

Universal Design

Designing Inclusive Environments

Edward Steinfeld and Jordana Maisel

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Creating Inclusive Environments

Edward Steinfeld

Jordana L. Maisel



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Foreword

This superb and well-illustrated book is intended not only for design students but for all who care about how we access, use, and enjoy the environment. Universal design differs significantly from what we have known in the United States through the language and litigation on accessibility in that it sets a paradigm of design excellence benefitting all users. The authors observe that barriers are part of our lives and deeply rooted in our artistic and social consciousness. Although usability, in a general sense, has been a part of design since the origins of civilization, crafting the built environment to reduce the undesirable impact of real and metaphorical barriers in order to facilitate social participation is a relatively new field of study, with roots in the civil rights movement and efforts to achieve social justice. Its impact is directly proportional to the degree we experience limitations in independence and social participation. Thus it is no wonder that this movement started among people with disabilities, whose engagement in society was restricted by artificial barriers in every aspect of their lives. But, attentiveness to civil rights drives design to benefit the many, not just the few. The lessons learned apply to design at a much broader level where achieving these goals for all is much more complex than simply complying with accessibility laws. The fundamental importance of the field is demonstrated by the fact that creative designers have thought about these ideas for a long time although they may not have articulated them. The authors note the example of the Guggenheim Museum in New York City, constructed before there were accessibility codes. Frank Lloyd Wright's vision for the building was nothing less than making art itself easier to access and more enjoyable for all museum visitors.

We have moved beyond the historical base and original delineation of universal design, which Ron Mace originally defined as the design of products and environments usable by all without the need for special accommodations. The authors propose a new definition, "a process that enables and empowers a diverse population by improving human performance, health and wellness and social participation." This new perspective supports an explicit relationship to sustainable design and active living, two more established progressive design initiatives. The emphasis on these two issues is a recurrent theme in the book and their importance is reflected in emerging design

practices. For example, conferences held by the AIA New York Chapter under the banners of Fit-City and Fit-Nation have stressed the adoption of universal design to insure that sustainable and walkable cities and communities enable all to benefit from a healthier lifestyle and more physical activity. This new definition also eschews an overly utopian perspective by putting the emphasis on the process rather than an idealistic but long-range goal.

Of paramount importance are the ethical and pragmatic responsibilities design professionals share when designing towns, urban centers, buildings, and products for increasingly diverse social communities. Making the necessary adjustments to address demography and the cultural possibilities of a pluralist society is not a question of tweaking existing formulations, but starting fresh, recognizing that the stress of contemporary life can be mitigated by design that places a high priority on meeting the physical, psychological, and social needs of all citizens. The authors, an architect and an urban planner, identify a clear need for an interdisciplinary and evidence-based perspective that goes beyond traditional silo-oriented education and professional practice. Design that is “human-centered” transcends this segmentation by focusing attention on the needs that are common to us all. In fact, economic and demographic factors intersect in ways that require multidisciplinary initiatives, universal in outlook and inclusive in intent. In particular, the aging of our societies demands that the current economic downturn should not be used as an excuse for poor design and indifference. In fact, if we do not implement universal design now, the economic burden of an aging society will be even greater in the future.

The authors and contributors to the book are colleagues at the Center for Inclusive Design and Environmental Access (IDeA Center), which is a leading center for research and development in universal design in North America. They stress the importance of developing a “community of practice” in universal design that will educate, enhance, and empower a new generation of thought leaders in both academia and practice. They also argue for improved communications and pedagogy, illustrating efforts in this country and abroad, to make universal design a more central focus of design education, both in professional schools and through continuing education. Universal design education must focus on innovation and creative problem-solving. It can be clearly demonstrated that the incorporation of universal design attributes makes projects more sustainable, more durable, and more valuable. But, to accomplish these objectives, it is not merely a question of enhancing prior definitions of accessibility, but re-thinking how design can be beneficial for the long term.

The book builds upon the foundation formed by seven well-established Principles of Universal Design through the formulation of the Goals of Universal Design. These Goals clarify outcomes for practice and tie those outcomes to existing knowledge bases. The authors review the literature on human performance, health and wellness, and social participation to identify key evidence-based guidelines for design practice. They also provide hundreds of examples of universal design from all the design disciplines. One of the most interesting current efforts described in the book is the initiative to develop voluntary performance standards and a certification system for universal design modeled after similar successful efforts in the field of sustainable design. This effort can serve as the focus for the development of a community of practice, creating connections across design disciplines, between researchers and practitioners, and between the professional community and academia.

Whether in product design, building systems or public infrastructure, to advance the field of universal design it is crucial to both identify best practices and, as the authors put it “document the benefits of universal design solutions.” This extraordinary book does both well in language accessible to both student and seasoned professional.

