Using Ergonomics to Provide Enhanced Accessible Environments for Disabled Travellers

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Abstract— The present study is geared toward establishing, documenting, and evaluating the accessibility of travel accommodations for people with disabilities. Even though there are many accessible designs and standards exists nowadays such as the American with Disability Act standards (ADA), UN Convention on the Rights of Persons with Disabilities, and the Universal Design techniques (UD), many disabled travelers still faces challenges when they need to stay at hotels due to the inaccessibility of their accommodations. A survey was conducted to assess why some accessible hotel rooms are not disabled-friendly and it was discovered that many of the accessible room configurations lack the consideration of ergonomics and anthropometry of guests and hence, inaccessible environments.

People with disabilities are an integral part of any community, and they must be fully and actively integrated in all activities of their communities. Any form of discrimination, whatever its nature; can lead to a kind of social exclusion. To avoid any form of social exclusion, it is necessary to provide accessible environments for all individuals, whatever their profile or capacity. Presence of such facilities lays the foundation needed to redefine disable members of any society as contributors and active members in the society as oppose to consumers of societal resources. Surely, the society and policy makers should do all necessary efforts to ensure and design environments that meet the needs of all members of the community, including of course people with special needs.

The assessment of accessibility was a topic for many researches in various fields such as urbanism and planning, architecture and design, rehabilitation, etc. One of the common methods to measure accessibility is find how much an environment is compliant with norms and standards. The American Disabilities Act (ADA), for example, highlights the most important guidelines and norms that must be taken into consideration while constructing a new environment, or analysing an existing one. This study, however, is an attempt to integrate human factors and its applications to enhance the design of accessible hotel rooms by highlighting any shortcomings in current practices and suggest solutions that would fit the person with disability including the assistive technology that he/she is using to the environment, i.e. hotel room.

The research started by collecting a number of complaints from hotel guest regarding their experience with accessible rooms through the internet. The complaints were analyzed and we have found that it varies by the kind of disability and the hurdles encountered. Then, we categorized best practices in terms of accessible hotel accommodations from many standards and laws and then attempt to identify apparent shortcoming of the accessible room accommodations in the built environment. The study found out that many of the shortcomings could be avoided if the designer of the accessible room consider human factors principals such as maximum reach of the hand, arm strength, etc.

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The ultimate goal of the study was to present to the hotel industry best practices regarding accommodating guest with disabilities. This would include simple ways to know guest needs before checking him into accessible rooms and practical ways to fit the room to person with disabilities with full illustrations. This research discusses the practical implication and lessons learned from integrating human factors considerations and techniques to accommodate person with disabilities.

Index Terms— Accessible built environment; Ergonomics; Universal Design; Human Factors.

I. INTRODUCTION

People with disabilities are an integral part of any community, and they must be fully and actively integrated in all aspects of their communities. Full accessibility to any environment or situation they may need is an essential part to integrate them in society and allow them to play their role in life. Any form of discrimination, whatever its nature; can lead to a kind of social exclusion. Social exclusion is 'a constraints-based process which causes individuals or groups not to participate in the normal activities of the society in which they are residents and has important spatial manifestations' [1]. To avoid any form of social exclusion, it is necessary to provide accessible environments for all individuals, whatever their profile or capacity. Presence of such facilities lays the foundation needed to redefine disable members of any society as contributors and active members in the society as oppose to consumers of societal resources. Surely, the society and policy makers should do all necessary efforts to ensure and design environments that meet the needs of all members of the community, including of course people with special needs.

II. LITERATURE REVIEW

The assessment of accessibility is a topic for many researches in various fields such as urbanism and planning, architecture and design, rehabilitation, etc. One of the common methods to measure accessibility is find how much an environment is compliant with norms and standards. There are many accessible designs and standards that exists nowadays such as the Americans with Disability Act (ADA) standard, UN Convention on the Rights of Persons with Disabilities, and the Universal Design (UD) techniques. The Americans with Disabilities Act (ADA), for example, highlights the most important guidelines and norms that must be taken into consideration while constructing a new environment, or analyzing an existing one [2].

Universal Design may be literally defined as the 'design for all'; it focuses on all users, to the greatest extent possible, without the need for adaptation or specialized design [3]. This design approach highlights a philosophy of design that accommodate the widest range of human abilities. By adopting this philosophy, universal design prevents the

exclusion of people because of their different abilities, which are generally not considered as belonging to 'the normal population'. Conversely, by adopting the universal design approach, all users are considered as belonging to only one population that comprises of individuals with heterogeneous characteristics and abilities [4]. According to the Center for Universal Design in North Carolina State [3], the Universal Design has seven main principles, which are:

1- Equitable use: Usable and marketable to people whatever their abilities or disabilities.
2- Flexibility in use: Accommodating a wide range of individual preference and abilities.
3- Simple and intuitive use: Easy to understand, regardless of experience or cognitive abilities.
4- Perceptible information: Communicating required and useful information effectively, regardless of ambient conditions or sensory abilities.
5- Tolerance for error: Reducing hazards and undesired consequences of accidental or unintended actions.
6- Low physical effort: Can be used efficiently and comfortably, with a minimum of physical and cognitive cost.
7- Size and space for approach and use: Appropriate size and space for approach, reach, manipulation, and use regardless the physical characteristics of individuals.

Based on the principles of 'Universal Design', several governments and authorities have issued norms and guidelines that aim to ensure the construction of environments that are accessible and barrier-free such as U.S. Department of Housing and Urban Development [5], and U.S. Architectural and Transportation Barriers Compliance Board [6].

