1 Introduction

Universal Design Defined

Universal design is an approach to the development of "products and environments that can be used effectively by all people, to the greatest extent possible, without the need for adaptation or specialized design" (North Carolina State University, 1997). It is an inclusive process aimed at enabling all of us to experience the full benefits of the products and environments around us regardless of our age, size or ability.

By designing for a diverse population, universal designers integrate usability by everyone into their work on a routine basis. This approach leads to greater inclusion for many groups often neglected in the design process (e.g., children, the elderly, people of small stature, frail people, etc.).

Universal design equalizes the ways people use products and services. For example, the stainless bus has a low floor section so that anyone can enter the bus from a pedestrian pathway using a short ramp that is extended to the pavement. This design makes entering the bus easier for everyone. This bus also has a system that verbally...

Figure 1.1. The stainless bus reduces stigma associated with requiring special accommodation and ensures social integration by enabling everyone to enter and exit the bus by the same means.

announces the next stop and displays it on an electronic message board at the same time, ensuring communication of essential information to all riders.

Is universal design a utopian dream? Is it really possible? 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 designing, a verb rather than a noun.

Universal design acknowledges that both consumers and producers have to live with cost constraints. As a result, cost can make a difference in its successful introduction into the marketplace. Consider the case of the Oxo line of kitchen utensils, one of the most successful examples of universal design in terms of market penetration. The original set of products Oxo introduced was competitive with other utensils because the cost of production was controlled by using inexpensive plastic for most parts and designing all the utensils with an identical handle and interface. Oxo utensils have thick, resilient and non-slip handles that improve grasping.

Once Oxo was successful in introducing the innovation of larger, more comfortable handles for small utensils, they started to diversify their line to address other issues. By doing so, they started a trend in the industry. Several other companies are now producing competing products with larger handles, including those that target the higher end of the market.

**Myths About Universal Design**

There are many demographic trends that are fueling the demand and need for universal design. There are other important issues, like
the difference between universal design and conventional ergonomic design, as well as cost implications that are not well understood. In this section, we address the many myths associated with universal design so that the value of this new design approach is clear.

**Myth #1: There are only a small number of people who can benefit from universal design; thus we should not let their needs dictate.**

There are many ways to define ability. By most criteria, over 10% of the population has some limitation in ability. Using the broadest category of functional limitations of any kind as a basis, (e.g., traveling three city blocks or hearing typical conversation), more than 50% of the U.S. population could be characterized as having diminished abilities. Thus, there is a sizable niche market for universal design according to the most conservative estimates, and a considerable general market by the most liberal. Throughout our lives, we all experience variations in our abilities. If we take this lifespan perspective, universal design eventually benefits all of us - hardly a small number.

**Myth #2: Universal design only helps people with disabilities and older people.**

Universal design extends the benefits of good functional design to many groups of people who are not necessarily classified as having a disability, but who regularly encounter functional obstacles. Consider the problems encountered by short people, tall people, large people, frail people, pregnant women, left-side dominant individuals, children, etc. In addition, consider those carrying packages, parents with children in strollers, those who are ill or fatigued and those with orientation difficulties. Visitors in an unfamiliar city or building also benefit from universal design because they might not know how to find things or how to operate its products.

![Figure 1.4](image1.png) **Figure 1.4.** Depending upon the definition used, the number of U.S. citizens with disabilities is conservatively estimated to be at least 30 million - hardly a small number.

![Figure 1.5](image2.png) **Figure 1.5.** Universal design makes environments more usable by many people who are not considered to have a disability.
and systems. (It is worth noting here that New York City has nearly 40 million visitors every year.) Universal design, in short, benefits everyone every day by helping us all overcome obstacles routinely encountered in our daily lives.

Myth #3: The Americans with Disabilities Act (ADA) and other disability rights laws have created equality, so there is no need to do any more.

The ADA ensures that certain protected groups with disabilities can use most of the designed environment. This is hardly equivalent to universal design. Universal design is not just about physical function. Understanding signs, finding one’s way, learning how to operate products and understanding alarms and warnings are all mental, not physical, tasks. The usability of products, places and systems depends as much on the way our minds work as they do on how our bodies work. Because of this, in universal designing we have to give consideration to differences in the way people think and interpret things.