Preface

The field of universal design represents a convergence of several threads of design practice with a focus on usefulness. Since the origins of the design professions, theorists have acknowledged that usefulness is a critical factor in the success of any design, be it a city plan, a building or a sign. But, in the history of design, usefulness is rarely the central focus of attention in the design professions. Even during the early twentieth century when the phrase “form follows function” was uttered frequently by leading architects, there was more attention given to “form” than “function.” Most architects who adopted that credo were concerned more with the concept of “integrity” of form, e.g. expressing function, than they were with actually making buildings more useful for the people who lived in them.

What about the people who did not live in them? People without decent housing, people with disabilities who could not enter most buildings, people isolated in institutions, factory workers, middle class housewives, children, refugees, etc.? Few design professionals thought about them unless they got a good commission to design a large institutional building or housing project for the “poor or unfortunate.” Even then, the focus was more on pleasing the client or glorifying themselves than on the welfare of the inhabitants. Remember Howard Roark, the prototype for the late twentieth century architect?

The new century demands that we start thinking differently. For the last twenty years, we have witnessed the transformation of sustainable or “green” design, re-invented by a few “idealists” in the late 1950s, into a mainstream endeavor. This movement is the first example of design for all of us because it puts the focus on protecting the natural world in which we all have a stake. Notwithstanding the importance of protecting the environment, we have to ask whether protecting people is not just as important. If protection of people had been the focus of design from the origins of the discipline, we believe we would naturally have practiced sustainable design early on, simply because it was good for species survival.

There are three major trends that are operating together to change design culture. First, a diverse, consumer oriented culture on a global scale is emerging, starting with the high-income

countries but spreading rapidly everywhere. This culture puts greater value on personal development and values difference rather than avoiding it. Those who participate in this culture are much better informed about their options and willing to change and be changed, in other words, to engage in transformative processes. Second, due to biomedical science and public health the world is aging rapidly. In the developing world, the older population is increasing even more rapidly than in the developed world. An interest in preserving quality of life during old age is increasingly driving decisions of all kinds. Third, economic forces are demanding higher standards of usefulness. Sustainability (eliminating waste) and better information are making performance more important in purchasing decisions by individuals and organizations.

The concept of universal design emerged through the disability rights movement, an example of the first trend above. Early experience with the concept has led leaders in the field to expand beyond those origins and to identify connections with design for aging, social sustainability and user centered design. At the same time, other proponents of design to improve people's lives are recognizing the value of the universal design paradigm. Thus, in writing this book we decided to avoid looking backward and look forward instead. We investigated how universal design could evolve and become more central to design thinking in the mainstream, with an admiring eye to how that happened with sustainable design. There are differences, of course. One can easily measure and quantify the benefits of sustainable design but we do not yet have all the tools we need to do the same with universal design. The cost of not paying attention to the environment is demonstrated clearly every day all around us—more pollution, less fish, higher fuel costs, etc. The cost of not practicing universal design is not as easy to perceive right now. One has to parse through statistics and learn how to look at things from the perspective of others. However, as with sustainable design, once we change our perspective and learn how to see the evidence, the future becomes clear.

We believe we are close to a watershed moment. Whether they know the term or not, the work of leading architects and design firms reflects the adoption of universal design concepts. Innovation in design practices occurs because good designers pay attention to what is going on around them. They may not necessarily label what they do, but they do it nevertheless. While writing this book, we also were completing an educational project that involved visits to other design schools and discussions with their faculty about how to bring universal design ideas to their curricula. One of the faculty members we consulted with listened a while and a look of awakening appeared on her face. She said, "We are already doing this! We just don't call it that." And it was true. As we speak the world is changing and we change to adapt to it, some faster than others. This book provides a cohesive yet open-ended view of the field with a futures perspective. It is said that good education is subversive; one of our major goals is to provide a tool for change.

The book is organized into three basic parts. The first part establishes a foundation and rationale for the universal design paradigm. This includes an essay on the concept of barrier, a chapter defining universal design as we see it evolving and one on the practice of universal design. The third chapter in the first section utilizes demography to demonstrate the trends that will drive the adoption of the concept. The second part of the book gives a summary of the three underlying knowledge bases for universal design practice. These are design for human performance, design for health and wellness, and design for social participation. The last part of the book provides summaries of practices in universal design across a broad range of topics. There are chapters on public accommodations, housing, home modifications, interior design, product design, and transportation. This structure is amenable for use as a textbook in a course on universal design, or, across several courses. It is also amenable for use in courses focusing on

different disciplines using the first two parts in their entirety as the core material and one or more from the last part as an introduction to a more in depth examination of the discipline. For the instructor, we have prepared review topics in each chapter but there is also an instructor's guide available online from the publisher with supplementary materials, including quiz questions, sample assignments, and suggested media.