In the USA, hotel and lodging facilities must comply with the 1991 ADA law and the 2010 revision of ADA law. The 2010 revision of the ADA was focused on [7]:

• Places of public accommodation such as hotels, restaurants, fitness centers, etc.
• Prohibition of public accommodations from denying services to individuals with disabilities.
• Protecting individuals with disabilities and individuals associated with disabled individuals.
• Making goods and services available to individuals with disabilities on an equal basis with general public.
• Make goods and services usable by people with disabilities.
• Requiring the removal of architectural and structural barriers in current facilities.

The hotel industry acts in accordance with these standards by employing engineering solutions to provide accessible accommodation for guests with special needs in accordance with the law. All hotels in the USA must offer what is called "ADA accessible rooms" following the guidelines of the ADA for hotels and lodging facilities.

These norms and guidelines have helped substantially to reduce social exclusions due to the characteristics of the physical environment in which people with disabilities carry out their daily activities. Despite these laws and regulations, many hotel guests with special needs find it difficult to locate accommodations that suit their particular need when traveling [8]. The problem of inaccessible hotel rooms was also apparent in many complaints collected in this study by searching the internet. Many of the complaints analyzed in this study could be easily avoided if basic ergonomics / human factors principals were employed when designing accessible rooms for hotel guests. Ergonomics discovers and applies information about human behavior, abilities, limitations, and other characteristics to the design of tools, machines, systems, tasks, jobs, and environments for productive, safe, and comfortable human use [9].

In this study, we attempt to integrate human factors and its applications to enhance the design of accessible hotel rooms. It is necessary to highlight any shortcomings in the current practices and suggest solutions that would fit the person with disability (including the assistive technology that he/she is using) to the environment, i.e. hotel room.

III. METHODOLGY

To assess the degree of satisfaction of disabled travelers, we started to collect a number of complaints regarding the adequacy of hotel accessible rooms. The internet was a good choice to search through many specialized magazine and web sites for the disabled. Then, we categorized best practices in terms of accessible hotel accommodations from many standards and laws and then attempt to identify apparent shortcoming of the "handicapped accessible rooms" accommodations in the built environment. The shortcomings of the accessible rooms were then further examined to find out ways to remedy the problems using human factors principals.

IV. DISCUSSION

What was interesting is that the search for the satisfaction with accessible accommodations revealed that many disabled hotel guests were complaining about their accessible room experience. All the complaints were about ADA approved accessible rooms. It was thought provoking to figure out why many guests with special needs say that their accessible rooms are not "accessible" enough for their specific needs. Table (1) give some examples of the complaints including the accessible fixtures, the reason for the complaint, and the source from which we obtained the complaint.

Table 1. Complaints about accessible fixtures

Accessible Fixture	Complaint	Source
Role in shower	Can't turn on water	Freewheelintravel.org [11]
Elevated toilet seat	Too high	Tripadvisor.com [10]
Room Guide	Should be in Brail	Ricksteves.com [12]

The complaints were then individually analyzed to figure out any shortcomings in the current standards in the built environment. The analysis of two of the complaints follows in the next section.

Role in showers are great feature for some guests with disabilities but not for all of them. Figure (1) depicts a typical configuration for the role in shower.

Fig. 1. Role in shower.

The configuration allows persons with mobility problems to shower without having to get into the tub. In addition, wheelchair users can get close enough to the seat and transfer with ease. As indicated in fig. (1), the user must be able to reach the knobs to operate the water. If the person were unable to walk however, it would be impossible for him to operate the water while he is on the seat without requiring assistance from another person. It is obvious that this configuration violates the human factor principal of maximum arm reach. This illuminates why some hotel guests on wheelchair will complain if they were accommodated in a room with similar role in shower. A simple yet an effective solution is to use a role in shower configured such as in fig. (2) where all users can shower independently.

Fig. 2. Modified role in shower.

People with hip problems will appreciate a room with an elevated toilet seat. The elevated seat shown in fig. (3) is permanent, which means it should fit all users.

Fig. 3. Elevated toilet seat

Some hotels surveyed in this study have their entire toilet seat elevated. Off course, this violates the use of anthropometry principal when fitting people to the environment. Some users, for instance people who suffers from polio, have no or weak hand and leg strength, which make it difficult for them to use these kind of toilet seats. A simple yet an effective and ergonomically sound solution is to use adjustable seat covers such as the one depicted in fig (4).

Fig. 4. Adjustable toilet seat

Such configuration will allow varying the elevation and maintains the original seat cover to use if needed.

Many accessibility problems encountered during this study, such as the above two, could be easily avoided if the designer of the accessible room took advantage of human factors principals, know the limitations of human body, and apply common sense. The complaints were analyzed and we have found that it varies by the kind of disability and the hurdles encountered. Apparently, even though all the hotel offer ADA accessible rooms, the code should be modified to designate rooms based on disability whenever feasible.

V. CONCLUSION

The main purpose of this study was geared toward establishing, documenting, and evaluating the accessibility of hotel rooms for people with disabilities. It seems that there is a gap between some design and hotel building codes and human factors principals. The research is a preliminary effort to integrate ergonomics when designing accessible travel accommodations for people with special needs.

This research was intended to provide a message and start a scientific approach to improve the accessibility in the travel industry. It appears that the current standard lack some consideration of the type of the disability and accordingly the accommodation needed to suit the guest. Many of the problems could be avoided by applying simple human factors