

# **SIMULATION OF MOBILITY IMPAIRMENT: EXPERIENTIAL LEARNING TOWARD UNIVERSAL DESIGN**

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## **Abstract**

*Universal design can be an elusive concept, even for the student of design or for the practicing designer. Simulation is a powerful learning tool for breaking through existing perceptions and opening the door to understanding and commitment to the concept of universal design. This paper reports on the use of simulation of mobility impairment through a wheelchair exercise by interior design students in a universal design course. A description of the exercise assignment is followed by excerpts from student essays that demonstrate the power of simulation as an active learning tool to sensitize design students to the needs of persons who use wheelchairs, and to enable them to “think” universal design in all design solutions.*

## **Introduction**

Universal design can be an elusive concept, even for the student of design or for the practicing designer. Yet interior designers are expected to take leadership roles in the application of universal design concepts (Null, 1988). Sensitivity to the needs of people with physical disabilities is necessary if designers are to create designs that go beyond the technically accessible into the realm of redesign of elements with improved functionality for the maximum number of people (Wilkoff & Abed, 1994). Increased sensitivity to diverse needs of users can foster an internal motivation for universal design solutions, so that designers no longer rely upon external mandates (Powell & Roberts, 1994).

Attitudes toward persons with disabilities can affect professional-client interactions. “Students in professional preparation education programs need to recognize the relationship between their own attitudes and their ability to provide beneficial service to individuals with disabilities” (Lynch & Thomas, 1994). Though the authors are speaking to rehabilitation professionals specifically, the advice is appropriate for other pro-

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professionals, including designers. A common perception that persons with physical disabilities are “victims” is portrayed in the media, and in the general public, through imagery and language (Lynch & Thomas, 1994). Such negative stereotyping of people with different abilities displaces attention from what they can do to what they cannot do, creating a negative model of interaction and problem-solving.

Research has shown that favorable attitudes toward persons with disabilities seem to be a function of familiarity and positive previous experiences (Levy, et al., 1993). This finding reinforces the need for emphasis and application of universal design concepts in the professional education of designers, as well as in design practice. When, through faulty or insensitive design, the built environment excludes people with physical impairments, the opportunity to develop positive interactions is reduced. When the built environment is inclusive, people’s differences with respect to person-environment interactions are deemphasized. To accomplish the aims of universal design, design education must first increase students’ understanding of the wide range of human needs and, thus broaden their scope of consideration in design problem-solving.

In the design classroom, game playing has been used to foster student empathy with user needs, an empathy that has led to more creative solutions (Canestaro & Wilson-Fauerbach, 1993). Simulation of physical disabilities by those without disabilities is another mode of developing the awareness and appreciation necessary to develop sensitive design solutions (Pastalan, Mautz, & Merrill, 1973). Simulation is a recognized strategy to promote active learning in the classroom (Meyers & Jones, 1993), and is an accepted method of behavioral research concerning physical handicaps and sensory deficits (Sommer & Sommer, 1986). “Behavioral simulations are imitations of actual situations. They are intended to resemble the true situation in many of its functional characteristics without being mistaken for that situation” (Sommer & Sommer, 1986, p. 77). Simulation has validity when it is sufficiently realistic without being overly stressful for participants.

This article reports on the use of simulation of mobility impairment through a wheelchair exercise in a junior-level course on universal design. Many programs already use such an activity, and others are encouraged to consider it. The power of simulation as a learning tool for breaking through existing perceptions and opening the door for understanding and commitment to the concept of universal design is illustrated through description and discussion of the purpose, process, and outcomes of the exercise.

### **Course Description**

The universal design course represents an evolution in course development from a primary emphasis on barrier-free concepts to a consideration of the full range of user needs. Special needs of elderly people and persons with physical disabilities (mobility-, visual-, and aural-impairments) are studied. Content is delivered through a one-hour lecture class and is applied in a co-requisite two-hour studio. In the lecture class students are introduced to clientele with special needs through a variety of assignments: sharing of personal knowledge and experience, discussion of readings, interviews with older people and persons with disabilities, exercises, and

simulation experiences. Because of the extent of existing and potential barriers imposed by the built environment upon persons with mobility impairment, especially users of wheelchairs, mobility impairment receives special emphasis.

The idea for the wheelchair exercise first developed in a design-for-special-needs course, as another method to acquire user information along with reading, interviewing, and observation assignments. Although the exercise was first included as an optional assignment, upon the advice of many students who did the exercise, it is now required of all interior design majors enrolled in the universal design course.