Figure 1.6. Universal design fosters social participation by the widest possible group of users.

Figure 1.7. As we get older, the likelihood of developing impairments increases dramatically – making us all likely beneficiaries of good universal design. (Source: 1992 Health Interview Survey, U.S. Census.)

Functional limitation rate by age and gender

![Graph showing functional limitation rate by age and gender.](image)
Myth #4: Improved medical technology is reducing the incidence of functional limitations, thus the need for universal design is short lived.

Contrary to this belief, since the 1970s the incidence of reduced ability in the U.S. has been increasing. Much of this increase has been accounted for by the aging of the population. The relationship between age and certain abilities is a major reason why universal design should be of interest to everyone. While statistics on functional

![Number of persons 65+ 1900 - 2020 (in millions)](image)

limitations might not include us when we are young, there is a very good chance they will when we get older. Even though older people are living longer in better health, they are living with some lessened abilities. The rate of activity limitation is 38.8% for the population 65 years or over and it rises to 56.6% for those 85 or over. While rates for men are generally higher than women, by the last years of the lifespan women are more likely to experienced activity limitations than men.

Over the next 20 years, the older population will increase by more than 50%. This in itself would be enough to fuel a greater demand

Figure 1.8. The percentage of U.S. citizens over 65 will increase by more than 50% in the next 20 years. The accompanying incidence of impairment can best be addressed through universal design. (Source: U.S. Census, 2001.)
for universal design, but there is more. The geographic distribution of older people varies significantly. New York State has one of the oldest populations. The 2000 Census reported that 12.8% of the population in the state was over 65. In New York City, 11.7% of the population was over 65 and 6.1% was over 75.

Perhaps the most important trend in aging affecting the demand for universal design, however, is the aging of the Baby Boom generation, the first of whom are now in their 50s. In New York City, the 2000 Census reported that 20.2% of the entire city population was over 55 – already a huge number – yet the first group of true Baby Boomers was born in 1946, so they are just turning 55. The bulge in the population curve caused by the large numbers of Boomers will slowly work its way toward old age. And as it does so, the need for universal design will increase steadily.

**Myth #5: Universal design cannot sustain itself in the marketplace because people who need it most cannot afford it.**

The older population alone has the resources to sustain a universal design industry. Although there are significant differences across groups, overall, older households have substantially more assets than younger households. Furthermore, the next generation is expected to have higher and more disposable incomes during old age than the current generation (Sabelhaus and Manchester, 1995). The Boomer generation also spends a lot more. So the combination of higher incomes, large numbers and higher consumption patterns means that this age group will have a big impact in driving the consumer economy and, consequently, increasing the demand for universal design. In addition, we often forget that there are two marketplaces for universal design, the free market and the public sector. Despite the rosy forecasts about the increasing affluence of this group, there are many people today with low annual incomes. Low-income

people depend more on public services and not-for-profit organizations to meet their security, health care, housing and recreation needs. Thus, while we can expect aging Baby Boomers to have a big impact in the free market economy, the lower income population will play an important role in driving the direction of government services and those of not-for-profit organizations. The more support this group has in getting access to services, the more independent they can be in daily life and the lower the burden of service delivery (and consequent liability) will be for public and private service organizations.

**Household Incomes in Late Middle Age and Old Age**

<table>
<thead>
<tr>
<th>Income Range</th>
<th>Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$50,000 to $74,999</td>
<td></td>
</tr>
<tr>
<td>$28,000 to $34,999</td>
<td></td>
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<tr>
<td>$15,000 to $19,999</td>
<td></td>
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<tr>
<td>$5,000 to $9,999</td>
<td></td>
</tr>
<tr>
<td>$1 to $2,499 or less</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1.10. The idea that older people are not consumers is a myth.