In summary, this book was developed to lead the way rather than reflect back upon what has already happened. We hope it will inspire others to bring their own wisdom and insights to the developing community of practice in this field because, as the reader will see, the development of this design paradigm will lead in many new directions and there is room for everyone. In particular, we hope it will lead to the evolution of universal design as an inclusive paradigm where all proponents of design to improve the quality of life for every citizen of the planet can find an intellectual home. Universal design is a search for design strategies that bring benefits for all.

—THE AUTHORS

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We must acknowledge all the leaders of the universal design movement throughout the world. Our interaction with them over the last 20 years was instrumental in forming the ideas presented in this book and we are indebted to this band of committed individuals for embracing an idea well before it was mainstream and investing their time and energy in building the foundation of a global initiative.

The development of this book was partly supported by the Rehabilitation Engineering Research Center on Universal Design in the Built Environment, a center of excellence grant provided by the National Institute on Disability and Rehabilitation Research (NIDRR). We thank NIDRR for funding the Center for Inclusive Design and Environmental Access (IDeA Center) generously for the last 12 years and recognizing the importance of dissemination and education as a critically important adjunct to research and development activities.

Barriers and Their Social Meaning

Design as Evolution

Much of life is about overcoming barriers. Every organism, from lowly one-celled animals to human beings, exists by interacting with its environment. This interaction includes moving from one place to another, creating a space for the self, lifting a load, or learning how to use a tool. Our ability to interact with the environment is, to a great degree, determined by our characteristics and abilities, such as height, strength, and intelligence, but also by the degree of resistance and its corollary, the support the environment provides in reaching our goals. The relationships humans have with the environment are much more complex than those of other organisms. We have reasoning abilities and tools that give us more freedom of interaction and a wider range of adaptive responses. Ants, for example, use instinctual foraging behaviors to find food and bring it back to their nests. If an ant encounters an obstacle in its path back to its nest, it may climb over or around it. If an observer drops more obstacles in its path, the ant continues to use the same limited set of behaviors to overcome the barrier. Humans, however, have a much larger range of adaptive behaviors. Faced with a situation similar to that of an ant, a person might remove the obstacle, use a map to find an alternative route, or find another source of food. People also can psychologically adapt to the presence of a barrier. A good example is the prisoner who overcomes physical confinement by exploring an interior intellectual world.

Human social groups have developed sophisticated methods of adaptation to overcome the resistance of environments. Design is an active, purposeful adaptation method that people use to adjust their world to their needs. Through design, humans both remove barriers and develop supportive environments, products, and systems to facilitate achievement of their goals. Design interventions have evolved with human experience and the development of technology. For example, one of the first tools early humans learned to use was a sharp-edged rock. Over time, some people discovered that such a rock could be enhanced by fashioning a sharper edge. Later humans discovered that fashioning a handle on part of the rock increased the comfort of using

such a tool. To hunt larger game that would provide more food to support a growing community, others discovered that adding a long handle to the rock added leverage and reduced effort. This was the first prototype of the modern ax (Williams 1981). Figure 1–1 shows this evolution.

