map to orient people with low or no vision and those with limited or no English language skills.
This Honeywell thermostat provides tactile, visual and audible cues and instructions. · The goal was to produce a design very similar to their existing product that looked "normal" rather than adaptive. The large numerals and arrow pointer ease the task of setting and reading the temperature for the visually impaired. The three dimensional raised indices allow those who are blind to count the degree increments, and the coarse knurled knob creates a secure grip for those with disabilities affecting the hand and grip.
The Aiphone Universal Video Entry System is a working prototype for an intercom system designed to allow residents to identify visitors before granting entrance.
The system features include visual, tactile and audible feedback offering an unusually high degree of redundancy in conveying information. Especially valuable to residents who are home alone, the Video Entry System offers security and convenience to all users.

GUIDELINES
(4a) Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information
(4b) Provide adequate contrast between essential information and its surroundings.
(4c)Maximize "legibility" of essential information.
(4d) Differentiate elements in was that can be described (i.e. make it easy to give instructions or directions).
(4e) Provide compatibility with a variety of techniques or devices used by people with sensory limitations.)

Principle 5: Tolerance for Error: The design minimizes hazards and the adverse consequences of accidental or unintended actions.

An "undo" feature in computer software allows the user to correct mistakes without penalty. This laboratory workstation locates frequently used knobs in the most accessible place, and hazardous elements out of reach.

- The adjustable height counters allow lab workers to stand or sit, and knobs are heavily knurled for sure grip.
- Allegro Cookware by Mirro is designed so that two of the corners create natural pouring spouts, handles located on the other two corners of the pot align and interlock with the lid handles, providing safe and balanced handling, and the flat lids contain steam vents designed to prevent "boil-overs" and allows safe and easy straining and draining.
- At Flood Park, MIG lined the channel of the "river stream" they created with brushed stones to slow down wading children so they would be less likely to run and slip and injure themselves.

GUIDELINES
(5a) Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.
(5b) Public warning of hazards and errors.
(5c) Provide fail safe features.
(5d) Discourage unconscious action in tasks that require vigilance.)

Principle 6: Low Physical Effort.

The design can be used efficiently and comfortably and with a minimum of fatigue.
- Lever handles on doors and faucets are much easier to use for children, and those who have problems with grip or dexterity than round door knobs and faucets.
- The TransG concept car was designed by Lear Corporation to meet the needs of the aging baby boom generation. The modular cargo system enables users to load large and heavy objects with ease.
- The interior contains swivel seats to make entering and exiting easier.
- The Handy Birdy ballpoint pen was developed originally for people who have difficulty gripping a writing implement with their fingers. It relies on the natural curve of the palm to grip the pen, is designed be used by people of all ages, is available in two configurations, one for right handed one for left handed, and in two sizes, small and standard.

The pen is packaged with a wearable loop that keeps the pen with the user and assists in one-handed removal of the cap.
- Finally, front loading washers and dryers minimize lifting and are more convenient for seated users and children.

GUIDELINES
(6a) Allow user to maintain a neutral body position
(6b) Use reasonable operating forces.
(6c) Minimize repetitive actions.
(6d) Minimize sustained physical effort.

Principle 7: 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.

- This universally designed kitchen prototype was exhibited in 1999 at the Smithsonian Institution's Cooper Hewitt National Design Museum in New York City as part of an exhibit titled "Unlimited by Design". The kitchen was developed by the faculty and more than one hundred students at the Rhode Island School of Design with the help of 17 corporate sponsors. It is an excellent example with which to end these slides because it incorporates principle seven as well as all the others principles of universal design. The kitchen provides for a person's natural comfort reach zone of 16 to 18 inches, and has ample turning space. The design puts everything within each reach, thus omitting extra preparation steps. Counter heights can be adjusted from 28 to 40 inches and no-spill edges can be used as grab rails. Contrasting colors are used for easier reading of controls -red for hot, blue for cold.

The universal kitchen also has an adjustable island for food preparation and unique smaller dishwasher for for easy cleanup while cooking. Multiple height carts and trays can be used for transporting items, trash removal and recycling. Oven and cabinet doors retract and slide back, and don't interfere with the work space. The counter-level

ovens lessen the danger of lifting hot dishes to a work surface.
This mini-universal kitchen, also on display at the exhibit, is a prototype designed to be installed in small spaces like a studio apartment, an office, or a bedroom that needs to be converted to a self-sufficient living space.

GUIDELINES
(7a) Provide a clear line of sight to important elements for any seated or standing user.
(7b) Make reach to all components comfortable for any seated or standing user.
(7c) Accommodate variations in hand and grip size.
(7d) Provide adequate space for the use of assistive devices or personal assistance.

I want to conclude by acknowledge the important contribution that Chicago has made to American architecture. Indeed the city is a treasure trove of well known historic and contemporary architectural master pieces. Through hosting this pioneering national design competition to build two universally designed public schools, Chicagoans have once again situated themselves at the center of architectural innovation and debate. Chicago is raising the standards of public school design and construction in America; making the benefits of good architecture available to American children with different abilities and racila and cultural backgrounds, but with the same right to an equal opportunity to learn; and establishing an innovative model for the design of ALL schools in the future that other cities and school boards will emulate - schools that are accessible for all, limiting to none, flexible for changing populations and uses over time; schools in which discrimination is not tolerated and children learn to respect and value people who are different from themselves, thereby becoming effective leaders and citizens in our democratic, multicultural, multiracial society. What you do here today and in the coming months and years, will have positive and enduring impacts on your neighborhood and the lives of children and teachers for generations to come. I wish you all success in this challenging and visionary undertaking and I look forward to returning in 2004 to tour your new school building.

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