Figure 1.11. In terms of percentage, relatively few people 55 and over are low-income. And those on the leading age of the Baby Boom generation often have substantial income and are inclined to spend it. (Source: U.S. Census, 1999.)

**Myth #6: Universal design is simply good ergonomic design.**

This is one myth that may be partially true. The field of human factors and ergonomics has developed principles to improve the design of products, places and systems to make them safer and easier to use. Accommodating variation in abilities is an important principle in ergonomic design. However, the traditional attitude in this field has been that design cannot satisfy the needs of everyone without too great a cost and effort. Until recently, advocates of ergonomic
Figure 1.12. The bell curve illustrates the fallacy of the average person. People come in a range of ages, sizes and abilities. Universally designed buildings accommodate those ranges rather than some theoretical average.

Figure 1.13. Incorporating principles of universal design into new construction projects typically requires less than 1% of total construction costs.

design typically focused on the large majority in the middle of the population curve. In contrast, universal design demonstrates that with creativity and appropriate use of new technologies, those who are not in the majority can also be included. So, human factors and ergonomics experts are now starting to adopt universal design as a good ergonomic approach. Good ergonomic design, in other words, means adopting ways to design products, places and systems that can accommodate all of us.

**Myth #7: Universal design costs even more than accessible design.**

Universal design goes beyond the codes to include improved functional design that can save money over the life of the building by lowering the cost of renovation. If buildings were usable by everyone from the start, then fewer renovations would be necessary in the future and those renovations that were required would be less expensive. Accessibility codes and laws are not static. New technology and knowledge about the barriers that people with functional limitations encounter in buildings and facilities generate new initiatives over time.
Unlike accessibility code compliance, universal design is flexible; there are no legal mandates. Moreover, many universal design features cost nothing, some save money and some increase income. For example, designing a main entry with level access and no change in level inside the vestibule eliminates stairs and a ramp. Selecting door handles that are easier to use does not require any additional expense. A universally designed signage system does not have to cost any more. These features provide an excellent value. Other features may have marginal additional costs but they also may have a value that exceeds their expense. For example, an automated door in a hotel can increase the comfort and satisfaction of guests and also reduce damage to door frames, staff effort, the potential for work related injuries and congestion at the entry during bad weather. In such applications, universal design makes good economic sense.

The ADA, Building Codes and Universal Design

As noted above, compliance with accessibility regulations is not the same thing as universal design. And yet, the ADA and local regulations (e.g., the New York City Building Code) do play a role in universal designing. In fact, anti-discrimination laws like the ADA embody the intent of universal design (i.e., eliminating discrimination in obtaining goods and services and in social participation caused by the physical environment). Thus, practicing universal design does not mean that one should ignore the requirements of the ADA regulations or local building codes – far from it. Universal designing means taking a broader look. We need to recognize that the provisions of accessibility regulations are the minimum requirements for ensuring access – and then for only a protected segment of the population. Universal design also addresses the needs of that segment – plus everyone else as well.
On the other hand, understanding the principles of universal design and knowing how to implement them should reduce problems with meeting regulations. These should automatically be fulfilled through good universal design. For example, reconsider the automated door. While neither the ADA nor the City Building Code require automated doors at building entrances, such a door is more usable for everyone who comes to the building — employees, visitors, senior citizens and children alike. As part of universal design, it is important that automated doors be usable and safe for everyone. This includes employing safety features to prevent the door from closing when someone is in the operating area and to make the door detectable by all users.

If implemented properly, universal design should reduce problems meeting ADA and City Building Code requirements.

Knowing how to accomplish these objectives is part of universal designing. Although the design criteria used to achieve universal design may be different, it is important to ensure that they also meet the ADA and City Building Code. A universal design should exceed those requirements in all respects.

**Toward the Universal City**

The ultimate purpose of this book is to move further toward the creation of the universal city. What kind of place would this be? Here is a list of features that the universal city should have:

- Pathways, street crossings, and plazas would be free of hazards and barriers to the flow of movement. Where there are unavoidable natural obstacles like steep hills, convenient alternative means of access would be provided.