## **Project Description**

### ***Purpose***

Lack of awareness rather than unconcern can limit a student in understanding the need for universal design. Students who have never been excluded, or have not witnessed the exclusion of others, by design of the physical environment cannot fully appreciate the necessity for design to be more broadly based. The wheelchair exercise breaks open their awareness to this need, and causes them to confront, through their own experience, their own and others' attitudes toward mobility-impaired persons. The purpose of the wheelchair exercise is to have students experience the physical environment from the perspective of the mobility-impaired person, reflect upon this experience, and use it to better understand and to appreciate the goals of universal design.

### ***Process***

Each student completes a 30 to 45 minute exercise outside the regular class period. A list of suggested activities is provided, but students have flexibility to construct their own exercise experience. The only specific requirements are that they not go off-campus, that they remain seated throughout the exercise, and that they work in pairs. Having a partner along not only prevents the student doing the exercise from "walking away" to get around barriers that are encountered, but provides a sense of safety and moral support as well. The partner is not allowed to "push" the student during the exercise.

Each student writes an essay describing her/his own personal experience of the exercise. In the essay, students record the activities they complete, identify specific physical barriers and difficulties they encounter, and include evaluative responses to their experiences, noting the feelings and observations that arise from negotiating even a familiar environment in a wheelchair. The essays conclude with the students' reflective thoughts on how the exercise experience may influence them as future designers.

### ***Outcomes***

On the day the essays are due, students share their experiences with other class members, first in small groups, then to the class as a whole. This discussion is important to dispell any lingering negative impressions of the experience, and to use frustra-

tions that have been experienced with the physical environment as a foundation to reinforce emerging perceptions of the need for universal design. The simulation exercise is scheduled during the term just prior to a visit to the class by a person who uses a wheelchair, so that students will have a broader experiential base for dialoguing with a client who has a mobility problem.

The essay is assigned a point value of 50 points, and is evaluated on completeness (10 points), quality (15 points), and evidence of learning (25 points). The exercise is used as a reference throughout the term in the class and in the co-requisite studio to help students formulate and critique solutions to design questions and problems. Other results have occurred, as well. During one term, the students confined their exercises to the lecture rooms, studios, and offices in the department; their experiences led to changes in the arrangement of teaching facilities, and to the purchase of height-adjustable drafting tables for one studio.

### **Student Responses to the Exercise Experience**

Over the past seven years, approximately 130 students have completed the exercise and written essays about their experiences. The insights and learnings from direct experience using a wheelchair are both broad and deep. Changes in attitudes about people who use wheelchairs, and about the design of the built environment, are reported, along with increased awareness of how people who use wheelchairs are perceived and treated by the ambulatory in our society.

Extensive excerpts from the students' reports are included below to show the extent of new insights gained by students, and to convey the richness of the exercise experience as a learning tool. The feelings expressed reveal students' attempts to struggle with the unfamiliar experience of mobility impairment and their shifting perceptions about the suitability of the designed environment and the myriad ways in which it imposes barriers upon a person in a wheelchair. Their language is also descriptive of their relative unsophistication and lack of experience with people who use wheelchairs. Even though emphasis upon the person, not the physical disability, is stressed in the class, such phrases as "confined to a wheelchair", "wheelchair bound", and "trapped in a wheelchair" are used, along with more acceptable descriptors as "people in wheelchairs", "persons with disabilities", sometimes by the same student in the same sentence or paragraph. This mixture in reference is indicative of emerging shifts in perceptions and is reflective of the learning process that is underway.

Student responses are organized into four categories, derived from a thematic analysis of 72 essays. Major themes were listed for each essay, and clusters of themes were identified by grouping similar themes across all essays (Sommer & Sommer, 1986). The topics, or themes, show a progression of insights gained as students experience the exercise: from anticipating the exercise, to initial experience of using a wheelchair, to changing perceptions about the built environment and people with mobility impairments, to dawning realization of the need for re-thinking design of the built environment to be more inclusive of people with special needs.

### ***Anticipating the Exercise***

Students approach this assignment with various attitudes, some anticipating the challenge as fun and exciting, others with dread and anxiety. One student said, “When I first heard of this exercise I was very intrigued and excited about it; I thought it sounded fun, in a strange way. When actually doing the assignment, I realized what an educational experience it really was.” Another student confided, “Through my semesters [here], I had heard several stories of the famous ‘wheelchair exercise’, so I was a little apprehensive.” Some students approach the exercise with false confidence, as reported by this student: “After watching as my partner toured and troubleshooted the building via wheelchair, I thought that I would have no problem. I had seen most of the pitfalls and expected that I would be able to avoid them. I was wrong.”

Another student wrote:

For my wheelchair exercise I chose to eat in the cafeteria, and browse the bookstore at the Student Union. I didn’t think this would be particularly hard, because I often see wheelchairs at the Union and the people using them seem to be quite comfortable. However, I was quick to realize that this was not due to the Union being “handicap accessible”; these individuals have simply adapted to the environment. I am sorry to say that I could not adapt during this exercise and remained awkward and miserable throughout it.