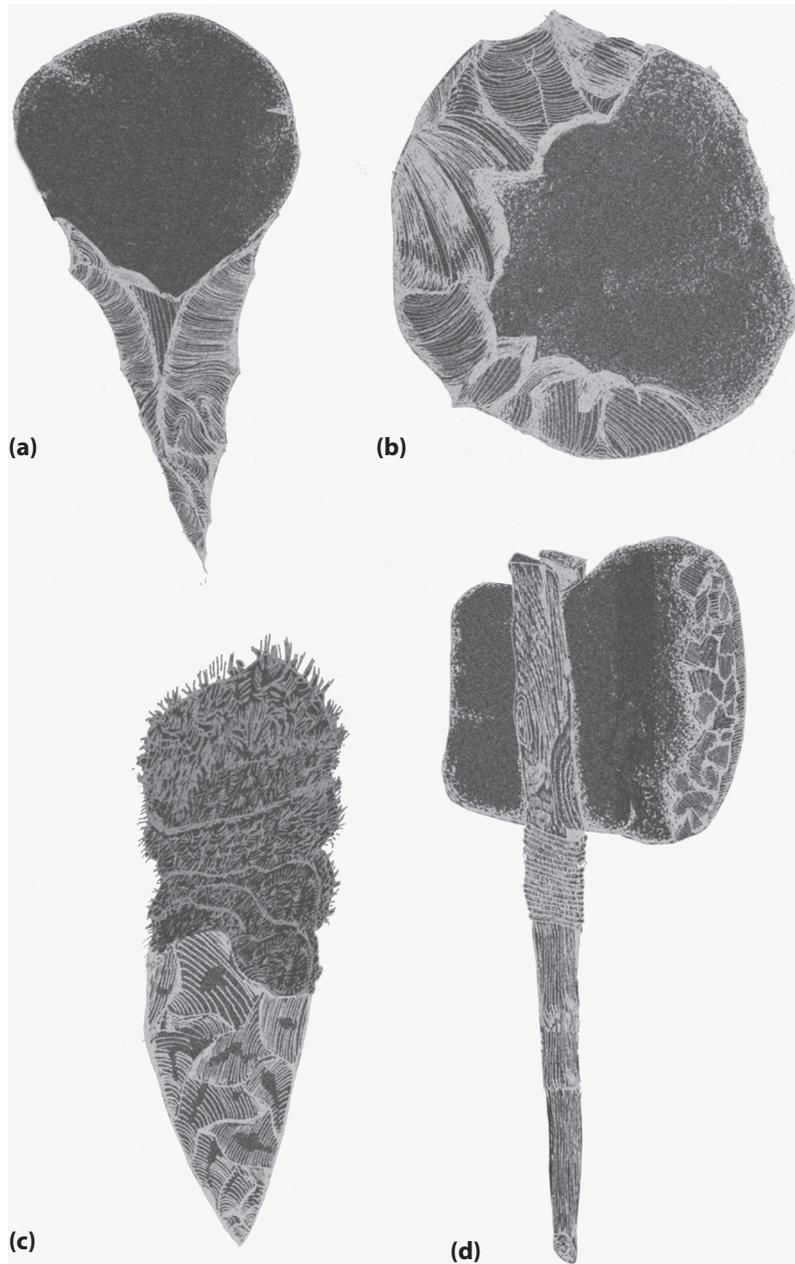


Figure 1–1: Evolution of the ax. Four examples of axes including (a) a rock fragment with sharpened edges, (b) a rock with a sharpened edge and a smooth area for easy grip, (c) a rock with sharpened edges partially covered with hide for a handle, and (d) a club with long wooden handle for leverage.

Source: Adapted from Williams (1981)

Technology can be a barrier as well as a facilitator for usability. For example, the flat-bottomed skiff is a traditional boat design that is ideally suited for use by shell fishers in shallow tidal water. The invention of the outboard engine offered opportunities for fishermen to be more productive, but mounting outboard engines on flat-bottomed skiffs made them unstable (Williams 1981). A new type of boat needed to be designed to overcome this problem. The Boston Whaler is an example of a modern design that works well in shallow water with an engine.

Adaptation is not always successful from an individual and/or community perspective. It can put an individual at risk, lead to maladaptive behavior, or put other people at risk. For example, if residents of a neighborhood adapt to violence by isolating themselves in their homes, afraid to go out in public, both the residents' quality of life and the health of the community suffer. Design interventions can also lead to negative consequences. Large residential institutions, such as poor houses, mental hospitals, and penitentiaries, were a late nineteenth-century adaptation to urbanization and the resulting increase in crime, poverty, and disability concentrated in cities. But these facilities created enormous barriers to independence and mental health, stigmatized their residents, and corrupted their caretakers (Foucault 1973; Rothman 1971; Sommer 1969). As knowledge about these problems developed in Europe and North America, most of these institutions were dismantled, and new policies of community living and short-term treatment emerged.

Within the context of human evolution, the purpose of design is to help the species increase its survival potential. Design is more than aesthetics, which is primarily a surface effect. Its fundamental purpose is to change the form and organization of our material world and even change how we interact with it. For example, changing the size of schools or developing a gestural language to control computers are both design decisions, even more important than the decision about what color, material, or shape to make the building or computer enclosure. Design is a "soft" tool that extends the effectiveness of human adaptive behaviors.

An environment can provide different degrees of support. Often people are satisfied with lower levels of performance than what could be achieved. Sometimes they accept barriers for some people but not for others. They may even intentionally create barriers to separate certain people from the larger community or one group from another, as in the case of the residential institution. Other goals, such as aesthetics or cost, sometimes may take precedence over the degree of enablement a built environment, product, or system provides.

Universal design, at its most elemental level, seeks to make our built environment, products, and systems as enabling as possible; in other words, it seeks both to avoid creating barriers in the first place and, through intelligent use of resources, to provide as much facilitation as possible to reach human goals. Social and technological trends have converged to put more value on enabling design. We discuss the underlying reasons for these trends in Chapter 3.

Barriers as a Universal Experience

Because the elimination of barriers is so central to the universal design philosophy, it is important to begin this book with an examination of barriers as an experiential and intellectual phenomenon. Doing this will help the reader to understand the potential scope of universal design and the reasons why it is so important in contemporary design thinking.