- All people, citizens and visitors alike, would have access to the information they need in the form they require to find their way through the city.
The city would be planned to provide opportunities for employment, childcare, education and recreation in close proximity to residential areas.

Public buildings would accommodate the diverse needs of the population in a cost-effective yet dignified and pleasant manner. Goods and services in these buildings would be easy to find and access.

Obtaining employment and being productive would not be constrained by physical barriers. This would contribute to improving economic development and the standard of living of the population.

Tourists would want to visit the city because of its convenience, ease of use and pleasant atmosphere. And they would return for the same reasons.

Older people would want to remain in the city after retirement because it provided a more convenient, safe and secure environment than other places they could live.
Sound impossible? It is not if policy makers, planners, designers, and builders keep these features in mind in their design processes. A city that rethinks itself in light of the social and demographic trends behind the demand for universal design will be better positioned to become a desirable place for all of us to work, live and visit in the future.

The Scope of Universal Design

Universal design should address five general building issues:

- Using circulation systems
- Entering and exiting
- Wayfinding
- Obtaining products and services
- Using public amenities

The accessibility and safety of public circulation in the built environment is critical for ensuring access throughout the city. Without this, individuals are subject to unnecessary risk, expense or inconvenience.

The first step in making buildings and facilities accessible is entering and exiting. The rest of a building’s features do not matter to the person who cannot get in or out the door.

To use the city effectively, we need information about where we are (orientation) and how to get where we want to go (wayfinding). This information is provided by many means: landmarks, signs and information services.

Buildings and facilities need to be designed so that their resources are accessible and usable by all inhabitants and visitors. In some
types of buildings, this means making goods on display accessible to everyone.

The use of buildings includes the use of public amenities in conjunction with the main activities of the facility. Access to restrooms, drinking fountains, public telephones and information displays is a necessity, not a luxury.

Beyond the general issues, buildings of specific occupancy types have their own unique considerations.

In this book we have focused on six occupancy types:

- Cultural facilities
- Public assembly and entertainment facilities
- Participant sports and recreation facilities
- Temporary lodging
- Workplace facilities
- Human service facilities

New York City is rich in cultural facilities. Its many museums, galleries, zoological gardens, etc., are there to enhance the lives of all visitors.

Citizens and visitors alike routinely flock to the City’s numerous public assembly and entertainment venues. Whether it is a music hall, a Broadway theatre or a major league baseball park, all the people should be able to find enjoyment and entertainment in these often world-renowned facilities.

In general, people enjoy participating in sports and recreation events. Children’s playgrounds, recreation centers, jogging and bicycle paths, outdoor basketball courts, and playing fields are
but a few examples of participant sports and recreation facilities that all New Yorkers and their guests love to frequent.

Hotels/motels and shelters are two forms of temporary lodging that are particularly important to life in large urban centers. New York City's many fine hotels/motels are there to ensure that all its visitors and guests are welcome. Its public and private shelters provide the safety net that reflects the City's concern for the welfare of all its citizens.

Workplace facilities — whether offices or factories, retail stores or assembly lines — are the economic lifeblood of New York. Ensuring all its citizens the ability to access and use such facilities keeps the City's vital signs strong.

Human service facilities such as community centers, child-care centers, senior centers, etc., are places where all people come to participate in programs that enrich their lives. Other human service facilities (e.g., police stations) are places that all people turn to for safety and security.

The guidebook's section on "Elements of the Universal City" illustrates ways that universal design can ensure that these general building issues and specific building types are available to everyone.

Although not covered in this book, transportation systems are also a critical feature of the universal city. Public transit should effectively transport riders throughout the city seamlessly. Options would be available to accommodate the needs of all citizens throughout their lifespans.
2 Using Universal Design Guidelines

This guidebook purposely avoids recommending prescriptive design standards for the universal design of buildings. Instead, it provides general guidelines designed to broaden and enhance the usability of buildings for everyone.

This guidebook's visual illustrations of successful applications of certain universal design guidelines are not meant to be copied or imitated. Rather, they are provided to promote a general understanding of the concept — i.e., to stimulate extension of the principles to other building applications.