### ***Experiencing the Environment in a Wheelchair***

One of the limitations of using simulation as a research or learning strategy is that the experimenter is thrown immediately into an unfamiliar situation. It takes some trial and error using a wheelchair before the user begins to adjust to its operation. Most students report the need for this accommodation before actually starting the exercise. For example, one student’s descriptive report said:

As soon as I was seated, I discovered that the problems did not lie only in the building itself, but in my own capabilities of maneuvering the chair. It was not as simple as it looked. Training my arms to do what is normally done by my legs was very difficult and awkward. I did not just sit down and start rolling, but instead I tested my new wings for a moment so I wouldn’t run into a wall or another person. Turning required a lot of coordination between both of my arms as well as my head. I frequently had the urge to look for the handlebars! Also, the temporary “transformation” from a fully abled individual to an assisted one was quite strange. I felt as conspicuous as a red pepper in a jar full of green ones.

The “transformation” this student refers to is a common experience, according to reports in the essays. Negative feelings are often mentioned, students’ attitudes about themselves, their experiences, and their perception of how they are seen by passers-by during the exercises. Fear, anger, and frustration are commonly reported, as well as feelings of being stared at, and worry that their slow movement will hamper the “normal” progress of people behind them. Feelings of being different, set apart, ignored, and somehow inferior are also reported. One student summarized her feelings this way:

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As soon as I sat in the wheelchair, barriers began to appear before me...Sitting in that chair set me apart from others. It made me feel inadequate and I felt unable to do what others were doing. The frustration of searching the entire building for facilities I could use turned to anger when I found that even though they were marked "accessible", I still struggled to use the facility.

Other students reported:

The moment I sat down in the chair I felt different. It was as if I had completely alienated myself from the rest of the campus...People walked by and pretended to act as if I didn't exist. Those who were brave enough to stare, looked quickly away as soon as we made eye contact.

Being seated while everyone around you is standing puts you at a lower physical level. You are no longer "equal". Others must physically look down to you. This is quite a different feeling.

Something I noticed throughout the exercise is the way people looked at me. I did get a noticeable amount of staring from other people on campus. This may be due to the fact that there are not many people in wheelchairs on campus, at least that I am aware of, and people aren't accustomed to seeing disabled people. This leads me to think about some of the social implications that are placed on disabled people.

Having done this exercise, I now know much needs to be done to improve our environment....I can't imagine experiencing the frustration and helplessness I felt day after day. I'm sure that one may gain control over a wheelchair with practice, but they should also be able to have control over their environment through accessible and adaptable design.

These comments show the impact on the students of directly experiencing both the built and social environments from the perspective of a person who uses a wheelchair. Their astonishment at the barriers imposed by the built environment on someone in a wheelchair is evident in the tone of their comments. They begin to see familiar places from a different perspective. Even though the experience is temporary, and undertaken without prior preparation to gain acceptance and ability for using a wheelchair, the frustrations with barriers imposed by the environment are a necessary dynamic in the students' process of realizing the practical realities of universal design. In directly experiencing the negativity of being excluded by the physical environment, and by people's attitudes toward persons with disabilities, students come to understand the need for design to be inclusive. The wheelchair exercise is a step in that direction.

### ***Respecting Persons With Mobility Impairment***

Completing the exercise generates respect among students for individuals who routinely use wheelchairs and must contend with barriers, both physical and social-psychological, every day. It is often with a feeling of relief and renewed appreciation for

being without disabilities that the exercise is concluded. Students confirm the importance of the exercise in recommending that all design professionals have similar experiences.

I have a whole new respect for wheelchair users after having done this project. I feel everyone should have to do this, no matter what field they plan to go into. I will now think about universal design for every project I do, not just for this class.

There is a saying that you can't judge someone until you've walked a mile in their shoes. Well, I think that saying should have the phrase "or spent a day in their wheelchair". Although my experience in a wheelchair was short, I believe I got the feel of how difficult simple tasks can be if you are confined to a wheelchair.

This experiment let me realize that wheelchair users deserve a lot of credit and respect. It would not be easy living in an environment that in some ways discriminates against you. Our accessible environment that we often take for granted is a wheelchair user's handicap. They are challenged with doing things that an able person does every day without giving it a second thought.

The respect which students develop for people who use wheelchairs is the beginning of recognition of those persons' abilities, and to looking beyond their disabilities as a basis for design. This attitude is reinforced when the students meet and dialog with a young professional woman, who happens to use a wheelchair, who visits the class to discuss ways she has adapted both her home and work environments to accommodate her needs.