Any obstacle we encounter can be a barrier to reaching our goals. Barriers may not be complete obstacles but simply resistance of some sort. For example, although a narrow doorway may not entirely prohibit a crowd of people from exiting, it could increase the total time it takes to exit. In an emergency, this can be fatal for some occupants. Other types of barriers are less severe; nevertheless, if many, many minor barriers are encountered in a relatively short period of time, they can be annoying, deter people from reaching goals, and result in the behavioral adaptation of avoidance. For example, driving a car in a congested area for a business appointment may result in many small inconveniences that add up to missing the appointment. A few experiences like that in the same area could result in a decision to seek opportunities elsewhere.

In everything we do, there are barriers: barriers to movement, barriers to space and time, barriers to access, barriers to communication, to perception, or to expression. Although blockades such as walls or locked gates that totally preclude access are obvious, other barriers are not always that easy to perceive. Less obvious examples are steep slopes and inclines, channeling that forces choices and limits spontaneity, discontinuity in flows, distances separating people or things, shortages of space that require people to take turns, noisy places that limit conversation, and cultural markers with little physical substance but high prohibitions on entry. In the world of products, we encounter such barriers as complex operating procedures, excessive forces of operation, ill-fitting equipment and furniture, and things that make us look awkward and out of place in the eyes of others.

A barrier does not always totally exclude use. It can make use difficult, or it can also be a selective barrier that allows use by one group of people and not another or that regulates access by schedule. Moreover, a barrier may be supportive in one sense and restrictive in another. Crime scene tape is an interesting example. It is a very flimsy barrier but one that is very powerful because of its cultural significance and legal implications that force people to avoid an area without significant physical means. Some law enforcement authorities can pass through the marked-off scene while others can enter only with permission. Cubicle farms are another, less obvious type of barrier. They support increased communication among workers on one hand because there are no full-height walls or doors, but they limit our ability to communicate our unique personality, thus creating fodder for a genre of humor about cubicle culture.

If we reflect about encounters with barriers as a general class of experiences faced in daily life, we can conclude that they all impede or restrict the flow of action, information, and communication. Barriers are significant to us in many ways. They can block us out, slow us down, divert us from our goals, cause fatigue, limit our opportunities, or restrict our ability to express ourselves. Barriers can even be used to control people to make them follow a predetermined course of action determined by others, reducing their ability to make choices. Consider, for example, a voicemail menu system or a security checkpoint that forces us to complete a series of meaningless or even degrading tasks to obtain services or benefits.

Barriers in Intellectual Life

While we normally think about barriers as part of our everyday life, they play an important role in our intellectual life as well. The sculptures of Richard Serra are some of the most powerful examples of barriers in art. He constructs huge planes of steel to divide space. When experiencing these sculptures in person, the walls of crude steel are overwhelming. They heighten our perception of barriers and demonstrate the power to separate and divide. Serra's *Tilted Arc* was originally installed as a site-specific work in Federal Plaza, New York City (Figure 1–2).



Figure 1–2: *Tilted Arc*, a sculpture by Richard Serra. Constructed in 1981, this sculpture is a 120-foot- (36.6-m-) long slab of curved steel, 12 feet (3.66 m) tall and 2.5 inches (6.35 cm) thick. It was designed to bisect a public plaza in front of the Jacob Javits Federal Building in Manhattan.

The office workers who regularly used the space complained that the work ruined the plaza, cut off views, created an obstacle to pedestrians, and was a hiding place for criminals. After a long, protracted legal battle, eventually *Tilted Arc* was removed, even though the public had paid for it through a percent-for-the-arts program (Senie 2002). The reaction that this sculpture provoked illustrates the power that barriers have to affect our lives and the anger that people can feel when restrictions are imposed on them. Even though Serra's work was critically acclaimed, the regular users of the space experienced its direct impact, which overshadowed any value it had to them as art. New Yorkers put a high value on accessibility to public places. It is possible that *Tilted Arc* would not have provoked such a reaction in other locations. The story of *Tilted Arc* demonstrates the interpretive component of barriers. One person's art can be another person's symbol of government interference in his or her life.

By its very nature, two-dimensional art creates barriers to perception. That is the source of its power. A two-dimensional image cannot be explored; the artist presents only one perspective to us, and it communicates only a specific intent. The frame of a painting and the bounded edge of a photograph limit the viewer's access to information. We cannot see what is happening outside the frame. Moreover, the static image prevents us from seeing, exploring, and knowing what is beyond the forms within the frame of the art piece. A good example is *Melancholy and Mystery of a Street* by Giorgio de Chirico (Figure 1–3). In this painting, the shadow on the ground is a strong clue to the presence of something outside the frame, something quite foreboding. So much detail is left out of the representation of buildings and space that the painting creates the feeling of the city as an enigma, an unknown place where potentially dangerous events may occur. The fragile image of the child projects a sense of vulnerability that we often feel in some urban streetscapes.