Audience for this Guidebook

Universal design guidelines can be applied to the planning, design and management of all buildings — private as well as public. This guidebook, however, is targeted primarily at three groups with whom the city's various departments routinely contract for services pertaining to public buildings: (1) professional designers, (2) building owners and developers and (3) general contractors and construction managers. It is intended to demonstrate how each of these audiences can use the guidelines to further both the city's and their own professional interests.
Professional Designers

Universal design is a rapidly expanding area of practice in all the design professions. The growing need to design buildings that are usable by everyone regardless of their intellectual, functional or sensory abilities is a demographic fact of life. This guidebook introduces professional designers to principles of universal design that will enable them to rise to the challenges posed by that demographic.

Moreover, universal design contributes to the socially and ethically responsible design of buildings. It promotes replacement of our current discriminatory exclusive designs with new affirming inclusive designs that are usable by all of us. And it does this without burdening the professional designer with prescriptive standards that stifle design innovation. The benefits of universal design are best achieved by reinforcing design innovation rather than design imitation, or worse, design duplication.

Building Owners and Developers

Universal design provides building owners and developers with ways to maximize their buildings' responsiveness to an increasingly diverse marketplace. Buildings that are not usable by everyone grow more marginalized with each passing day and, consequently, tend to lose their relative value. Through these Guidelines, building owners and developers should be able to discover that universal design has become a cost-effective strategy for maintaining or even enhancing the profitability of their building inventories.

Building construction, renovation and maintenance costs are more readily justified when all people benefit. A primary benefit of universal design is that it enhances the usability of buildings for everyone. Consequently, building owners and managers who embrace the principles of universal design are less likely to see their decision-making during construction, renovation and maintenance
projects become the targets of “penny wise and pound foolish” criticisms following their completion.

**General Contractors and Construction Managers**

This guidebook illustrates practical universal design solutions in many contexts. They can help contractors and construction managers keep the intent of universal design in mind as they respond to conditions encountered during construction.

More importantly, the examples and guidelines provide a broad understanding of how application of the principles of universal design at a construction site can ensure the realization of a building that is truly usable by everyone — and, typically, at a cost that is competitive with conventional design and construction methods.

**Evaluation and Improvement Over Time**

Universal design is a continuous process of innovation targeted at improving buildings’ usability for everyone regardless of their intellectual, functional and sensory abilities. And as with any design, improvement upon the status quo is always possible. But with universal design, the motivation to continually enhance the usability of a building is ever present.

A universally designed building is as much about becoming universally usable as it is about being universally usable.

It is through post-occupancy evaluations of buildings that universal design principles are most readily tested and documented. Through such evaluations, even our best current examples of universal design in buildings will, over time, be challenged and replaced by better examples.

Whether through construction, renovation or maintenance projects, buildings designed to reflect the principles of universal design are
part of a continuous process of innovation. This process is targeted at improving usability of buildings and cities over time.
3 Principles of Universal Design

Purposes and History

Accessible design is primarily about court-enforced compliance with regulations. The regulations are intended to eliminate certain physical barriers that limit the usability of environments for people with disabilities. Historically, accessible design has focused on compliance with state or local building codes. These typically were based on the American National Standards Institute’s requirements. With the passage of the Americans with Disabilities Act (ADA) in 1990 and the subsequent development of the ADA Accessibility Guidelines, accessible design has focused more recently on satisfying these minimum technical criteria to allow most people with disabilities to use most of the designed environment (Salmen, 1996).

Universal design is a market-driven process intended to create environments that are usable by all people. While considerations for people with disabilities are certainly necessary for universal design, they are not sufficient when planning and designing for the whole population. Accommodating the needs and wishes of

everyone — e.g., children, the elderly, women and men — is also necessary for universal design (Norwegian State Council on Disability, 1997).

Acknowledging this greater inclusiveness, in the mid-1990s the Center for Universal Design in Raleigh, NC asked ten leading advocates to identify the underlying performance requirements of universal design. The resulting Principles of Universal Design (Connell, et al, 1997; North Carolina State University, 1997), developed through funding provided by the U.S. Department of Education’s National Institute on Disability and Rehabilitation Research (NIDRR), has since become the internationally referenced definition.