### ***Committing to Universal Design***

Students come away from the exercise experience not only with a firmly grounded awareness of the need for barrier-free design, but of the importance of designing beyond the minimums and for the need for universal design. These kinds of insights are revealed in the following remarks:

After my wheelchair experience I feel that I have a greater understanding of what special considerations are to be taken when designing a space that is to be accessible to everyone. I believe that universal design is a wonderful concept. People in wheelchairs should be able to move around as easily as a person who can walk. I believe that people who are in wheelchairs are handicapped by the designs of those who do not take their needs into consideration, not by their wheelchairs.

Encountering the many barriers the disabled person has to deal with, I understand the need for designing spaces, objects, and object location so that people restricted to wheelchairs can take care of themselves. I see now that it's our lack of sensitivity to understanding how things need to be changed so that all people,

the disabled, elderly, children, as well as the so-called average person, can exist equally in the man-made environment.

Most important, I realized that minimum standards for wheelchair accessibility are uncomfortably less than generous. This exercise forced to my awareness the importance of designing for *comfortable* accessibility, provision of options, and for adjustability of surfaces.

Now I feel I can design for wheelchair users better because I have tried to experience some of the obstacles they have to encounter. I can also better understand the measurements it takes to maneuver a wheelchair and how to apply them in certain situations. Hopefully, by doing exercises like this, and trying to understand what it's like to be in a wheelchair, I will be able to provide interiors that are both functional and aesthetically pleasing for both wheelchair users and ambulant persons. I'm glad I did this exercise; I think it gives great insight to design implications for wheelchair users.

These reports demonstrate the students' sense of responsibility to broaden their concern about human needs related to design. The insight into the limitations of designing to accommodate minimum accessibility requirements shows an openness to rethinking design solutions, rather than accepting modifications of existing problems. This new paradigm in thinking is fundamental to the universal design concept. The wheelchair exercise is a step in the direction of appreciating the abilities of people with impairments, and getting beyond their disabilities as a basis for design.

### **Summary**

Universal design is inclusive design. New and creative design solutions are necessary to move design beyond "barrier free". An experience base gained through simulation can begin the process of sensitizing potential designers to diverse needs of people with varying abilities, and can provide the impetus for implementing the intent of universal design.

The responses from student essays included in this paper are testimony to the value of having design students simulate mobility impairment through a wheelchair exercise. The active experience of meeting and grappling with physical and social barriers common to the wheelchair user heightens awareness of the relationship between design of the environment and human needs, and changes perceptions about people with mobility impairments. By placing themselves in the position of the person with a physical disability, students build direct experience, however brief and temporary, that they can draw upon when solving design problems. Such concrete experience reinforces classroom learning, and increases the potential that students will commit to universal design in the classroom studio, and as practicing designers.



### References

- Canestaro, N. C., & Wilson-Fauerbach, D. (1993). Teaching design by feeling or thought. In L. Nissen, (Ed.), *IDEC Conference proceedings* (pp. 28-30). Coeur d'Alene, ID.: Interior Design Educators Council.
- Levy, J. M., Jessop, D. J., Rimmerman, A., Francis, F., & Levy, P. H. (1993). Determinants of attitudes of New York state employers towards the employment of persons with severe handicaps. *Journal of Rehabilitation*, 59 (1), 49-54.
- Lynch, R. T., & Thomas, K. R. (1994). People with disabilities as victims: Changing an ill-advised paradigm. *Journal of Rehabilitation*, 60 (1), 8-11.
- Meyers, C., & Jones, T. B. (1993). *Promoting active learning: Strategies for the college classroom*. San Francisco: Jossey-Bass Inc.
- Null, R. L. (1988). A universal kitchen design for the low-vision elderly: Research applied in practice. *Journal of Interior Design Education and Research*, 14(2), 45-50.
- Pastalan, L. A., Mautz, R. K. II, & Merrill, J. (1973). The simulation of age-related sensory losses: A new approach to the study of environmental barriers. In W. F. E. Preiser (Ed.), *Environmental Design Research* (pp. 383-392). Stroudsburg, PA: Dowden, Hutchinson, and Ross, Inc.
- Powell, B., & Roberts, C. (1994). Strategies for implementing universal design concepts in the design curriculum. In L. Nissen (Ed.), *IDEC Annual Conference Proceedings* (pp. 30-32). San Antonio, TX: Interior Design Educators Council.
- Sommer, R., & Sommer, B. B. (1986). *A practical guide to behavioral research*. (2nd ed.) New York: Oxford University Press.
- Wilkoff, W. L., & Abed, L. W. (1994). *Practicing universal design, an interpretation of the ADA*. New York: Van Nostrand Reinhold.