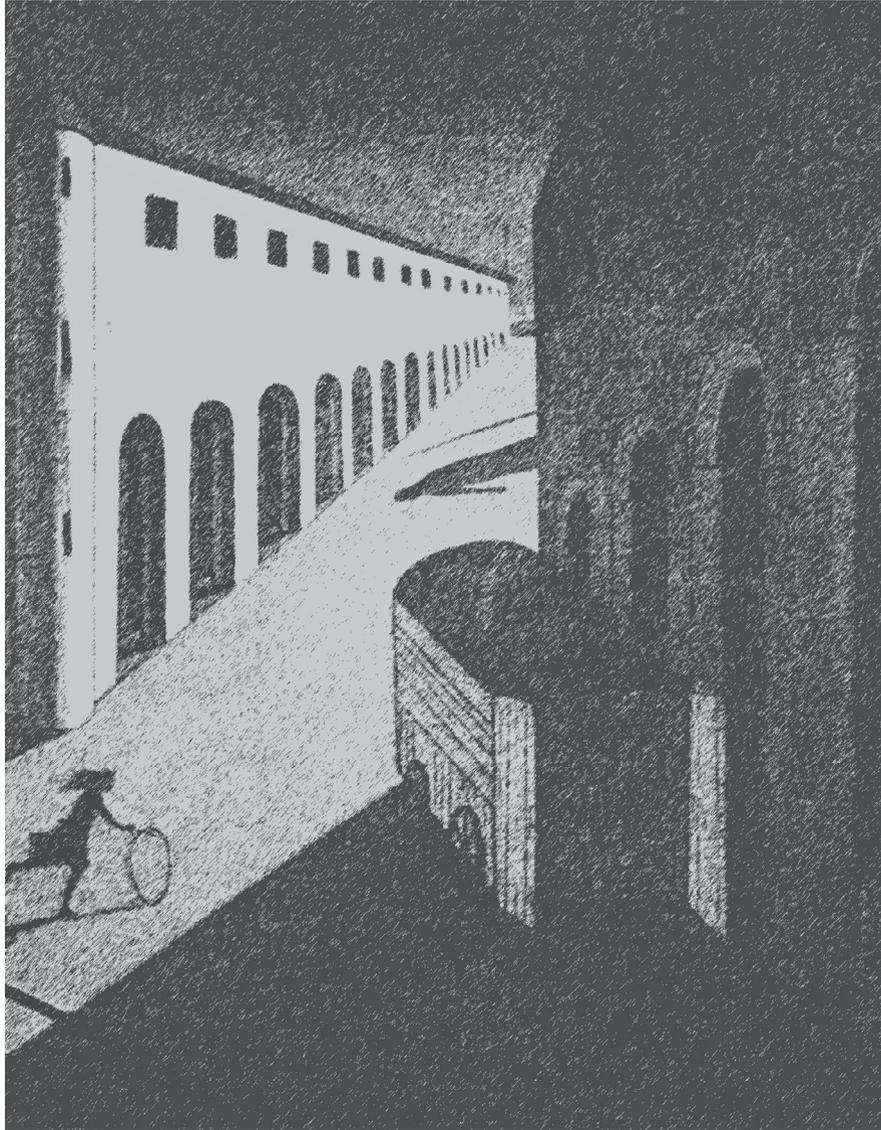


Figure 1-3: *Melancholy and Mystery of a Street* by Giorgio de Chirico, 1914. The painting depicts an urban streetscape with a silhouette of a young girl pushing a hoop along a street. Out of view is a mysterious and ominous figure depicted only by a shadow falling across the street.

Source: Image redrawn by authors.

Physical restrictions are often used as metaphors in literature. One of the most interesting examples is the metaphor of overcoming resistance as a transformation in understanding. In the novel *Snow Falling on Cedars* by David Guterson, a relentless snowstorm serves as a metaphor for the gradual shift in the perception of history and fact surrounding a murder trial. As the snowstorm advances, the world of the island on which the story takes place presents more and more resistance to the activities of daily life. The chief protagonist, Ishmael (undoubtedly a reference to the narrator in Melville's *Moby-Dick*), the town's newspaper publisher and its only

reporter and photographer, doggedly pursues facts about the case as the trial proceeds in the courthouse. As he does so, his perceptions of the case are altered. Here is a quote from the book:

Outside the wind blew steadily from the north driving snow against the courthouse. By noon three inches had settled on the town. A snow so ethereal it could hardly be said to have settled at all. Instead it swirled like some icy fog, like the breath of ghosts. Up and down Amity Harbor's streets. Powdery dust devils frosted puffs of ivory cloud, spiraling tendrils of white smoke. By noon the smell of the sea was eviscerated. The site of it mistily depleted too. One feels the vision narrowed in close. Burned in the nostrils of those who ventured out-of-doors. The snow flew up from their rubbery boots as they struggled. Heads down towards Peterson's Groceries. When they looked out into the whiteness of the world, the wind flung it sharply at their narrowed eyes and foreshortened their view of everything. (p. 170)