Explaining and Illustrating the Principles

These seven principles are not without their critics. Some consider them vague and difficult to understand. Others argue that they are more applicable to product and graphic design than building design. And yet, as evidenced by their growing international acknowledgment, these principles continue to maintain their status as the definitive statement of what constitutes universal design. This guidebook also acknowledges the seven Principles of Universal Design by explaining and illustrating their applicability to the universal design of the built environment.
On the following pages, each of the seven principles is explained and associated with a simple pictogram. When guidelines are listed in subsequent sections of this guidebook, the principles most relevant to each guideline are acknowledged through use of these pictograms. The front and back covers of this guidebook include flipout pages listing the seven principles and their associated pictograms that can be kept open for quick reference while reviewing the guidelines.

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**Principle 1: Equitable Use**

The building's design should make it equally usable by everyone. Ideally, the means by which people use the building should be the same (e.g., providing one means of entry to the building that works well for everyone). If it cannot be identical, the several means provided must be equivalent in terms of their privacy, security, safety and convenience. The building must never employ means that isolate or stigmatize any group of users or privilege one group over another.

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**Figure 3.1.** People who require an accessible entrance should not be exiled to a remote delivery area such as the one shown here.
Principle 2: Flexibility in Use

The building’s design should allow people to use its design features in more than one prescribed way (e.g., providing a countertop orientation map that is viewable from either a seated or standing position). It should accommodate both right- and left-handed use and be adaptable to the individual user’s pace. The building’s design should have the built-in flexibility to be usable even when it is employed in an unconventional or unanticipated manner.

Figure 3.2. A toilet seat that is height-adjustable can be used by people of all sizes and ages.

Principle 3: Simple and Intuitive

The building should make it easy for everyone to understand the purpose of each design feature and how to use it (e.g., providing washroom lavatory faucets that make their method of operation readily apparent and relatively easy). Moreover, its means of use should be intuitively obvious so that it operates as anticipated and, therefore, can be used spontaneously.

Figure 3.3. The absence of detectable information makes these elevator call buttons difficult for first time users with reduced vision to recognize.
Principle 4: Perceptible Information

The building should provide all essential information in a variety of modes (e.g., written, symbolic, tactile, verbal) to ensure effective communication with all users regardless of their sensory abilities. The information provided must be presented with sufficient contrast to surrounding conditions so that it is distinguishable from its context and decipherable in all its various modes of presentation.

Figure 3.4. This high-contrast directional signage uses both text and pictograms to communicate to a wide group of users.

Principle 5: Tolerance for Error

Ideally, the building’s design should eliminate, isolate or shield any design features that could prove hazardous to or inconvenience any user. When potentially dangerous conditions are unavoidable, users should receive warnings as they approach the design feature (e.g., providing proximity warnings in a variety of sensory modes near the top of stairs.) The building’s design should also anticipate accidental or unintended actions by any user to minimize the inconvenience and/or protect the user from harm.

Figure 3.5. The boardwalk has raised edges to prevent users from accidently leaving the path of travel.
Principle 6: Low Physical Effort

The building's design should employ design features that require little or no physical force to use them (e.g., replacing a traditional door knob with a lever handle that does not require the ability to grasp and turn the wrist). If a low level of force is required, any user should be able to engage the feature without assuming an awkward or hazardous body position (e.g., providing a smooth travel surface with minimal slope along the path of travel leading to the entrance).

Figure 3.6. This lavatory has up and down controls that allow each user to adjust its height.

Principle 7: Size and Space for Approach and Use

A building's design features should provide an adequate amount of space that is appropriately arranged to enable anyone to use them (e.g., providing knee space under a washroom lavatory to enable use by someone in a seated position). In addition, the space needs to be arranged to provide a clear path of travel to and from important design features for all users.

Figure 3.7. The height of the concession stand counter permits convenient use by customers of varying heights.