The familiar world of the island was obscured. The snow created both physical obstacles and obstacles to perception where none had been before. The storm unfolds as the testimony in the trial makes the first and most obvious explanation of the death harder and harder to understand. But the true facts are not easy to uncover due to the complexity of the human relations leading up to the incident. Later, as Ishmael starts to solve the mystery, the weather changes:

Outside he found the snow had stopped. Only a few scattered flakes fell. A hard winter sunlight seeped through the clouds. A north wind blew hard and fast. It seemed colder now than it had been that morning. The air burned in his nostrils. The wind and snow had scoured everything clean. There was the sound of snow crunching under his feet. The whine of the wind and nothing else. The eye of the storm he knew had passed. The worst of it was behind them. It occurred to Ishmael for the first time of his life that such destruction could be beautiful. (p. 427)

As the storm clears up, in the clarity of the bright sunny day framed by the virgin snow, barriers disappear, the murder mystery is solved, and the townspeople's perception is altered. They see things in a new light.

The barrier of disorientation has been used heavily as a metaphor in literature. In the famous existentialist novel *The Castle* by Kafka, a surveyor named K arrives at a town to which he has been summoned by a government official to do some work. K spends much of the story trying to contact the official who works and lives in the castle on the hill above the town. He does not know what is required of him and is unable to get a clear idea of whether he will even begin his work. Throughout the story, he is never able to make contact with the official or anyone else in the castle except through a messenger and other second- and third-hand sources. K suffers bouts of disorientation, disillusionment, and distraction. The most enduring image is of K trying to get closer to the castle, becoming confused by the labyrinth of streets in the town and never finding it. In fact, the closer he seems to move toward the castle, the farther it seems to recede in the distance.

The castle could be a symbol for life as a search for purpose. The inability to obtain clear "instructions" for life leads to a feeling of unease. This gap of understanding creates the psychological feeling of being lost and adrift, disoriented without purpose. This is a universal feeling that we have all experienced at one time or another as we try to understand the mystery of life.

Barriers as metaphors in film are also common. Consider all the *Die Hard* and *Lethal Weapon* films in which the heroes encounter incredible adversity and, of course, overcome it all by

cleverness and toughness. But communication and emotional barriers are also fertile subjects for film. In Wim Wenders's movie *Paris, Texas*, space is used as a metaphor for psychological distance between people. The protagonist seeks to reconstruct his family after his wife has left him and their child. The empty barren Texas plains that he travels through on his quest to find her symbolize the emotional distance between them. When he does find his wife, she is working in an adult entertainment shop. He can only see her by buying time and talking through the glass of a peep show booth. This scene uses barriers in space and access to information as a powerful comment on the gulf between estranged partners. The movie highlights the role of negotiations, power, and desire in the relationships between men and women.

Barriers play an important intellectual role in scientific endeavor. Much like the fictional K, real scientists are forever running up against barriers to knowledge and understanding. In fact, it could be argued that the desire to uncover knowledge and overcome those barriers is a prime motivator behind the scientific endeavor. One good example is the limitation on our powers of perception to observe the workings of the universe. Even using telescopes, microscopes, and scanning devices, we cannot uncover or record phenomena beyond certain levels.

Beyond the physical, there are intellectual barriers in science as well. Science evolves through systematic research. Observations that do not fit within the established theories are identified. As these unexplained phenomena add up, they precipitate critical periods in the history of science when shifts in thinking, or new paradigms, occur (Kuhn 1962). Old theories are replaced by new or improved theories. The scientific "breakthrough" removes artificial restrictions on thinking within a limited frame of ideas and provides a new intellectual perspective to conduct further research. The two most obvious examples in the history of scientific paradigm shifts are the change in the conception of the world as a flat surface to a sphere and the shift from the belief that the sun and planets revolve around the earth to the understanding that the earth and other planets all revolve around the sun.

The experience of barriers in both everyday human life and intellectual life clearly is a central phenomenon of human existence. Not only do barriers serve to limit our everyday actions, they also can alter our perceptions and our understanding of the world, our place in it, and our sense of purpose. It is no accident that barriers play an important role in the life of the intellect as well as in the more ordinary aspects of human experience. The common shared experience of barriers in daily life makes them a ripe subject for intellectual curiosity and useful as metaphors to communicate universal truths.

Social Functions of Space

Barriers clearly play a major role in design at all scales. It is important to note that the same physical features can both facilitate and impede the achievement of goals. The most obvious example is how a door can simultaneously protect a home from unwanted entries (prevent people from coming in) while also providing privacy for the household (prevent information from going out). Another example is a toll road that both facilitates social interaction and excludes those who cannot afford the toll. A third is the mobile phone, which facilitates communications but also may increase interruptions. Thus, the barrier, as used here, is a psychosocial construct, not the physical feature itself. This psychological nature of barriers is always open to interpretation by individuals and groups. Understanding those interpretations is a major focus of universal design.



Figure 1-4: Public marketplace. This market is located in a public square in Stockholm, Sweden. Each vendor has a stand with a tent-like structure providing weather protection. All the stands are the same size and arranged in rows.

The relationship between the social order and spatial order of society is one of the most important topics in universal design. Ordering space is achieved by claiming space through protective or legal boundaries that control access to the resources within. This activity is called territorial behavior. Some territories are private and used exclusively by one person; some are shared by a few, and some are public in that a large number of people share them. Figure 1-4 shows two examples of territories in one space, a public marketplace with stalls that are owned, at least temporarily, by individual vendors. Objects can be part of territorial behavior; some objects, such as automobiles and camping tents, are territories themselves, although mobile rather than static. Claiming space is an innate behavior exhibited by all animals, not a behavior unique to humans. All animals defend and control access to places and things for their own benefit. Territorial behavior has survival value. It ensures predictable access to resources. It protects assets from being taken by another animal, helps organize social relationships, and communicates important rules of behavior within a group or species. Literal examples of territorial behavior among humans include the building of fences and walls to demarcate one's property, separating it from a neighbor's; protected national borders; and no-trespassing signs. The spatial distance that we normally keep between us and others, or the body buffer zone, is an example of a portable territory that is not tied to one particular set of spatial features but is a short-term claim on space (Hall 1969; Sommer 1974).

The resources that generate claims on space and objects are quite diverse. Territoriality may involve claiming strategic locations for commerce or defense. A good example in contemporary culture is how Starbucks attempts to dominate a coffee market in certain neighborhoods by claiming the most exposed locations on every street corner. Physical attributes of an environment or an object can be resources for their own sake. Thus, a home site with a good view of an ocean is a very desirable property; a comfortable chair may become a regular visitor's

favorite seating location in the shared space of a library reading room. Proximity to other people can be one of the resources that people seek in claiming territory—for example, living in a high-status neighborhood or an arts district. Information can also be a desirable resource—an office located close to the leader of a work group is desirable for an aspiring executive, providing opportunities to share information (Steele 1986). Finally, sometimes it is the absence of something that makes a place desirable as a territory, as in a quiet neighborhood or distance from neighbors.

People, like many other animals, mark territorial boundaries to identify owners and communicate information about their social status. Shared understandings about these markings develop within a culture, including precise legal definitions. Social relations are reflected in both the pattern of territory and the markings used. These patterns and markings denote and connote many aspects of social relations, including social dominance and roles, such as gatekeeper or boss, and class. As an example in architecture, during the Renaissance in Italy, each urban estate house, or palazzo, was divided vertically into a servant floor, a *piano nobile* (“noble floor” or “noble level,” the main floor in a Renaissance building), and living quarters. The spatial organization of a palazzo reflected the degree of access that different classes of outsiders might have to the inhabitants and the social status of different types of inhabitants as well. Stable hands did not get access to the *piano nobile*; family friends were entertained there but did not necessarily get access to the living quarters.

Privacy is the process of adjusting control over information about the self to desirable levels. It is a second function of barriers, often used in conjunction with territorial behavior. In privacy behavior, the physical and virtual environments are organized to control information flows between people. We need such control for many reasons, such as preventing negative information about the self from being known, maintaining security of financial information, or simply to provide an opportunity for self-reflection, free from the need to be “on stage” in social relations. The design of space, through physical boundaries, distance, and spatial organization, is a method used extensively to control the flow of information. Many boundaries created to maintain privacy are purposely adjustable because the desired state of information control varies over time. Closing and opening doors, gates, and curtains and other flexible boundaries help us achieve the state of privacy we desire. The desired level of control is based on the social interaction goals, emotional state, or activities of individuals and groups. Clearly, privacy behavior also can erect barriers to communication. The teenager who locks himself in his room to avoid his parents is a good example. Designing for privacy is also evident in the virtual world. The best examples are social networking Web sites through which individuals communicate their online identity but also restrict access to classes of people, such as friends, relatives, and colleagues.

Identity behavior is the third key function of barriers. People communicate important information to each other during social relations, which include friendships, work, education, politics, love, and rituals, such as religious activities. For example, we need some means to identify who is the teacher and who are the students, we need to know who is qualified to build a house or prescribe medication, we need to know how to recognize a police officer, and we need to know who our potential partners, friends, and enemies might be. If we are a teacher, a doctor, or a police officer, we use identity behavior to convey our status and obtain respect. If we are looking for a relationship, we use identity behavior to advertise who we are in order to attract a compatible person.

Territoriality and privacy are both two spatial practices that we use to manage identity. For example, territorial markers are often used to convey information about the owner of the